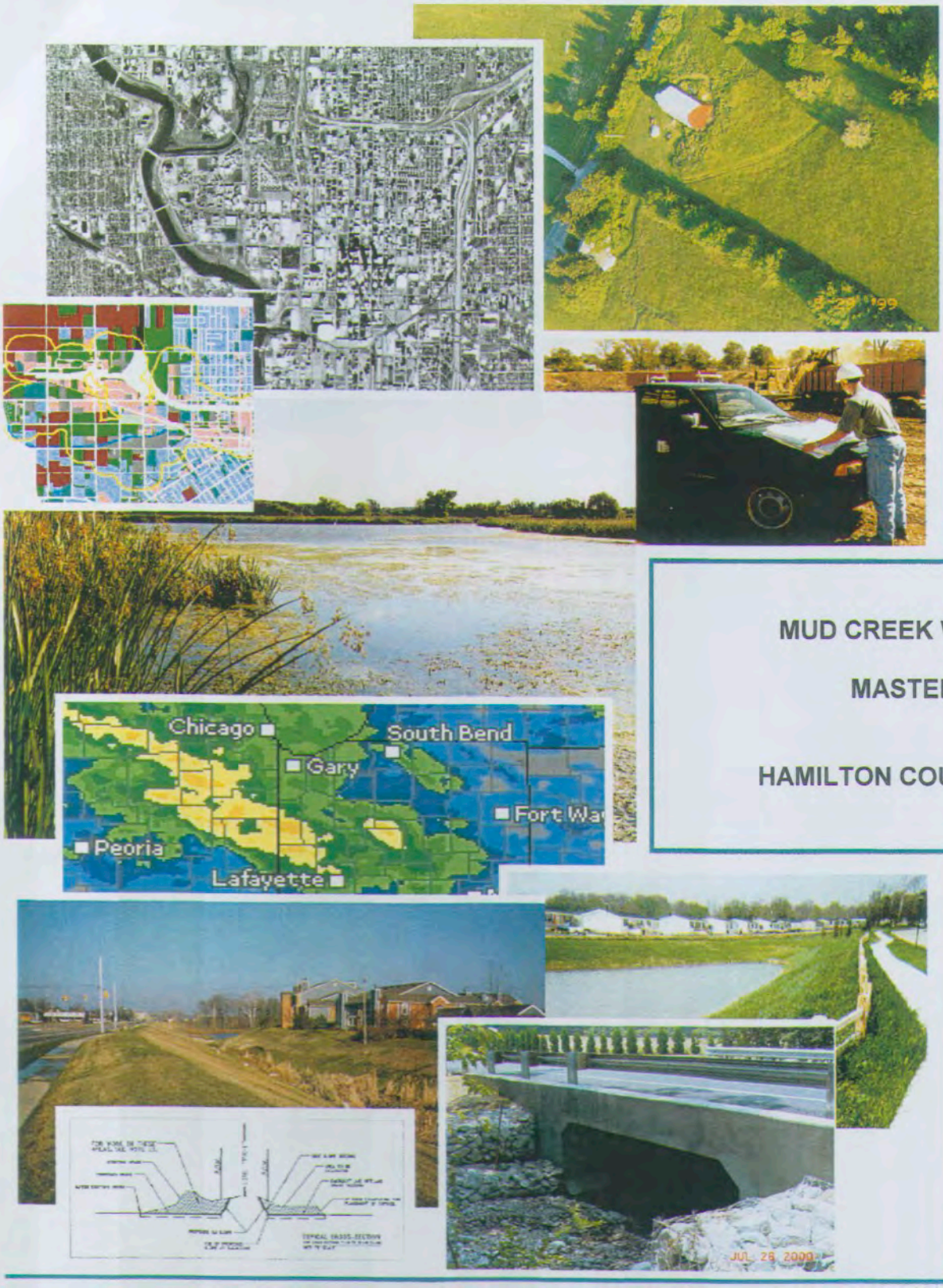

MUD CREEK WATERSHED

MASTER PLAN

HAMILTON COUNTY, INDIANA

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Mud Creek Watershed Master Plan

Prepared for

Hamilton County Surveyor
One Hamilton County Square
Noblesville, Indiana 46060

February 2005

Prepared by

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CBBEL Project No. 01-410A

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E. Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues

EXECUTIVE SUMMARY

This report compiles the results of the Christopher B. Burke Engineering, Ltd. (CBBEL) analyses of Mud Creek. The studies include: 1) Mud Creek Watershed Hydrologic Analysis (Appendix A), dated February 1997; 2) Existing – Condition Hydrologic Analysis Refinement (Appendix B), dated May 1998; 3) Mud Creek Watershed Flood Protection Alternatives Analysis (Appendix C), dated October 2002; 4) Biomonitoring, Water Quality and Habitat Assessment for the Mud Creek Watershed, Hamilton County, Indiana (Binder #2, Appendix D), dated February 2004; and 5) Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues (Binder #2, Appendix E), dated April 2004. Mud Creek watershed, which is a tributary to Fall Creek, drains approximately 44 square miles of area at its mouth. The watershed contains two major streams, Mud Creek and Sand Creek. Portions of the watershed are located within Hamilton, Marion, and Madison Counties.

The studies were conducted on behalf of the Hamilton County Surveyor's Office to address two main issues. First, County officials were concerned about stormwater quantity and wanted options for improving flood control. Second, County officials wanted an evaluation of stormwater quality within the Hamilton County portion of the Mud Creek watershed and related recommendations for complying with the United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System's (NPDES) Phase II regulations.

The work required to complete these studies included field investigation of the Mud Creek watershed, field investigations of the hydraulic, hydrologic, and geomorphologic conditions along Mud Creek and Sand Creek, reviewing and revising previous hydrologic modeling, analyzing alternatives for improving flood control and making general recommendations regarding potential solutions, and rapid bioassessment techniques throughout the Mud Creek watershed and recommendations for BMPs. Findings and/or recommendations regarding each of the two issues described above are as follows:

Issue #1: For the Mud Creek Watershed Hydrologic Analysis, dated February 1997, CBBEL recommended revising the coordinated discharge for Mud Creek and Sand Creek, performing a comprehensive hydraulic analysis using the revised Coordinated Discharges for Mud Creek and Sand Creek, and conducting a comprehensive feasibility-level study evaluating various flood control options.

For Existing – Condition Hydrologic Analysis Refinement, dated May 1998, CBBEL completed a detailed analysis of the hydrology of the watershed including revised Coordinated Discharge curves for Mud Creek and Sand Creek. The Coordinated Discharge curves were subsequently adopted in accordance with the multi-agency agreement between the Indiana Department of Natural Resources (IDNR), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS) and

the United States Army Corps of Engineers (USACE). These revised curves were subsequently utilized by IDNR for conducting a comprehensive hydraulic analysis of Mud Creek and Sand Creek, as recommended by CBBEL.

For Mud Creek Watershed Flood Protection Alternatives Analysis, dated October 2002, CBBEL provided two main recommendations. First, notify residents, or developers, as applicable, via a public meeting, that their property is shown as being within the floodplain limits and, if there is no existing letter from FEMA for their property, they can pursue a letter from FEMA to formally remove their property. Secondly, consider future implementation of a "floodplain management" solution to these problems, and other flooding problems throughout the County, by means of a countywide "Flood Hazard Mitigation Plan".

Issue #2: For Biomonitoring, Water Quality and Habitat Assessment for the Mud Creek Watershed, Hamilton County, Indiana, dated February 2004, it was found that Mud Creek has issues associated with rapid urban development and the flat agricultural nature of the watershed. The following BMPs that are consistent with Hamilton County's NPDES Stormwater Phase II requirements, according to the Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues, dated April 2004, were recommended.

- Restoration of eroded streambanks and riparian areas through vegetative practices
- Implementation of conservation tillage on agricultural lands, as well as nutrient management and conservation buffers croplands
- Adoption and enforcement of erosion and sediment control practices for construction sites
- Utilization of post-construction BMPs in developing and re-developing areas
- Utilization of rain gardens, grassy swales, and dry detention ponds on commercial and residential properties

1.0 PROJECT OVERVIEW

1.1 BACKGROUND

Christopher B. Burke Engineering, Ltd. (CBBEL) completed a detailed study of the Mud Creek watershed and presented the results in the report Mud Creek Watershed Hydrologic Analysis, dated February 1997. That report was originally directed toward examining regional detention options within the watershed. However, the detailed hydrologic analysis showed the regulatory discharges for Mud Creek and Sand Creek were significantly less than the results of the CBBEL modeling. Based on that conclusion, the report included the following recommendations:

1. The Coordinated Discharge curves for Mud Creek and Sand Creek should be revised.
2. A comprehensive hydraulic analysis using the revised Coordinated Discharges should be completed for Mud Creek and Sand Creek.
3. Based on the results of the revised hydraulic analysis, a comprehensive feasibility-level study evaluating various flood control options, beyond regional detention basins should be completed.
4. Using additional, more detailed information, conduct additional evaluation of regional detention basin functions.

The first recommendation was implemented when CBBEL completed a detailed analysis of the hydrology of the watershed including revised Coordinated Discharge curves for Mud Creek and Sand Creek. The results of that analysis were presented in the report Existing – Condition Hydrologic Analysis Refinement, dated May 1998. The Coordinated Discharge curves were subsequently adopted in accordance with the multi-agency agreement between the Indiana Department of Natural Resources (IDNR), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS) and the United States Army Corps of Engineers (USACE) wherein each agency agreed to coordinate discharge-frequency values for use in water resources investigations and planning activities in the state of Indiana.

The second recommendation was implemented when staff from the IDNR completed a comprehensive hydraulic analysis using the flow rates from the revised Coordinated Discharge curves. The results of this comprehensive analysis were used to develop new floodplain and floodway mapping along Mud Creek and Sand Creek. This mapping was submitted to the Federal Emergency Management Agency (FEMA) to be included in the revised Hamilton County Flood Insurance Study (FIS). FEMA completed its review of the hydraulic analyses and the proposed FIS maps were distributed for public comment. The revised FIS maps for Mud Creek and Sand Creek were formally published in February 2003.

In response to the third recommendation, the Hamilton County Surveyor's office contracted with CBBEL to complete a comprehensive feasibility-level study to evaluate a wide array of flood protection measures. Details of the results of that study are contained in Mud Creek Watershed Flood Protection Alternatives Analysis, dated October 2002. The overall conclusions were that several road crossings would be overtopped by flood flows, and that most of the other problems resulting from the revised hydraulic analysis were apparently due to inaccuracies in the proposed mapping of the revised floodplain boundaries. The study resulted in ten specific conclusions and associated recommendations. The study also concluded that regional detention (the fourth recommendations from the 1997 report) would not be warranted for this watershed.

Finally, the Hamilton County Surveyor's Office expanded the analysis of the Mud Creek watershed to include evaluation of the stormwater quality and United States Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System's (NPDES) Phase II stormwater regulation issues as they pertain to the Mud Creek watershed. Details of the results of that study are contained in Biomonitoring, Water Quality and Habitat Assessment for the Mud Creek Watershed, Hamilton County, Indiana, dated February 2004. It was found that Mud Creek has issues associated with rapid urban development and the flat agricultural nature of the watershed. A variety of recommendations for addressing the pollutants impacting water quality in the watershed were provided. The following BMPs that are consistent with Hamilton County's NPDES Stormwater Phase II requirements, according to the Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues, dated April 2004, were recommended.

- Restoration of eroded streambanks and riparian areas through vegetative practices
- Implementation of conservation tillage on agricultural lands, as well as nutrient management and conservation buffers croplands
- Adoption and enforcement of erosion and sediment control practices for construction sites
- Utilization of post-construction BMPs in developing and re-developing areas
- Utilization of rain gardens, grassy swales, and dry detention ponds on commercial and residential properties.

1.2 INTRODUCTION

This report compiles the results of the Mud Creek hydrologic studies, the watershed flood protection alternatives analysis, and Mud Creek watershed water quality evaluation completed by CBBEL for Hamilton County. The reports revise published hydrologic data, identify alternative solutions to problems, evaluate alternative solutions for their technical effectiveness, economic feasibility, institutional/social acceptance, and environmental impacts, and recommend a plan of action based on these evaluations. The Mud Creek watershed includes approximately 44 square miles of area upstream of the creek's

confluence with Fall Creek in Marion County. The Mud Creek watershed includes two major streams, Mud Creek and Sand Creek, and several smaller ditches including High Ditch, Hynett Ditch, Henry Ditch, as well as several unnamed tributary streams. Roughly 11 miles of Mud Creek and all of Sand Creek traverse the southeast part of Hamilton County. Portions of the Mud Creek watershed are located in Marion, Hamilton, and Madison Counties. **Exhibit 1** shows the approximate Hamilton County limits of Mud Creek and Sand Creek.

The existing land use along Mud Creek and Sand Creek ranges from rural areas in the upper reaches with little development to extensive suburban and urban development along the middle and lower reaches.

1.3 ORGANIZATION OF THIS DOCUMENT

This report is organized into one chapter and several appendices, contained in two binders. A brief summary of the contents of each binder is provided below:

Binder #1

- Mud Creek Watershed Master Plan, presents the executive summary and background regarding the watershed analyses.
- Appendix A, Mud Creek Watershed Hydrologic Analysis, dated February 1997, contains a complete copy of the report, including appendices.
- Appendix B, Existing – Condition Hydrologic Analysis Refinement, dated May 1998, contains a complete copy of the report, including appendices.
- Appendix C, Mud Creek Watershed Flood Protection Alternatives Analysis, dated October 2002, contains a complete copy of the report, including appendices. The report incorporates IDNR comprehensive hydraulic analysis using flow rates from the revised Coordinated Discharge curves developed by CBBEL.

Binder #2

- Appendix D, Biomonitoring, Water Quality and Habitat Assessment for the Mud Creek Watershed, Hamilton County, Indiana, dated February 2004, contains a complete copy of the report, including appendices.
- Appendix E, Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues, dated April 2004, contains CBBEL's summary of the report in Appendix D and evaluation of the NPDES Phase II permit issues.

2.0 REFERENCES

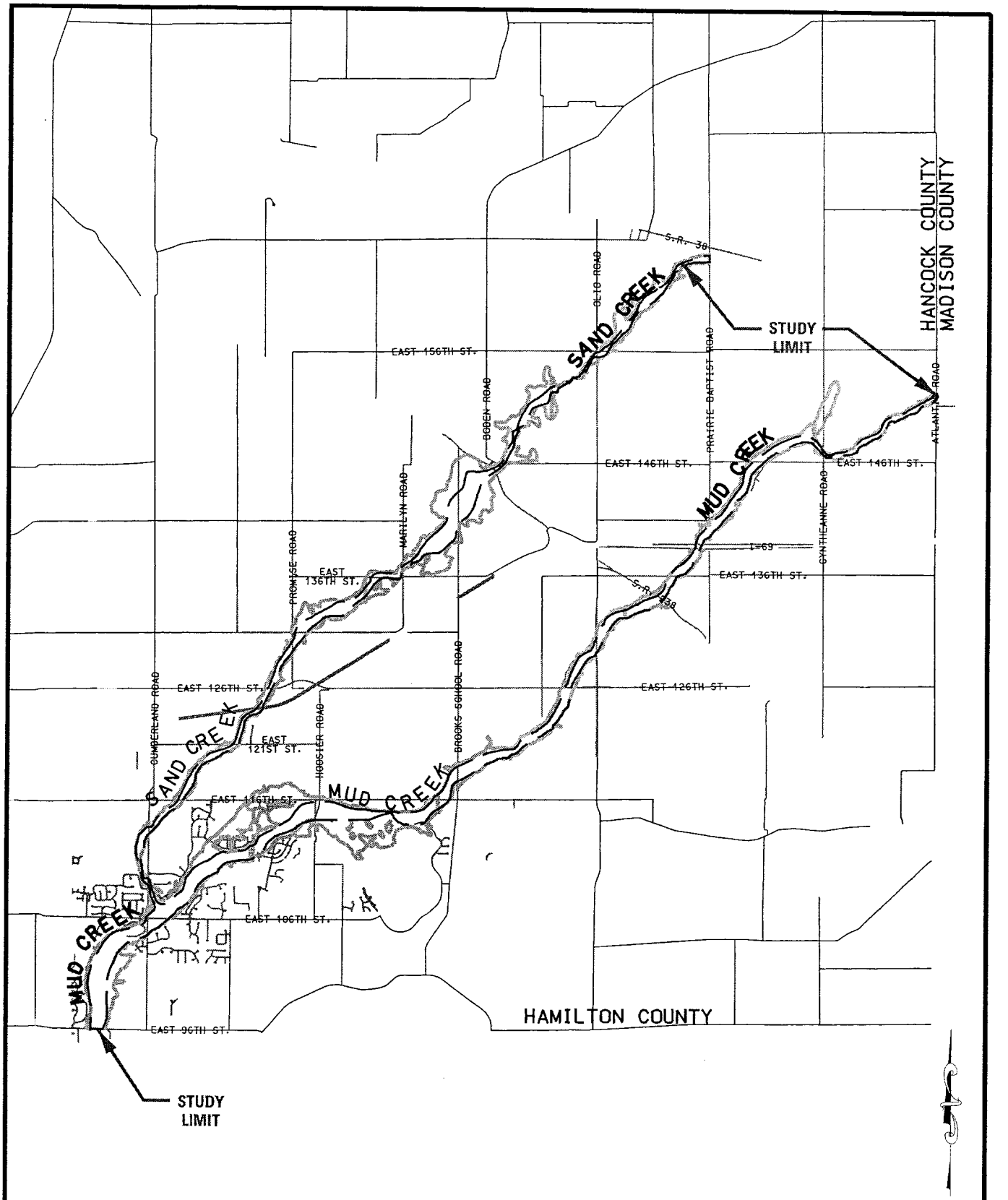
Christopher B. Burke Engineering, Ltd. Mud Creek Watershed Hydrologic Analysis. Hamilton County, Indiana, February 1997.

Christopher B. Burke Engineering, Ltd. Existing Condition Hydrologic Analysis Refinement. Mud Creek Watershed, Hamilton County, Indiana, May 1998.

Christopher B. Burke Engineering, Ltd. Mud Creek Watershed Flood Protection Alternatives Analysis. Hamilton County, Indiana, October 2002.

Christopher B. Burke Engineering, Ltd. Mud Creek Watershed Summary of Water Quality Study and Evaluation of NPDES Phase II Permit Issues, Hamilton County, Indiana, April 2004.

Claude D. Baker, Ph.D, Indiana University Southeast. Biomonitoring, Water quality and Habitat Assessment for the Mud Creek Watershed, Hamilton County, IN, Hamilton County, Indiana, February 2004.



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PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED MASTER PLAN	01-410A	1"=1.25 mi
TITLE:	**DATE:**	**EXHIBIT:**
MUD CREEK AND SAND CREEK LOCATION MAP	02/05	1

CHRISTOPHER B. BURKE ENGINEERING, LTD.

HAMILTON COUNTY, INDIANA
MUD CREEK WATERSHED
HYDROLOGIC ANALYSIS

Prepared for
Hamilton County Drainage Board

February 1997

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CBBEL Project Number 96-297

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EXECUTIVE SUMMARY

INTRODUCTION

The Mud Creek watershed, which is tributary to Fall Creek, drains approximately 44 square miles of area at its confluence. The watershed contains two major creeks, identified as Mud Creek and Sand Creek, as well as several ditches including High Ditch, Kynett Ditch, Henry Ditch, and several unnamed tributaries. Portions of the watershed are located within Marion, Hamilton, and Madison Counties, as shown on Exhibit 1. Focus of this report is on the portion of the watershed that lies within Hamilton County.

Since much of the Mud Creek watershed within Hamilton County is experiencing a significant transformation from agricultural to urbanized land uses, it is important to evaluate the best watershed management practices for the County. These practices are necessary to mitigate potential adverse effects of this on-going urbanization process on the rate and volume of runoff. The purpose of this study is to evaluate both existing hydrologic conditions as well as future alternative solutions, aimed at reducing future condition peak discharges to a level below that of the existing condition. In addition, this study provides an opinion of probable cost for each alternative project examined to meet the project goals.

WATERSHED ANALYSIS RESULTS

A detailed hydrologic analysis of the Mud Creek watershed is required to quantify existing flood discharges and to provide a basis of comparison for potential flood control projects. This analysis was performed using computer modeling to simulate the rainfall-runoff process for both observed storm events and design storm events. The hydrologic analysis was performed using the U.S. Army Corps of Engineers HEC-1 computer model. HEC-1 is a single storm event model that estimates runoff from hydrologic parameters input by the user.

The results of the existing-condition hydrologic analysis are an indication of existing potential flood hazards. The results of this analysis were verified against a major storm event observed in April of 1964. The existing-condition discharges are computed by modeling the watershed in a current state of development and simulating the model for various synthetic storm events.

This analysis assumed negligible peak discharge attenuation due to potentially restrictive structures such as inadequate bridge or culvert crossings, on the assumption that any such structures were not necessarily designed to be restrictive and would eventually be replaced.

The existing-condition model was executed using standard 2-year through 100-year design storm events. The results of the existing-condition analysis revealed unexpectedly large differences between peak discharges estimated in this study and those previously estimated by regulatory agencies through less detailed analysis. Table ES-1 provides a summary comparison of flowrates estimated by various sources at several key locations within the watershed.

TABLE ES-1
Comparison of Peak Discharges Estimated by Various Sources

Location Description	100-Year Peak Discharges			
	Drainage Area (Sq. mi.)	Coordinated Discharge (cfs)	Flood Insurance Study Discharge (cfs)	Existing-Condition Model Discharge (cfs)
Mud Creek at Hamilton-Madison County Border	12.1	NA*	NA**	2407
Mud Creek at I-69	17.0	NA*	NA**	3187
Mud Creek at Sand Creek Confluence	26.2	1740	1740	3862
Sand Creek at its mouth	11.4	975	990	1864
Mud Creek at 106th Street Bridge	37.6	2280	2280	5607
Mud Creek at 96th Street Bridge	39.0	2300	2500	5615

* The specified location is beyond the limits shown on the Coordinated Discharge curve, which ends at 126th Street.

** The specified location is beyond the limits of the detailed Flood Insurance Study hydraulic model.

From Table ES-1, it can be seen that the 100-year flowrates used in the regulatory hydraulic model and those determined from the effective Coordinated Discharge relationships are smaller than one-half of that predicted by the existing-condition hydrologic model for the Mud Creek mainstem, and about one-half for Sand Creek at its mouth. There are serious implications to this, as the flood protection grade for existing residential structures built adjacent to the regulatory floodplain is expected to have been based on this lower flowrate. The extreme differences in existing-condition and Coordinated Discharges, as shown in Table ES-1, imply a significant need for agency re-evaluation of discharge-drainage area relationships (also known as" re-coordination") of Mud Creek and Sand Creek, based on the results of this detailed HEC-1 study. This re-coordination would more effectively guide future development in the basin since flood elevations would be based on more refined estimates of Mud Creek and Sand Creek discharges.

Based on a comparison of the results of the existing-condition hydrologic modeling and the regulatory hydraulic modeling, a reduction in future-condition flowrates to a level below that of existing-conditions is a justified and important objective. Therefore, this study adopted the objective of limiting the future-condition peak flowrates to the existing-condition peak flowrates for the 10-year event at the Mud Creek crossing of the Hamilton-Marion County border (96th Street).

Using the existing-condition HEC-1 model as a base, several alternative flood control management options were examined. These alternatives include:

Alternative 1. Allowing for future-condition development of Sand and Mud Creek tributaries with an exemption to the individual site detention requirements specified in the Hamilton County Drainage Ordinance (i.e., allowing "Direct Release");

Alternative 2. Construction of a single regional detention facility along Mud Creek, with no additional detention provided along Sand Creek;

Alternative 3. Construction of three regional detention facilities, one on Mud Creek and two on Sand Creek; and

Alternative 4. Continuing development of the Mud Creek Watershed as specified in the Hamilton County Drainage Ordinance, with on-site detention provided on a project-specific basis.

Table ES-2 provides a summary of the results of hydrologic analyses performed for various alternatives at several key locations.

TABLE ES-2
Summary of Results for Alternatives

Location	Drainage Area (sq. mi)	Existing-Condition Peak Discharge (cfs)		Alternative 1 100-year Peak Discharge (cfs)	Alternative 2 100-year Peak Discharge (cfs)	**Alternative 3 100-year Peak Discharge (cfs)**	Alternative 4 100-year Peak Discharge (cfs)
		100-year	**10-year (Target)**				
U/S of Madison Co. Line	12.13	2407	**1515**	2407	2407	**2407**	2407
Mud Ck. at I-69	17.00	3187	**2008**	3114	3114	**2289**	3193
Mud Ck at SR-238	17.84	3294	**2076**	3197	1891	**2331**	3315
Mud Ck u/s of Sand Ck.	26.19	3862	**2426**	3662	1929	**2403**	4205
Sand Ck. at 156 St.	2.53	571	**363**	578	578	**123**	449
Sand Ck. at 136 St.	7.54	1538	**977**	1637	1637	**423**	1156
Sand Ck. at Mouth	11.38	1864	**1186**	2047	2047	**1267**	1611
Marion Co. Line (96th St.)	39.03	5615	**3527**	5449	3612	**3391**	5913

As Table ES-2 indicates, only alternative 3 (three regional detention basins) has the capability to reduce the future-condition 100-year peak discharges (at pre-determined key locations) to approximately the 10-year, existing-condition levels. However, the preliminary opinion of probable cost for Alternative 3 is approximately $33.5 million, making the economic feasibility of this alternative questionable.

SUMMARY AND CONCLUSIONS

This study was performed to evaluate flood control management methods within the Mud Creek watershed within Hamilton County, Indiana. A detailed hydrologic model was formulated, which indicated significantly higher flowrates than the peak discharges that are currently being used for regulating development along Mud Creek and Sand Creek. As these differences appear to be well-founded (based on historic storm event verification), four (4) alternative flood control scenarios were evaluated in comparison to the existing-conditions.

Several major conclusions can be reached from the results of this study. These conclusions are listed below.

1. The flowrates presently being used by State and Federal regulatory agencies for the watershed do not appear to be accurate estimates of potential existing-condition discharges. The current Mud Creek and Sand Creek regulatory discharges are based on statistical analyses of a former USGS gaging station and did not account for historic cross-watershed diversion.

2. A continuation of the detention methods required by the current Hamilton County Drainage Ordinance, while effective in regulating discharges on a smaller scale (especially downstream of on-site detention facilities), could cause increased peak discharges for the watershed as a whole due to peak discharge timing issues.

3. The Sand Creek flood hydrograph at its confluence reaches a peak sooner than the upstream Mud Creek mainstem at this location. Any potential flood control management option should seek to maintain or increase this difference in the timing of peak discharges.

4. It may be possible, but very costly, to construct one central, regional detention facility on Mud Creek with a live-storage volume similar to that which would be required for several project-specific on-site detention facilities. Such a regional facility would be much more effective in reducing peak discharges for extreme rainfall events along Mud Creek.

5. Reasonable reduction of future-condition 100-year peak flowrates to 10-year existing-condition levels is possible through construction of three (3) regional detention facilities along Mud Creek and Sand Creek. However, the preliminary opinion of probable cost for such facilities is approximately $33.5 million, making the economical feasibility of this alternative questionable.

6. Due to lack of needed detailed topographic and hydraulic data and the complexity of issues involved, it is not possible to accurately determine the configurations or costs of various potential alternatives at this phase of the study. Considering the magnitude of probable costs involved, a detailed feasibility-level study is needed before recommendations can be made regarding alternative locations, configurations, or details of desirable amenities involved with proposed facilities.

RECOMMENDATIONS

Based on the results of this study, several recommendations may be made. These recommendations can be grouped into two categories. The first group of recommendations (1 and 2) attempt to address issues involved with the somewhat unexpected findings regarding the inaccuracy of regulatory flowrates, as they exist today. The second group (recommendations 3 and 4) attempt to address study findings with regards to feasibility and effectiveness of regional detention facilities.

The following recommendations attempt to address the study findings with regards to the inaccuracy of effective regulatory discharges.

1. Due to the differences between the current regulatory discharges and those produced by the existing-condition hydrologic model, the results of this study should be provided to Indiana Department of Natural Resources (IDNR), requesting revisions to Coordinated Discharge curves for Mud Creek and Sand Creek.

2. Using the revised Coordinated Discharge curves, a comprehensive hydraulic analysis/FIS restudy should be performed for the entire lengths of Mud Creek and Sand Creek within Hamilton County to verify or correctly determine existing flood hazard areas.

The following recommendations attempt to address the findings of this study with regards to effectiveness and feasibility of regional detention basins in the watershed.

3. Once the regulatory discharges and flood profiles have been revised (providing a more accurate description on the extent and nature of flood damages), the County should initiate a comprehensive feasibility-level study. This study should evaluate, based on a new detailed topographic mapping, a wider array of flood control options. These options may include such measures as restoration of the historic Geist Reservoir diversion path (or constructing an equivalent diversion path), channel improvements, replacement of restrictive bridges, and regional detention facilities.

4. After further information and details about the potential locations for regional facilities become available, additional evaluation of regional basin functions would be warranted. Each of the regional ponds would likely incorporate the multi-functional amenities desired for such a facility. Each facility should incorporate the benefits inherent with uses such as regional parks, environmental mitigation/enhancement, and erosion control basins.

1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

The Mud Creek watershed, which is tributary to Fall Creek, drains approximately 44 square miles of area at its confluence. The watershed contains two major creeks, identified as Mud Creek and Sand Creek, as well as several ditches including High Ditch, Kynett Ditch, Henry Ditch, and several unnamed tributaries. Portions of the watershed are located within Marion, Hamilton, and Madison Counties, as shown on Exhibit 1. Focus of this report is on the portion of the watershed that lies within Hamilton County.

Since much of the Mud Creek watershed within Hamilton County is experiencing a significant transformation from agricultural to urbanized land uses, it is important to evaluate the best watershed management practices for the County. These practices are necessary to mitigate potential adverse effects of this on-going urbanization process on the rate and volume of runoff. The purpose of this study is to evaluate both existing hydrologic conditions as well as future alternative solutions, aimed at reducing future condition peak discharges to a level below that of the existing condition. In addition, this study provides an opinion of probable cost for each alternative project examined to meet the project goals.

1.2 OBJECTIVES

The following list identifies the major objectives of this study:

- Formulate an existing condition hydrologic model to provide a basis for evaluating future condition watershed alternatives;
- Verify the existing condition hydrologic model using the best available historic data;
- Provide alternative solutions to reduce future condition discharges below the level experienced in existing conditions within Hamilton County;
- Provide an order-of-magnitude cost opinion for each of the potential alternatives;
- Identify major permitting requirements involved with each alternative project on both a state and federal level; and
- Provide watershed management recommendations to the Hamilton County Drainage Board, based on the study results.

2.0 DATA COLLECTION

2.1 INTRODUCTION

Several sources were used to collect the best available data for the hydrologic modeling performed in conjunction with this study. The following sections briefly cite the sources of information used in the preparation of this report.

2.2 SOILS INFORMATION

Permeability can be described as a measure of the ability of a given soil to pass (infiltrate) water from its superficial layers to underlying soil layers. The permeability of soil can have a dominant effect on the amount of surface runoff produced and the duration of soil saturation for extreme rainfall events. Soil distribution information was derived from the soil maps for the watershed prepared by the Natural Resource Conservation Service (NRCS) in 1967 and 1978.

Soil groups identified from the NRCS soil maps were classified into four (4) groups according to the tabular information presented in the HERPICC manual (HERPICC, 1994). These categories are identified as A, B, C and D in order of decreasing permeability. Some groups of soils exhibit different permeability characteristics, depending on whether or not there is a subsurface conveyance system in place to drain infiltrated water. These soils are given a multiple group classification, such as A/D or B/D. For the purposes of this study, it was assumed that soils with a multiple classification have a tile drain in place, except for areas adjacent to overland flow paths identified on the soils maps. For future-condition models, disturbed Type B soils were assumed to have Type C soil attributes due to the inherent soil compaction and tile drain disturbances associated with construction activities.

The majority of soils within the watershed are type B and C, with some type D soils. The watershed is virtually devoid of Type A soils. Information regarding the distribution of the different soil classifications across the watershed can be found in Appendix 1.

2.3 EXISTING-CONDITION LAND USE INFORMATION

The aerial photography of the watershed indicates a predominantly agricultural land use for the portions of the watershed in Madison County. The extent of the watershed examined in Marion County indicates a fully developed residential land

use. In Hamilton County, the land use is predominantly residential in the areas west of Klepfer School Road and south of Interstate 69, with agricultural land uses predominating the remaining areas. There are also significant areas of existing woods and open space scattered throughout Hamilton and Madison Counties. Detailed, existing-condition land use conditions across the watershed are also contained in Appendix 1.

2.4 FUTURE-CONDITION LAND USE INFORMATION

Future condition land uses are assumed to follow the planning/zoning maps obtained from various local government agencies. A collaboration of the various zoning maps is presented as future land use in Exhibit 2.

Exhibit 2 indicates a significant development of existing open space and agricultural areas within Hamilton County into residential, commercial, and industrial land uses. In general, the current zoning maps for Hamilton County indicate that only the area north of 156th Street will retain its agricultural nature. In comparison, the areas within Madison County indicate that no significant development of existing agricultural areas is planned at this time. Areas within Marion County are assumed to be fully developed at present, for the purposes of this study.

2.5 REGULATORY HYDRAULIC MODELS

Although an extensive hydraulic analysis of the major tributaries within the Mud Creek watershed is beyond the scope of this study, several hydraulic models have been formulated for portions of the watershed in conjunction with the National Flood Insurance Program. These data were utilized in the study to estimate runoff travel times along the channels of Mud and Sand Creeks. The Flood Insurance Rate Maps (FIRMs) produced from this hydraulic modeling are also valuable as an indication of areas prone to flooding under existing conditions. The areas inundated by design flood discharges are delineated as the regulatory floodplain. The effective FIRMs for the affected area are contained within the Noblesville Flood Insurance Study (FIS) for the Hamilton County part of the watershed and within the Indianapolis FIS for Marion County portion. Copies of the FIS regulatory hydraulic modeling computer input/output can be found in Appendix 2.

In addition to portions of Mud and Sand Creeks for which a detailed hydraulic model exists, the FIRM's indicate an approximate extent of flooding in areas not studied in

detail. These unstudied areas have a "Zone A" designation for the area within the floodplain. Areas within Madison County have no regulatory floodplain indicated on the Madison County Flood Insurance Rate Map. This is an indication that there was not enough information to approximate the existing floodplain, rather than an indication of a lack of flood hazard.

It should be noted that the FIS regulatory hydraulic models for Mud Creek and Sand Creek appear to have been based on discharge data obtained from a multi-agency coordinated discharge relationship which was developed, in turn, based on data from a gaging station formerly operated by the United States Geologic Survey. The reliability of the data obtained from this gaging station is discussed in Sections 3.2.6 and 3.2.7.

2.6 TOPOGRAPHIC DATA

The topographic features of an area define the path of surface runoff through that area and ultimately define the contributing drainage area for a watershed. The outer boundary of the Mud Creek watershed was delineated based upon the most recent quadrangle topography mapping prepared by the United States Geological Survey (USGS, 1984-1994). This was verified against a delineation performed by the Indiana Department of Natural Resources (IDNR, unknown date), with no major discrepancies found between the two delineations. The downstream extent of the watershed delineation corresponds to the gaging station previously discussed in Section 2.5.

The watershed was further subdivided into twenty-six (26) subbasins, as is shown in Exhibit 3, based on the same quadrangle mapping. The number and location of subbasins were based on land use, as well as major locations of interest, such as roadway crossings and tributary confluences.

The subbasin delineation allows for a detailed hydrologic analysis of the watershed at various locations, rather than at a single location such as at the Hamilton County-Marion County border alone. By measuring the areas of the individual subbasins, the tributary area can be determined at points of interest. The tributary areas at several locations are summarized in Table 1. As can be seen in Table 1, there are 39 square miles of tributary area at the Marion-Hamilton County Border. It should be noted that of this total drainage area, significant portions are contributed by a major tributary, Sand Creek, and by upstream areas under the control of Madison County authorities.

TABLE 1
Tributary Area Summary at Several Locations

Location Description/Waterway	Upstream Drainage Area (Square Miles)
Mud Creek at Madison-Hamilton Co. Border	12.1
Mud Creek at Interstate-69 Bridge	17.0
Mud Creek at Sand Creek Confluence	26.2
Sand Creek at its Mouth	11.4
Mud Creek at 106th Street Bridge	37.6
Mud Creek at 96th Street Bridge	39.0
Mud Creek at USGS Gage Station (Lantern Rd.)	42.4

3.0 WATERSHED ANALYSIS

3.1 INTRODUCTION

A detailed hydrologic analysis of the Mud Creek watershed is required to quantify existing flood discharges and to provide a basis of comparison for potential flood control projects. This analysis was performed using computer modeling to simulate the rainfall-runoff process for both observed storm events and design storm events. This chapter includes a discussion of the computer model selected for the hydrologic simulation, as well as the input parameters estimated for the hydrologic simulation.

3.2 HEC-1 COMPUTER MODEL

The hydrologic analysis was performed using the U.S. Army Corps of Engineers HEC-1 computer model. HEC-1 is a single storm event model that estimates runoff from hydrologic parameters input by the user. Typical input parameters include rainfall duration-depth patterns, rainfall-runoff response parameters for each subbasin, and routing parameters of the subbasin hydrographs (discharges as a function of time) at specified nodes. Nodes may represent the confluence of a subbasin with another subbasin, a detention facility, a channel reach, or a diversion location. The model will produce hydrographs and will identify peak flows and volumes at specified locations.

3.2.1 APPLICATION USE AND LIMITATIONS

Since HEC-1 is based on a single storm pattern and duration, multiple executions of the program are required to determine the critical duration at a given location. The critical duration storm for this study is defined as that which produces the highest discharges at a specific location.

Because HEC-1 requires the user to input rainfall-runoff response parameters for each subbasin, it is the user's responsibility to verify the results of the analysis versus measured events, if this information is available. HEC-1 does have the ability to calibrate parameters to approximately match an observed (gaged) event. Once again, it is the user's responsibility to determine what parameters and methods are appropriate for a specific site.

3.2.2 DESIGN STORM PARAMETERS

HEC-1 requires observed or synthesized rainfall depth-distribution relationships to produce a runoff response to a given storm. This study utilizes both observed event and design (synthetic) storm data.

The highest storm ever recorded at the Mud Creek gaging station (during its operation) was the Spring 1964 event. Daily rainfall depths for the two closest available rain gages (Oaklandon Geist Reservoir and Anderson Waterworks) were averaged to yield daily depths for the Mud Creek watershed. A third gage (Indianapolis Riverside) was used to estimate the distribution of the daily rainfall depths, as this was the closest gage with detailed (hourly) rainfall distribution data.

In addition to verifying that the HEC-1 model produces results consistent with historical events, it is necessary to determine the response of the watershed to design events. To meet this requirement, storms of various durations were analyzed for the 2-, 5-, 10-, 25-, 50- and 100-year design events. Rainfall depths were based on the publication identified as TP-40, with rainfall distribution based on the statistically-based, median HUFF curves presented in the HERPICC manual (HERPICC, 1994). Table 2 indicates the design rainfall depths used for various durations and frequencies.

TABLE 2
Site-Specific TP-40 Rainfall Depths for Various Durations and Frequencies

Storm Duration (HOURS)	Rainfall Depth (Inches)					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
6	2.12	2.64	3.02	3.44	3.78	4.25
12	2.57	3.17	3.67	4.15	4.56	5.14
24	2.91	3.70	4.17	4.76	5.32	5.75
48	3.40	4.14	4.73	5.51	6.05	6.65
96	3.95	4.90	5.45	6.44	6.85	7.80

3.2.3 SUBBASIN PARAMETERS

As previously stated, the Mud Creek Watershed was subdivided, based on topographic data, into twenty-six (26) subbasins in order to more clearly define the locations of interest. Of these twenty-four subbasins, twelve (12) are associated with the Mud Creek mainstem, seven (7) are associated with Sand Creek, two (2) are associated with Kynett Ditch, three (3) are associated with unnamed tributaries, and two (2) are associated with High and Henry ditches. The areas of the individual subbasins range from 0.84 to 3.3 square miles with an average size of approximately 1.6 square miles.

The SCS dimensionless unit hydrograph method was selected as the basis of the rainfall-runoff generation for individual subareas, based on the available information. This method requires three inputs for a given subbasin: basin area, NRCS curve number, and NRCS lag time. The HEC-1 computer model uses the following two-letter abbreviations to recognize these input parameters:

BA - Basin area (Sq. mi) LS - NRCS curve number UD - Lag time (hours)

Basin areas were digitized and verified using an electronic planimeter. Curve numbers were calculated based on the soil data and land use information described in Sections 2.2 -2.4. Detailed curve number calculations for existing and future conditions are contained in Appendix 1. NRCS lag time is usually estimated as a ratio of time-of-concentration (Tc), which is defined as the time required for the entire subbasin to contribute runoff at the subbasin outfall. Time-of-concentration calculations were performed using TR-55 methodologies, considering the ground cover and slopes found in the individual subbasins. Detailed delineations and assumed subbasin flow paths for all subbasins are shown on a topographic map as Appendix 3. Additionally, detailed time-of-concentration calculations can be found in Appendix 4.

A summary of the subbasin hydrologic input parameters for existing and future conditions are shown in Table 3. As can be seen in Table 3, eleven (11) subbasins remain unchanged between existing and future conditions. These subbasins represent the upper watershed areas, which are expected to retain their agricultural nature, and the two fully-developed subbasins within Marion County. Future condition time-of-concentration calculations for developing subareas are assumed to be at a ratio of 0.6 times the existing time-of-concentration. This assumption of increased travel velocities has been verified by past experience to adequately represent the future watershed conditions.

TABLE 3
Hydrologic Parameter Summary

Subarea ID	AREA (ACRES)	AREA (Sq. mi.)	Tc (EXISTING)/ Tc (FUTURE) (HOURS)	CN(EXISITNG)/ CN(FUTURE)
MUD1	2131	3.33	5.04	78
MUD2	874	1.37	3.99	80
MUD3	1109	1.73	7.13	79
MUD4	1213	1.89	4.26	80
MUD5	1308	2.04	3.23/1.94	77/82
MUD6	840	1.31	2.89/1.73	75/79
MUD7	539	0.84	3.19/1.91	80/80
MUD8	1445	2.26	2.19/1.31	79/79
MUD9	1068	1.67	2.72/1.63	79/81
MUD10	1163	1.82	3.66/2.20	75/79
MUD11	932	1.46	2.28/1.37	74/79
MUD12	991	1.55	4.11	71
MUD13	1177	1.84	2.30	76
SAND1	629	0.98	3.70	79
SAND2	993	1.55	3.36/2.02	79/79
SAND3	1228	1.92	3.36/2.02	79/85
SAND4	666	1.04	3.43/2.06	79/83
SAND5	1308	2.04	4.15/2.49	79/86
SAND6	1382	2.16	2.78/1.67	79/84
SAND7	1079	1.69	2.71/1.63	76/79
TRIB1	1103	1.72	5.56	80
TRIB2	702	1.10	3.76/2.26	80/81
HENRY1	974	1.52	6.31	78
KYNET1	729	1.14	4.42	79
KYNET2	736	1.15	3.1	79
HIGH1	828	1.29	3.03/1.82	81/81

3.2.4 SUBBASIN CHANNEL ROUTING

In general, the watershed subbasins are characterized as long and narrow in shape. For this reason, a method of pure hydrograph translation with no attenuation of peak flows was selected to route hydrographs through downstream channels. The HEC-1 computer model uses the following two-letter abbreviation to recognize this channel routing (lagging) method:

RT - Hydrograph lagging

3.2.5 FLOW DIVERSIONS

Diversion occurs when flood elevations along a stream or conveyance path reach an elevation above the outer boundary of the watershed at a location other than the most downstream location within the watershed. Once this elevation is reached, runoff can exit the subject watershed at this location, thus causing a loss of runoff volume at the ultimate outfall.

Two potential diversion locations were preliminarily identified based on the topographic mapping. The first location is approximately 2500 feet east of Brooks School Road along the southern watershed boundary. The second is near the Sand Creek crossing of 136th Street. The first location would divert Mud Creek runoff into Geist Reservoir, located approximately 5000 feet downstream of the diversion crest. The second location would divert Sand Creek runoff to William Lehr Ditch. The historic profile for Mud Creek would indicate that the first location did divert runoff in past extreme events, including the April 1964 event (IDNR, 1973). No documentation was found as to whether the potential diversion at Sand Creek has been observed to divert runoff.

Although the Geist Reservoir diversion has occurred in the past, it is assumed that this diversion location is no longer effective, as this area has since been developed into residential neighborhoods.

Since no historic profile was found for Sand Creek, the current regulatory hydraulic model for Sand Creek was examined near 136th Street to estimate the flood profile at this location. The model indicates an elevation of 812 feet at the upstream face of the 136th Street crossing. Using detailed topography compiled in 1970 (Williams, 1970), the minimum roadway elevation for 136th Street near the potential diversion path was 813.5 feet. It is therefore assumed that diversion to Lehr Ditch would only

have occurred for events more extreme than the 100-year event. This is not to say that diversion of flows did not occur in the past, since the current regulatory model may or may not be hydraulically representative of site conditions or consistent with historic events due to physical changes that may have occurred along Sand Creek and Sand Creek bridge crossings. However, the available information dictates that this potential diversion path be ignored for the purposes of this study.

Therefore, although both locations may have diverted runoff in past storm events, no diversion is accounted for in existing or future condition hydrologic modeling at these locations.

3.2.6 USGS GAGE DATA

During the period of years from 1958-1976, the United States Geological Survey maintained a continuous record gage on Mud Creek adjacent to Lantern Road on the north side of Marion County. This gage was then reduced to read only crest stage and low-flow partial records until 1984 when gage measurements were discontinued altogether. The former location of this gage is identified on the most recent quadrangle mapping for the area. It can be noted that the reported drainage area at this gage is 42.4 square miles, coinciding with the delineation performed for this study and with the delineation performed by the Indiana Department of Natural Resources.

Both the Indiana Department of Natural Resources and the United States Geological Survey were contacted to obtain available information on the gage records. The fate of the original continuous gage data is unknown at this point, which would have provided hydrographs for historic events. However, peak discharge data was provided by the Indiana Department of Natural Resources. This information indicates a peak flowrate of 2010 cfs for the April 1964 storm event, the highest flow recorded at the gage.

An examination into the historic flood profiles for Mud Creek yielded a maximum flood profile elevation of approximately 795.5 feet for the Mud Creek mainstem, which was influenced by the Geist Reservoir diversion during a 1961 storm event. Based on Fall Creek (Geist) Reservoir mapping compiled in 1971, Brooks School Road would have been overtopped at an elevation of 794.8 feet along the diversion path. An analysis of the Brooks School roadway profile, obtained from the 1971 mapping, yielded a roadway overtopping capacity of 200 cfs at an elevation of 795.5. Increasing the overtopping profile to an elevation of 796.0 feet would increase the diversion capacity

to 600 cfs, with a diversion capacity in excess of 1000 cfs at a roadway overtopping elevation of 796.5 feet.

The historic profile obtained from the Indiana Department of Natural Resources corresponded to a peak flowrate measured at the USGS gaging station of 1090 cfs. Based on a listing of observed peak flow rates during the gage station operation period, it appears that four (4) out of twenty-one (21) peak annual discharges measured at the USGS gage station were equal or greater than the discharge of 1090 cfs, for which diversion of flow have occurred.

3.2.7 COORDINATED DISCHARGE DATA

The coordinated discharge for Mud Creek was based, at least partially, on a statistical analysis of twenty-one (21) annual peak discharges measured at the former gaging station. The current 100-year coordinated discharge at the Mud Creek gage station is approximately 2400 cfs, with the Sand Creek discharge coordination based on the Mud Creek coordination. The 100-year coordinated discharge for Sand Creek at its mouth is approximately 975 cfs.

As discussed in Section 3.2.6, the USGS gage data, which included only twenty (21) annual peak discharges, likely experienced unaccounted diversion flow for at least four of the annual peak discharge measurements. Therefore, extrapolation of this gage data to predict extreme flood discharges, such as a 100-year event discharge, would not appear to produce an accurate estimate. As will be discussed later in Section 4.2.2, it appears that the coordinated discharges for Mud Creek and Sand Creek significantly underestimate the expected 100-year discharge, as calculated through detailed hydrologic analyses. A comparison of Mud Creek coordinated discharges relationships with relationships of other similar streams in the area reveals a significant discrepancy in the magnitude of expected discharges for a given size of watershed area.

4.0 HYDROLOGIC ANALYSIS RESULTS

4.1 INTRODUCTION

This chapter presents the results of detailed hydrologic analyses for historic, existing-conditions, and future-condition alternatives. These results form the basis for the recommendations regarding flood control management projects within the watershed. Flood control management options examined include the following:

Alternative 1. Allowing for future-condition development of Sand and Mud Creek tributaries with an exemption to the individual site detention requirements specified in the Hamilton County Drainage Ordinance (i.e., allowing "Direct Release");

Alternative 2. Construction of a single regional detention facility along Mud Creek, with no additional detention provided along Sand Creek;

Alternative 3. Construction of three regional detention facilities, one on Mud Creek and another two on Sand Creek; and

Alternative 4. Continuing development of the Mud Creek Watershed as specified in the Hamilton County Drainage Ordinance, with on-site detention provided on a project-specific basis.

For each potential flood control management project, a conceptual opinion of probable cost is presented. In addition, potential Federal and State permitting issues are presented for each alternate flood control project.

It is important to note that the current study is preliminary in nature, and its main purpose is to evaluate the appropriateness of the four (4) aforementioned alternatives. The study will provide guidance on the appropriateness of certain alternatives based on hydrologic considerations, will give general locations of potential detention facilities, and will address whether detention facilities are recommended to be off-line or on-line.

The level of this study does not lend itself to provide exact detention facility locations, configurations, footprints, extent of any needed utility relocations, or refined cost estimates. Such parameters should be more clearly defined and optimized through future feasibility studies.

4.2 EXISTING-CONDITION ANALYSIS

The results of the existing-condition hydrologic analysis are an indication of existing potential flood hazards. The results of this analysis were verified against a major storm event observed in April of 1964. The existing-condition discharges are computed by modeling the watershed in a current state of development and simulating the model for various synthetic storm events.

This analysis assumed negligible peak discharge attenuation due to potentially restrictive structures such as inadequate bridge or culvert crossings, on the assumption that any such structures were not necessarily designed to be restrictive and would eventually be replaced.

4.2.1 HEC-1 MODEL VERIFICATION/CALIBRATION

As previously stated in Section 3.2.6, the USGS maintained and operated a gage on Mud Creek adjacent to Lantern Road in various capacities during the period of years from 1958-1984. Available information regarding this gage is presently limited to peak discharges at the gage for various events, with the maximum recorded discharge of 2010 cfs occurring during the April 1964 storm event.

In order to verify that the existing-condition hydrologic model produces results consistent with observed events, the model was subjected to a simulated rainfall event based on observed rainfall data, as described in Section 3.2.2. The resulting peak discharge at the gaging station for this historic event was simulated as 2421 cfs by the existing-condition hydrologic model, a difference of 410 cfs from the peak discharge measured at the gage. However, the Geist Reservoir flow diversion for this storm event, described in Section 3.2.5, would have reduced peak discharges on the order of 200-600 cfs from that discharge measured at the gaging station. Therefore, the peak discharges produced by the verification model appear to be consistent with the storm of record. No further calibration was performed on the model, since actual flood hydrographs were not available at the time of this study. The computer input/output for the Spring 1964 verification model are included in Appendix 5.

4.2.2 EXISTING-CONDITION DETERMINATIONS

The existing or base model was modified slightly from the historic verification model to account for a detention facility currently being constructed at the outfall of High

Ditch. The detention facility characteristics were obtained from the most recent submittal to the Indiana Department of Natural Resources (IDNR). Although this detention facility is not fully functional at the current time, it is assumed that the detention facility construction would be completed shortly and before any future-condition flood control projects would be initiated. The High Ditch detention is, therefore, included in all design storm hydrologic modeling, to provide for an equal basis of evaluation between existing-condition and future-condition modeling.

The existing-condition model was executed using the design storm events described in Section 3.2.2. The critical duration at the Hamilton-Marion County border was found to be the 24-hour duration event. Existing-condition peak discharges at various locations for the 24-hour storm event are summarized in Table 4. A comparison to the flowrates used in the current regulatory hydraulic models at the same locations are presented in Table 5. A similar comparison to Coordinated Discharges at these locations is presented in Table 6.

TABLE 4
Existing-Condition Peak Discharges at Select Locations

Location Description	Peak Discharges in CFS for Various Design Storm Recurrence Intervals					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
Mud Creek at Hamilton-Madison County Border	834	1228	1515	1840	2172	2407
Mud Creek at I-69	1107	1630	2008	2439	2878	3187
Mud Creek at Sand Creek Confluence	1338	1970	2426	2949	3484	3862
Sand Creek at its mouth	663	967	1186	1434	1686	1864
Mud Creek at the 106th Street Bridge	1940	2859	3524	4281	5058	5607
Mud Creek at the 96th Street Bridge	1942	2862	3527	4287	5065	5615

TABLE 5
Comparison of Existing-Condition and Flood Insurance Study 100-year Peak Discharges at Select Locations

Location Description	100-Year Peak Discharges		
	Flood Insurance Study Discharge (CFS)	Existing-Condition Model Discharge (CFS)	Percent increase (%)
Mud Creek at Hamilton-Madison County Border	NA*	2407	NA*
Mud Creek at I-69	NA*	3187	NA*
Mud Creek at Sand Creek Confluence	1740	3862	122
Sand Creek at its mouth	990	1864	88
Mud Creek at 106th Street Bridge	2280	5607	146
Mud Creek at 96th Street Bridge	2500	5615	125

* The specified location is beyond the limits of the detailed Flood Insurance Study hydraulic model.

TABLE 6
Comparison of Existing-Condition Peak Discharges
and Coordinated Discharges at Select Locations

Location Description	100-Year Peak Discharges			
	Drainage Area (Sq. mi.)	Coordinated Discharge (CFS)	Existing-Condition Model Discharge (CFS)	Percent increase (%)
Mud Creek at Hamilton-Madison County Border	12.1	NA*	2407	NA*
Mud Creek at I-69	17.0	NA*	3187	NA*
Mud Creek at Sand Creek Confluence	26.2	1740	3862	122
Sand Creek at its mouth	11.4	975	1864	91
Mud Creek at 106th Street Bridge	37.6	2280	5607	146
Mud Creek at 96th Street Bridge	39.0	2300	5615	144

* The specified location is beyond the limits shown on the Coordinated Discharge curve, which ends at 126th Street.

From Table 5, it can be seen that the 100-year flowrates used in the regulatory hydraulic model are smaller than one-half of that predicted by the existing-condition hydrologic model for the Mud Creek mainstem, and about one-half for Sand Creek at its mouth. There are serious implications to this, as the flood protection grade for existing residential structures built adjacent to the regulatory floodplain is expected to have been based on this lower flowrate. As the regulatory flowrates were generated based on statistical analyses of the gage data, which appears to be influenced by a historic diversion path, it would appear appropriate to revisit the hydraulic modeling for all of Mud Creek and Sand Creek to evaluate the extent of impact to existing structures. However, this hydraulic reevaluation is beyond the scope of this particular study.

The extreme differences in existing-condition and Coordinated Discharges, as shown in Table 6, imply a significant need to re-coordinate, based on the results of this detailed HEC-1 study, the effective discharge-drainage area relationship for Mud Creek and Sand Creek. This recoordination would more effectively guide future development in the basin since flood elevations would be based on more refined estimates of Mud Creek and Sand Creek discharges.

From a detailed analysis of the existing-condition hydrographs, it was observed that the composite Sand Creek hydrograph at its mouth peaks before the corresponding Mud Creek mainstem hydrograph peak at that same location (24.0 verses 26.0 hours after start of the 24-hour 100-year rainfall event). Potential future-condition detention facilities should be cognizant of this timing difference between the two watersheds. Such facilities should be designed to benefit from the difference in timing of the Sand Creek and Mud Creek hydrographs, rather than exacerbating the downstream flooding problem. Representative flood hydrographs for existing-conditions are provided in Exhibit 4.

4.3 FUTURE-CONDITION OBJECTIVES

Based on a comparison of the results of the existing-condition hydrologic modeling and the regulatory hydraulic modeling, a reduction in future-condition flowrates to a level below that of existing-conditions is a justified and important objective. Ideally, the objective would be to reduce Sand Creek and Mud Creek flowrates to the levels employed in the current regulatory modeling. However, there does not appear to be sufficient open space available to construct a detention facility to meet this objective, due to the density of residential development in downstream portions of the watershed. Even if this space was available, the associated cost for such an alternative is expected to be prohibitive. Therefore, this study adopted the more realistic objective of limiting the future-condition peak flowrates to the existing-condition peak flowrates for the 10-year event at the Mud Creek crossing of the Hamilton-Marion County border (96th Street).

It should be noted that the adopted objective, noted above, is the basis for determining the required sizes of regional detention basins and evaluating the performance of various alternatives. Therefore, if the location of the reference point or the assumed level of discharge reduction is changed from the adopted values, the findings of the study would be different.

4.4 OPINION OF PROBABLE COST PROCEDURE

Conceptual opinion of probable costs for alternative future-condition flood control projects were based on estimated land acquisition costs as well as typical detention facility construction items such as earth excavation and disposal, top soil replacement, seeding and mulching, erosion control materials, low-flow control structures, and principal spillways.

Both on-line and off-line detention facilities were considered in this study. The most substantial cost items for on-line (in-channel) detention facilities will be excavation, concrete dam construction, and land acquisition. The most substantial cost items for off-line (side-channel) detention facilities will be excavation, side-weir spillway construction, and land acquisition. For the purpose of this study, an average overall cost of $15,000 per acre-foot of active detention storage space was assumed to cover all expenses associated with providing large detention facilities in the watershed. The noted unit cost was assumed based on CBBEL's experience with similar projects within the area and has a proven record of being a good preliminary cost opinion tool for large retention ponds.

A more refined cost analysis would require detailed topographic maps as well as detailed hydraulic modeling of the proposed detention facility locations, which are located outside the limits of the Flood Insurance Study hydraulic modeling for both Mud Creek and Sand Creek. Detailed hydraulic models would allow for an analysis of existing channel-storage at given elevations, as well as evaluations of upstream flooding and downstream scour impacts. For this level of study, downstream erosion control measures, such as settling basins, and upstream hydraulic impacts have been omitted from the analysis due to a lack of hydraulic modeling in the areas of concern. In summary, there are significant parameters missing to provide a more detailed cost opinion. Due to the size of facilities being considered and the associated complicating issues, a uniform rate based on storage requirements would provide a reasonable estimate for this level of study.

4.5 ALTERNATIVE 1 (NO ADDITIONAL DETENTION)

Before an evaluation of different future-condition flood control projects can be made, it is important to formulate a future-condition base model to evaluate the effects of proposed development on runoff volumes and the timing of individual hydrographs on the cumulative hydrograph at specified locations. To this end, a future-condition hydrologic model was formulated based on development of the watershed without additional detention, other than the High Ditch detention facility described in Section

4.2.2. This alternative assumes that the Hamilton County Drainage Ordinance would allow a variance of existing standards with regard to on-site detention requirement for areas within the Mud Creek Watershed. Individual site development would be allowed to be constructed with no detention facilities considered for these sites. It is assumed that developed condition flows would require improved conveyance systems (ditches and pipes) to safely discharge flows into the main stream.

The results of this analysis for various subbasins and several key locations along Mud Creek and Sand Creek are summarized in Table 7 along with the existing-condition discharges. The computer input/output for Alternative 1 hydrologic modeling can be found in Appendix 6. Graphs of representative flood hydrographs for this alternative is contained in Exhibits 5A through 5C for three key locations within the watershed. For comparison purposes, the existing-condition flood hydrograph at each location is also shown in these exhibits.

TABLE 7
Discharge Comparisons For **Alternative 1**

Subarea ID / Location	Drainage Area (sq. mi)	Existing-Condition Peak Discharge (cfs)		Future-Condition 100-year Peak Discharge for the Alternative (cfs)
		100-year	10-year	
HENRY1	1.52	297	185	297
MUD1	3.33	693	434	693
MUD2	1.37	313	201	313
KYNET1	1.14	250	159	250
KYNET2	1.15	268	171	268
MUD3	1.73	333	210	333
MUD4	1.89	429	275	429
U/S of Madison Co. Line	**12.13**	**2407**	**1515**	**2407**
TRIB1	1.72	366	233	366
TRIB2	1.10	254	163	274
MUD5	2.04	454	284	524
Mud Ck. at I-69	**17.00**	**3187**	**2008**	**3114**
MUD7	0.84	200	129	208
Mud Ck at SR238	**17.84**	**3294**	**2076**	**3197**
MUD6	1.31	282	174	320
MUD8	2.26	544	350	555
MUD9	1.67	395	253	423
HIGH1	1.29	39	18	39
MUD10	1.82	377	231	438
Mud Ck u/s of Sand Ck.	**26.19**	**3862**	**2426**	**3662**
SAND1	0.98	223	142	223
SAND2	1.55	358	228	376
Sand Ck. at 156 St.	**2.53**	**571**	**363**	**578**
SAND3	1.92	443	282	516
SAND4	1.04	239	152	270
SAND5	2.04	455	289	553
Sand Ck. at 136 St.	**7.54**	**1538**	**977**	**1637**
SAND6	2.16	510	326	575
SAND7	1.69	374	233	411
Sand Ck. at Mouth	**11.38**	**1864**	**1186**	**2047**
MUD11	1.46	313	193	358
Marion Co. Line (96th St.)	**39.03**	**5615**	**3527**	**5449**

As shown in Table 7, despite increases in 100-year peak discharges and runoff volumes for individual developing subbasins, the overall results indicate a slight decrease in 100-year peak discharge between the existing and Alternative 1 conditions at the Hamilton - Marion County border (96th Street). Based on a detailed inspection of the HEC-1 model output for this alternative (Appendix 6), this decrease in the overall peak discharge is primarily the result of differences between the timing of the peak discharge of each developing subbasin and the unaffected peak discharge from the significantly larger watershed upstream of the Hamilton - Madison County border. The noted differences in the timing of the peak discharges are also present in the existing-condition model. However, these differences are more pronounced in the Alternative 1 model because each developing subbasin would peak sooner due to a decrease in time of concentration which results from assumed development in these subbasins. Another reason for the decrease in the overall peak discharge is an increase in the time separation between the Mud Creek and Sand Creek hydrograph peaks from 2 hours (in the existing-condition) to 4 hours.

Alternative 1 involves no regional basin cost considerations and requires no construction permits, since it does not involve any proposed flood control facilities. However, this alternative is assumed to be inadequate due to the disparity in discharges between the effective regulatory hydraulic modeling values and the Alternative 1 hydrologic modeling, and the fact that it does not meet the objectives stated earlier in Section 4.3.

4.6 ALTERNATIVE 2 (ONE DETENTION BASIN)

One directive within the scope of services of this study is to evaluate the viability of the construction of a single flood control structure. In order to meet the objective at the Hamilton-Marion County border (96th Street), this detention facility must be far enough downstream to be able to offset increases in Sand Creek discharges.

Based on a preliminary hydrologic evaluation of the watershed, the proposed wet-bottom detention facility needed to achieve this objective would have to be located in an area near the State Road 238 crossing of Mud Creek (Exhibit 6) and would need to have an active storage of approximately 1,750 acre-feet. To achieve the noted 1,750 acre-feet of live flood control storage, it is estimated that in excess of 5000 acre-feet of excavation would have to be performed along the Mud Creek channel banks due to the relatively steep topography in this area. The resulting discharges for Alternative 2 are shown in Table 8. The computer input/output for Alternative 2 hydrologic modeling can be found in Appendix 8. Representative flood hydrographs for this alternative are provided in Exhibits 7A through 7C.

TABLE 8
Discharge Comparisons for **Alternative 2**

Subarea ID / Location	Drainage Area (sq. mi.)	Existing-Condition Peak Discharge (cfs)		Future-Condition 100-year Peak Discharge for the Alternative (cfs)
		100-year	10-year	
HENRY1	1.52	297	185	297
MUD1	3.33	693	434	693
MUD2	1.37	313	201	313
KYNET1	1.14	250	159	250
KYNET2	1.15	268	171	268
MUD3	1.73	333	210	333
MUD4	1.89	429	275	429
U/S of Madison Co. Line	**12.13**	**2407**	**1515**	**2407**
TRIB1	1.72	366	233	366
TRIB2	1.10	254	163	274
MUD5	2.04	454	284	524
Mud Ck. at I-69	**17.00**	**3187**	**2008**	**3114**
MUD7	0.84	200	129	208
Mud Ck at SR238	**17.84**	**3294**	**2076**	**1891**
MUD6	1.31	282	174	320
MUD8	2.26	544	350	555
MUD9	1.67	395	253	423
HIGH1	1.29	39	18	39
MUD10	1.82	377	231	438
Mud Ck u/s of Sand Ck.	**26.19**	**3862**	**2426**	**1929**
SAND1	0.98	223	142	223
SAND2	1.55	358	228	376
Sand Ck. at 156 St.	**2.53**	**571**	**363**	**578**
SAND3	1.92	443	282	516
SAND4	1.04	239	152	270
SAND5	2.04	455	289	553
Sand Ck. at 136 St.	**7.54**	**1538**	**977**	**1637**
SAND6	2.16	510	326	575
SAND7	1.69	374	233	411
Sand Ck. at Mouth	**11.38**	**1864**	**1186**	**2047**
MUD11	1.46	313	193	358
Marion Co. Line (96th St.)	**39.03**	**5615**	**3527**	**3612**

From Table 8, it can be seen that this alternative does produce results consistent with the objectives for the Mud Creek mainstem. However, the preliminary opinion of probable cost for an assumed configuration of Alternative 2 is approximately $26.25 million.

Aside from cost considerations, the main disadvantage for Alternative 2 is that it provides no flood protection directed at reducing increased discharges along Sand Creek. The on-line detention facility does, however, increase the separation between the Mud Creek and Sand Creek hydrograph peaks by delaying the Mud Creek composite hydrograph peak at the confluence point of these two streams to approximately 10 hours (compared to 2 hours in the existing-condition scenario).

The construction of the Alternative 2 detention facility would require a permit from the Indiana Department of Natural Resources for construction in a floodway. If the principle spillway and dam structure could be constructed without placing fill to construct embankments, no dam safety permits would be required for this low-head on-line dam structure. A permit from the United States Army Corps of Engineers may be required if wetland impacts are discovered in the course of design engineering data collection.

4.7 ALTERNATIVE 3 (THREE DETENTION BASINS)

This flood control option consists of constructing one regional wet-bottom, on-line detention facility on Mud Creek at a location upstream of Interstate 69 and two off-line detention facilities along Sand Creek, one near the 156th Street crossing and the other near the 136th Street crossing, to reduce discharges in both streams to levels described in Section 4.3. The general location of detention basins for this alternative is shown in Exhibit 8.

The reason for considering off-line facilities along Sand Creek was that an on-line facility along this stream would have caused a delay in the timing of peak discharge from Sand Creek at its mouth, thus placing it closer in time to the Mud Creek mainstem hydrograph peak at that location. The proposed off-line facilities, on the other hand, could be assumed to remove runoff volumes from the Sand Creek hydrograph to be discharged after the Mud Creek peak discharge had passed. Thus, the timing of the resultant Sand Creek hydrograph peak remains unaffected by these off-line detention facilities. Representative flood hydrographs for this alternative are provided in Exhibits 9A through 9C.

Based on a preliminary hydrologic evaluation of the watershed, the proposed wet-bottom regional detention facility along Mud Creek would need to have an active storage of approximately 1,200 acre-feet. The proposed off-line regional detention facilities along Sand Creek would need to have active storage capacities of approximately 310 acre-feet and 720 acre-feet, near the 156th Street and near the 136th Street, respectively. The resulting discharges for Alternative 3 are shown in Table 9. The computer input/output for Alternative 3 hydrologic modeling can be found in Appendix 9.

TABLE 9
Discharge Comparisons for **Alternative 3**

Subarea ID / Location	Drainage Area (sq. mi.)	Existing-Condition Peak Discharge (cfs)		Future-Condition 100-year Peak Discharge for the Alternative (cfs)
		100-year	10-year	
HENRY1	1.52	297	185	297
MUD1	3.33	693	434	693
MUD2	1.37	313	201	313
KYNET1	1.14	250	159	250
KYNET2	1.15	268	171	268
MUD3	1.73	333	210	333
MUD4	1.89	429	275	429
U/S of Madison Co. Line	**12.13**	**2407**	**1515**	**2407**
TRIB1	1.72	366	233	366
TRIB2	1.10	254	163	274
MUD5	2.04	454	284	524
Mud Ck. at I-69	**17.00**	**3187**	**2008**	**2289**
MUD7	0.84	200	129	208
Mud Ck at SR238	**17.84**	**3294**	**2076**	**2331**
MUD6	1.31	282	174	320
MUD8	2.26	544	350	555
MUD9	1.67	395	253	423
HIGH1	1.29	39	18	39
MUD10	1.82	377	231	438
Mud Ck u/s of Sand Ck.	**26.19**	**3862**	**2426**	**2403**
SAND1	0.98	223	142	223
SAND2	1.55	358	228	376
Sand Ck. at 156 St.	**2.53**	**571**	**363**	**123**
SAND3	1.92	443	282	516
SAND4	1.04	239	152	270
SAND5	2.04	455	289	553
Sand Ck. at 136 St.	**7.54**	**1538**	**977**	**423**
SAND6	2.16	510	326	575
SAND7	1.69	374	233	411
Sand Ck. at Mouth	**11.38**	**1864**	**1186**	**1267**
MUD11	1.46	313	193	358
Marion Co. Line (96th St.)	**39.03**	**5615**	**3527**	**3391**

From Table 9, it can be seen that this alternative does produce results consistent with the objectives for both the Mud Creek mainstem and Sand Creek. However, the preliminary opinion of probable cost for Alternative 3 is approximately $33.5 million, making the economic feasibility of this alternative questionable.

The construction of each Alternative 3 detention facility would require a permit from the Indiana Department of Natural Resources for construction in a floodway. If the principle spillway and dam structure for the Mud Creek on-line facility could be constructed without placing fill to construct embankments, no dam safety permits would be required for this low-head on-line dam structure. The off-line facilities on Sand Creek will more than likely not require dam safety permits. Permits from the United States Army Corps of Engineers may be required if wetland impacts are discovered in the course of design engineering data collection.

4.8 ALTERNATIVE 4 (PROJECT-SPECIFIC ON-SITE DETENTION)

The current Hamilton County Drainage Ordinance requires, among other things, that an individual site reduce the 100-year future-condition peak discharge to the level experienced for a 10-year event for existing-conditions. the 10-year future-condition peak discharges are required to be lowered to the 2-year flowrates in existing conditions. To simulate this condition of many detention facilities, each detaining a project-specific amount of site runoff, it was assumed that project-specific site detention would mimic the results of providing one detention pond for each subbasin. Fourteen (14) detention facilities were added to the Alternative 1 hydrologic model, one for each developing subbasin (Exhibit 10). Based on storing the volume of runoff between the existing-condition 10-year storm and the future-condition 100-year storm, the total detention volume in the model is about 1,700 acre-feet (excluding the detention provided in the High Ditch facility, which is common to all alternatives).

The results of the Alternative 4 hydrologic analysis are summarized in Table 10. Alternative 4 involves no direct cost to the County, and does not require the County to seek permits, as these issues would be addressed by the individual developers. Also, as Table 10 indicates, Alternative 4 is very effective in addressing the increased runoff in each of the developing subbasins. However, the results as shown in Table 10 indicate that not only is this alternative not effective in meeting the objectives described in Section 4.3, but causes an increase in peak discharges along downstream reaches in comparison to providing no additional detention along Mud Creek (Alternative 1).

TABLE 10
Discharge Comparisons for **Alternative 4**

Subarea ID / Location	Drainage Area (sq. mi.)	Existing-Condition Peak Discharge (cfs)		Future-Condition 100-year Peak Discharge for the Alternative (cfs)
		100-year	10-year	
HENRY1	1.52	297	185	297
MUD1	3.33	693	434	693
MUD2	1.37	313	201	313
KYNET1	1.14	250	159	250
KYNET2	1.15	268	171	268
MUD3	1.73	333	210	333
MUD4	1.89	429	275	429
U/S of Madison Co. Line	**12.13**	**2407**	**1515**	**2407**
TRIB1	1.72	366	233	366
TRIB2	1.10	254	163	160
MUD5	2.04	454	284	281
Mud Ck. at I-69	**17.00**	**3187**	**2008**	**3193**
MUD7	0.84	200	129	128
Mud Ck at SR238	**17.84**	**3294**	**2076**	**3315**
MUD6	1.31	282	174	172
MUD8	2.26	544	350	345
MUD9	1.67	395	253	250
HIGH1	1.29	39	18	39
MUD10	1.82	377	231	229
Mud Ck u/s of Sand Ck.	**26.19**	**3862**	**2426**	**4205**
SAND1	0.98	223	142	223
SAND2	1.55	358	228	227
Sand Ck. at 156 St.	**2.53**	**571**	**363**	**449**
SAND3	1.92	443	282	279
SAND4	1.04	239	152	150
SAND5	2.04	455	289	286
Sand Ck. at 136 St.	**7.54**	**1538**	**977**	**1156**
SAND6	2.16	510	326	322
SAND7	1.69	374	233	230
Sand Ck. at Mouth	**11.38**	**1864**	**1186**	**1611**
MUD11	1.46	313	193	191
Marion Co. Line (96th St.)	**39.03**	**5615**	**3527**	**5913**

At the Sand Creek confluence, the time at which the Sand Creek and upstream Mud Creek hydrographs meet would nearly coincide for Alternative 4. Although additional on-site detention facilities in the Sand Creek watershed reduce the Sand Creek peak discharges to desired levels, these facilities cause the composite Sand Creek flood hydrograph to peak considerably later, resulting in coincident peaks with the Mud Creek mainstem hydrograph. Representative flood hydrographs for this alternative are provided in Exhibits 11A through 11C. The computer input/output for Alternative 4 hydrologic modeling can be found in Appendix 10.

As can be seen from Table 10, the mainstem Mud Creek peak discharges upstream of its confluence with Sand Creek is also expected to increase as a result of providing on-site detention in each individual developing Mud Creek subbasin. Again, this can be attributed to time delays caused by additional on-site detention basins to be located in Mud Creek subbasins upstream of the Sand Creek confluence. The noted time delays appear to result in coincident peaks between the flood hydrographs of these subbasins and the Mud Creek hydrograph generated upstream of the Madison County - Hamilton County border.

Comparison of the resultant peak discharges of this alternative (providing project-specific on-site detention) and alternative 2 (constructing one major regional detention basin) appears to lead to an interesting conclusion. Despite the fact that the total amount of provided storage is nearly the same between the two alternatives, the effectiveness of these alternatives in reducing the mainstem Mud Creek peak discharges is drastically different. This conclusion highlights the importance of comprehensive watershed analysis as a necessary decision-making tool.

It is important to note that the results obtained for this alternative are valid for a time horizon in future when all individual subbasins would reach their fully-developed stage at the same time. In reality, the noted "completely built-out" condition would occur gradually, perhaps in a 20-year time span. In addition, it should be noted that the results assumed, based on available future-condition land use plans, no development within the Madison County portion of the watershed. If the noted portion of the watershed were to experience development rates similar to the Hamilton County area, the results and conclusions for this alternative may change due to several factors, including the hydrograph timing issues pointed out earlier. The results of analysis presented for Alternative 4 should, therefore, be viewed as the worst-case scenario that may be expected for this alternative.

5.0 SUMMARY

5.1 INTRODUCTION

This study was performed to evaluate flood control management methods within the Mud Creek watershed within Hamilton County, Indiana. A detailed hydrologic model was formulated, which indicated significantly higher flowrates than the peak discharges now used to regulate development along Mud Creek and Sand Creek. As these differences appear to be well-founded (based on historic storm event verification) four (4) alternative flood control scenarios were evaluated in comparison to the existing-conditions. This chapter is intended to summarize the results of the hydrologic analyses performed, and to present recommendations based on the results of these hydrologic analyses.

5.2 CONCLUSIONS

Several major conclusions can be reached from the results of this study. These conclusions are listed below.

1. The flowrates presently being used by State and Federal regulatory agencies for the watershed do not appear to be accurate estimates of potential existing-condition discharges. The current Mud Creek and Sand Creek regulatory discharges are based on statistical analyses of a former USGS gaging station and did not account for historic cross-watershed diversion.

2. A continuation of the detention methods required by the current Hamilton County Drainage Ordinance, while effective in regulating discharges on a smaller scale (especially downstream of on-site detention facilities), could cause increased peak discharges for the watershed as a whole due to peak discharge timing issues.

3. The Sand Creek flood hydrograph at its confluence reaches a peak sooner than the upstream Mud Creek mainstem at this location. Any potential flood control management option should seek to maintain or increase this difference in the timing of peak discharges.

4. It may be possible, but very costly, to construct one central, regional detention facility on Mud Creek with a live-storage volume similar to that which would be required for several project-specific on-site detention facilities. Such a regional

facility would be much more effective in reducing peak discharges for extreme rainfall events along Mud Creek.

5. Reasonable reduction of future-condition 100-year peak flowrates to 10-year existing-condition levels is possible through construction of three (3) regional detention facilities along Mud Creek and Sand Creek. However, the preliminary opinion of probable cost for such facilities is approximately $33.5 million, making the economical feasibility of this alternative questionable.

6. Due to lack of needed detailed topographic and hydraulic data and the complexity of issues involved, it is not possible to accurately determine the configurations or costs of various potential alternatives at this phase of the study. Considering the magnitude of probable costs involved, a detailed feasibility-level study is needed before recommendations can be made regarding alternative locations, configurations, or details of desirable amenities involved with proposed facilities.

5.3 RECOMMENDATIONS

Based on the results of this study, several recommendations may be made. These recommendations can be grouped into two categories. The first group of recommendations (1 and 2) attempt to address issues involved with the somewhat unexpected findings regarding the inaccuracy of regulatory flowrates, as they exist today. The second group (recommendations 3 and 4) attempt to address study findings with regards to feasibility and effectiveness of regional detention facilities.

The following recommendations attempt to address the study findings with regards to the inaccuracy of effective regulatory discharges.

1. Due to the differences between the current regulatory discharges and those produced by the existing-condition hydrologic model, the results of this study should be provided to IDNR requesting revisions to Coordinated Discharge curves for Mud Creek and Sand Creek.

2. Using the revised Coordinated Discharge curves, a comprehensive hydraulic analysis/FIS restudy should be performed for the entire lengths of Mud Creek and Sand Creek within Hamilton County to verify or correctly determine existing flood hazard areas.

It should be noted that the results of the updated hydraulic analyses described above may indicate no substantial increase in the extent of flood hazard areas, despite increased discharges. If this were the case, however unlikely, the County would be left with a decision as to whether additional flood control measures are required along Mud and Sand Creeks at this time.

The following recommendations attempt to address the findings of this study with regards to effectiveness and feasibility of regional detention basins in the watershed.

3. Once the regulatory discharges and flood profiles have been revised (providing a more accurate description on the extent and nature of flood damages), the County should initiate a comprehensive feasibility-level study. This study should evaluate, based on a new detailed topographic mapping, a wider array of flood control options. These options may include such measures as restoration of the historic Geist Reservoir diversion path (or constructing an equivalent diversion path), channel improvements, replacement of restrictive bridges, and regional detention facilities.

   The proposed feasibility study should include a detailed damage-frequency analysis to optimize the appropriate level of flood protection and economic analysis for optimizing the configuration and locations of proposed detention facilities. As a result of the recommended analyses, the performance criteria for various alternatives would be based on protecting existing as well as proposed property/infrastructure as opposed to an arbitrary performance goal, such as a 10-year discharge at a point.

   This study should also include a detailed evaluation of existing diversion paths, such as those noted in Section 3.2.5, to ensure that such potential diversion paths are not blocked in the future. Economic implications should be addressed at the feasibility study level with a plan to distribute flood protection costs to the beneficiaries of the protection provided.

4. Once additional information that can provide further details about the potential locations for regional facilities become available, additional evaluation of regional basin functions would be warranted. Each of the regional ponds would likely incorporate the multi-functional amenities desired for such a facility. Each facility should incorporate the benefits inherent with uses such as parks, environmental mitigation/enhancement, and erosion control basins.

Each basin could incorporate water use as a recreational/parks benefit without jeopardizing the resultant flood control benefits. In the case of Mud Creek, it is very likely that the subject parcel would be in excess of 100 acres in size, lending itself for a County park site, if desired. In several of the examined scenarios, significant excavation and disposal of excess material could allow a park plan to incorporate desired topographic features.

The Mud Creek watershed consists of scattered regulatory wetlands and a stream corridor of significant environmental value. Depending on facility design, mitigation may be necessary to construct the basin and appurtenances. It may also be of value to the County to enhance the environmental quality of the site, to encourage public use of the area or to facilitate approval by federal or state permitting agencies.

Erosion control elements may also need to be incorporated into the final design to improve the general water quality of the stream and to extend the effective design life of the regional basin. Since much of the watershed in currently agriculture, efforts to promote best management practices for erosion control are beneficial and should be supported by the County. In addition, efforts to promote erosion control within new developments would also benefit the potential life of the facility. The design of the basin should incorporate a means of controlling erosion into the basin and means for maintaining the erosion control feature.

Addressing more specific issues relating to the other multi-functional uses of the facility would be impractical until further investigation of the selected site and flood control benefits could be ascertained. However, these issues warrant further investigation when the next phase is pursued by the County.

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- Lapel - Created 1967, Minor Revisions 1994.
- McCordsville - Created 1962, Revised 1981, Photoinspected 1984.
- Riverwood - Created 1969, Photorevised 1988, Minor Revisions 1994.

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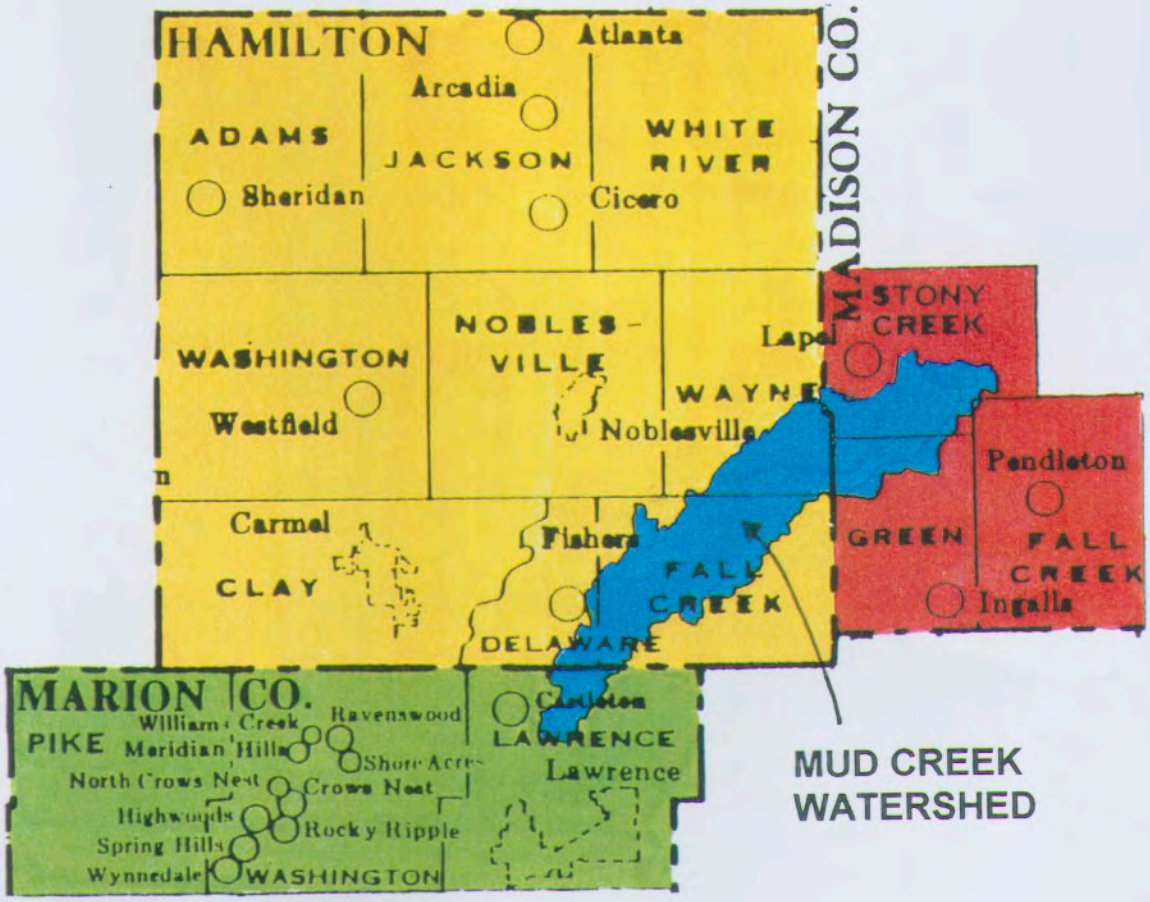
Town of Fishers Subdivision Map, 1996.



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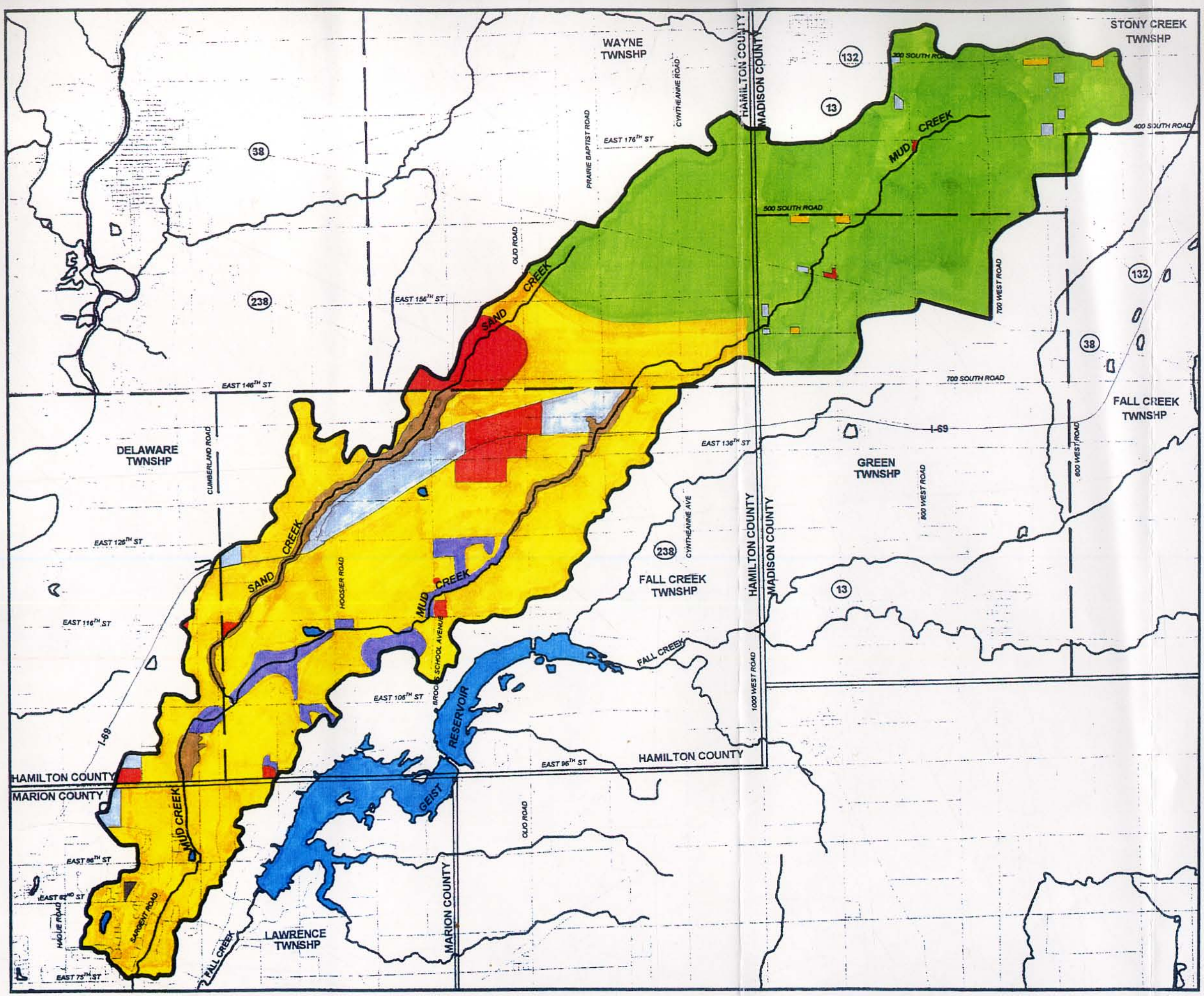
CLIENT: HAMILTON COUNTY DRAINAGE BOARD	PROJECT No. 96-297	APPROX. SCALE: N / A
TITLE: LOCATION MAP		DATE: 01/97
		EXHIBIT 1



LEGEND

- County Boundary
- Township Boundary
- Watershed Boundary
- Agriculture
- Commercial
- Flood Zone
- Industrial
- Open Space / Golf Course / Park
- Residential

Sources Used

1990 Hamilton County Comprehensive Plan
1992 Hamilton County Parks and Recreation Master Plan
1995 Marion County Zoning Base Maps 6B, 6D, 7A, 7C
1996 Madison County Zoning Maps
1996 Town of Fishers Subdivision Map
1996 Town of Fishers Future Land Use Map
City of Noblesville Zoning Maps

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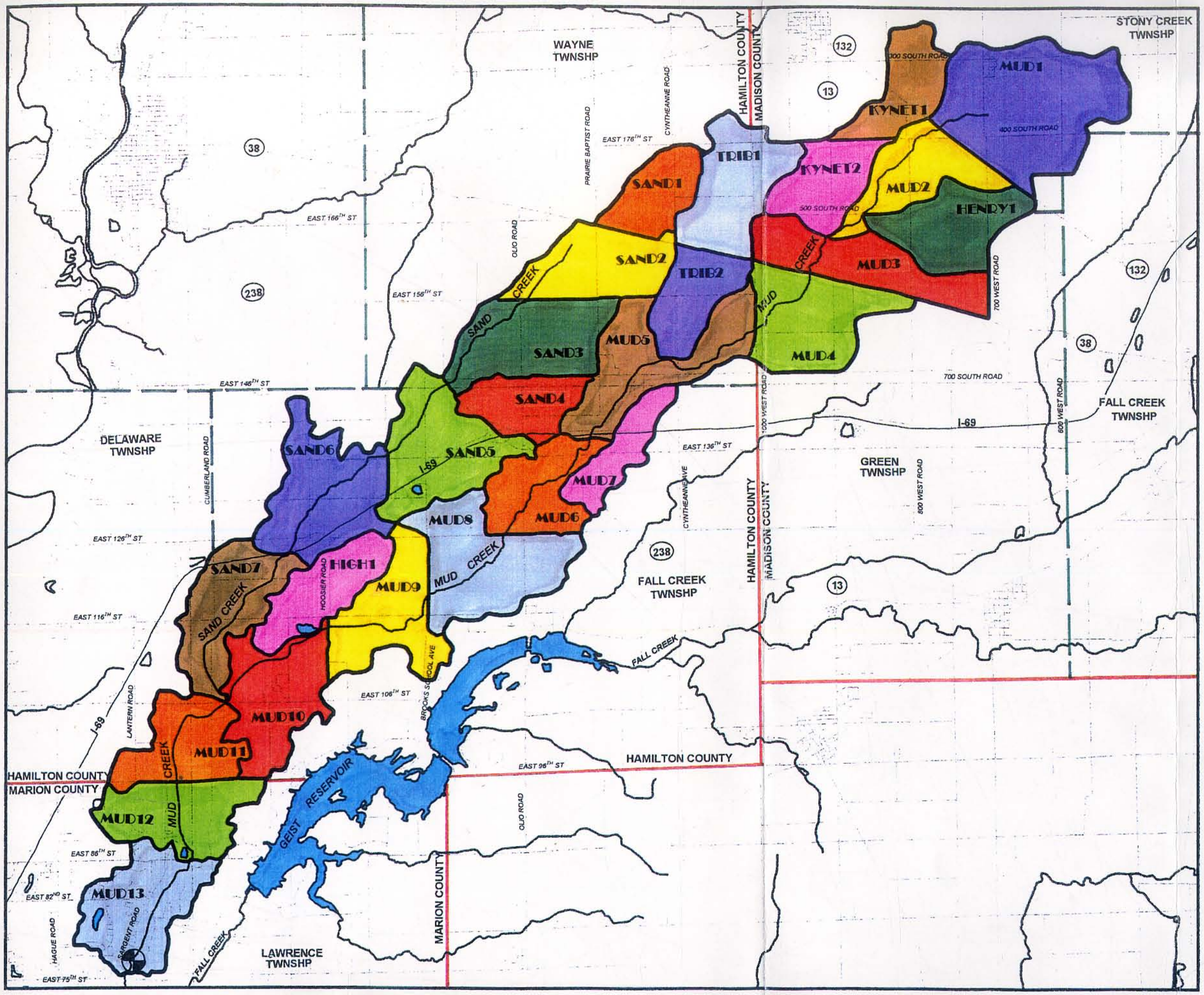
PROJECT:	PROJECT NO.	APPROX. SCALE:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY	96-297	1 : 80,000
TITLE: FUTURE LAND USE		DATE: 01/97
		EXHIBIT 2



LEGEND

- County Boundary
- Township Boundary
- Sub-Basin Boundary
- MUD7 — Sub-Basin Name
- Abandoned USGS Gaging Station

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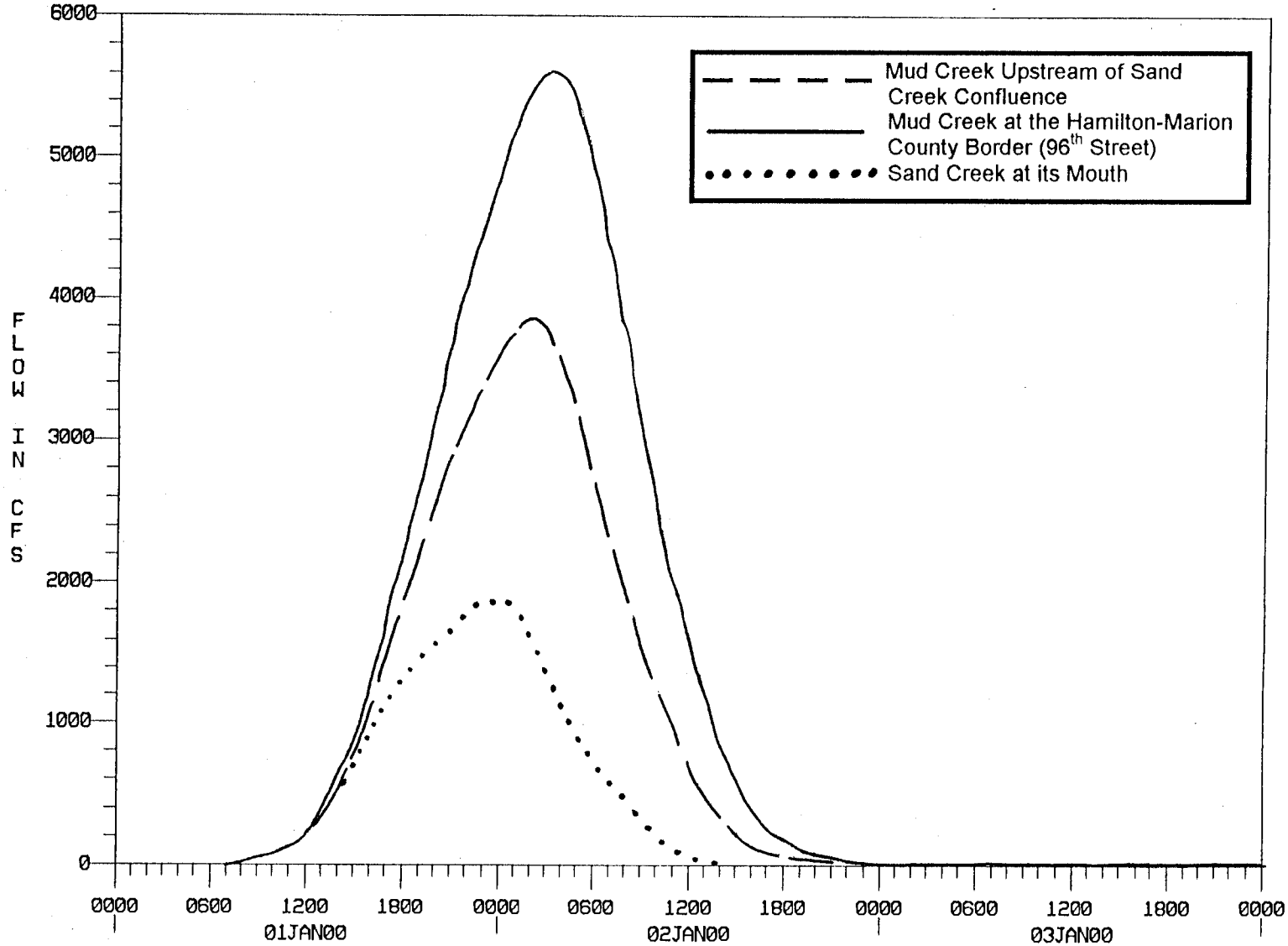
PROJECT:	PROJECT NO.	APPROX. SCALE:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY	96-297	1 : 80,000
TITLE:		DATE: 01/97
SUBBASIN IDENTIFICATION		EXHIBIT 3



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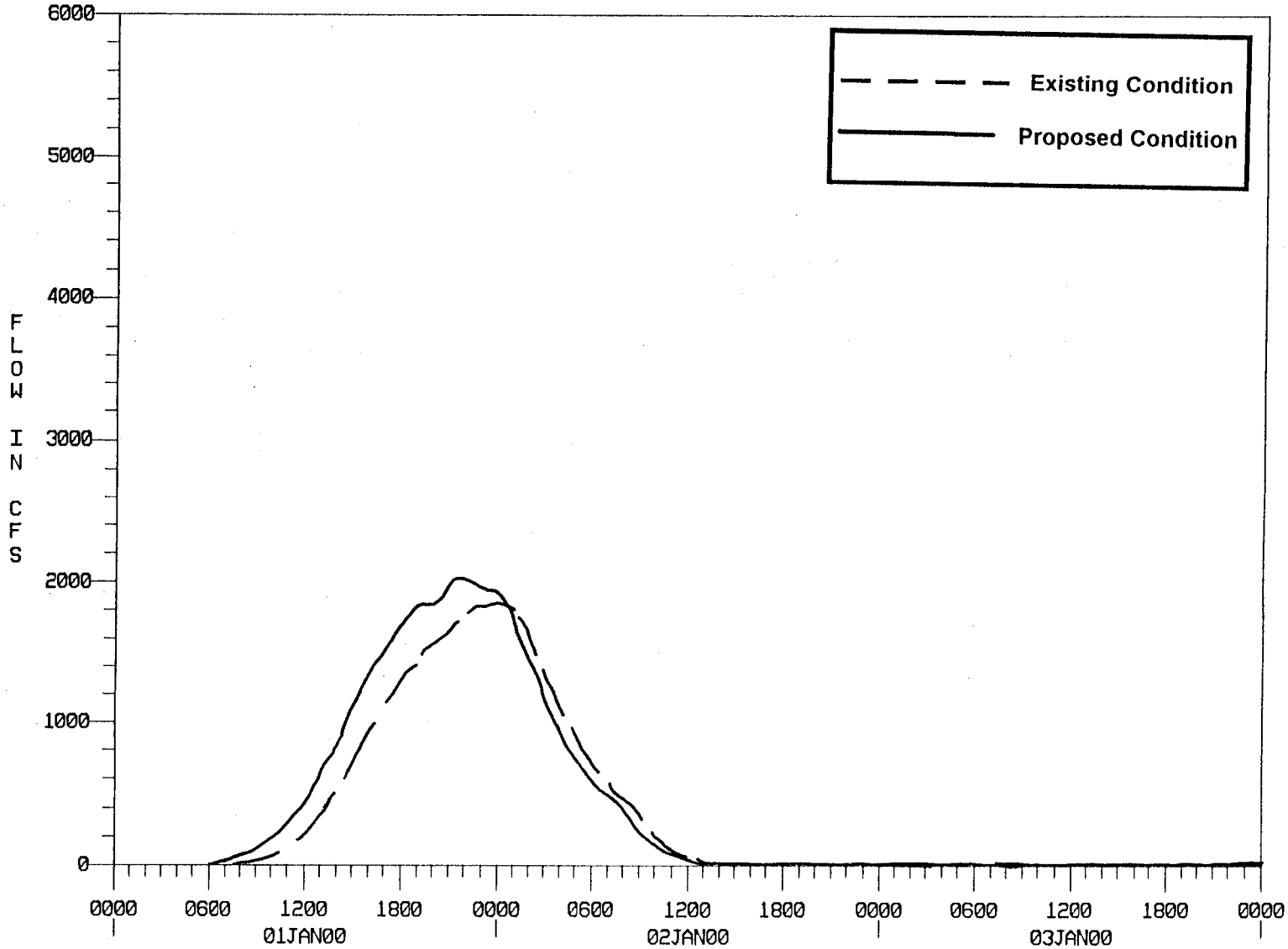
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
EXISTING CONDITION FLOOD HYDROGRAPHS

DATE: 02/97

EXHIBIT 4



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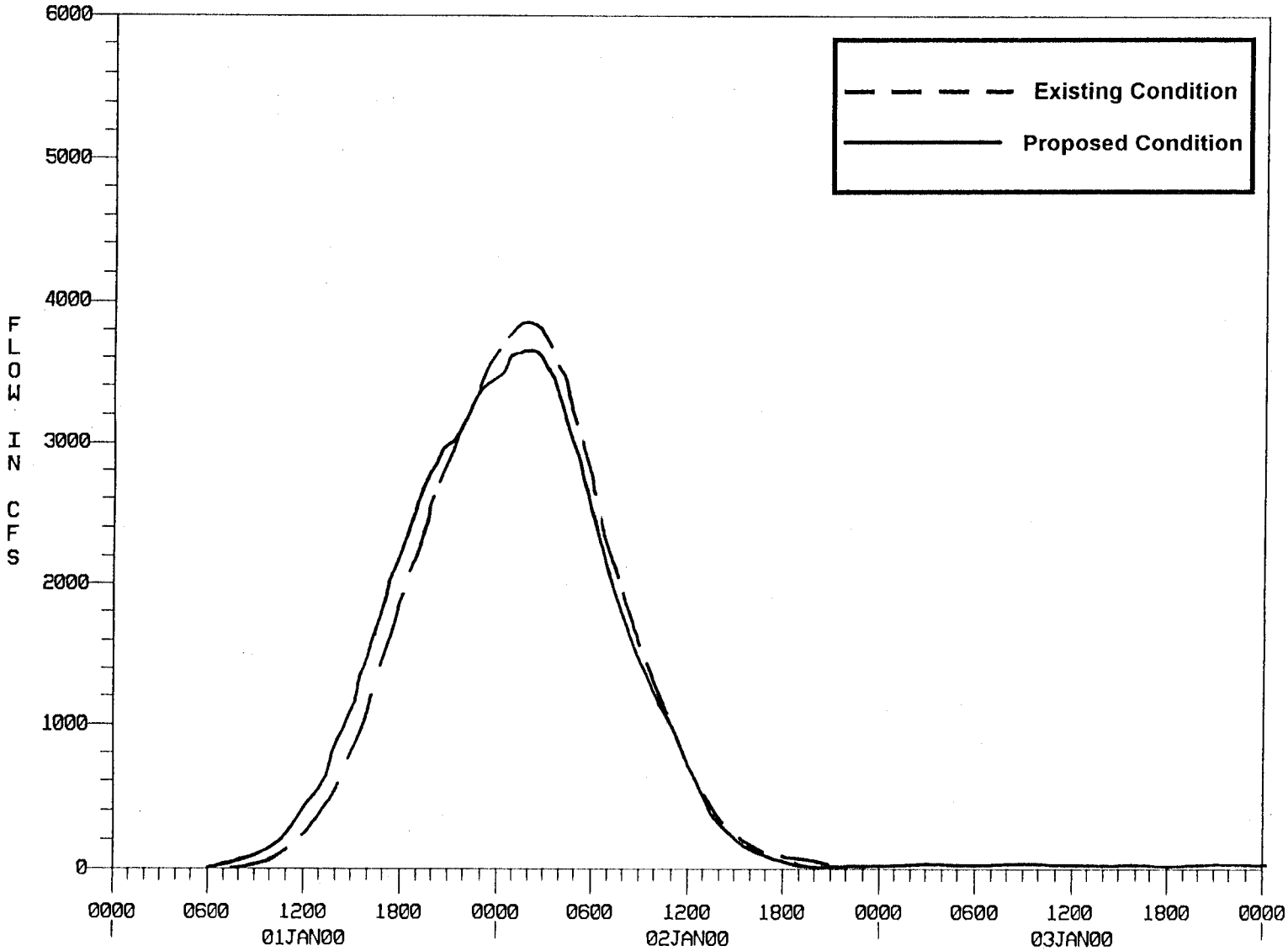
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 1 FLOOD HYDROGRAPH FOR SAND CREEK AT ITS MOUTH

DATE: 02/97

EXHIBIT 5A



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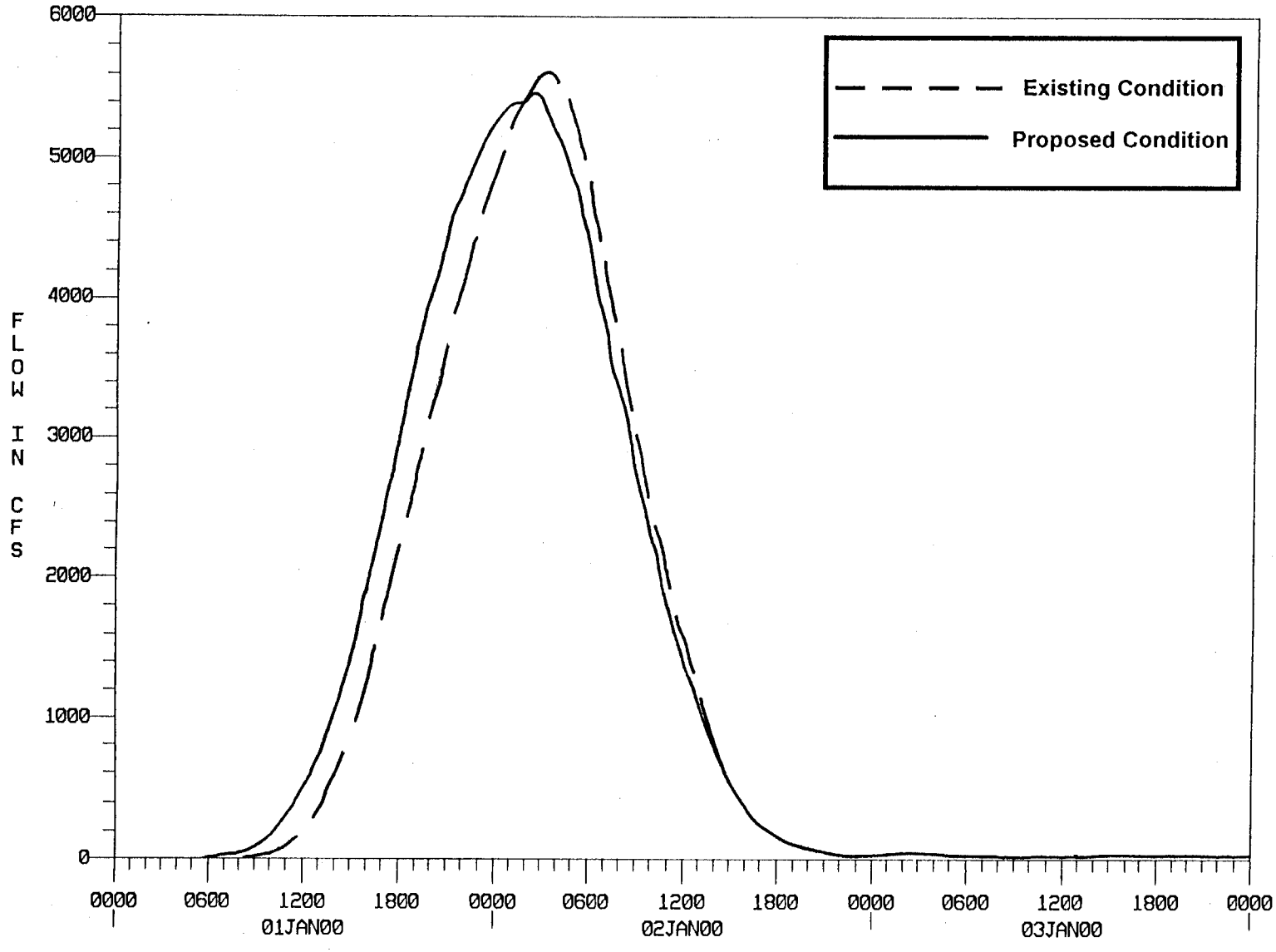
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 1 FLOOD HYDROGRAPH FOR MUD CREEK UPSTREAM OF SAND CREEK CONFLUENCE

DATE: 02/97

EXHIBIT 5B



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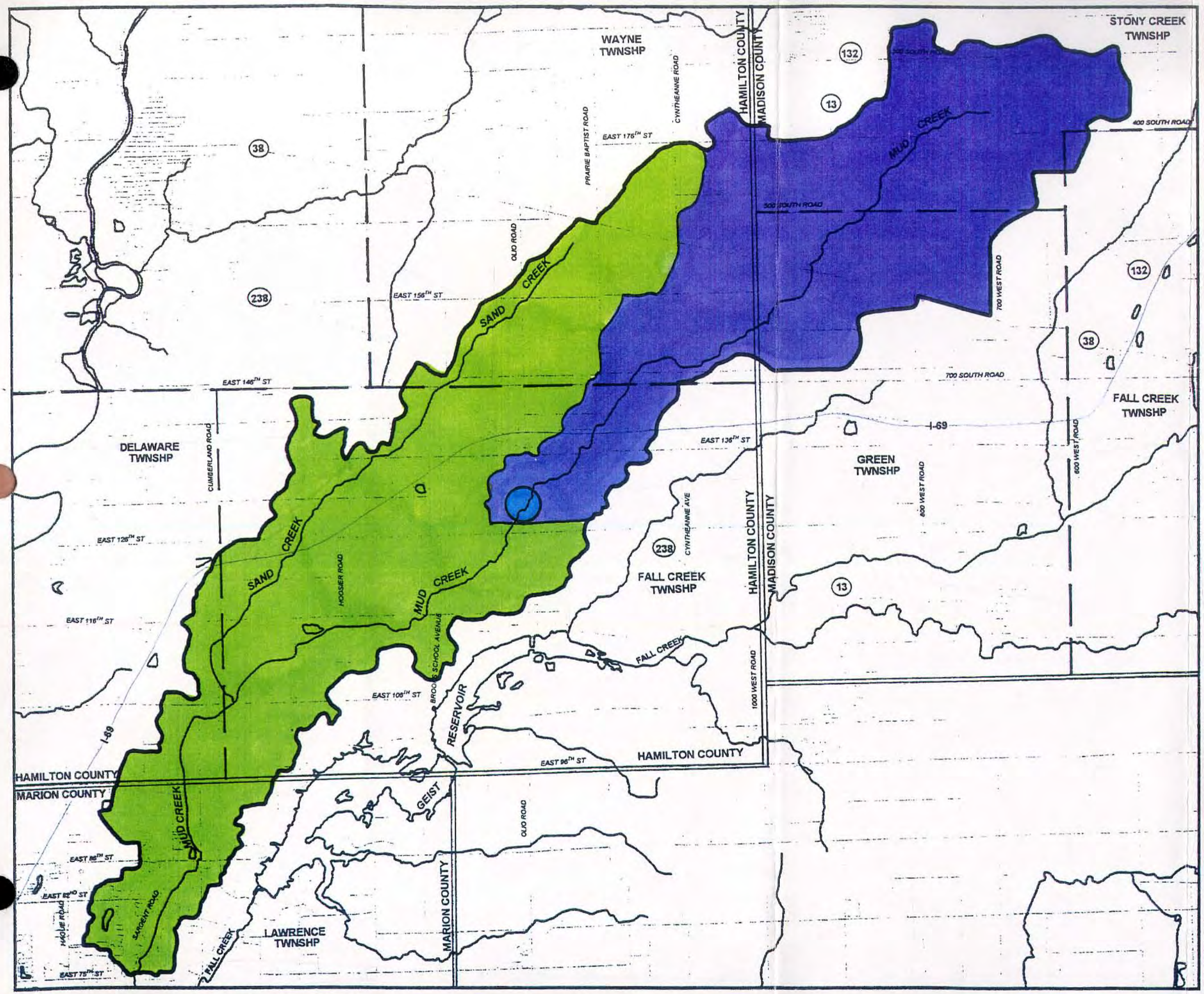
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 1 FLOOD HYDROGRAPH FOR MUD CREEK AT THE HAMILTON-MARION COUNTY BORDER (96TH STREET)

DATE: 02/97

EXHIBIT 5C



LEGEND

- County Boundary
- Township Boundary
- Watershed Boundary
- Detention Facility Contributing Area
- Subbasins Downstream of Detention Faciltiy
- General Location of Proposed Detention Facility

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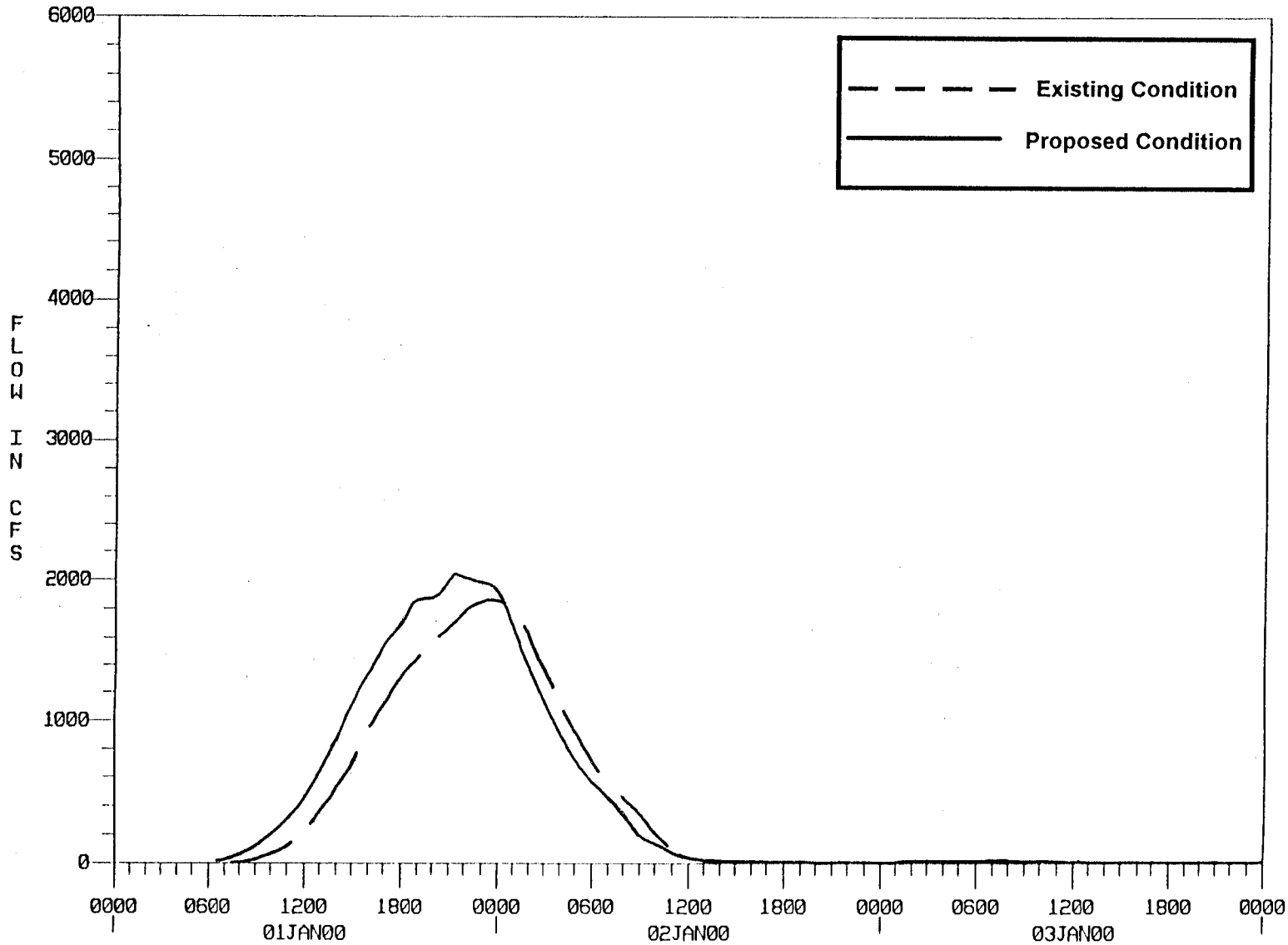
PROJECT:	PROJECT NO.	APPROX. SCALE:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY	96-297	1 : 80,000
TITLE: GENERAL LOCATION OF PROPOSED REGIONAL DETENTION FACILITY FOR ALTERNATIVE 2		DATE: 01/97
		EXHIBIT 6



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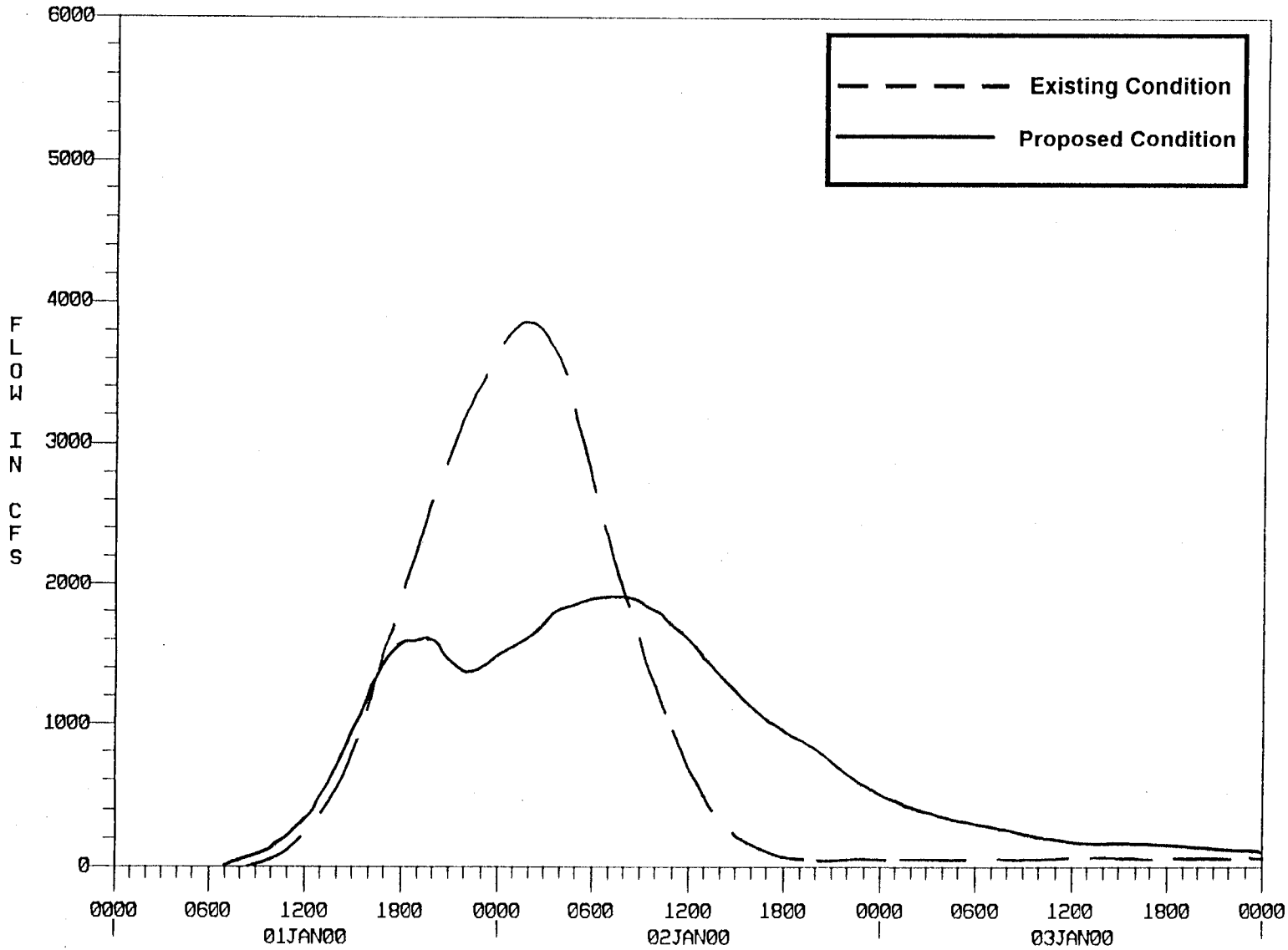
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 2 FLOOD HYDROGRAPH FOR SAND CREEK AT ITS MOUTH

DATE: 02/97

EXHIBIT 7A



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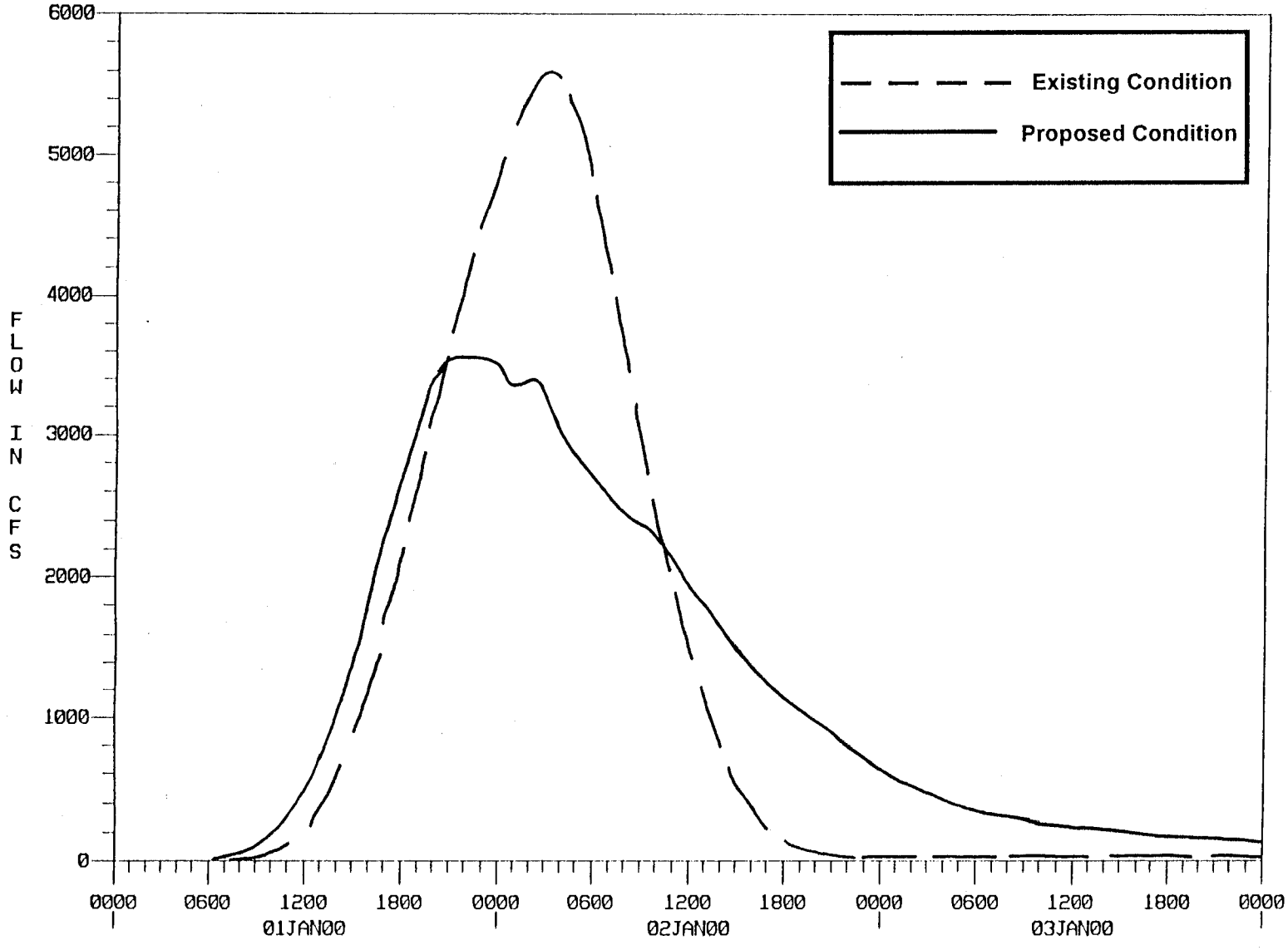
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 2 FLOOD HYDROGRAPH FOR MUD CREEK UPSTREAM OF SAND CREEK CONFLUENCE

DATE: 02/97

EXHIBIT 7B



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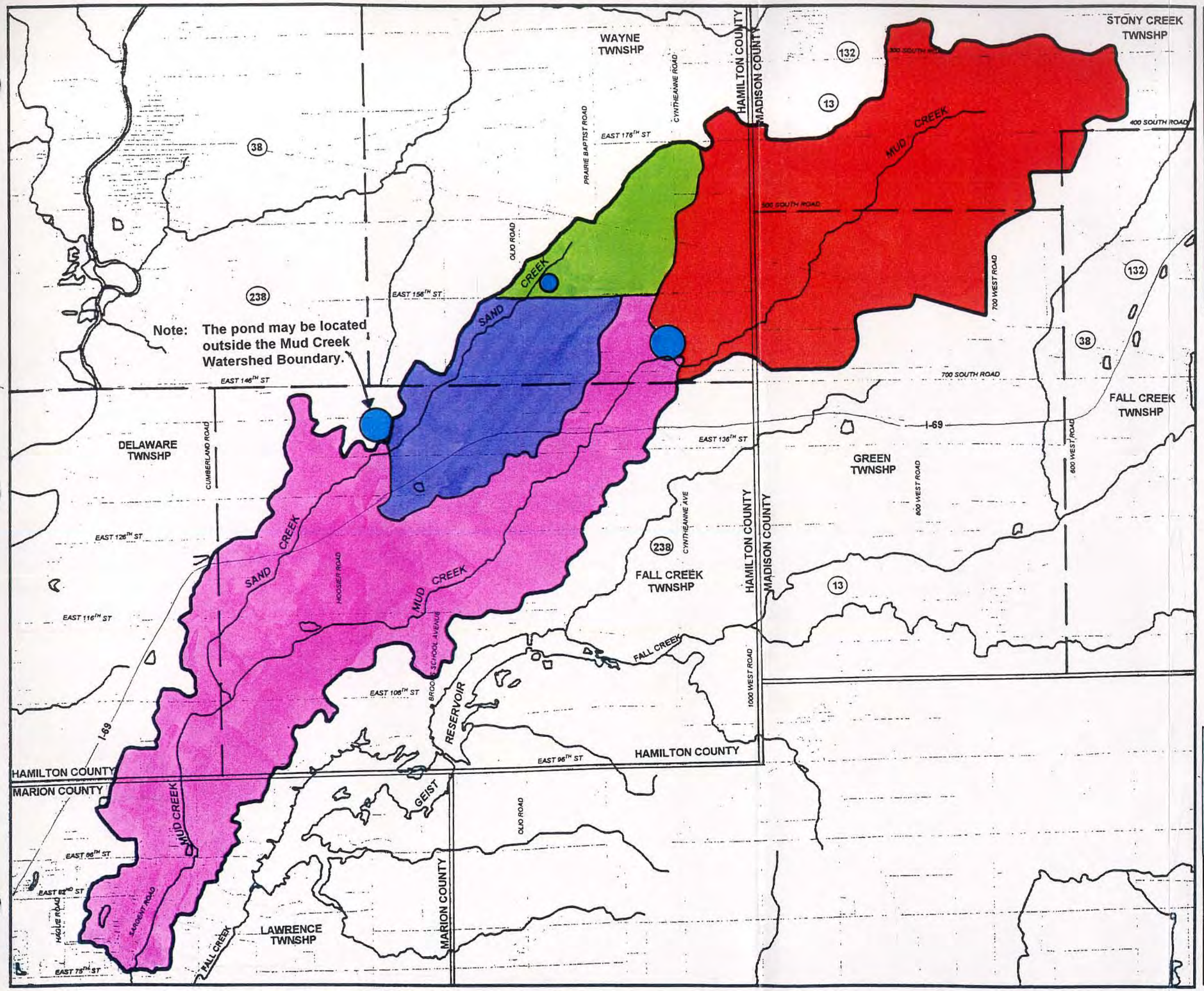
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 2 FLOOD HYDROGRAPH FOR MUD CREEK AT THE HAMILTON-MARION COUNTY BORDER (96TH STREET)

DATE: 02/97

EXHIBIT 7C



LEGEND

- County Boundary
- Township Boundary
- Watershed Boundary
- Detention Facilities' Contributing Areas
- Subbasins Downstream of Detention Facilities
- General Locations of Proposed Detention Facilities

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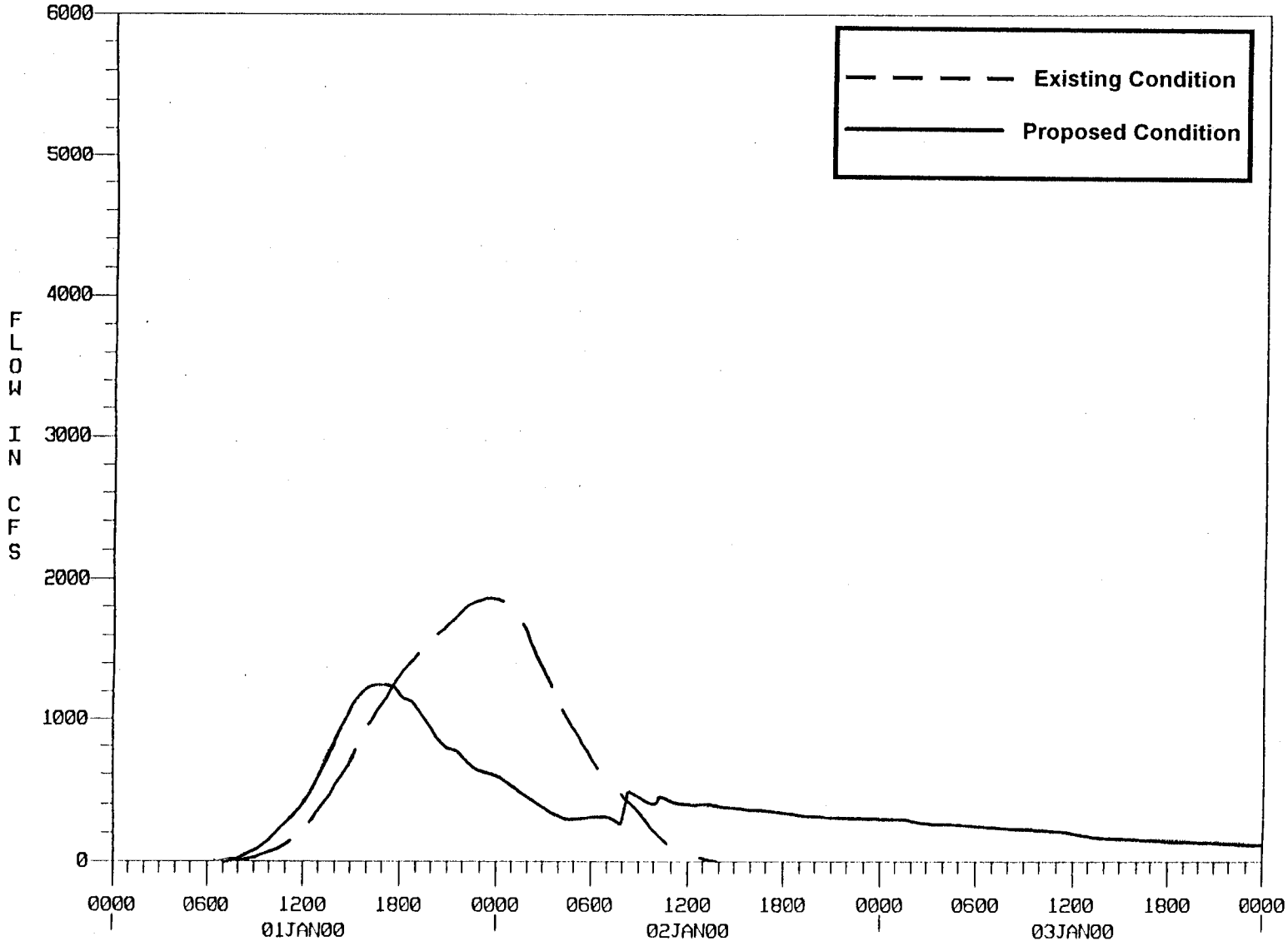
PROJECT:	PROJECT NO.	APPROX. SCALE:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY	96-297	1 : 80,000
TITLE: GENERAL LOCATION OF PROPOSED REGIONAL DETENTION FACILITIES FOR ALTERNATIVE 3		DATE: 01/97
		EXHIBIT 8



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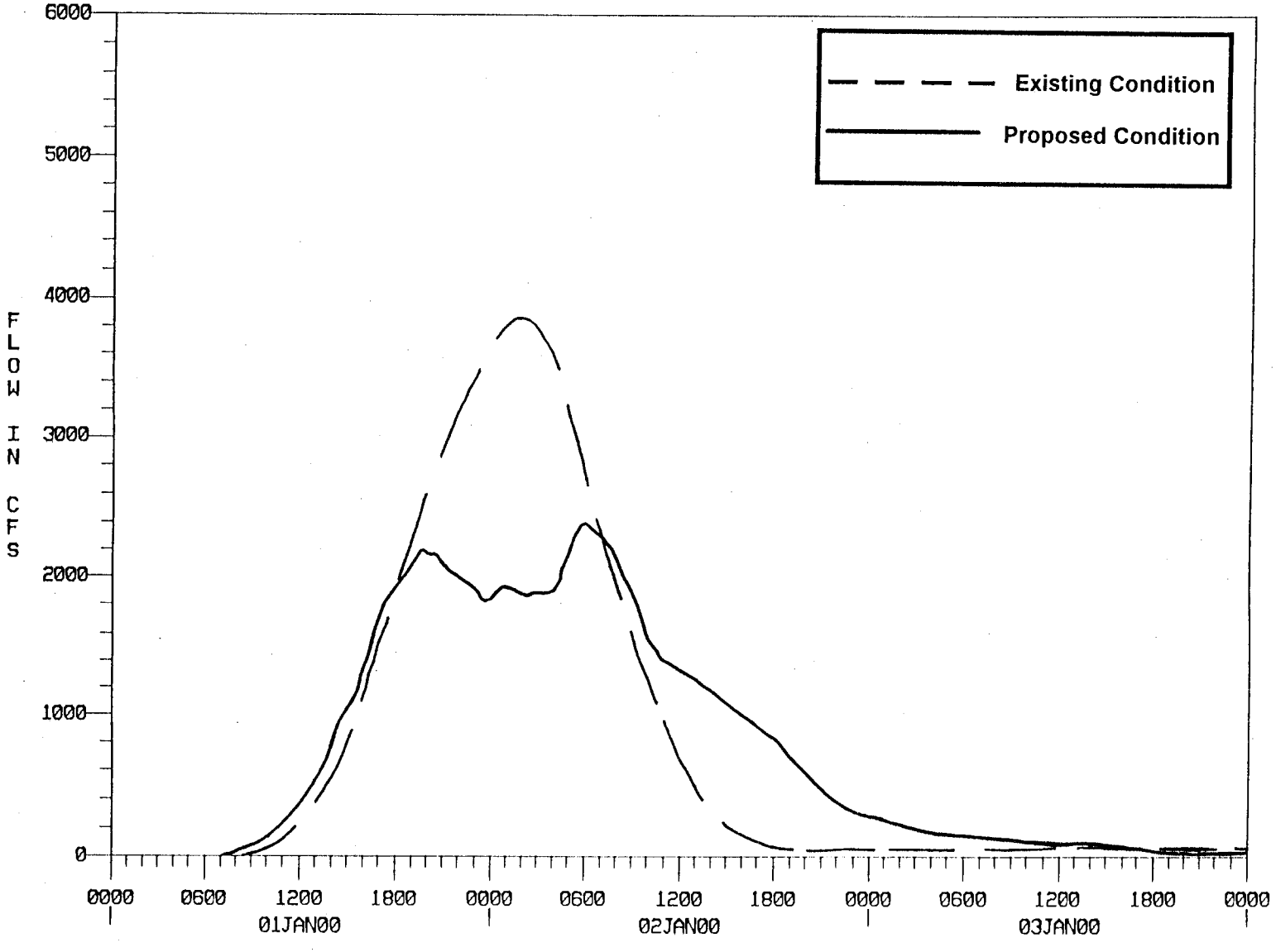
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 3 FLOOD HYDROGRAPH FOR SAND CREEK AT ITS MOUTH

DATE: 02/97

EXHIBIT 9A



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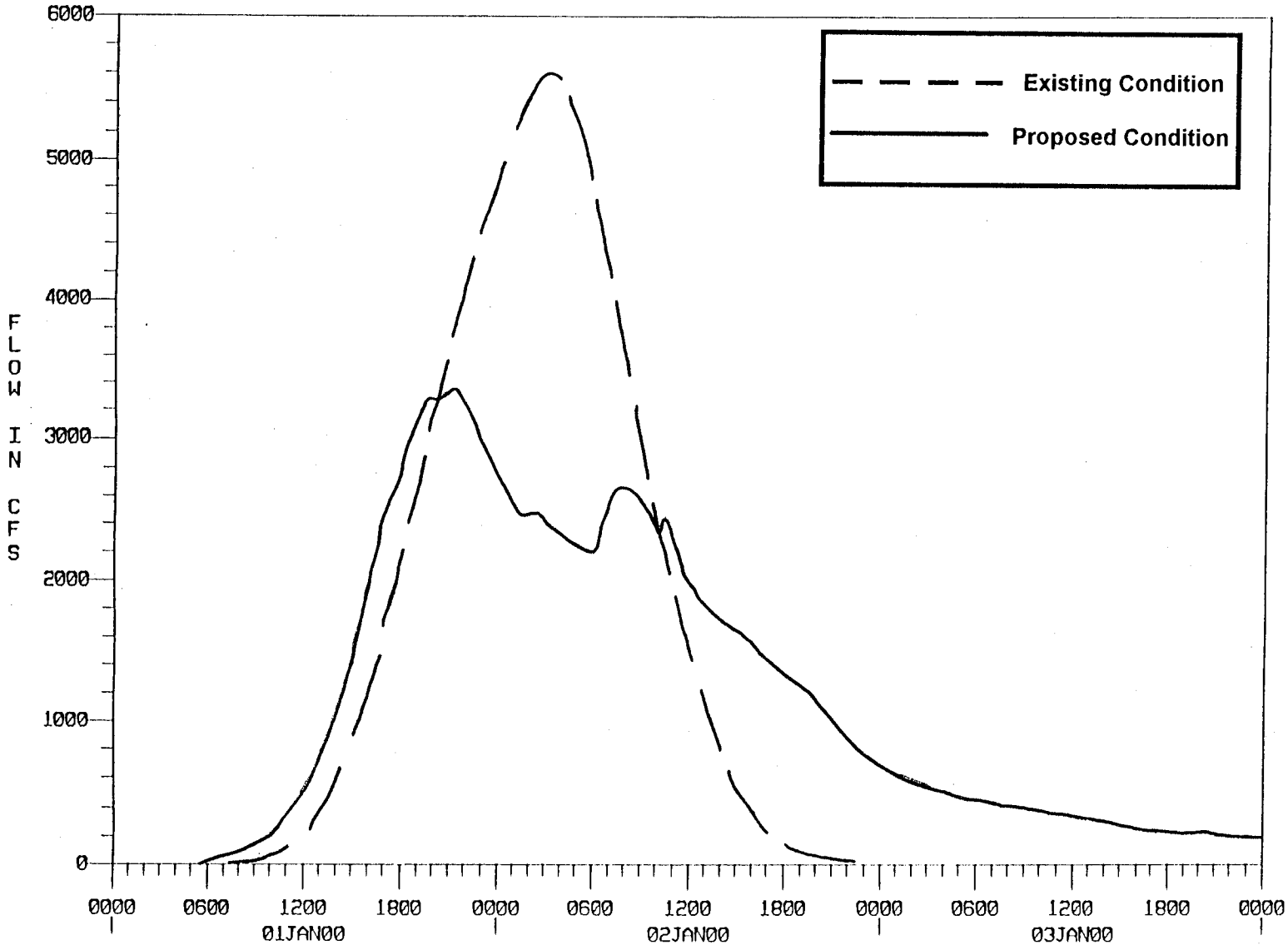
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 3 FLOOD HYDROGRAPH FOR MUD CREEK UPSTREAM OF SAND CREEK CONFLUENCE

DATE: 02/97

EXHIBIT 9B



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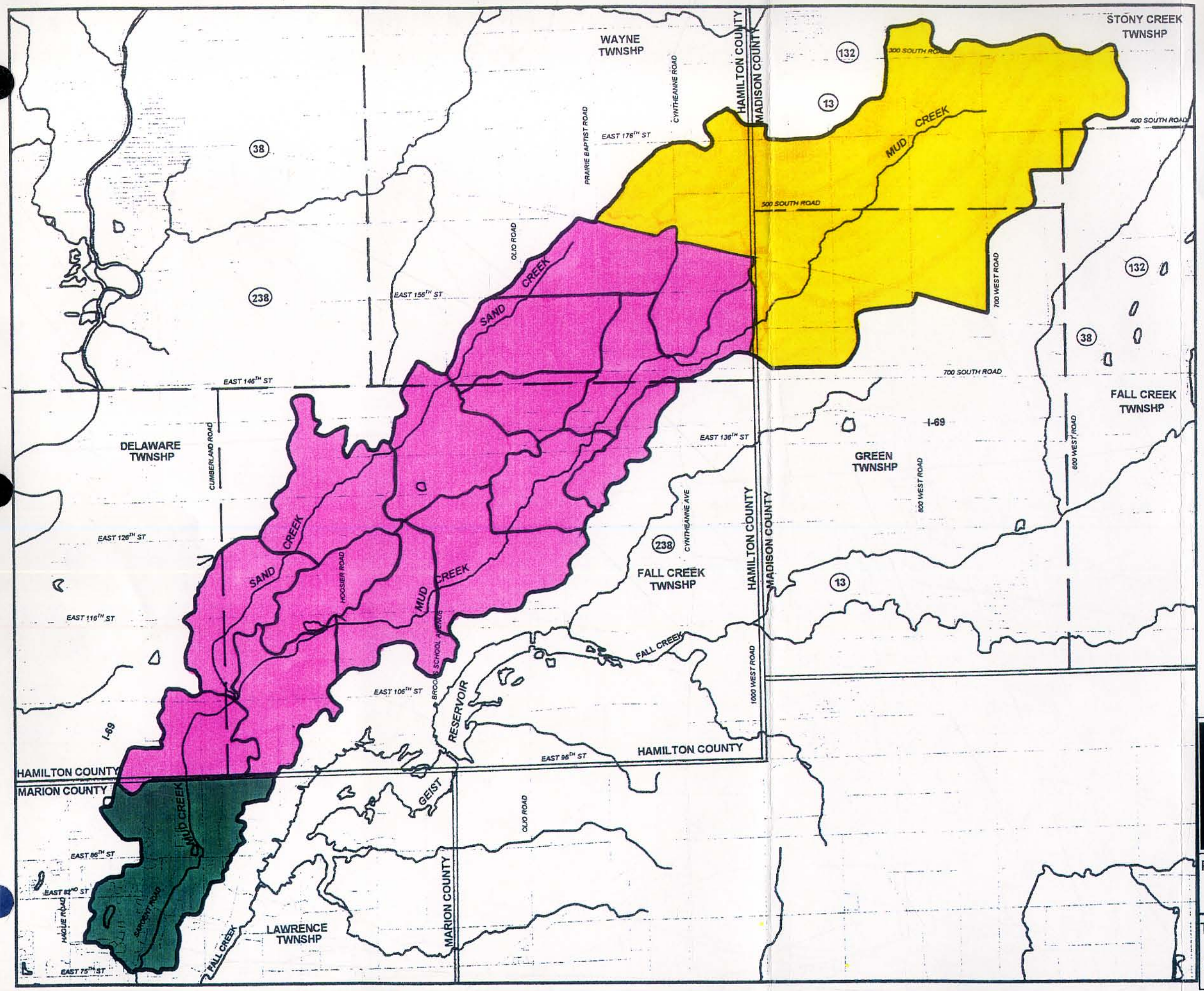
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 3 FLOOD HYDROGRAPH FOR MUD CREEK AT THE HAMILTON-MARION COUNTY BORDER (96TH STREET)

DATE: 02/97

EXHIBIT 9C



LEGEND

- County Boundary
- Township Boundary
- Watershed Boundary
- Areas of Minimal Development
- Fully-Developed Areas
- Subbasins where additional detention was considered

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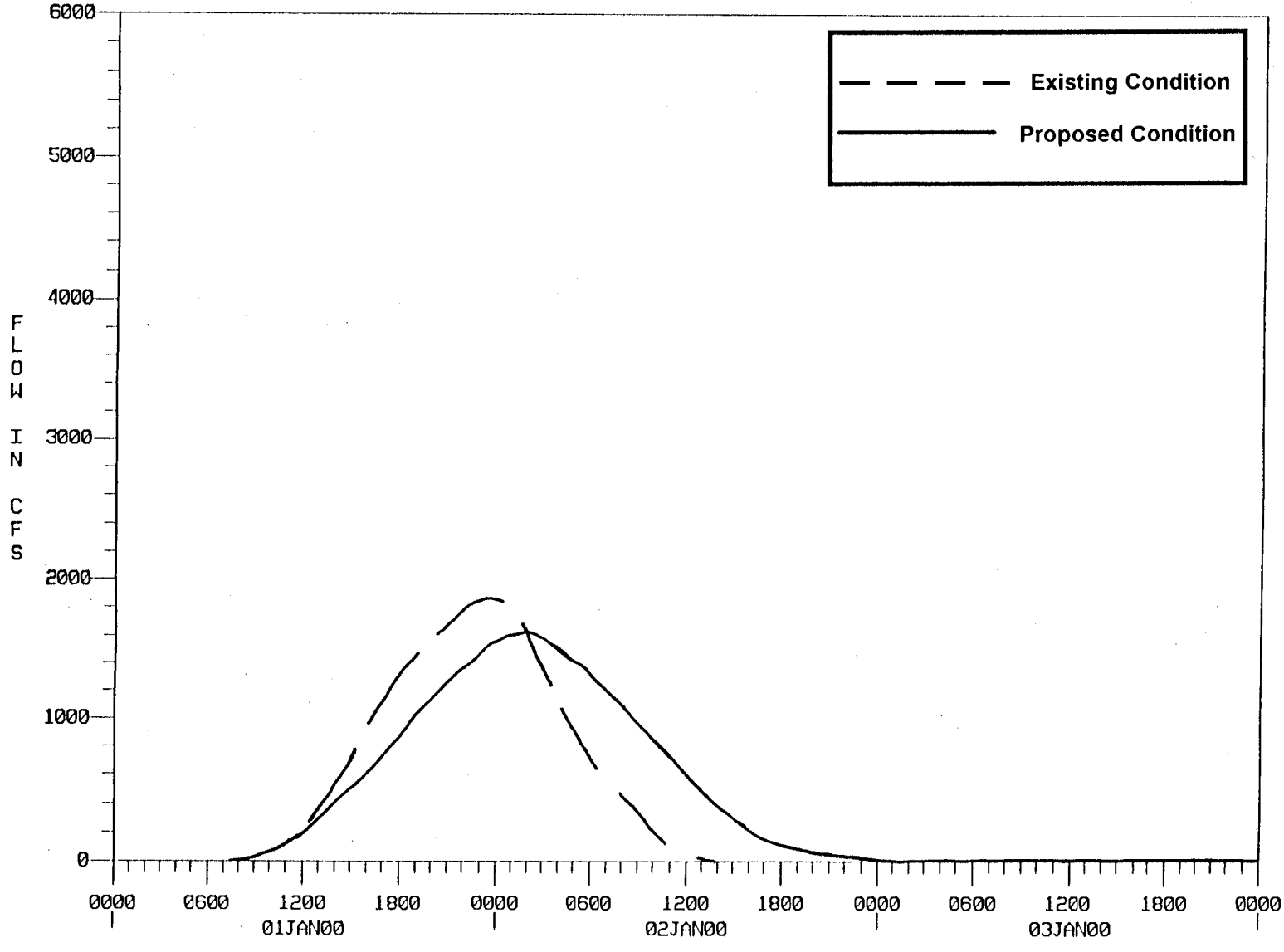
PROJECT:	PROJECT NO.	APPROX. SCALE:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY	96-297	1 : 80,000
TITLE: SUBBASINS WHERE ADDITIONAL ON-SITE DETENTION WAS CONSIDERED		DATE: 01/97
		EXHIBIT 10



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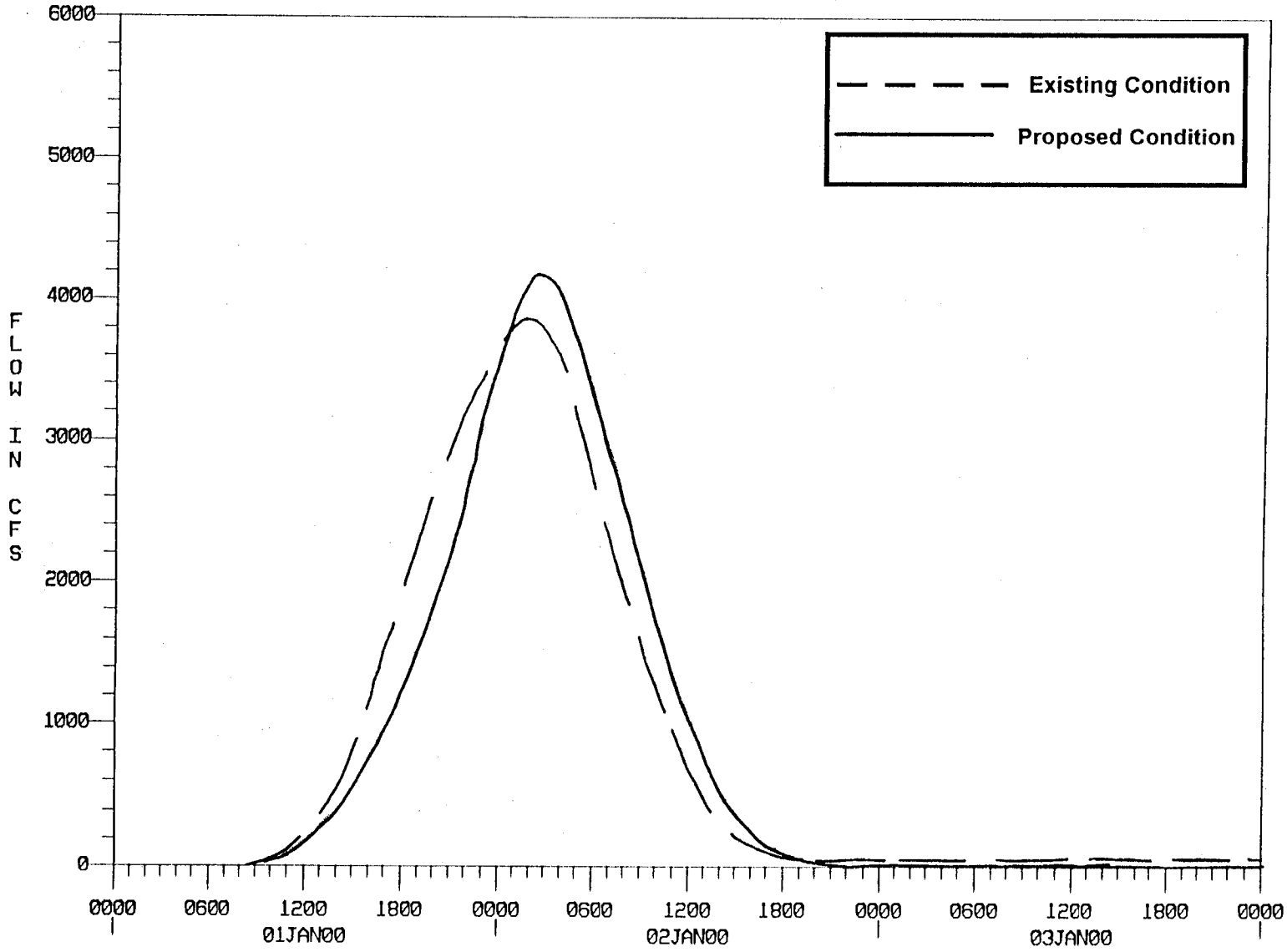
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 4 FLOOD HYDROGRAPH FOR SAND CREEK AT ITS MOUTH

DATE: 02/97

EXHIBIT 11A



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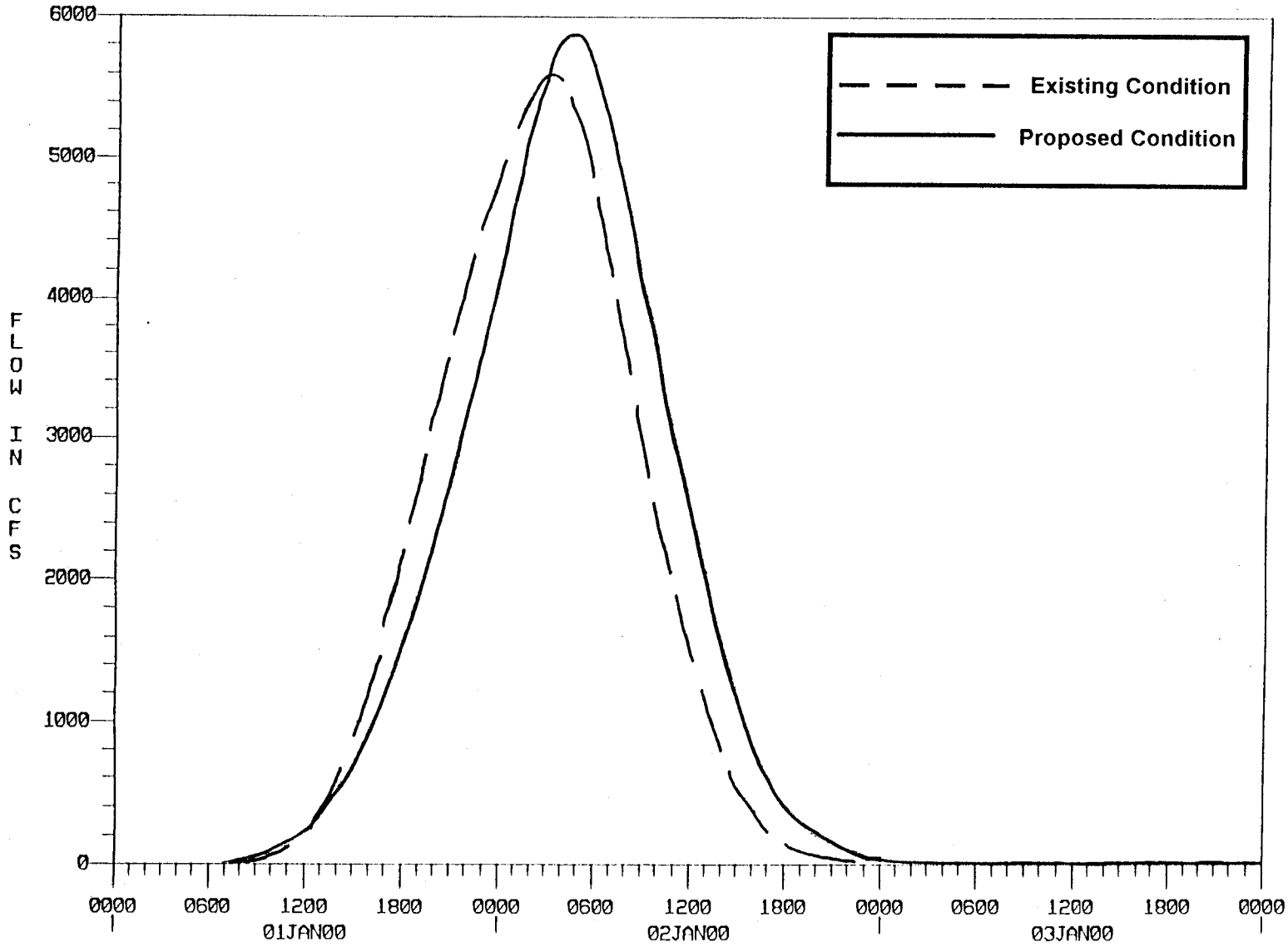
PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 4 FLOOD HYDROGRAPH FOR MUD CREEK UPSTREAM OF SAND CREEK CONFLUENCE

DATE: 02/97

EXHIBIT 11B



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PROJECT:
MUD CREEK WATERSHED REGIONAL DETENTION STUDY

PROJECT NO.
96-297

TITLE:
ALTERNATIVE 4 FLOOD HYDROGRAPH FOR MUD CREEK AT THE HAMILTON-MARION COUNTY BORDER (96TH STREET)

DATE: 02/97

EXHIBIT 11C

CHRISTOPHER B. BURKE ENGINEERING, LTD.

HAMILTON COUNTY, INDIANA
MUD CREEK WATERSHED
HYDROLOGIC ANALYSIS
(TECHNICAL APPENDICES)

Prepared for
Hamilton County Drainage Board

February 1997

Christopher B. Burke Engineering, Ltd.
115 W. Washington St., Suite 1368-South
Indianapolis, Indiana 46204

CBBEL Project Number 96-297

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APPENDIX 1

Existing-Condition Land Use/Soil Classification Data and Curve Number Calculations

Mud Creek Watershed Study
CBBEL Project No. i96-297

CALCULATED BY DLM DATE 12/27/96
CHECKED BY MMR DATE 12/30/96

HYDROLOGIC SOIL GROUP DISTRIBUTIONS FOR EACH SUBAREA*

Subarea ID	A	B	C	D
MUD1	0.0%	50.0%	30.0%	20.0%
MUD2	0.0%	35.0%	40.0%	25.0%
MUD3	0.0%	50.0%	45.0%	5.0%
MUD4	0.0%	35.0%	50.0%	15.0%
MUD5	0.0%	50.0%	45.0%	5.0%
MUD6	2.0%	64.0%	30.0%	4.0%
MUD7	0.0%	35.0%	60.0%	5.0%
MUD8	0.0%	35.0%	60.0%	5.0%
MUD9	0.0%	35.0%	40.0%	25.0%
MUD10	0.0%	40.0%	45.0%	15.0%
MUD11	0.0%	65.0%	30.0%	5.0%
MUD12	0.0%	70.0%	25.0%	5.0%
MUD13	0.0%	50.0%	40.0%	10.0%
SAND1	0.0%	35.0%	65.0%	0.0%
SAND2	0.0%	40.0%	50.0%	10.0%
SAND3	0.0%	50.0%	35.0%	15.0%
SAND4	0.0%	52.0%	40.0%	8.0%
SAND5	1.0%	42.0%	42.0%	15.0%
SAND6	0.0%	40.0%	50.0%	10.0%
SAND7	0.0%	55.0%	40.0%	5.0%
TRIB1	0.0%	35.0%	45.0%	20.0%
TRIB2	0.0%	35.0%	45.0%	20.0%
HENRY1	0.0%	60.0%	30.0%	10.0%
KYNET1	0.0%	50.0%	35.0%	15.0%
KYNET2	0.0%	45.0%	40.0%	15.0%
HIGH1	0.0%	30.0%	40.0%	30.0%

* - Distribution estimated based on visual inspection of soil distribution in each subarea

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JOB Mud Creek Watershed Study 96-297
SHEET NO. CN (summary + assumptions) OF
CALCULATED BY MR DATE 12/31/96
CHECKED BY DLM DATE 1/3/97
SCALE

Assumptions for CNs (present condition)

① aerials flown in 1985 → assume land use has not changed significantly*

② Unless soil maps showed convincingly otherwise, wooded areas and farmsteads were associated with soil groups proportionate to the percentage over the entire sub-watershed. If total was 2% or less of subarea, C soils were used.

③ All farmland was assumed to be Row Crops, Straight Row + Residue Cover, + in good condition

④ All wooded areas were assumed to be in fair condition

⑤ Areas inundated by water were subtracted from the total percentage of C soils within the sub-watershed.

⑥ For Town of Fishers:
- ⓐ Residential (Subdivisions) are assumed ½ acre lots
- ⓑ Golf Courses are in good condition
- ⓒ heavily wooded residential lots are assumed woods, fair condition

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed MUD 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			1	0.73
B	Row Crops, SR+CR, Good	75			48	36.0
C	"	82			27	22.14
D	"	85			20	17.0
C	Farmsteads	82			2	1.64
				Totals =	100	77.66

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = _____, Use CN = 78

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed MUD 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	Farmstead	82			1.0	0.82
B	Row Crops, SR+CR, Good	75			35.0	26.25
C	"	82			39.0	31.98
D	"	85			25.	21.25
				Totals =	100	80.3

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = _____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DJM Date 1/3/97

Circle one: (Present) Developed MUD 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Farmsteads	74			2	1.48
C	Farmsteads	82			2	1.64
C	Woods, Fair	73			1	0.73
B	Row Crops, STR, Good	75			48	36.0
C	"	82			42	34.44
D	"	85			5	4.25
				Totals =	100	78.54

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed MUD 4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Woods, Fair	73			2.0	1.46
B	Row Crop, SR+CR, Good	75			35.0	26.25
C	"	82			47.0	38.54
D	"	85			15.0	12.75
C	Farmsteads	82			1.0	0.82
				Totals =	100	79.82

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			11	8.03
-	Water	98			1	0.98
C	Residential, 1 acre lots	79			1	0.79
C	Farmsteads	82			1	0.82
B	Row Crops SR+CR, Good	75			48	36
C	"	82			31	25.42
D	"	85			5	4.25
				Totals =	100	77.49

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 77

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/3/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
-	Water	98			1	0.98
A	Woods, Fair	36			2	0.72
B	Woods, Fair	60			3	1.8
C	Woods, Fair	73			12	8.76
D	Woods, Fair	79			1	0.79
C	Farmsteads	82			2	1.64
B	Row Crops, SR+CR, Good	75			61	45.75
C	"	82			15	12.3
D	"	85			3	2.55
				Totals =	100	75.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 75

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/9

Circle one: (Present) Developed MUD 7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	Woods Fair	73			2	1.46
C	Farmsteads	82			2	1.64
B	Row Crops SR+CR Good	75			35	26.25
C	"	82			56	45.92
D	"	85			5	4.25
				Totals =	100	79.52

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

cation Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 8

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi^2 ☐ %	Product of CN x area
B	Farmstead	74			2	1.48
C	Farmstead	82			5	4.1
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			5	3.65
D	Woods, Fair	79			1	0.79
B	Row Crop, SR+CR, Good	75			31	23.25
C	"	82			50	41
D	"	85			4	3.4
				Totals =	100	78.87

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
off, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 9

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	Woods, Fair	60			2.0	1.2
C	Woods, Fair	73			4.5	3.29
D	Woods, Fair	79			1.0	0.79
B	Farmsteads	74			3.5	2.59
C	Farmsteads	82			3.5	2.87
B	Row Crop, SR+CR, Good	75			26.5	19.87
C	"	82			29	23.78
D	"	85			24	20.4
B	Residential, 1/2 acre lots	70			3	2.1
C	Residential 1/2 acre lots	80			3	2.4
				Totals =	100	79.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/31/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed MUD 10

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Residential, 1/2 acre lots	70			24	16.8
C	"	80			26	20.8
D	"	85			2	1.7
B	Open Space (Golf Course) Good	61			3	1.83
C	"	74			8	5.92
D	"	80			1	0.8
B	Woods, Fair	60			6	3.6
C	"	73			6	4.38
D	"	79			2	1.58
B	Row Crops, SR + CR, Good	75			6	4.5
C	"	82			6	4.92
D	"	85			10	8.5
				Totals =		75.33

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 75

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed MUD 11

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
C	Open Space, (Park), Good	74			4	2.96
D	"	80			3	2.40
B	Residential, ½ acre lots	70			20	14
C	"	80			12	9.6
D	"	85			1	0.85
B	Woods Fair	60			9	5.4
C	"	73			4	2.92
D	"	79			1	0.79
B	Row Crops SR + CR Good	75			36	27
C		82			10	8.2
				Totals =	100	74.12

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 74

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 1/2/97

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 12

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Residential, 1/4 acre	75			14	10.5
C	Residential 1/4 acre	83			16	13.28
B	Woods, Fair	60			33	19.8
C	Woods Fair	73			3	2.19
D	Woods Fair	79			4	3.16
B	Residential 1/2-acre	70			23	16.1
C	"	80			6	4.8
D	"	85			1	0.85
				Totals =		70.68

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 71

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
off, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MR Date 1/2/97

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed Mud 13

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Residential, 1-acre lots	68			30	20.4
C	"	79			24	18.96
D	"	84			9	7.56
B	Residential, 1/4 acre lots	75			20	15
C	"	83			16	13.28
D	"	87			1	.87
				Totals =		76.07

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 76

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed SAND 1.

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	Woods, Fair	73			2.5	1.825
B	Woods, Fair	60			1.0	.60
C	Farmsteads	82			2.0	1.64
B	Row Crops, SR + CR, Good	75			34.0	25.5
C	"	82			60.5	49.61
				Totals =	100	79.18

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MWR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
B	Woods, Fair	60			3.0	1.8
D	Woods, Fair	79			1.0	.79
C	Farmsteads	82			1.0	.82
B	Row Crops, SR+CR, Good	75			37	27.75
C	"	82			49	40.18
D	"	85			9	7.65
				Totals =	100	78.99

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: HWR Date: 12/31/96

Location: Marion, Hamilton + Madison Counties Checked: DLH Date: 1/3/97

Circle one: (Present) Developed SAND 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Farmstead	74			2.0	1.48
C	Farmstead	82			1.0	0.82
B	Row Crops, SR+CR, Good	75			48	36
C	"	82			34	27.88
D	"	85			15	12.75
				Totals =	100	78.93

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MWR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
-	Paved	98			3.5	3.43
B	Woods, Fair	60			1.5	0.90
C	Woods Fair	73			1.0	0.73
C	Farmsteads	82			1.0	0.82
B	Row Crops SR+CR, Good	75			50.5	37.88
C	"	82			34.5	28.29
D	"	85			8.0	6.8
				Totals =	100	78.85

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____, Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed SAND 5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
-	Paved	98			4.5	4.41
B	Woods, Fair	60			2.5	1.50
C	Woods, Fair	73			2.5	1.83
D	Woods, Fair	79			1.0	0.79
-	Water	98			0.5	0.49
B	Farmstead	74			0.8	0.59
C	Farmstead	82			0.8	0.65
A	Row Crops, Strcr, Good	64			1.0	0.64
B	"	75			38.7	29.03
C	"	82			33.7	27.63
D	"	85			14	11.9
				Totals =	100	79.46

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By NMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed SAND 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
	Water	98			0.5	0.49
–	Paved	98			3	2.94
B	Woods, Fair	60			2	1.2
C	Woods Fair	73			3	2.19
D	Woods fair	79			1	0.79
B	Farmstead	74			3.5	2.59
C	Farmstead	82			4.5	3.69
B	Row Crops, SR+CR, Good	75			34.5	25.87
C	"	82			39.0	31.98
D	"	85			9	7.65
				Totals =	100	79.39

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/13/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
B	Residential, 1/2 acre lots	70			3	2.1
C	"	80			6	4.8
D	"	85			2	1.7
B	Woods, Fair	60			12	7.2
C	Woods, Fair	73			6	4.38
C	Farmstead	82			2	1.64
B	Row Crop, SR + CR, Good	75			40	30
C	"	82			26	21.32
D	"	85			3	2.55
				Totals =	100	75.69

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 76

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MWR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed TRIB 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2.0	1.2
C	Woods Fair	73			1.0	0.73
C	Farmstead	82			2.0	1.64
B	Row Crop, SR+CR, Good	75			33	24.75
C	"	82			42	34.44
D	"	85			20	17
				Totals =	100	79.76

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MWR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DCM Date 1/3/97

Circle one: (Present) Developed TRIB 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
—	Water	98			0.75	0.74
B	Farmsteads	74			2.0	1.48
C	Farmsteads	82			2.25	1.85
B	Row Crops SR+CR Good	75			33	24.75
C	"	82			42	34.44
D	"	85			20	17
				Totals =	100	80.26

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed HENRY 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Row Crops, SR+CR, Good	75			59	44.25
C	"	82			28	22.96
D	"	85			10	8.5
C	Farmsteads	82			2	1.64
B	Woods Fair	60			1	.60
				Totals =	100	77.95

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{77.84}{100} = 77.84$ Use CN = 78

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed KYNET 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Woods Fair	73			1.0	0.73
C	Farmsteads	82			1.0	0.82
B	Row Crops, STR, Good	75			50	37.5
C	"	82			33	27.06
D	"	85			15.0	12.75
				Totals =	100	78.86

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed KYNET 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	Woods, Fair	60			4.0	2.4
C	Woods, Fair	73			1.0	.73
B	Farmsteads	74			2.0	1.48
C	Farmsteads	82			1.0	.82
B	Row Crops, SR+CR, Good	75			39	29.25
C	"	82			38	31.16
D	"	85			15	12.75
				Totals =	100	78.59

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MWR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed HIGH 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
-	Water Wetland area	100			6.5	6.5
B	Woods, Fair	60			4	2.4
C	Woods, Fair	73			7	5.11
D	Woods, Fair	79			2	1.58
D	Residential, 1 acre lots	84			4	3.36
B	Row Crop, SR+CR, Good	75			22.5	16.88
C	"	82			22.0	18.04
D	"	85			24.0	20.4
B	Farmstead	74			3.5	2.59
C	Farmstead	82			4.5	3.69
				Totals =	100	80.55

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 81

2. Runoff

Storm #1	Storm #2	Storm #3

Frequency ..... yr

Rainfall, P (24-hour) ..... in

Runoff, Q ..... in
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

CHRISTOPHER B. BURKE
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JOB Mud Creek Watershed Study 95-297

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE CN assumptions - Developed Condition

1. Residential Development in the Northern Part of the Watershed will be 1-acre lots, as it is presently a rural area.

2. Residential Development that occurs in wooded areas will assume that 1/2 of the wooded area will be removed.

3. Golf Courses in good condition

4. Residential Development in the Central + Southern parts of the watershed will be 1/2 acre lots.

5. Wooded Areas kept in HIGH-1 Suts → as all was existing R-S.

6. EXISTING TYPE A/B SOILS WILL HAVE TYPE C ATTRIBUTES UNDER PROPOSED CONDITIONS IF THERE IS HYDROLOGIC DISTURBANCE (DEVELOPMENT)

PRODUCT 204-1 (Single Sheets) 205-1 (Padded) NEBS inc., Groton, Mass. 01471. To Order PHONE TOLL FREE 1-800-225-6380

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	ROW CROPS, SR & CR, GOOD	75			6	4.5
C	"	82			6	4.92
C	INDUSTRIAL	91			13	11.83
D	INDUSTRIAL	93			1	0.93
C	FARMSTEADS	82			1	0.82
—	WATER	98			1	0.98
C	RESIDENTIAL, 1/2 AC LOTS	80			68	54.40
D	RESIDENTIAL, 1/2 AC LOTS	85			4	3.40
				Totals =	100	81.78

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 82

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked ____ Date ____

Circle one: Present (Developed) MUD 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	RESIDENTIAL, 1 AC LOTS	79			79	62.41
D	RESIDENTIAL, 1 AC LOTS	84			3	2.52
B	WOODS, FAIR	60			9	5.40
C	COMMERCIAL	94			7	6.58
D	COMMERCIAL	95			1	0.95
—	WATER	98			1	0.98
				Totals =	100	78.84

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD 7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
C	RESIDENTIAL, 1AC LOTS	79			90	71.10
D	"	84			10	8.40
					Totals =	79.5

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD 8

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	OPEN SPACE, GOOD	74			11	8.14
D	"	80			3	2.40
C	COMMERCIAL	94			2	1.88
C	RESIDENTIAL, 1/2 AC LOTS	80			78	62.4
D	"	85			2	1.7
B	WOODS, FAIR	60			1	0.6
C	"	73			3	2.19
				Totals =	100	79.31

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD9

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	OPEN SPACE, GOOD	74			5	3.7
D	"	80			12	9.6
C	COMMERCIAL	94			4	3.76
D	"	95			2	1.90
C	RESIDENTIAL, 1/2 AC LOTS	80			63	50.4
D	"	85			10	8.5
C	WOODS FAIR	73			3	2.19
D	WOODS FAIR	79			1	0.79
				Totals =	100	80.84

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 81

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD10

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	OPEN SPACE, GOOD	74			8	5.92
D	"	80			12	9.60
B	WOODS, FAIR	60			3	1.80
C	"	73			3	2.19
D	"	79			1	0.79
C	COMMERCIAL	94			1	0.94
C	RESIDENTIAL, 1/2 AC LOTS	80			70	56.0
D	RESIDENTIAL, 1/2 AC LOTS	85			2	1.70
				Totals =		78.94

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) MUD11

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	OPEN SPACE, GOOD	74			18	13.32
D	"	80			3	2.40
C	COMMERCIAL	94			5	4.70
C	WOODS, FAIR	73			14	10.22
C	RESIDENTIAL, 1/2 AC LOTS	80			58	46.4
D	"	85			2	1.70
				Totals =		78.74

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) SAND 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	RESIDENTIAL, 1/2 AC LOTS	80			20	16.0
D	"	85			3	2.55
B D	WOODS, FAIR "	60 79			3 1	1.80 0.79
C	FARMSTEADS	82			1	0.82
B	ROW CROPS, SR&CR, GOOD	75			25	18.75
C	"	82			41	33.62
D	"	85			6	5.10
				Totals =	100	79.43

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) SAND 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ■ %	Product of CN x area
C	ROW CROPS, SR&CR, GOOD	82			9	7.38
C	COMMERCIAL	94			20	18.8
D	"	95			13	12.35
C	RESIDENTIAL, ½ AC LOTS	80			56	44.80
D	"	85			2	1.70
				Totals =	100	85.03

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 85

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) SAND 4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
–	PAVED I-69	95			3.5	3.43
C	COMMERCIAL	94			19	17.86
D	"	95			5	4.75
C	INDUSTRIAL	91			23	20.93
C	RESIDENTIAL, ½ AC LOTS	80			46.5	37.2
D	"	85			3	2.55
				Totals =		83.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 83

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked ____ Date ____

Circle one: Present (Developed) SANDS

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
—	WATER	98			0.5	0.49
—	PAVED	98			4.5	4.41
C	OPEN SPACE, GOOD	74			3	2.22
D	"	80			10	8.00
C	INDUSTRIAL	91			20	18.2
D	INDUSTRIAL	93			1	0.93
C	COMMERCIAL	94			20	18.8
D	COMMERCIAL	95			2.0	1.9
C	RESIDENTIAL, 1/2 AC LOTS	80			37	29.6
D	"	85			2	1.70
				Totals =	100	86.25

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 86

2. Runoff

Storm #1	Storm #2	Storm #3

Frequency ..... yr

Rainfall, P (24-hour) ..... in

Runoff, Q ..... in
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) SAND 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
—	WATER	98			0.5	0.94
—	PAVED (I-69)	98			3.0	2.94
B	WOODS, FAIR	60			2	1.12
C	"	73			3	2.19
D	"	79			1	0.79
C	OPEN SPACE GOOD	74			4	2.96
D	"	80			4	3.20
C	INDUSTRIAL	91			35	31.85
C	RESIDENTIAL, ½ AC LOTS	80			45.5	36.40
D	"	85			2	1.70
				Totals =		84.09

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 84.

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked _____ Date _____

Circle one: Present (Developed) SANDY

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	INDUSTRIAL	91			3	2.73
C	COMMERCIAL	94			2	1.88
B C	WOODS, FAIR "	60 73			6 3	3.60 2.19
C	OPEN SPACE, FAIR	74			7	5.18
C	RESIDENTIAL, 1/2 AC LOTS	80			74	59.2
D	"	85			5	4.25
				Totals =	100	79.03

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked ____ Date ____

Circle one: Present (Developed) TRIB2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
—	WATER	98			0.75	0.74
B	FARMSTEADS	74			2.0	1.48
C	"	82			2.25	1.845
B	ROW CROPS, SR & CR, GOOD	75			18	13.5
C	"	82			34	27.88
D	"	85			13	11.05
C	RESIDENTIAL, 1/2 AC LOTS	80			23	18.4
D	"	85			7	5.95
				Totals =	100	80.84

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 81

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Project MUD CREEK WATERSHED STUDY By DLM Date 2/6/97

Location HAMILTON, MARION, MADISON COUNTIES Checked ____ Date ____

Circle one: Present (Developed) HIGH 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
—	WATER	98			6.5	6.4
B	WOODS, FAIR	60			4	2.4
C	"	73			7	5.11
D	"	79			2	1.58
C	RESIDENTIAL, ½ AC LOTS	80			54.0	43.2
D	"	85			26.5	22.53
				Totals =		81.22

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 81

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

APPENDIX 2

Regulatory Hydraulic Modeling Computer Inputs/Outputs

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*****************************************
*  HEC-2 WATER SURFACE PROFILES          *
*                                        *
     rsion   4.6.2;  May 1991            *
                                        *
*  RUN DATE    13FEB97    TIME   14:16:04  *
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
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```
X     X  XXXXXXX   XXXXX             XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX            XXXXXXX
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1

13FEB97 14:16:04 PAGE 1

THIS RUN EXECUTED 13FEB97 14:16:04

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*********************************
·2 WATER SURFACE PROFILES

Version   4.6.2;  May 1991
*************************************
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T1      MARION COUNTY FIS
T2      PROFILES,            10 , 50, 100, 500, 100 YEAR FLOODS
T3      MUD CREEK
   MUD CREEK-MARION CO FIS     RM 0.00-4.40

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      -1        4                                                -1            750.36

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1         0        -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    200        38        27        21        22        28        16        18        17

'F  LPRNT    NUMSEC                    ********REQUESTED SECTION NUMBERS********

    -10       -10

QT        7      1450      2100      2500      3000      2500      2500      2500
NC     .055      .055      .055        .1        .3
ET                                                                                  1.4
```

X1	240.10	18.	584.1	751.3						
X4	1	750.0	780.0							
GR	775.1	500.0	764.4	543.5	751.0	575.1	748.8	584.1	746.5	593.1
	744.2	678.5	744.3	708.5	744.4	723.6	743.6	733.5	744.6	745.1
	748.7	751.3	752.7	757.4	749.0	763.5	750.5	856.7	750.8	983.5
GR	750.4	1213.6	752.9	1315.7	765.8	1423.4				
X1	240.40	17	960	1040	1454	1354	1554			
GR	822	520	810	580	800	690	790	750	780	800
GR	780	870	770	905	750	960	744	990	744	1010
GR	748	1040	753	1100	755.0	1270	756	1350	756.7	1465
GR	757	1560	758	1920						
X1	240.42				100	100	100			
X3	10							757.1	756.7	
SB	0.90	1.8	2.5		66.40	2.0	851	.75	745.1	745.1
X1	24042	0			30	30	30			
X2			1	757.1	756.7					
X3	10							760.0	756.7	
BT	7	500	790.9	0	906	762	0	957.7	760.7	0
BT	1033.1	759.5	0	1214.7	756.7	0	1651.6	756.7	0	1909.0

BT	777.9									
	240.44	0			100	100	100			
X1	240.75	11	560.1	650.0	1660	1750	1690			
X4	1	754.0	975.0							
GR	779.0	500.0	751.4	560.1	749.0	570.0	747.1	591.5	747.6	599.1
GR	747.7	611.3	750.3	614.6	752.0	650.0	753.8	837.8	757.3	993.7
GR	761.8	1088.3								
X1	241.17	12.	716.7	767.4	2118	2118	2118			
X4	2	758.0	660.0	765.0	575.0					
GR	794.0	500.0	772.2	565.3	764.9	613.5	755.2	716.7	751.3	727.1
GR	750.0	733.4	751.1	756.1	755.5	767.4	758.0	913.5	761.2	1161.4
GR	771.1	1175.3	775.3	1213.5						
X1	241.54	18	1058	1112.3	1954	1954	1954			
X4	1	764.0	1132.3							
GR	789.5	500.0	770.9	581.5	764.2	840.9	757.6	1057.9	755.1	1058.0
GR	755.1	1058.1	753.5	1062.1	752.3	1086.3	752.6	1112.1	752.6	1112.2
GR	755.2	1112.3	764.3	1256.5	764.7	1306.2	764.8	1324.6	765.1	1362.9
GR	766.1	1504.4	776.0	1518.3	780.2	1556.5	0.	0.	0.	0.
X1	241.55	00			51.0	51.0	51.0			
X3	10							764.0	764.0	
SB	.001	2.00	2.50	0.	47.12	.001	457	.001	752.30	752.3
X1	24155.				18.0	18.0	18.0			
	0.		1	762.0	764.2					
X3	10.0							764.2	764.6	
BT	16.0	500.0	789.5	789.5	581.5	770.9	770.9	840.9	764.2	764.2
BT	1057.9	764.6	757.6	1058.0	764.6	762.0	1058.1	767.2	762.0	1086.3
BT	767.2	762.0	1112.1	767.2	762.0	1112.2	764.6	762.0	1112.3	764.6
BT	755.2	1306.2	765.8	764.7	1324.6	774.5	764.8	1362.9	783.5	765.1

BT	1504.4	781.1	766.1	1518.3	780.9	776.0	1556.5	829.0	780.2	0.
X1	241.57				74.0	74.0	74.0			
			.045							
X1	242.12	12	564.2	625.7	2904	2904	2904			
GR	805.7	500.0	764.7	564.2	759.6	585.4	758.9	613.5	759.7	623.6
GR	763.3	625.7	764.6	766.3	764.8	801.7	766.2	856.1	771.0	1101.2
GR	774.4	1201.7	784.3	1263						
NC	0.060									
X1	242.39	10	756.0	878.1	1426	1426	1426			
GR	801.8	500.0	778.7	756.0	758.7	801.0	758.7	802.0	762.0	844.0
GR	762.0	846.0	771.1	878.1	770.0	1000.	768.3	1116.3	781.2	1455.3

1

X1	999.04				100	100	100			
X3	10							778.7	768.3	
X1	242.41				3	3	3			
X3	10							778.7	768.3	
X4	2	773.5	845.0	776.0	801.5					
BT	6	500.0	801.8	801.8	756.1	781.8	778.7	878.1	774.7	771.1
BT	1000.	771.4	770.0	1116.3	768.3	768.3	1455.3	781.2	781.2	
X1	24241.				30.0	30.0	30.0			
							1			
[illegible]	10							781.8	768.3	
X1	999.05	10	756.0	878.1	3	3	3			
X3	10							781.8	768.3	
GR	801.8	500.0	778.7	756.0	758.7	801.0	758.7	802.0	762.0	844.0
GR	762.0	846.0	771.1	878.1	770.0	1000.	768.3	1116.3	781.2	1455.3
X1	242.43	0	0	0	74.0	74.0	74.0			
X1	242.82	13.	613.7	648.9	2059	2059	2059			
X4	2	763.0	620.0	763.0	635.0					
GR	788.2	500.0	783.0	585.6	777.1	597.3	768.3	613.7	764.1	616.5
GR	762.8	629.3	764.0	642.7	768.3	648.9	768.0	815.7	769.0	913.3
GR	771.7	1152.3	777.8	1248.2	782.2	1256.3				
X1	243.08	14.	856.7	890.3	1360.8	1350.8	1372.8			
X4	1	765.5	857.0							
GR	782.8	500.0	775.2	540.3	773.3	663.5	771.7	737.5	770.9	856.7
GR	766.7	861.7	765.1	874.1	766.2	881.5	772.7	890.3	770.1	983.1
GR	771.0	1042.7	772.4	1103.3	775.1	1256.7	780.3	1433.3		
X1	243.30	30	856.4	1006.1	1162	1162	1162			
GR	793.8	500.0	783.1	557.0	775.5	597.3	773.9	703.5	773.6	720.5
GR	772.0	794.5	776.4	856.3	776.4	856.4	776.4	856.5	776.2	861.4
	768.7	873.4	768.0	890.5	768.0	892.0	765.4	915.4	769.0	933.5
	769.0	935.0	770.0	975.4	770.0	976.9	771.7	999.4	775.4	1001.1
GR	775.6	1006.0	775.6	1006.1	775.6	1006.2	775.9	1040.1	776.6	1099.7
GR	776.9	1160.3	777.9	1313.7	778.5	1427.0	780.6	1490.3	780.6	1633.4
X1	999.06	0	0	0	100.0	100.0	100.0			

X3	10.0							778.6	777.6	
NC	0.065									
X1	243.31				3.0	3.0	3.0			
	10.0							778.6	777.6	
X4	3.0	781.0	891.3	780.8	934.3	780.6	976.1	0.	0.	0.
BT	25.0	500.0	796.4	793.8	557.0	792.2	783.1	597.3	789.2	775.5
BT	703.5	781.3	773.9	720.5	781.2	773.6	794.5	780.6	772.0	856.3
BT	780.2	776.4	856.4	780.2	778.6	856.5	783.7	778.6	890.5	783.6
BT	778.4	892.0	783.6	778.4	915.4	783.5	778.2	933.5	783.5	778.1
BT	935.0	783.5	778.1	975.4	783.4	777.8	976.9	783.4	777.8	1006.0
BT	783.3	777.6	1006.1	779.8	777.6	1006.2	779.8	775.6	1040.1	779.7

BT	770.4	1099.7	779.5	771.3	1160.3	779.3	772.7	1313.7	778.8	775.4
BT	1427.0	778.5	778.5	1633.4	790.4	780.6	0.	0.	0.	0.
X1	24331.				30.0	30.0	30.0			
X2	0.						1			
X3	10.0							780.2	778.5	
X1	999.07	30.	856.4	1006.1	3.0	3.0	3.0			
X3	10.0							780.2	778.5	
GR	793.8	500.0	783.1	557.0	775.5	597.3	773.9	703.5	773.6	720.5
GR	772.0	794.5	776.4	856.3	776.4	856.4	776.4	856.5	776.2	861.4
GR	768.7	873.4	768.0	890.5	768.0	892.0	765.4	915.4	769.0	933.5
GR	769.0	935.0	770.0	975.4	770.0	976.9	771.7	999.4	775.4	1001.1
	775.6	1006.0	775.6	1006.1	775.6	1006.2	775.9	1040.1	776.9	1099.7
	776.9	1160.3	777.6	1313.7	778.5	1427.0	780.6	1490.3	780.6	1633.4
X1	243.33				74.0	74.0	74.0			
X1	244.04	9.	1200.0	1263.5	3776	3726	3749			
X4	1	771.0	1210.							
GR	798.3	846.1	780.3	1096.1	774.3	1200.0	769.6	1249.2	766.1	1258.4
GR	769.6	1261.2	774.2	1263.5	780.7	1310.1	804.1	1513.6		
NC	0.065	0.060								
X1	244.39	22	1111.9	1159.5	1848	1848	1848			
X4	1	780.5	1000.							
GR	794.5	381.0	789.2	500.0	785.2	591.7	782.6	694.0	782.0	767.0
GR	781.2	769.1	781.0	794.7	775.5	1108.8	775.5	1108.9	774.1	1111.7
GR	774.1	1111.8	774.1	1111.9	770.6	1131.9	771.1	1142.1	774.1	1159.5
GR	774.1	1159.6	775.3	1162.8	775.3	1162.9	781.9	1203.8	779.9	1287.1
GR	786.1	1633.5	793.8	1799.2	0.	0.	0.	0.	0.	0.
X1	999.08	0	0	0	100	100	100			
X3	10							782.1	779.9	
X1	244.41				3.0	3.0	3.0			
X3	10							782.1	779.9	
BT	20.0	381.0	797.5	794.5	500.0	793.1	789.2	591.7	789.7	785.2
	694.0	785.9	782.6	767.0	783.2	781.2	769.1	783.2	781.2	794.7
	783.1	777.0	1108.8	782.1	775.5	1108.9	785.1	775.5	1111.8	785.2
BT	780.1	1111.9	785.2	780.1	1131.9	785.6	780.1	1159.5	786.2	780.1
BT	1159.6	786.2	774.1	1162.8	786.3	775.3	1162.9	783.3	775.3	1203.8
BT	781.9	781.9	1287.1	779.9	779.9	1633.5	786.1	786.1	1799.2	793.8
BT	793.8	0.	0.	0.	0.	0.	0.	0.	0.	0.

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X1   24441.                                    18.0       18.0       18.0
X2       0.                                                            1
        10.0                                                                    782.1      779.9
1
   13FEB97      14:16:04                                                                                    PAGE    5


X1   999.09                                     3.0        3.0        3.0
X3     10.0                                                                    782.1      779.9

X1   244.43        22     1111.9     1159.5      74.0       74.0       74.0
X4        1     780.5     1000.
GR    794.5     381.0      789.2      500.0     785.2      591.7      782.6      694.0      782.0      767.0
GR    781.2     769.1      781.0      794.7     775.5     1108.8      775.5     1108.9      774.1     1111.7
GR    774.1    1111.8      774.1     1111.9     770.6     1131.9      771.1     1142.1      774.1     1159.5
GR    774.1    1159.6      775.3     1162.8     775.3     1162.9      781.9     1203.8      779.9     1287.1
GR    786.1    1633.5      793.8     1799.2        0.        0.         0.         0.         0.         0.

   13FEB97      14:16:04                                                                                    PAGE    6


T1      MARION COUNTY FIS
T2      PROFILES,             10 , 50, 100, 500, 100 YEAR FLOODS
T3      MUD CREEK

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

    -10        8                                            -1            750.46

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

    15         0       -1


   13FEB97      14:16:04                                                                                    PAGE    7


                                                                                THIS RUN EXECUTED 13FEB97    14:16:06
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************


NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST


MUD CREEK

    \RY PRINTOUT


      SECNO    STENCL     STCHL     STCHR    STENCR     K*XNL     K*XNR    K*XNCH

    240.100       .00    584.10    751.30       .00     55.00     55.00     55.00
```

	240.100	584.10	584.10	751.30	751.30	.00	.00	55.00
	240.400	.00	960.00	1040.00	.00	55.00	55.00	55.00
	240.400	960.00	960.00	1040.00	1060.82	.00	55.00	55.00
	240.420	.00	960.00	1040.00	.00	.00	.00	55.00
	240.420	960.00	960.00	1040.00	1040.00	.00	.00	55.00
	24042.000	.00	960.00	1040.00	.00	.00	.00	55.00
	24042.000	.00	960.00	1040.00	.00	.00	.00	55.00
	240.440	.00	960.00	1040.00	.00	55.00	55.00	55.00
	240.440	960.00	960.00	1040.00	1065.87	.00	55.00	55.00
	240.750	.00	560.10	650.00	.00	55.00	55.00	55.00
	240.750	560.10	560.10	650.00	918.86	.00	55.00	55.00
*	241.170	.00	716.70	767.40	.00	55.00	55.00	55.00
*	241.170	687.65	716.70	767.40	866.56	55.00	55.00	55.00
*	241.540	.00	1058.00	1112.30	.00	55.00	55.00	55.00
*	241.540	989.53	1058.00	1112.30	1118.44	55.00	55.00	55.00
	241.550	.00	1058.00	1112.30	.00	.00	.00	55.00
	241.550	1058.00	1058.00	1112.30	1112.30	.00	.00	55.00
	24155.000	.00	1058.00	1112.30	.00	.00	.00	55.00
	24155.000	1058.00	1058.00	1112.30	1112.30	.00	.00	55.00
	241.570	.00	1058.00	1112.30	.00	55.00	55.00	55.00
*	241.570	973.96	1058.00	1112.30	1119.81	55.00	55.00	55.00

	SECNO	STENCL	STCHL	STCHR	STENCR	K*XNL	K*XNR	K*XNCH
*	242.120	.00	564.20	625.70	.00	55.00	55.00	45.00
*	242.120	564.20	564.20	625.70	770.92	.00	55.00	45.00
	242.390	.00	756.00	878.10	.00	.00	55.00	45.00
	242.390	756.00	756.00	878.10	878.10	.00	.00	45.00
	999.040	.00	756.00	878.10	.00	.00	55.00	45.00
	999.040	756.00	756.00	878.10	878.10	.00	.00	45.00
	242.410	.00	756.00	878.10	.00	.00	55.00	45.00
	242.410	756.00	756.00	878.10	878.10	.00	.00	45.00
	24241.000	.00	756.00	878.10	.00	.00	55.00	45.00
	24241.000	756.00	756.00	878.10	878.10	.00	.00	45.00
	999.050	.00	756.00	878.10	.00	.00	55.00	45.00
	999.050	756.00	756.00	878.10	878.10	.00	.00	45.00
	242.430	.00	756.00	878.10	.00	.00	55.00	45.00
	242.430	756.00	756.00	878.10	878.10	.00	.00	45.00
	242.820	.00	613.70	648.90	.00	60.00	55.00	45.00

	242.820	613.70	613.70	648.90	963.79	.00	55.00	45.00
*	243.080	.00	856.70	890.30	.00	60.00	55.00	45.00
	243.080	742.24	856.70	890.30	1071.74	60.00	55.00	45.00
*	243.300	.00	856.40	1006.10	.00	60.00	.00	45.00
*	243.300	758.74	856.40	1006.10	1006.10	60.00	.00	45.00
	999.060	.00	856.40	1006.10	.00	.00	.00	45.00
	999.060	856.40	856.40	1006.10	1006.10	.00	.00	45.00
	243.310	.00	856.40	1006.10	.00	.00	.00	45.00
	243.310	856.40	856.40	1006.10	1006.10	.00	.00	45.00
	24331.000	.00	856.40	1006.10	.00	.00	.00	45.00
	24331.000	856.40	856.40	1006.10	1006.10	.00	.00	45.00
	999.070	.00	856.40	1006.10	.00	.00	.00	45.00
	999.070	856.40	856.40	1006.10	1006.10	.00	.00	45.00
	243.330	.00	856.40	1006.10	.00	65.00	.00	45.00
	243.330	749.95	856.40	1006.10	1006.10	65.00	.00	45.00
	244.040	.00	1200.00	1263.50	.00	65.00	55.00	45.00
	244.040	1172.56	1200.00	1263.50	1272.68	65.00	55.00	45.00
	244.390	.00	1111.90	1159.50	.00	65.00	60.00	45.00
	244.390	1057.02	1111.90	1159.50	1176.36	65.00	60.00	45.00

	SECNO	STENCL	STCHL	STCHR	STENCR	K*XNL	K*XNR	K*XNCH
	999.080	.00	1111.90	1159.50	.00	.00	60.00	45.00
	999.080	1111.90	1111.90	1159.50	1175.08	.00	60.00	45.00
*	244.410	.00	1111.90	1159.50	.00	.00	60.00	45.00
*	244.410	1111.90	1111.90	1159.50	1290.93	.00	60.00	45.00
	24441.000	.00	1111.90	1159.50	.00	.00	60.00	45.00
	24441.000	1111.90	1111.90	1159.50	1293.44	.00	60.00	45.00
*	999.090	.00	1111.90	1159.50	.00	.00	60.00	45.00
*	999.090	1111.90	1111.90	1159.50	1178.20	.00	60.00	45.00
	244.430	.00	1111.90	1159.50	.00	65.00	60.00	45.00
	244.430	1029.64	1111.90	1159.50	1253.83	65.00	60.00	45.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 241.170 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

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WARNING SECNO=    241.170  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    241.540  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    *NG SECNO=    241.540  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    241.570  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    241.570  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    242.120  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    242.120  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    243.080  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    243.080  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    243.300  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    243.300  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    244.410  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    244.410  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=    999.090  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=    999.090  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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    WAY DATA,   MUD CREEK
PROFILE NO.  2
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STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
240.100	167.	902.	2.8	750.5	750.4	.1
240.400	101.	623.	4.0	752.7	752.6	.1
240.420	80.	558.	4.5	752.8	752.7	.1
24042.000	80.	556.	4.5	752.8	752.7	.1
240.440	106.	685.	3.6	753.1	753.0	.1
240.750	359.	1154.	2.2	755.4	755.3	.1
241.170	179.	668.	3.7	758.7	758.6	.1
241.540	129.	768.	3.3	762.0	761.9	.1
241.550	54.	499.	5.0	762.0	761.9	.1
24155.000	54.	530.	4.7	762.5	762.4	.1
241.570	146.	928.	2.7	762.9	762.8	.1
242.120	207.	692.	3.6	766.2	766.1	.1
242.390	92.	580.	4.3	768.9	768.8	.1
999.040	93.	595.	4.2	769.0	768.9	.1
242.410	93.	578.	4.3	769.0	768.9	.1
24241.000	93.	584.	4.3	769.1	769.0	.1
999.050	94.	604.	4.1	769.1	769.0	.1
2.430	94.	614.	4.1	769.3	769.2	.1
42.820	350.	1241.	2.0	771.5	771.4	.1
243.080	329.	844.	3.0	773.3	773.2	.1
243.300	242.	957.	2.6	774.9	774.8	.1
999.060	138.	820.	3.0	774.9	774.8	.1
243.310	137.	799.	3.1	774.9	774.8	.1

24331.000	138.	803.	3.1	775.0	774.9	.1
999.070	138.	824.	3.0	775.0	774.9	.1
243.330	251.	1020.	2.5	775.1	775.0	.1
44.040	100.	632.	4.0	778.3	778.2	.1
4.390	119.	703.	3.6	780.6	780.5	.1
999.080	63.	478.	5.2	780.6	780.5	.1
244.410	179.	390.	6.4	780.5	780.4	.1
24441.000	182.	395.	6.3	780.6	780.5	.1
999.090	66.	504.	5.0	780.9	780.8	.1
244.430	224.	899.	2.8	781.2	781.1	.1

```
1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
    rsion   4.6.2;  May 1991             *
                                         *
*  RUN DATE    13FEB97    TIME   14:15:05  *
*****************************************
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
```

1

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THIS RUN EXECUTED 13FEB97 14:15:05

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*****************************************
    2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*****************************************
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```
T1 NOBLESVILLE FLOOD INSURANCE
T2 MUD CREEK
T3 100 YEAR FLOOD
   MUD CREEK-NOBLESVILLE FIS   RM 4.40-10.76

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

     -1        4                                            -1            780.42

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

     1                 -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     1        34        4        27       21       22       28       110      150      200

J5  LPRNT    NUMSEC                  ********REQUESTED SECTION NUMBERS********

    -10      -10

ET                                                                   1.4
NC     .070      .070      .070       .1        .3
QT        6     1400.     2000.     2280.     2930.     1017.     2280
```

```
X1     4.43       18      480      524      100      100      100
GR    782.2        0    779.4      100    775.3      300    776.0      400    776.2      480
GR    772.5      484    769.0      488    768.5      500    771.9      505    770.2      512
      771.9      517    776.2      524    776.0    541.1    775.4      600    776.2      700
      778.6      800    780.2      900    784.2     1000

NC     .080     .080     .080
NC                                .1       .3
X1     4.85       21     1988     2030     2250     2200     2218
GR    791.0       47    789.4      100    787.0      300    785.6      500    783.6      700
GR    783.1      800    782.1      900    782.0     1000    780.1     1300    779.6     1500
GR    777.7     1700    777.3     1800    776.7     1900    778.1     1988    770.7     2000
GR    773.4     2022    778.0     2030    777.9     2100    781.0     2200    781.4     2300
GR    793.4     2365

X1     5.62       19      147      216     2200     3800     4060
GR    793.5        0    782.0      100    781.3      147    778.1      172    775.2      177
GR    774.2      200    775.2      205    779.8      216    780.0      232    780.2      300
GR    780.2      500    780.6      600    779.7      700    779.9      800    780.4      900
GR    781.5     1000    783.6     1100    787.4     1147    790.2     1156
```



```
NC                                .6       .8
X1     5.64        0                      100      600      100
X3       10                                                          786.5    782.05

       1.0      1.3      2.8               25        3      624      3.2    774.4    774.4
X1     5.64        0                     26.8     26.8     26.8
X2                          1    786.5    782.3
X3       10                                                          788.5    782.3
BT       13        0    796.0        0      100    790.7        0      300    783.9        0
BT      400    782.3        0      600    782.8        0      700    782.6        0      800
BT    782.9        0      900    783.9        0      918    784.0        0     1000    783.6
BT        0     1200    784.9        0     1400    786.8        0     1600    790.7        0

X1     5.66        0                      100      100      100

NC      .08      .08      .09       .1       .3
X1     5.85       22      185      250     1000      500     1000
GR    790.3        0    781.7      185    775.9      194    774.8      205    775.9      214
GR    777.6      217    777.6      232    782.9      250    782.0      300    782.0      355
GR    781.6      400    780.6      500    781.3      560    781.0      600    781.4      700
GR    781.3      800    781.4      900    781.9     1000    781.7     1100    781.4     1200
GR    782.0     1300    784.0     1337

NC                                .6       .8
X1     5.87        0                      100      100      100
X3       10                                                          788.3    782.2

SB     1.00      1.5      2.6               15      4.0      549      2.2    773.8    773.8
X1     5.87        0                       28       28       28
                            1    788.3    782.5
        10                                                          790.1    782.5
BT        7        0    792.0        0      200    785.4        0      300    783.0        0
BT      400    782.5        0      700    783.0        0     1000    782.9        0     1064
BT    784.0
```

X1	5.89	22	185	250	100	100	100			
X4	2	779.9	331	775.0	337					
GR	790.3	0	781.7	185	775.9	194	774.8	205	775.9	214
	777.6	217	777.6	232	782.9	250	782.0	300	782.0	355
	781.6	400	780.6	500	781.3	560	781.0	600	781.4	700
GR	781.3	800	781.4	900	781.9	1000	781.7	1100	781.4	1200
GR	782.0	1300	784.0	1337						
QT	6	1080	1520	1740	2280	790	1740			
NC	.080	.080	.090							
X1	6.17	10	900	950	1250	1600	1480			
GR	800.0	0	790.0	70	784.0	300	783.3	900	777.7	913
GR	776.8	925	777.7	936	783.3	950	784.0	1160	790.0	1500

X1	6.45	24	1432	1467	1250	1600	1480			
GR	791.1	0	787.5	200	786.5	400	786.0	500	785.1	600
GR	783.8	800	784.2	900	784.0	1000	784.2	1100	784.0	1200
GR	783.6	1262	783.5	1275	783.4	1300	783.1	1400	784.3	1432
GR	778.9	1438	778.1	1453	778.9	1458	784.5	1467	785.4	1495
GR	784.5	1509	783.8	1523	782.2	1700	790.0	1850		
X1	6.98	10	20	72	2600	4300	2800			
GR	789.8	0	786.3	20	779.6	54	786.8	72	788.0	100
GR	784.7	200	786.5	400	790.2	600	791.0	700	791.0	800
				.6	.8					
X1	6.99	0			25	25	25			
X3	10							789.2	787.8	
SB	1.1	1.5	2.6		19	1.5	357	1.60	778.9	778.9
X1	6.99	0			26	26	26			
X2			1	789.2	787.8					
X3	10							791.0	788.2	
BT	11	0	792.9	0	100	790.0	0	200	788.4	0
BT	300	788.0	0	400	788.6	0	500	788.4	0	700
BT	789.2	0	800	788.2	0	1000	787.8	0	1100	789.8
BT	0	1200	790.1	0						
X1	7.00	0			25	25	25			
NC				.1	.3					
X1	7.13	19	575	643	550	25	690			
GR	789.5	0	786.9	100	786.7	300	787.1	400	787.0	500
GR	788.1	575	779.9	600	780.9	615	785.5	625	787.8	643
GR	786.2	700	786.0	800	789.5	1000	789.2	1100	789.3	1300
GR	788.3	1400	788.1	1422	795.7	1500	804.6	1561		
NC	.065	.065	.065							
X1	7.66	28	900	965	2350	2550	2800			
GR	800.3	0	794.1	100	793.1	200	792.8	300	791.6	400
	790.9	500	792.4	600	792.3	700	791.7	800	791.6	900
	787.4	915	787.4	915.1	783.2	930	782.1	942	782.5	946
GR	783.1	953	790.0	962	791.2	965	791.2	965.1	789.5	1000
GR	789.3	1100	789.0	1200	789.6	1300	789.3	1400	789.2	1500
GR	789.3	1600	791.7	1619	792.0	1630				

X1	7.67	0			50	50	50			
X3	10							792.9	791.5	
		1.3	2.8		17		306	1.8	782.1	782.1
	7.67	0			16	16	16			
X2			1	794.0	791.5					
X3	10							792.9	791.5	
BT	23	0	800.9	800.3	100	797.5	794.1	200	795.0	793.1
BT	300	793.8	792.8	400	793.0	791.6	500	792.9	790.9	600
BT	793.1	792.4	700	793.1	792.3	800	793.2	791.7	900	795.1
BT	791.6	915	794.9	787.4	915.1	794.9	788.6	946	794.5	794.0

1

BT	965	794.3	788.7	965.1	794.3	791.2	1000	793.8	789.5	1100
BT	792.5	789.3	1200	792.1	789.0	1300	791.7	789.6	1400	791.5
BT	789.3	1500	792.0	789.2	1600	792.4	789.3	1630	792.2	792.0
X1	7.68	0			50	50	50			
X5	1						791.59			
QT	6	970	1380	1580	2030	705.	1580			
NC				.1	.3					
ET							8.1	775	1125	
X1	8.30	13	1036	1125	3100	3170	3270			
GR	800.0	0	795.5	.1	794.8	690	794.5	710	794.3	720
GR	794.2	1036	787.3	1044	784.8	1050	787.3	1065	790.0	1078
[illegible]	790.0	1096	795.2	1125	800.0	1150				
ET							1.4			
X1	8.50	16	258	347	1100	1080	1060			
X5	1						796.57			
GR	800.5	0	796.1	100	796.0	200	796.3	258	788.2	266
GR	785.7	272	788.2	287	790.9	300	790.8	318	796.1	347
GR	795.8	500	795.1	600	795.4	800	795.9	900	798.7	1000
GR	800.3	1017								
ET							8.1	387	737	
X1	8.88	13	640	737	2480	1430	2010			
GR	805.0	0	800.0	140	799.9	250	799.5	295	799.3	340
GR	798.5	570	798.5	640	791.8	648	789.3	652	791.8	667
GR	799.7	737	800.0	810	805.0	870				
ET							1.4			
X1	9.06	17	84	129	370	270	950			
X3	10							799.5	799.5	
X5	1						800.26			
GR	807.0	0	795.9	50	796.8	67.9	797.6	84	791.0	96
GR	792.0	107	795.5	118	798.6	129	798.1	200	798.1	300
GR	797.2	400	797.4	500	799.2	600	799.4	700	799.6	800
GR	799.8	900	800.0	1000						
NC				.3	.5					
	9.07	18	68	129	50	50	50			
	10							802.1	800.4	
GR	807.0	0	795.9	50	796.8	67.9	796.8	68	791.0	96
GR	792.0	107	792.2	117.9	795.5	118	798.6	129	798.1	200
GR	798.1	300	797.2	400	797.4	500	799.2	600	799.4	700
GR	799.6	800	799.8	900	800.0	1000				

SB		1.3	2.8		44.5		501	.26	791.0	791.0
X1	9.07	0			28.5	28.5	28.5			
			1	802.1	800.4					
	10							805.0	800.3	
BT	16	0	807.0	807.0	50	805.4	795.9	67.9	805.0	796.8
BT	68	805.0	802.1	117.9	804.1	801.2	118	804.1	795.5	129
BT	804.0	798.6	200	803.0	798.1	300.0	801.3	798.1	400	800.4
BT	797.2	500	800.6	797.4	600	800.9	799.2	700	800.5	799.4

BT	800	800.5	799.6	900	800.9	799.8	1000	801.1	800.0	
X1	9.08	17	84	129	50	50	50			
GR	807.0	0	795.9	50	796.8	67.9	797.6	84	791.0	96
GR	792.0	107	795.5	118	798.6	129	798.1	200	798.1	300
GR	797.2	400	797.4	500	799.2	600	799.4	700	799.6	800
GR	799.8	900	800.0	1000						
NC	.070	.070	.080							
NC				.1	.3					
X1	9.34	16	771	835	500	2200	1373			
GR	810.0	200	800.0	300	799.6	350	799.2	400	799.4	500
GR	799.4	600	799.6	700	800.5	771	794.1	789	792.9	800
GR	799.3	835	800.9	900	801.7	1000	809.5	1200	810.9	1400
GR	814.5	1568								
				.3	.5					
X1	9.35	0			50	50	50			
X3	10							800.7	804.9	
SB	1.0	1.3	2.8		21	3.0	614	2.7	792.8	792.8
X1	9.35	0			28	28	28			
X2			1	804.9	800.8					
X3	10							800.8	806.1	
BT	9	300	800.8	0	400	800.8	0	500	800.9	0
BT	800	806.4	0	900	806.4	0	1000	806.1	0	1100
BT	806.4	0	1300	810.1	0	1568	813.5	0		
X1	9.36	0			50	50	50			
NC	.06	.06	.07							
NC				.1	.3					
X1	9.73	16	363	400	2150	1650	1950		-2.7	
GR	820.2	0	813.2	100	812.1	167	804.1	200	804.2	300
GR	805.4	363	800.9	372	799.9	382	800.9	391	802.6	400
GR	804.9	500	810.6	600	817.2	648	818.5	700	816.1	900
GR	820.3	953								
NC	.06	.06	.065							
X1	9.96	0	0	0	1350	1050	1220		2.7	
	10.38	0	0	0	1950	1750	2220		2.2	
X1	10.76	16	660	720	2150	1550	2000			
GR	820.6	0	815.9	200	812.6	300	812.0	400	810.9	500
GR	810.5	600	809.8	660	806.2	675	804.2	700	806.2	713
GR	809.5	720	809.7	800	812.0	900	817.2	1000	824.1	1100

GR 824.7 1116

1

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T1 NOBLESVILLE FLOOD INSURANCE
T2 MUD CREEK
T3 100 YEAR ENCROACHMENT .1 FOOT

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10	7					-1		780.52	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2		-1							

1

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T1 NOBLESVILLE FLOOD INSURANCE
T2 MUD CREEK
T3 10 YEAR FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-1	2					-1		778.91	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3		-1							

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T1 NOBLESVILLE FLOOD INSURANCE
T2 MUD CREEK
T3 50 YEAR FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10	3					-1		779.96	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4		-1							

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T1 NOBLESVILLE FLOOD INSURANCE
JD CREEK
500 YEAR FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10	5					-1		781.43	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	5		-1							

T1 NOBLESVILLE FLOOD INSURANCE STUDY
T2 MUD CREEK
T3 1961 FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-1	6					-1		778.15	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15		-1							

1

THIS RUN EXECUTED 13FEB97 14:15:10

****
2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EAR FLOOD

SUMMARY PRINTOUT

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	780.420	1752.85	841.93	.00	480.00	524.00	.00
	780.520	1752.09	615.89	173.52	480.00	524.00	789.41
	778.910	904.65	695.47	.00	480.00	524.00	.00
	779.960	1457.25	805.00	.00	480.00	524.00	.00
	781.430	2509.40	903.25	.00	480.00	524.00	.00
	778.150	604.64	620.28	.00	480.00	524.00	.00
*	781.015	1030.01	1048.08	.00	1988.00	2030.00	.00
*	781.115	1029.53	732.15	1382.37	1988.00	2030.00	2114.52
	779.788	500.49	735.99	.00	1988.00	2030.00	.00
	780.633	836.54	972.30	.00	1988.00	2030.00	.00
*	781.885	1585.84	1284.43	.00	1988.00	2030.00	.00
*	779.189	333.31	598.13	.00	1988.00	2030.00	.00
	782.788	941.44	968.18	.00	147.00	216.00	.00

	782.896	937.93	780.12	147.00	147.00	216.00	927.12
	782.063	586.27	927.37	.00	147.00	216.00	.00
	782.570	825.49	955.85	.00	147.00	216.00	.00
	783.296	1234.47	996.42	.00	147.00	216.00	.00
	781.673	430.73	886.34	.00	147.00	216.00	.00
	783.039	1067.59	926.27	.00	147.00	216.00	.00
	783.147	1071.25	777.67	147.00	147.00	216.00	924.67
	782.286	682.71	890.45	.00	147.00	216.00	.00
	782.815	944.78	915.62	.00	147.00	216.00	.00
	783.548	1373.22	950.52	.00	147.00	216.00	.00
*	781.938	174.03	69.00	.00	147.00	216.00	.00
	783.270	1205.32	937.55	.00	147.00	216.00	.00
	783.378	1209.62	793.07	147.00	147.00	216.00	940.07
	782.512	793.62	901.58	.00	147.00	216.00	.00
	783.069	1090.60	928.20	.00	147.00	216.00	.00
	783.704	1479.23	954.37	.00	147.00	216.00	.00
	781.948	174.66	69.00	.00	147.00	216.00	.00

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	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	783.306	1247.79	997.62	.00	147.00	216.00	.00
	783.414	1245.70	821.26	147.00	147.00	216.00	968.26
	782.543	815.26	954.73	.00	147.00	216.00	.00
	783.103	1124.53	986.24	.00	147.00	216.00	.00
	783.743	1535.11	1017.00	.00	147.00	216.00	.00
*	782.229	660.03	936.69	.00	147.00	216.00	.00
	783.586	880.40	1185.23	.00	185.00	250.00	.00
	783.692	879.65	1036.63	185.00	185.00	250.00	1221.63
*	782.840	484.60	1151.49	.00	185.00	250.00	.00
*	783.382	753.47	1176.46	.00	185.00	250.00	.00
	784.027	1158.45	1202.06	.00	185.00	250.00	.00
*	782.498	347.67	1117.77	.00	185.00	250.00	.00
	783.652	903.15	1145.41	.00	185.00	250.00	.00
	783.758	903.75	1015.85	185.00	185.00	250.00	1200.85
	782.920	518.69	1132.02	.00	185.00	250.00	.00
	783.451	785.91	1141.68	.00	185.00	250.00	.00
	784.090	1184.78	1152.00	.00	185.00	250.00	.00
	782.580	377.03	1106.87	.00	185.00	250.00	.00
	783.732	960.27	1147.15	.00	185.00	250.00	.00
	783.838	963.15	1031.20	185.00	185.00	250.00	1216.20
	783.147	632.80	1136.39	.00	185.00	250.00	.00
	783.563	858.27	1144.01	.00	185.00	250.00	.00
	784.141	1228.39	1152.00	.00	185.00	250.00	.00
	782.801	469.39	1124.57	.00	185.00	250.00	.00
	783.785	1080.28	1193.14	.00	185.00	250.00	.00
	783.891	1075.92	1044.32	185.00	185.00	250.00	1229.32
	783.193	726.95	1169.48	.00	185.00	250.00	.00
	783.614	972.08	1186.35	.00	185.00	250.00	.00
	784.195	1362.65	1205.77	.00	185.00	250.00	.00
	782.844	551.67	1152.72	.00	185.00	250.00	.00

*	784.906	378.69	946.08	.00	900.00	950.00	.00
*	785.016	380.00	712.69	381.06	900.00	950.00	1093.75
	784.266	194.61	885.21	.00	900.00	950.00	.00
	784.717	316.49	928.22	.00	900.00	950.00	.00
*	785.309	533.01	984.23	.00	900.00	950.00	.00
*	783.890	129.10	731.18	.00	900.00	950.00	.00
*	786.019	887.12	1277.39	.00	1432.00	1467.00	.00
*	786.123	888.45	1020.40	687.43	1432.00	1467.00	1707.83
*	785.473	582.34	1204.47	.00	1432.00	1467.00	.00
*	785.849	785.92	1253.64	.00	1432.00	1467.00	.00
*	786.392	1134.52	1359.21	.00	1432.00	1467.00	.00
*	785.165	439.39	1153.15	.00	1432.00	1467.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
*	788.417	435.22	495.77	.00	20.00	72.00	.00
*	788.521	431.44	378.56	20.00	20.00	72.00	398.56
*	787.667	270.92	433.02	.00	20.00	72.00	.00
*	788.193	380.72	482.44	.00	20.00	72.00	.00
*	788.896	565.52	524.33	.00	20.00	72.00	.00
*	787.240	199.49	384.61	.00	20.00	72.00	.00
	788.457	440.75	485.38	.00	20.00	72.00	.00
	788.560	440.94	372.27	20.00	20.00	72.00	392.27
*	787.692	108.59	52.00	.00	20.00	72.00	.00
	788.234	386.13	473.28	.00	20.00	72.00	.00
	788.936	570.77	511.27	.00	20.00	72.00	.00
*	787.279	92.76	52.00	.00	20.00	72.00	.00
	788.671	498.65	497.35	.00	20.00	72.00	.00
	788.774	499.05	381.19	20.00	20.00	72.00	401.19
	787.693	108.70	52.00	.00	20.00	72.00	.00
	788.488	450.59	487.47	.00	20.00	72.00	.00
	789.035	602.00	517.00	.00	20.00	72.00	.00
	787.294	93.58	52.00	.00	20.00	72.00	.00
	788.703	511.50	512.97	.00	20.00	72.00	.00
	788.807	506.42	388.97	20.00	20.00	72.00	408.97
*	788.207	383.49	483.14	.00	20.00	72.00	.00
	788.518	462.01	501.99	.00	20.00	72.00	.00
	789.073	618.39	534.89	.00	20.00	72.00	.00
*	787.631	264.45	428.99	.00	20.00	72.00	.00
	788.997	681.66	1052.49	.00	575.00	643.00	.00
	789.105	685.63	751.51	107.04	575.00	643.00	858.55
	788.446	452.28	940.41	.00	575.00	643.00	.00
	788.807	595.69	1013.45	.00	575.00	643.00	.00
*	789.386	881.12	1385.94	.00	575.00	643.00	.00
	787.945	288.57	841.15	.00	575.00	643.00	.00
	790.985	568.73	724.49	.00	900.00	965.00	.00
	791.083	568.17	637.82	900.00	900.00	965.00	1542.44
	790.337	347.39	683.78	.00	900.00	965.00	.00
	790.797	497.78	699.68	.00	900.00	965.00	.00

	791.395	744.69	819.75	.00	900.00	965.00	.00
	790.050	270.01	673.65	.00	900.00	965.00	.00
	790.805	223.44	61.18	.00	900.00	965.00	.00
	790.916	229.52	61.85	900.00	900.00	965.00	965.00
*	790.304	197.27	58.13	.00	900.00	965.00	.00
*	790.671	216.21	60.36	.00	900.00	965.00	.00
*	791.057	237.50	62.72	.00	900.00	965.00	.00
*	790.055	185.11	56.62	.00	900.00	965.00	.00

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	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	790.846	187.11	61.42	.00	900.00	965.00	.00
	790.956	231.71	62.09	900.00	900.00	965.00	965.00
	790.334	173.74	58.32	.00	900.00	965.00	.00
	790.709	183.69	60.59	.00	900.00	965.00	.00
	791.098	193.12	62.95	.00	900.00	965.00	.00
	790.076	166.44	56.75	.00	900.00	965.00	.00
*	791.479	784.32	838.03	.00	900.00	965.00	.00
*	791.590	789.29	658.51	900.00	900.00	965.00	1558.55
*	790.628	438.11	693.79	.00	900.00	965.00	.00
*	791.217	663.01	780.11	.00	900.00	965.00	.00
*	792.096	1134.61	1116.43	.00	900.00	965.00	.00
*	790.249	322.11	680.68	.00	900.00	965.00	.00
	794.508	278.56	411.23	.00	1036.00	1125.00	.00
*	794.560	284.69	346.43	775.00	1036.00	1125.00	1125.00
*	793.753	215.98	80.41	.00	1036.00	1125.00	.00
*	794.320	257.64	401.02	.00	1036.00	1125.00	.00
*	794.771	317.76	430.52	.00	1036.00	1125.00	.00
*	793.136	176.22	76.28	.00	1036.00	1125.00	.00
*	796.471	487.16	828.83	.00	258.00	347.00	.00
*	796.570	486.21	533.30	258.00	258.00	347.00	791.30
	795.438	276.26	341.62	.00	258.00	347.00	.00
*	796.233	414.03	802.06	.00	258.00	347.00	.00
*	796.884	644.91	852.96	.00	258.00	347.00	.00
	794.568	209.96	78.90	.00	258.00	347.00	.00
*	799.409	323.14	417.73	.00	640.00	737.00	.00
*	799.459	332.04	347.85	387.00	640.00	737.00	737.00
	798.468	221.43	86.05	.00	640.00	737.00	.00
	799.203	292.33	362.18	.00	640.00	737.00	.00
*	799.795	398.87	498.29	.00	640.00	737.00	.00
	797.468	160.04	75.99	.00	640.00	737.00	.00
*	800.155	728.38	969.16	.00	84.00	129.00	.00
*	800.260	730.70	653.28	51.81	84.00	129.00	705.09
*	799.522	463.33	727.21	.00	84.00	129.00	.00
	799.949	631.18	942.23	.00	84.00	129.00	.00
	800.534	933.20	970.86	.00	84.00	129.00	.00
	799.346	154.07	45.00	.00	84.00	129.00	.00
*	800.084	291.81	61.00	.00	68.00	129.00	.00
*	800.193	295.44	61.00	68.00	68.00	129.00	129.00

*	799.508	249.23	61.00	.00	68.00	129.00	.00
*	799.900	277.97	61.00	.00	68.00	129.00	.00
	800.555	966.24	932.00	.00	68.00	129.00	.00
	799.511	249.40	61.00	.00	68.00	129.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	800.150	274.27	61.00	.00	68.00	129.00	.00
	800.259	300.28	61.00	68.00	68.00	129.00	129.00
	799.544	238.44	61.00	.00	68.00	129.00	.00
	799.957	262.68	61.00	.00	68.00	129.00	.00
*	800.361	287.08	932.00	.00	68.00	129.00	.00
	799.529	237.06	61.00	.00	68.00	129.00	.00
*	800.561	950.77	970.99	.00	84.00	129.00	.00
*	800.593	914.68	773.31	50.93	84.00	129.00	824.24
*	799.736	542.25	835.30	.00	84.00	129.00	.00
*	800.292	799.85	969.78	.00	84.00	129.00	.00
*	800.993	1223.30	972.94	.00	84.00	129.00	.00
*	799.632	502.65	782.86	.00	84.00	129.00	.00
*	801.248	452.32	656.24	.00	771.00	835.00	.00
*	801.324	444.58	507.04	335.43	771.00	835.00	842.47
*	800.545	253.43	590.54	.00	771.00	835.00	.00
*	801.028	383.27	626.47	.00	771.00	835.00	.00
	801.665	602.63	713.01	.00	771.00	835.00	.00
	800.206	187.71	549.89	.00	771.00	835.00	.00
	801.308	452.01	548.08	.00	771.00	835.00	.00
	801.387	440.79	476.46	358.54	771.00	835.00	835.00
*	800.595	148.49	64.00	.00	771.00	835.00	.00
	801.092	388.48	545.92	.00	771.00	835.00	.00
	801.721	586.55	552.21	.00	771.00	835.00	.00
	800.270	132.71	63.35	.00	771.00	835.00	.00
	801.494	510.60	549.94	.00	771.00	835.00	.00
	801.573	499.73	482.96	352.04	771.00	835.00	835.00
	800.610	149.62	64.00	.00	771.00	835.00	.00
	801.279	443.13	547.79	.00	771.00	835.00	.00
	801.901	650.59	554.01	.00	771.00	835.00	.00
	800.278	133.09	63.38	.00	771.00	835.00	.00
	801.545	556.62	696.60	.00	771.00	835.00	.00
	801.625	546.95	528.01	327.49	771.00	835.00	855.51
*	800.878	339.82	607.90	.00	771.00	835.00	.00
	801.330	480.66	667.69	.00	771.00	835.00	.00
	801.954	719.68	726.11	.00	771.00	835.00	.00
*	800.455	235.78	582.79	.00	771.00	835.00	.00
*	803.745	386.57	336.89	.00	363.00	400.00	.00
	803.861	390.04	285.48	205.67	363.00	400.00	491.14
	803.063	240.85	322.02	.00	363.00	400.00	.00
	803.543	340.91	332.59	.00	363.00	400.00	.00
*	804.160	489.62	345.78	.00	363.00	400.00	.00
	802.708	179.10	314.30	.00	363.00	400.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	806.130	321.42	329.88	.00	363.00	400.00	.00
	806.226	320.71	273.01	208.96	363.00	400.00	481.97
	805.454	191.83	315.19	.00	363.00	400.00	.00
	805.922	277.67	325.34	.00	363.00	400.00	.00
	806.552	419.81	339.07	.00	363.00	400.00	.00
	805.066	136.70	288.64	.00	363.00	400.00	.00
*	809.068	502.85	346.04	.00	363.00	400.00	.00
*	809.172	504.18	294.84	203.59	363.00	400.00	498.43
*	808.334	322.77	330.01	.00	363.00	400.00	.00
*	808.845	445.32	341.28	.00	363.00	400.00	.00
*	809.521	631.02	355.78	.00	363.00	400.00	.00
*	807.932	240.76	321.22	.00	363.00	400.00	.00
	811.600	358.34	447.21	.00	660.00	720.00	.00
	811.701	357.69	281.95	535.23	660.00	720.00	817.18
*	810.807	212.09	326.13	.00	660.00	720.00	.00
*	811.366	308.04	415.91	.00	660.00	720.00	.00
	812.055	476.35	511.76	.00	660.00	720.00	.00
*	810.320	156.21	211.70	.00	660.00	720.00	.00

EAR FLOOD

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	4.430	780.42	.00	780.43	841.93	987.74	465.49	826.77	.00	.00	480.00	524.00	.00
	4.430	780.52	.10	780.53	615.89	986.00	474.03	819.96	.04	173.52	480.00	524.00	789.41
	4.430	778.91	.00	778.92	695.47	537.32	412.84	449.84	.00	.00	480.00	524.00	.00
	4.430	779.96	.00	779.97	805.00	842.95	451.52	705.52	.00	.00	480.00	524.00	.00
	4.430	781.43	.00	781.44	903.25	1318.75	495.81	1115.44	.00	.00	480.00	524.00	.00
	4.430	778.15	.00	778.16	620.28	348.50	378.53	289.97	.00	.00	480.00	524.00	.00
*	4.850	781.02	.00	781.03	1048.08	1526.37	480.85	272.79	.00	.00	1988.00	2030.00	.00
*	4.850	781.12	.10	781.13	732.15	1558.79	491.73	229.48	.05	1382.37	1988.00	2030.00	2114.52
*	4.850	779.79	.00	779.81	735.99	817.92	453.07	129.01	.00	.00	1988.00	2030.00	.00
*	4.850	780.63	.00	780.65	972.30	1296.53	476.58	226.88	.00	.00	1988.00	2030.00	.00
*	4.850	781.88	.00	781.90	1284.43	2044.03	480.84	405.13	.00	.00	1988.00	2030.00	.00
*	4.850	779.19	.00	779.21	598.13	530.03	419.08	67.89	.00	.00	1988.00	2030.00	.00
	5.620	782.79	.00	782.80	968.18	26.87	551.96	1701.17	.00	.00	147.00	216.00	.00
	5.620	782.90	.11	782.91	780.12	.00	562.08	1717.92	.06	147.00	147.00	216.00	927.12
	5.620	782.06	.00	782.08	927.37	4.78	433.68	961.54	.00	.00	147.00	216.00	.00
	5.620	782.57	.00	782.58	955.85	18.65	517.22	1464.13	.00	.00	147.00	216.00	.00
	5.620	783.30	.00	783.31	996.42	49.59	622.72	2257.69	.00	.00	147.00	216.00	.00
	5.620	781.67	.00	781.68	886.34	.67	374.17	642.16	.00	.00	147.00	216.00	.00
	5.640	783.04	.00	783.05	926.27	.00	523.01	1756.99	.00	.00	147.00	216.00	.00

	5.640	783.15	.11	783.16	777.67	.00	537.13	1742.87	.05	147.00	147.00	216.00	924.67
	5.640	782.29	.00	782.30	890.45	.00	400.74	999.26	.00	.00	147.00	216.00	.00
	5.640	782.82	.00	782.83	915.62	.00	486.30	1513.70	.00	.00	147.00	216.00	.00
	5.640	783.55	.00	783.56	950.52	.00	599.31	2330.69	.00	.00	147.00	216.00	.00
	5.640	781.94	.00	782.08	69.00	.00	1017.00	.00	.00	.00	147.00	216.00	.00
	5.640	783.27	.00	783.28	937.55	.00	494.45	1785.55	.00	.00	147.00	216.00	.00
	5.640	783.38	.11	783.39	793.07	.00	506.39	1773.61	.05	147.00	147.00	216.00	940.07
	5.640	782.51	.00	782.52	901.58	.00	371.01	1028.99	.00	.00	147.00	216.00	.00
	5.640	783.07	.00	783.08	928.20	.00	454.22	1545.78	.00	.00	147.00	216.00	.00
	5.640	783.70	.00	783.72	954.37	.00	579.99	2350.01	.00	.00	147.00	216.00	.00
	5.640	781.95	.00	782.09	69.00	.00	1017.00	.00	.00	.00	147.00	216.00	.00
	5.660	783.31	.00	783.32	997.62	39.05	482.16	1758.79	.00	.00	147.00	216.00	.00
	5.660	783.41	.11	783.42	821.26	.00	486.44	1793.56	.05	147.00	147.00	216.00	968.26
	5.660	782.54	.00	782.55	954.73	12.73	364.37	1022.90	.00	.00	147.00	216.00	.00
	5.660	783.10	.00	783.11	986.24	30.31	444.14	1525.54	.00	.00	147.00	216.00	.00
	5.660	783.74	.00	783.76	1017.00	61.49	563.89	2304.62	.00	.00	147.00	216.00	.00
*	5.660	782.23	.00	782.23	936.69	5.42	295.54	716.03	.00	.00	147.00	216.00	.00

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	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	5.850	783.59	.00	783.60	1185.23	17.89	508.50	1753.62	.00	.00	185.00	250.00	.00
	5.850	783.69	.11	783.71	1036.63	.00	513.28	1766.72	.06	185.00	185.00	250.00	1221.63
	5.850	782.84	.00	782.85	1151.49	5.15	451.16	943.69	.00	.00	185.00	250.00	.00
	5.850	783.38	.00	783.40	1176.46	13.21	488.93	1497.86	.00	.00	185.00	250.00	.00
	5.850	784.03	.00	784.04	1202.06	30.26	559.70	2340.04	.00	.00	185.00	250.00	.00
*	5.850	782.50	.00	782.51	1117.77	2.02	412.30	602.68	.00	.00	185.00	250.00	.00
	5.870	783.65	.00	783.66	1145.41	.00	502.77	1777.22	.00	.00	185.00	250.00	.00
	5.870	783.76	.11	783.77	1015.85	.00	518.14	1761.86	.07	185.00	185.00	250.00	1200.85
	5.870	782.92	.00	782.93	1132.02	.00	431.79	968.21	.00	.00	185.00	250.00	.00
	5.870	783.45	.00	783.46	1141.68	.00	478.16	1521.84	.00	.00	185.00	250.00	.00
	5.870	784.09	.00	784.11	1152.00	.00	555.55	2374.45	.00	.00	185.00	250.00	.00
	5.870	782.58	.00	782.59	1106.87	.00	389.79	627.20	.00	.00	185.00	250.00	.00
	5.870	783.73	.00	783.74	1147.15	.00	485.53	1794.47	.00	.00	185.00	250.00	.00
	5.870	783.84	.11	783.85	1031.20	.00	497.65	1782.35	.06	185.00	185.00	250.00	1216.20
	5.870	783.15	.00	783.16	1136.39	.00	381.36	1018.64	.00	.00	185.00	250.00	.00
	5.870	783.56	.00	783.57	1144.01	.00	454.17	1545.83	.00	.00	185.00	250.00	.00
	5.870	784.14	.00	784.15	1152.00	.00	544.85	2385.15	.00	.00	185.00	250.00	.00
	5.870	782.80	.00	782.81	1124.57	.00	335.28	681.72	.00	.00	185.00	250.00	.00
	5.890	783.78	.00	783.79	1193.14	18.99	438.11	1822.90	.00	.00	185.00	250.00	.00
	5.890	783.89	.11	783.90	1044.32	.00	441.96	1838.04	.05	185.00	185.00	250.00	1229.32
	5.890	783.19	.00	783.20	1169.48	7.15	336.52	1056.33	.00	.00	185.00	250.00	.00
	5.890	783.61	.00	783.62	1186.35	14.78	407.23	1578.00	.00	.00	185.00	250.00	.00
	5.890	784.20	.00	784.21	1205.77	31.12	497.85	2401.03	.00	.00	185.00	250.00	.00
	5.890	782.84	.00	782.85	1152.72	3.38	288.93	724.68	.00	.00	185.00	250.00	.00
	6.170	784.91	.00	784.95	946.08	756.79	709.39	273.82	.00	.00	900.00	950.00	.00
	6.170	785.02	.11	785.06	712.69	780.34	728.11	231.55	.09	381.06	900.00	950.00	1093.75
*	6.170	784.27	.00	784.34	885.21	275.68	707.42	96.90	.00	.00	900.00	950.00	.00
*	6.170	784.72	.00	784.77	928.22	601.82	702.52	215.66	.00	.00	900.00	950.00	.00
*	6.170	785.31	.00	785.35	984.23	1126.56	737.01	416.43	.00	.00	900.00	950.00	.00
*	6.170	783.89	.00	784.00	731.18	74.69	689.16	26.14	.00	.00	900.00	950.00	.00

*	6.450	786.02	.00	786.03	1277.39	1003.46	219.54	517.00	.00	.00	1432.00	1467.00	.00
*	6.450	786.12	.10	786.13	1020.40	1029.17	225.41	485.41	.07	687.43	1432.00	1467.00	1707.83
	6.450	785.47	.00	785.48	1204.47	564.41	177.86	337.74	.00	.00	1432.00	1467.00	.00
	6.450	785.85	.00	785.86	1253.64	855.27	206.69	458.04	.00	.00	1432.00	1467.00	.00
*	6.450	786.39	.00	786.40	1359.21	1373.51	248.09	658.40	.00	.00	1432.00	1467.00	.00
*	6.450	785.16	.00	785.17	1153.15	375.96	156.90	257.14	.00	.00	1432.00	1467.00	.00
*	6.980	788.42	.00	788.45	495.77	9.79	552.91	1177.31	.00	.00	20.00	72.00	.00
*	6.980	788.52	.10	788.56	378.56	.00	559.80	1180.20	.06	20.00	20.00	72.00	398.56
*	6.980	787.67	.00	787.70	433.02	3.04	429.14	647.82	.00	.00	20.00	72.00	.00
*	6.980	788.19	.00	788.23	482.44	7.27	514.53	998.20	.00	.00	20.00	72.00	.00
*	6.980	788.90	.00	788.94	524.33	16.98	642.51	1620.51	.00	.00	20.00	72.00	.00
*	6.980	787.24	.00	787.27	384.61	1.11	362.83	426.05	.00	.00	20.00	72.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	6.990	788.46	.00	788.49	485.38	.00	551.34	1188.66	.00	.00	20.00	72.00	.00
	6.990	788.56	.10	788.60	372.27	.00	569.69	1170.31	.06	20.00	20.00	72.00	392.27
*	6.990	787.69	.00	788.00	52.00	.00	1080.00	.00	.00	.00	20.00	72.00	.00
	6.990	788.23	.00	788.27	473.28	.00	512.40	1007.60	.00	.00	20.00	72.00	.00
	6.990	788.94	.00	788.98	511.27	.00	642.53	1637.47	.00	.00	20.00	72.00	.00
*	6.990	787.28	.00	787.48	52.00	.00	790.00	.00	.00	.00	20.00	72.00	.00
	6.990	788.67	.00	788.70	497.35	.00	521.00	1219.00	.00	.00	20.00	72.00	.00
	6.990	788.77	.10	788.81	381.19	.00	536.55	1203.45	.05	20.00	20.00	72.00	401.19
	6.990	787.69	.00	788.00	52.00	.00	1080.00	.00	.00	.00	20.00	72.00	.00
	6.990	788.49	.00	788.52	487.47	.00	476.74	1043.26	.00	.00	20.00	72.00	.00
	6.990	789.03	.00	789.07	517.00	.00	627.59	1652.41	.00	.00	20.00	72.00	.00
	6.990	787.29	.00	787.49	52.00	.00	790.00	.00	.00	.00	20.00	72.00	.00
	7.000	788.70	.00	788.73	512.97	11.70	513.13	1215.17	.00	.00	20.00	72.00	.00
	7.000	788.81	.10	788.84	388.97	.00	517.25	1222.75	.05	20.00	20.00	72.00	408.97
*	7.000	788.21	.00	788.22	483.14	5.21	364.33	710.46	.00	.00	20.00	72.00	.00
	7.000	788.52	.00	788.54	501.99	9.15	469.74	1041.11	.00	.00	20.00	72.00	.00
	7.000	789.07	.00	789.11	534.89	18.51	617.41	1644.08	.00	.00	20.00	72.00	.00
*	7.000	787.63	.00	787.65	428.99	2.12	317.49	470.39	.00	.00	20.00	72.00	.00
	7.130	789.00	.00	789.01	1052.49	765.12	437.50	537.38	.00	.00	575.00	643.00	.00
	7.130	789.10	.11	789.12	751.51	770.13	450.25	519.61	.07	107.04	575.00	643.00	858.55
	7.130	788.45	.00	788.46	940.41	419.84	340.45	319.71	.00	.00	575.00	643.00	.00
	7.130	788.81	.00	788.82	1013.45	646.39	411.11	462.50	.00	.00	575.00	643.00	.00
*	7.130	789.39	.00	789.40	1385.94	1049.98	500.22	729.80	.00	.00	575.00	643.00	.00
	7.130	787.95	.00	787.96	841.15	242.79	324.49	222.72	.00	.00	575.00	643.00	.00
	7.660	790.99	.00	791.02	724.49	.07	714.21	1025.72	.00	.00	900.00	965.00	.00
	7.660	791.08	.10	791.12	637.82	.00	731.51	1008.49	.06	900.00	900.00	965.00	1542.44
	7.660	790.34	.00	790.38	683.78	.00	618.68	461.32	.00	.00	900.00	965.00	.00
	7.660	790.80	.00	790.83	699.68	.00	681.19	838.81	.00	.00	900.00	965.00	.00
	7.660	791.39	.00	791.43	819.75	7.11	790.77	1482.12	.00	.00	900.00	965.00	.00
	7.660	790.05	.00	790.09	673.65	.00	540.14	249.86	.00	.00	900.00	965.00	.00
*	7.670	790.81	.00	791.24	61.18	.00	1740.00	.00	.00	.00	900.00	965.00	.00
*	7.670	790.92	.11	791.33	61.85	.00	1740.00	.00	.00	900.00	900.00	965.00	965.00
*	7.670	790.30	.00	790.50	58.13	.00	1080.00	.00	.00	.00	900.00	965.00	.00
*	7.670	790.67	.00	791.02	60.36	.00	1520.00	.00	.00	.00	900.00	965.00	.00

*	7.670	791.06	.00	791.73	62.72	.00	2280.00	.00	.00	.00	900.00	965.00	.00
*	7.670	790.06	.00	790.17	56.62	.00	790.00	.00	.00	.00	900.00	965.00	.00
	7.670	790.85	.00	791.38	61.42	.00	1740.00	.00	.00	.00	900.00	965.00	.00
	7.670	790.96	.11	791.36	62.09	.00	1740.00	.00	.00	900.00	900.00	965.00	965.00
	7.670	790.33	.00	790.57	58.32	.00	1080.00	.00	.00	.00	900.00	965.00	.00
	7.670	790.71	.00	791.13	60.59	.00	1520.00	.00	.00	.00	900.00	965.00	.00
	7.670	791.10	.00	791.97	62.95	.00	2280.00	.00	.00	.00	900.00	965.00	.00
	7.670	790.08	.00	790.21	56.75	.00	790.00	.00	.00	.00	900.00	965.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	7.680	791.48	.00	791.50	838.03	7.78	585.15	1147.07	.00	.00	900.00	965.00	.00
*	7.680	791.59	.11	791.61	658.51	.00	597.97	1142.03	.06	900.00	900.00	965.00	1558.55
*	7.680	790.63	.00	790.65	693.79	.00	527.41	552.59	.00	.00	900.00	965.00	.00
*	7.680	791.22	.00	791.24	780.11	1.61	565.32	953.07	.00	.00	900.00	965.00	.00
*	7.680	792.10	.00	792.11	1116.43	65.82	625.43	1588.74	.00	.00	900.00	965.00	.00
*	7.680	790.25	.00	790.27	680.68	.00	477.08	312.92	.00	.00	900.00	965.00	.00
*	8.300	794.51	.00	794.71	411.23	41.45	1538.55	.00	.00	.00	1036.00	1125.00	.00
*	8.300	794.56	.05	794.75	346.43	49.02	1530.98	.00	350.00	775.00	1036.00	1125.00	1125.00
*	8.300	793.75	.00	793.87	80.41	.00	970.00	.00	.00	.00	1036.00	1125.00	.00
*	8.300	794.32	.00	794.50	401.02	4.45	1375.55	.00	.00	.00	1036.00	1125.00	.00
*	8.300	794.77	.00	795.03	430.52	158.28	1871.72	.00	.00	.00	1036.00	1125.00	.00
*	8.300	793.14	.00	793.22	76.28	.00	705.00	.00	.00	.00	1036.00	1125.00	.00
*	8.500	796.47	.00	796.53	828.83	24.40	1178.40	377.21	.00	.00	258.00	347.00	.00
*	8.500	796.57	.10	796.64	533.30	.00	1212.35	367.65	.07	258.00	258.00	347.00	791.30
	8.500	795.44	.00	795.52	341.62	.00	957.72	12.28	.00	.00	258.00	347.00	.00
*	8.500	796.23	.00	796.30	802.06	5.51	1129.68	244.81	.00	.00	258.00	347.00	.00
*	8.500	796.88	.00	796.94	852.96	80.79	1283.58	665.63	.00	.00	258.00	347.00	.00
	8.500	794.57	.00	794.63	78.90	.00	705.00	.00	.00	.00	258.00	347.00	.00
*	8.880	799.41	.00	799.55	417.73	148.31	1431.69	.00	.00	.00	640.00	737.00	.00
*	8.880	799.46	.05	799.59	347.85	165.30	1414.70	.00	350.00	387.00	640.00	737.00	737.00
	8.880	798.47	.00	798.57	86.05	.00	970.00	.00	.00	.00	640.00	737.00	.00
	8.880	799.20	.00	799.33	362.18	78.10	1301.90	.00	.00	.00	640.00	737.00	.00
*	8.880	799.79	.00	799.94	498.29	360.45	1669.38	.17	.00	.00	640.00	737.00	.00
	8.880	797.47	.00	797.56	75.99	.00	705.00	.00	.00	.00	640.00	737.00	.00
*	9.060	800.15	.00	800.17	969.16	163.55	425.18	991.26	.00	.00	84.00	129.00	.00
*	9.060	800.26	.11	800.28	653.28	115.94	436.51	1027.55	.07	51.81	84.00	129.00	705.09
*	9.060	799.52	.00	799.54	727.21	110.63	340.95	518.42	.00	.00	84.00	129.00	.00
*	9.060	799.95	.00	799.97	942.23	147.93	404.43	827.65	.00	.00	84.00	129.00	.00
*	9.060	800.53	.00	800.55	970.86	197.30	472.05	1360.65	.00	.00	84.00	129.00	.00
	9.060	799.35	.00	799.49	45.00	.00	705.00	.00	.00	.00	84.00	129.00	.00
*	9.070	800.08	.00	800.34	61.00	.00	1580.00	.00	.00	.00	68.00	129.00	.00
*	9.070	800.19	.11	800.44	61.00	.00	1580.00	.00	.00	68.00	68.00	129.00	129.00
*	9.070	799.51	.00	799.63	61.00	.00	970.00	.00	.00	.00	68.00	129.00	.00
	9.070	799.90	.00	800.11	61.00	.00	1380.00	.00	.00	.00	68.00	129.00	.00
	9.070	800.56	.00	800.58	932.00	.00	690.62	1339.38	.00	.00	68.00	129.00	.00
*	9.070	799.51	.00	799.57	61.00	.00	705.00	.00	.00	.00	68.00	129.00	.00
	9.070	800.15	.00	800.45	61.00	.00	1580.00	.00	.00	.00	68.00	129.00	.00
	9.070	800.26	.11	800.50	61.00	.00	1580.00	.00	.00	68.00	68.00	129.00	129.00

	9.070	799.54	.00	799.68	61.00	.00	970.00	.00	.00	.00	68.00	129.00	.00
	9.070	799.96	.00	800.20	61.00	.00	1380.00	.00	.00	.00	68.00	129.00	.00
*	9.070	800.36	.00	800.83	932.00	.00	2030.00	.00	.00	.00	68.00	129.00	.00
	9.070	799.53	.00	799.60	61.00	.00	705.00	.00	.00	.00	68.00	129.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	9.080	800.56	.00	800.57	970.99	152.84	363.45	1063.71	.00	.00	84.00	129.00	.00
*	9.080	800.59	.03	800.61	773.31	111.44	380.92	1087.64	.06	50.93	84.00	129.00	824.24
*	9.080	799.74	.00	799.75	835.30	107.47	310.96	551.57	.00	.00	84.00	129.00	.00
*	9.080	800.29	.00	800.30	969.78	139.50	351.29	889.21	.00	.00	84.00	129.00	.00
*	9.080	800.99	.00	801.00	972.94	184.56	404.53	1440.91	.00	.00	84.00	129.00	.00
*	9.080	799.63	.00	799.64	782.86	79.26	236.30	389.44	.00	.00	84.00	129.00	.00
*	9.340	801.25	.00	801.28	656.24	868.64	648.76	62.60	.00	.00	771.00	835.00	.00
*	9.340	801.32	.08	801.36	507.04	890.02	675.42	14.56	.07	335.43	771.00	835.00	842.47
*	9.340	800.54	.00	800.58	590.54	394.42	557.31	18.27	.00	.00	771.00	835.00	.00
*	9.340	801.03	.00	801.06	626.47	713.26	622.65	44.10	.00	.00	771.00	835.00	.00
*	9.340	801.66	.00	801.70	713.01	1206.13	711.21	112.65	.00	.00	771.00	835.00	.00
*	9.340	800.21	.00	800.24	549.89	210.00	487.16	7.85	.00	.00	771.00	835.00	.00
	9.350	801.31	.00	801.34	548.08	918.75	661.25	.00	.00	.00	771.00	835.00	.00
	9.350	801.39	.08	801.43	476.46	900.42	679.58	.00	.06	358.54	771.00	835.00	835.00
*	9.350	800.60	.00	800.76	64.00	.00	970.00	.00	.00	.00	771.00	835.00	.00
	9.350	801.09	.00	801.13	545.92	752.93	627.07	.00	.00	.00	771.00	835.00	.00
	9.350	801.72	.00	801.76	552.21	1288.44	741.56	.00	.00	.00	771.00	835.00	.00
	9.350	800.27	.00	800.37	63.35	.00	705.00	.00	.00	.00	771.00	835.00	.00
	9.350	801.49	.00	801.52	549.94	960.07	619.93	.00	.00	.00	771.00	835.00	.00
	9.350	801.57	.08	801.60	482.96	945.91	634.09	.00	.06	352.04	771.00	835.00	835.00
	9.350	800.61	.00	800.78	64.00	.00	970.00	.00	.00	.00	771.00	835.00	.00
	9.350	801.28	.00	801.31	547.79	796.28	583.72	.00	.00	.00	771.00	835.00	.00
	9.350	801.90	.00	801.93	554.01	1326.01	703.99	.00	.00	.00	771.00	835.00	.00
	9.350	800.28	.00	800.38	63.38	.00	705.00	.00	.00	.00	771.00	835.00	.00
	9.360	801.54	.00	801.57	696.60	921.78	578.08	80.14	.00	.00	771.00	835.00	.00
	9.360	801.62	.08	801.65	528.01	940.04	600.21	39.75	.06	327.49	771.00	835.00	855.51
*	9.360	800.88	.00	800.90	607.90	474.62	469.20	26.18	.00	.00	771.00	835.00	.00
	9.360	801.33	.00	801.35	667.69	773.46	547.65	58.89	.00	.00	771.00	835.00	.00
	9.360	801.95	.00	801.98	726.11	1245.04	646.18	138.77	.00	.00	771.00	835.00	.00
*	9.360	800.45	.00	800.48	582.79	269.88	423.19	11.92	.00	.00	771.00	835.00	.00
*	9.730	803.75	.00	803.81	336.89	565.37	466.63	548.00	.00	.00	363.00	400.00	.00
	9.730	803.86	.12	803.93	285.48	564.73	479.44	535.83	.06	205.67	363.00	400.00	491.14
	9.730	803.06	.00	803.11	322.02	285.52	360.47	324.01	.00	.00	363.00	400.00	.00
	9.730	803.54	.00	803.60	332.59	473.19	432.27	474.54	.00	.00	363.00	400.00	.00
*	9.730	804.16	.00	804.23	345.78	776.42	539.05	714.53	.00	.00	363.00	400.00	.00
	9.730	802.71	.00	802.75	314.30	172.12	305.71	227.16	.00	.00	363.00	400.00	.00
	9.960	806.13	.00	806.22	329.88	512.02	541.21	526.77	.00	.00	363.00	400.00	.00
	9.960	806.23	.10	806.32	273.01	507.29	561.63	511.08	.07	208.96	363.00	400.00	481.97
	9.960	805.45	.00	805.53	315.19	235.54	430.20	304.25	.00	.00	363.00	400.00	.00
	9.960	805.92	.00	806.01	325.34	418.88	507.39	453.73	.00	.00	363.00	400.00	.00
	9.960	806.55	.00	806.65	339.07	724.09	614.35	691.56	.00	.00	363.00	400.00	.00
	9.960	805.07	.00	805.14	288.64	126.07	377.21	201.72	.00	.00	363.00	400.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	10.380	809.07	.00	809.11	346.04	593.20	441.56	545.25	.00	.00	363.00	400.00	.00
*	10.380	809.17	.10	809.22	294.84	591.50	453.96	534.54	.05	203.59	363.00	400.00	498.43
*	10.380	808.33	.00	808.37	330.01	314.89	331.60	323.52	.00	.00	363.00	400.00	.00
*	10.380	808.84	.00	808.89	341.28	501.08	406.76	472.16	.00	.00	363.00	400.00	.00
*	10.380	809.52	.00	809.57	355.78	803.02	515.61	711.36	.00	.00	363.00	400.00	.00
*	10.380	807.93	.00	807.96	321.22	198.55	278.26	228.19	.00	.00	363.00	400.00	.00
	10.760	811.60	.00	811.70	447.21	227.96	989.38	362.66	.00	.00	660.00	720.00	.00
	10.760	811.70	.10	811.81	281.95	213.85	1018.56	347.59	.06	535.23	660.00	720.00	817.18
*	10.760	810.81	.00	810.91	326.13	38.08	786.65	145.27	.00	.00	660.00	720.00	.00
*	10.760	811.37	.00	811.47	415.91	155.14	934.00	290.86	.00	.00	660.00	720.00	.00
	10.760	812.05	.00	812.15	511.76	410.36	1094.65	524.99	.00	.00	660.00	720.00	.00
*	10.760	810.32	.00	810.42	211.70	5.31	643.50	56.18	.00	.00	660.00	720.00	.00

EAR FLOOD

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	4.430	.00	.00	.00	768.50	2280.00	780.42	.00	780.43	1.69	1.13	3084.78	1752.85
	4.430	.00	.00	.00	768.50	2280.00	780.52	.00	780.53	1.69	1.14	2874.19	1752.09
	4.430	.00	.00	.00	768.50	1400.00	778.91	.00	778.92	2.39	1.20	1915.45	904.65
	4.430	.00	.00	.00	768.50	2000.00	779.96	.00	779.97	1.88	1.16	2705.02	1457.25
	4.430	.00	.00	.00	768.50	2930.00	781.43	.00	781.44	1.36	1.09	3966.10	2509.40
	4.430	.00	.00	.00	768.50	1017.00	778.15	.00	778.16	2.83	1.22	1416.95	604.64
*	4.850	2218.00	.00	.00	770.70	2280.00	781.02	.00	781.03	4.90	1.51	2533.06	1030.01
*	4.850	2218.00	.00	.00	770.70	2280.00	781.12	.00	781.13	4.90	1.52	2342.26	1029.53
*	4.850	2218.00	.00	.00	770.70	1400.00	779.79	.00	779.81	7.82	1.69	1405.96	500.49
*	4.850	2218.00	.00	.00	770.70	2000.00	780.63	.00	780.65	5.72	1.57	2147.98	836.54
*	4.850	2218.00	.00	.00	770.70	2930.00	781.88	.00	781.90	3.41	1.35	3570.69	1585.84
*	4.850	2218.00	.00	.00	770.70	1017.00	779.19	.00	779.21	9.31	1.73	1017.06	333.31
	5.620	4060.00	.00	.00	774.20	2280.00	782.79	.00	782.80	5.87	1.41	2483.70	941.44
	5.620	4060.00	.00	.00	774.20	2280.00	782.90	.00	782.91	5.91	1.41	2343.37	937.93
	5.620	4060.00	.00	.00	774.20	1400.00	782.06	.00	782.08	5.70	1.27	1796.93	586.27
	5.620	4060.00	.00	.00	774.20	2000.00	782.57	.00	782.58	5.87	1.37	2273.14	825.49
	5.620	4060.00	.00	.00	774.20	2930.00	783.30	.00	783.31	5.63	1.46	2976.23	1234.47
	5.620	4060.00	.00	.00	774.20	1017.00	781.67	.00	781.68	5.57	1.19	1442.86	430.73
	5.640	100.00	.00	.00	774.20	2280.00	783.04	.00	783.05	4.56	1.28	2658.27	1067.59
	5.640	100.00	.00	.00	774.20	2280.00	783.15	.00	783.16	4.53	1.29	2538.80	1071.25
	5.640	100.00	.00	.00	774.20	1400.00	782.29	.00	782.30	4.21	1.12	1975.06	682.71
	5.640	100.00	.00	.00	774.20	2000.00	782.82	.00	782.83	4.48	1.23	2452.37	944.78
	5.640	100.00	.00	.00	774.20	2930.00	783.55	.00	783.56	4.55	1.35	3136.11	1373.22
*	5.640	100.00	.00	.00	774.20	1017.00	781.94	.00	782.08	34.15	3.05	333.87	174.03
	5.640	26.80	782.30	786.50	774.20	2280.00	783.27	.00	783.28	3.58	1.16	2879.01	1205.32

	5.640	26.80	999999.00	.00	774.20	2280.00	783.38	.00	783.39	3.55	1.17	2759.07	1209.62
	5.640	26.80	782.30	786.50	774.20	1400.00	782.51	.00	782.52	3.11	.99	2184.46	793.62
	5.640	26.80	782.30	786.50	774.20	2000.00	783.07	.00	783.08	3.36	1.10	2695.84	1090.60
	5.640	26.80	782.30	786.50	774.20	2930.00	783.70	.00	783.72	3.92	1.27	3291.43	1479.23
	5.640	26.80	782.30	786.50	774.20	1017.00	781.95	.00	782.09	33.90	3.04	334.60	174.66
	5.660	100.00	.00	.00	774.20	2280.00	783.31	.00	783.32	3.34	1.13	2997.53	1247.79
	5.660	100.00	.00	.00	774.20	2280.00	783.41	.00	783.42	3.35	1.12	2853.28	1245.70
	5.660	100.00	.00	.00	774.20	1400.00	782.54	.00	782.55	2.95	.97	2254.01	815.26
	5.660	100.00	.00	.00	774.20	2000.00	783.10	.00	783.11	3.16	1.07	2797.13	1124.53
	5.660	100.00	.00	.00	774.20	2930.00	783.74	.00	783.76	3.64	1.23	3437.12	1535.11
*	5.660	100.00	.00	.00	774.20	1017.00	782.23	.00	782.23	2.37	.84	1951.09	660.03

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	5.850	1000.00	.00	.00	774.80	2280.00	783.59	.00	783.60	6.71	1.34	2627.93	880.40
	5.850	1000.00	.00	.00	774.80	2280.00	783.69	.00	783.71	6.72	1.33	2523.87	879.65
*	5.850	1000.00	.00	.00	774.80	1400.00	782.84	.00	782.85	8.35	1.37	1745.36	484.60
*	5.850	1000.00	.00	.00	774.80	2000.00	783.38	.00	783.40	7.05	1.34	2369.19	753.47
	5.850	1000.00	.00	.00	774.80	2930.00	784.03	.00	784.04	6.40	1.38	3145.23	1158.45
*	5.850	1000.00	.00	.00	774.80	1017.00	782.50	.00	782.51	8.56	1.34	1358.73	347.67
	5.870	100.00	.00	.00	774.80	2280.00	783.65	.00	783.66	6.37	1.32	2646.37	903.15
	5.870	100.00	.00	.00	774.80	2280.00	783.76	.00	783.77	6.36	1.33	2540.13	903.75
	5.870	100.00	.00	.00	774.80	1400.00	782.92	.00	782.93	7.29	1.29	1822.36	518.69
	5.870	100.00	.00	.00	774.80	2000.00	783.45	.00	783.46	6.48	1.30	2415.77	785.91
	5.870	100.00	.00	.00	774.80	2930.00	784.09	.00	784.11	6.12	1.35	3152.29	1184.78
	5.870	100.00	.00	.00	774.80	1017.00	782.58	.00	782.59	7.28	1.25	1441.46	377.03
	5.870	28.00	782.50	788.30	774.80	2280.00	783.73	.00	783.74	5.64	1.25	2753.98	960.27
	5.870	28.00	999999.00	.00	774.80	2280.00	783.84	.00	783.85	5.60	1.26	2662.33	963.15
	5.870	28.00	782.50	788.30	774.80	1400.00	783.15	.00	783.16	4.89	1.09	2089.92	632.80
	5.870	28.00	782.50	788.30	774.80	2000.00	783.56	.00	783.57	5.43	1.20	2559.74	858.27
	5.870	28.00	782.50	788.30	774.80	2930.00	784.14	.00	784.15	5.69	1.31	3225.56	1228.39
	5.870	28.00	782.50	788.30	774.80	1017.00	782.80	.00	782.81	4.69	1.02	1696.42	469.39
	5.890	100.00	.00	.00	774.80	2280.00	783.78	.00	783.79	4.45	1.12	2985.80	1080.28
	5.890	100.00	.00	.00	774.80	2280.00	783.89	.00	783.90	4.49	1.11	2865.47	1075.92
	5.890	100.00	.00	.00	774.80	1400.00	783.19	.00	783.20	3.71	.95	2287.28	726.95
	5.890	100.00	.00	.00	774.80	2000.00	783.61	.00	783.62	4.23	1.07	2784.00	972.08
	5.890	100.00	.00	.00	774.80	2930.00	784.20	.00	784.21	4.62	1.19	3475.44	1362.65
	5.890	100.00	.00	.00	774.80	1017.00	782.84	.00	782.85	3.40	.87	1882.49	551.67
*	6.170	1480.00	.00	.00	776.80	1740.00	784.91	.00	784.95	21.11	2.40	1351.53	378.69
*	6.170	1480.00	.00	.00	776.80	1740.00	785.02	.00	785.06	20.97	2.42	1243.00	380.00
*	6.170	1480.00	.00	.00	776.80	1080.00	784.27	.00	784.34	30.80	2.69	764.77	194.61
*	6.170	1480.00	.00	.00	776.80	1520.00	784.72	.00	784.77	23.07	2.46	1175.30	316.49
*	6.170	1480.00	.00	.00	776.80	2280.00	785.31	.00	785.35	18.30	2.34	1739.08	533.01
*	6.170	1480.00	.00	.00	776.80	790.00	783.89	.00	784.00	37.44	2.82	444.68	129.10
	6.450	1480.00	.00	.00	778.10	1740.00	786.02	.00	786.03	3.85	1.02	2685.61	887.12
	6.450	1480.00	.00	.00	778.10	1740.00	786.12	.00	786.13	3.84	1.03	2527.57	888.45
*	6.450	1480.00	.00	.00	778.10	1080.00	785.47	.00	785.48	3.44	.90	2008.50	582.34
*	6.450	1480.00	.00	.00	778.10	1520.00	785.85	.00	785.86	3.74	.98	2472.17	785.92
*	6.450	1480.00	.00	.00	778.10	2280.00	786.39	.00	786.40	4.04	1.08	3177.64	1134.52
*	6.450	1480.00	.00	.00	778.10	790.00	785.16	.00	785.17	3.23	.84	1643.46	439.39

*	6.980	2800.00	.00	.00	779.60	1740.00	788.42	.00	788.45	15.98	1.98	1190.91	435.22
*	6.980	2800.00	.00	.00	779.60	1740.00	788.52	.00	788.56	16.26	1.96	1113.52	431.44
	6.980	2800.00	.00	.00	779.60	1080.00	787.67	.00	787.70	15.89	1.78	838.42	270.92
	6.980	2800.00	.00	.00	779.60	1520.00	788.19	.00	788.23	15.94	1.92	1081.85	380.72
*	6.980	2800.00	.00	.00	779.60	2280.00	788.90	.00	788.94	16.25	2.11	1434.63	565.52
*	6.980	2800.00	.00	.00	779.60	790.00	787.24	.00	787.27	15.68	1.66	663.93	199.49

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6.990	25.00	.00	.00	779.60	1740.00	788.46	.00	788.49	15.58	1.96	1193.47	440.75
	6.990	25.00	.00	.00	779.60	1740.00	788.56	.00	788.60	15.57	1.98	1115.89	440.94
*	6.990	25.00	.00	.00	779.60	1080.00	787.69	.00	788.00	98.92	4.46	242.04	108.59
	6.990	25.00	.00	.00	779.60	1520.00	788.23	.00	788.27	15.50	1.90	1086.19	386.13
	6.990	25.00	.00	.00	779.60	2280.00	788.94	.00	788.98	15.96	2.10	1432.11	570.77
*	6.990	25.00	.00	.00	779.60	790.00	787.28	.00	787.48	72.54	3.59	220.20	92.76
	6.990	26.00	787.80	789.20	779.60	1740.00	788.67	.00	788.70	12.18	1.78	1302.27	498.65
	6.990	26.00	999999.00	.00	779.60	1740.00	788.77	.00	788.81	12.16	1.80	1216.76	499.05
	6.990	26.00	787.80	789.20	779.60	1080.00	787.69	.00	788.00	98.71	4.46	242.19	108.70
	6.990	26.00	787.80	789.20	779.60	1520.00	788.49	.00	788.52	11.38	1.68	1212.29	450.59
	6.990	26.00	787.80	789.20	779.60	2280.00	789.03	.00	789.07	14.34	2.01	1486.65	602.00
	6.990	26.00	787.80	789.20	779.60	790.00	787.29	.00	787.49	71.26	3.57	221.37	93.58
	7.000	25.00	.00	.00	779.60	1740.00	788.70	.00	788.73	11.57	1.74	1336.08	511.50
	7.000	25.00	.00	.00	779.60	1740.00	788.81	.00	788.84	11.81	1.73	1244.71	506.42
*	7.000	25.00	.00	.00	779.60	1080.00	788.21	.00	788.22	7.93	1.36	1087.51	383.49
	7.000	25.00	.00	.00	779.60	1520.00	788.52	.00	788.54	10.82	1.65	1242.79	462.01
	7.000	25.00	.00	.00	779.60	2280.00	789.07	.00	789.11	13.59	1.97	1528.24	618.39
*	7.000	25.00	.00	.00	779.60	790.00	787.63	.00	787.65	8.92	1.33	823.11	264.45
	7.130	690.00	.00	.00	779.90	1740.00	789.00	.00	789.01	6.52	1.24	2095.44	681.66
	7.130	690.00	.00	.00	779.90	1740.00	789.10	.00	789.12	6.44	1.25	1921.37	685.63
	7.130	690.00	.00	.00	779.90	1080.00	788.45	.00	788.46	5.70	1.07	1552.93	452.28
	7.130	690.00	.00	.00	779.90	1520.00	788.81	.00	788.82	6.51	1.21	1899.55	595.69
*	7.130	690.00	.00	.00	779.90	2280.00	789.39	.00	789.40	6.70	1.31	2553.70	881.12
	7.130	690.00	.00	.00	779.90	790.00	787.95	.00	787.96	7.49	1.15	1107.81	288.57
	7.660	2800.00	.00	.00	782.10	1740.00	790.99	.00	791.02	9.36	2.09	1388.59	568.73
	7.660	2800.00	.00	.00	782.10	1740.00	791.08	.00	791.12	9.38	2.11	1339.01	568.17
	7.660	2800.00	.00	.00	782.10	1080.00	790.34	.00	790.38	9.67	2.05	936.80	347.39
	7.660	2800.00	.00	.00	782.10	1520.00	790.80	.00	790.83	9.32	2.07	1255.52	497.78
	7.660	2800.00	.00	.00	782.10	2280.00	791.39	.00	791.43	9.37	2.15	1704.39	744.69
	7.660	2800.00	.00	.00	782.10	790.00	790.05	.00	790.09	8.56	1.89	737.67	270.01
*	7.670	50.00	.00	.00	782.10	1740.00	790.81	.00	791.24	60.64	5.27	330.14	223.44
*	7.670	50.00	.00	.00	782.10	1740.00	790.92	.00	791.33	57.47	5.16	336.97	229.52
*	7.670	50.00	.00	.00	782.10	1080.00	790.30	.00	790.50	29.97	3.60	300.20	197.27
*	7.670	50.00	.00	.00	782.10	1520.00	790.67	.00	791.02	49.42	4.72	321.97	216.21
*	7.670	50.00	.00	.00	782.10	2280.00	791.06	.00	791.73	92.16	6.59	345.86	237.50
	7.670	50.00	.00	.00	782.10	790.00	790.06	.00	790.17	18.21	2.76	285.95	185.11
	7.670	16.00	791.50	794.00	782.10	1740.00	790.85	.00	791.38	86.48	5.88	295.79	187.11
	7.670	16.00	999999.00	.00	782.10	1740.00	790.96	.00	791.36	56.39	5.13	339.41	231.71
	7.670	16.00	791.50	794.00	782.10	1080.00	790.33	.00	790.57	38.64	3.89	277.61	173.74
	7.670	16.00	791.50	794.00	782.10	1520.00	790.71	.00	791.13	68.47	5.22	291.08	183.69

7.670	16.00	791.50	794.00	782.10	2280.00	791.10	.00	791.97	139.39	7.50	304.18	193.12
7.670	16.00	791.50	794.00	782.10	790.00	790.08	.00	790.21	22.53	2.95	267.88	166.44

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	7.680	50.00	.00	.00	782.10	1740.00	791.48	.00	791.50	4.92	1.57	1772.94	784.32
*	7.680	50.00	.00	.00	782.10	1740.00	791.59	.00	791.61	4.86	1.57	1701.34	789.29
*	7.680	50.00	.00	.00	782.10	1080.00	790.63	.00	790.65	6.08	1.65	1136.53	438.11
*	7.680	50.00	.00	.00	782.10	1520.00	791.22	.00	791.24	5.26	1.59	1560.95	663.01
*	7.680	50.00	.00	.00	782.10	2280.00	792.10	.00	792.11	4.04	1.52	2382.30	1134.61
*	7.680	50.00	.00	.00	782.10	790.00	790.25	.00	790.27	6.02	1.61	875.51	322.11
*	8.300	3270.00	.00	.00	784.80	1580.00	794.51	.00	794.71	32.17	3.65	501.74	278.56
*	8.300	3270.00	.00	.00	784.80	1580.00	794.56	.00	794.75	30.80	3.59	509.01	284.69
*	8.300	3270.00	.00	.00	784.80	970.00	793.75	.00	793.87	20.17	2.70	359.04	215.98
*	8.300	3270.00	.00	.00	784.80	1380.00	794.32	.00	794.50	28.69	3.39	427.31	257.64
*	8.300	3270.00	.00	.00	784.80	2030.00	794.77	.00	795.03	40.81	4.22	614.08	317.76
*	8.300	3270.00	.00	.00	784.80	705.00	793.14	.00	793.22	16.01	2.27	311.01	176.22
*	8.500	1060.00	.00	.00	785.70	1580.00	796.47	.00	796.53	10.52	2.30	1088.80	487.16
*	8.500	1060.00	.00	.00	785.70	1580.00	796.57	.00	796.64	10.56	2.33	981.91	486.21
	8.500	1060.00	.00	.00	785.70	970.00	795.44	.00	795.52	12.33	2.27	469.19	276.26
*	8.500	1060.00	.00	.00	785.70	1380.00	796.23	.00	796.30	11.11	2.30	894.04	414.03
*	8.500	1060.00	.00	.00	785.70	2030.00	796.88	.00	796.94	9.91	2.34	1435.95	644.91
	8.500	1060.00	.00	.00	785.70	705.00	794.57	.00	794.63	11.27	2.01	350.91	209.96
	8.880	2010.00	.00	.00	789.30	1580.00	799.41	.00	799.55	23.91	3.12	638.76	323.14
*	8.880	2010.00	.00	.00	789.30	1580.00	799.46	.00	799.59	22.64	3.05	647.62	332.04
	8.880	2010.00	.00	.00	789.30	970.00	798.47	.00	798.57	19.19	2.59	374.05	221.43
	8.880	2010.00	.00	.00	789.30	1380.00	799.20	.00	799.33	22.28	2.97	556.78	292.33
*	8.880	2010.00	.00	.00	789.30	2030.00	799.79	.00	799.94	25.90	3.37	816.23	398.87
	8.880	2010.00	.00	.00	789.30	705.00	797.47	.00	797.56	19.40	2.41	292.92	160.04
*	9.060	950.00	.00	.00	791.00	1580.00	800.15	.00	800.17	4.71	1.57	1701.77	728.38
*	9.060	950.00	.00	.00	791.00	1580.00	800.26	.00	800.28	4.68	1.59	1591.20	730.70
*	9.060	950.00	.00	.00	791.00	970.00	799.52	796.03	799.54	4.38	1.41	1148.08	463.33
*	9.060	950.00	.00	.00	791.00	1380.00	799.95	.00	799.97	4.78	1.55	1503.85	631.18
*	9.060	950.00	.00	.00	791.00	2030.00	800.53	.00	800.55	4.73	1.64	2068.13	933.20
	9.060	950.00	.00	.00	791.00	705.00	799.35	.00	799.49	20.94	3.02	233.67	154.07
*	9.070	50.00	.00	.00	791.00	1580.00	800.08	.00	800.34	29.32	4.07	388.57	291.81
*	9.070	50.00	.00	.00	791.00	1580.00	800.19	.00	800.44	28.60	4.00	395.26	295.44
*	9.070	50.00	.00	.00	791.00	970.00	799.51	.00	799.63	15.15	2.74	353.49	249.23
*	9.070	50.00	.00	.00	791.00	1380.00	799.90	.00	800.11	24.65	3.66	377.40	277.97
	9.070	50.00	.00	.00	791.00	2030.00	800.56	.00	800.58	4.41	1.65	2043.28	966.24
*	9.070	50.00	.00	.00	791.00	705.00	799.51	.00	799.57	7.99	1.99	353.63	249.40
	9.070	28.50	800.40	802.10	791.00	1580.00	800.15	.00	800.45	33.19	4.41	358.32	274.27
	9.070	28.50	999999.00	.00	791.00	1580.00	800.26	.00	800.50	27.69	3.96	399.29	300.28
	9.070	28.50	800.40	802.10	791.00	970.00	799.54	.00	799.68	16.55	2.96	328.09	238.44
	9.070	28.50	800.40	802.10	791.00	1380.00	799.96	.00	800.20	27.60	3.96	348.70	262.68
	9.070	28.50	800.40	802.10	791.00	2030.00	800.36	796.66	800.83	50.00	5.50	368.80	287.08
	9.070	28.50	800.40	802.10	791.00	705.00	799.53	.00	799.60	8.84	2.16	326.88	237.06

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	9.080	50.00	.00	.00	791.00	1580.00	800.56	.00	800.57	2.76	1.26	2097.23	950.77
*	9.080	50.00	.00	.00	791.00	1580.00	800.59	.00	800.61	2.98	1.31	1939.18	914.68
*	9.080	50.00	.00	.00	791.00	970.00	799.74	.00	799.75	3.20	1.24	1315.45	542.25
*	9.080	50.00	.00	.00	791.00	1380.00	800.29	.00	800.30	2.98	1.27	1836.09	799.85
*	9.080	50.00	.00	.00	791.00	2030.00	800.99	.00	801.00	2.75	1.31	2516.17	1223.30
*	9.080	50.00	.00	.00	791.00	705.00	799.63	.00	799.64	1.97	.96	1231.35	502.65
*	9.340	1373.00	.00	.00	792.90	1580.00	801.25	.00	801.28	12.20	1.93	1231.97	452.32
*	9.340	1373.00	.00	.00	792.90	1580.00	801.32	.00	801.36	12.63	1.98	1143.41	444.58
*	9.340	1373.00	.00	.00	792.90	970.00	800.54	.00	800.58	14.65	1.92	791.96	253.43
*	9.340	1373.00	.00	.00	792.90	1380.00	801.03	.00	801.06	12.96	1.93	1090.54	383.27
*	9.340	1373.00	.00	.00	792.90	2030.00	801.66	.00	801.70	11.35	1.96	1519.88	602.63
*	9.340	1373.00	.00	.00	792.90	705.00	800.21	.00	800.24	14.11	1.80	603.84	187.71
	9.350	50.00	.00	.00	792.90	1580.00	801.31	.00	801.34	12.22	1.94	1181.51	452.01
	9.350	50.00	.00	.00	792.90	1580.00	801.39	.00	801.43	12.85	1.97	1117.87	440.79
*	9.350	50.00	.00	.00	792.90	970.00	800.60	.00	800.76	42.67	3.30	294.31	148.49
	9.350	50.00	.00	.00	792.90	1380.00	801.09	.00	801.13	12.62	1.92	1063.22	388.48
	9.350	50.00	.00	.00	792.90	2030.00	801.72	.00	801.76	11.98	2.02	1408.56	586.55
	9.350	50.00	.00	.00	792.90	705.00	800.27	.00	800.37	28.22	2.57	273.97	132.71
	9.350	28.00	800.80	804.90	792.90	1580.00	801.49	.00	801.52	9.58	1.76	1283.74	510.60
	9.350	28.00	999999.00	.00	792.90	1580.00	801.57	.00	801.60	10.00	1.77	1222.08	499.73
	9.350	28.00	800.80	804.90	792.90	970.00	800.61	.00	800.78	42.03	3.28	295.65	149.62
	9.350	28.00	800.80	804.90	792.90	1380.00	801.28	.00	801.31	9.70	1.72	1165.49	443.13
	9.350	28.00	800.80	804.90	792.90	2030.00	801.90	.00	801.93	9.74	1.86	1508.29	650.59
	9.350	28.00	800.80	804.90	792.90	705.00	800.28	.00	800.38	28.06	2.57	274.49	133.09
	9.360	50.00	.00	.00	792.90	1580.00	801.54	.00	801.57	8.06	1.63	1434.19	556.62
	9.360	50.00	.00	.00	792.90	1580.00	801.62	.00	801.65	8.34	1.67	1332.52	546.95
*	9.360	50.00	.00	.00	792.90	970.00	800.88	.00	800.90	8.15	1.50	997.43	339.82
	9.360	50.00	.00	.00	792.90	1380.00	801.33	.00	801.35	8.24	1.60	1288.14	480.66
	9.360	50.00	.00	.00	792.90	2030.00	801.95	.00	801.98	7.96	1.69	1725.36	719.68
*	9.360	50.00	.00	.00	792.90	705.00	800.45	.00	800.48	8.94	1.48	744.66	235.78
*	9.730	1950.00	.00	.00	797.20	1580.00	803.75	.00	803.81	16.71	2.50	823.49	386.57
	9.730	1950.00	.00	.00	797.20	1580.00	803.86	.00	803.93	16.41	2.51	794.60	390.04
	9.730	1950.00	.00	.00	797.20	970.00	803.06	.00	803.11	16.22	2.23	597.31	240.85
	9.730	1950.00	.00	.00	797.20	1380.00	803.54	.00	803.60	16.39	2.41	757.03	340.91
*	9.730	1950.00	.00	.00	797.20	2030.00	804.16	.00	804.23	17.19	2.67	963.41	489.62
	9.730	1950.00	.00	.00	797.20	705.00	802.71	.00	802.75	15.50	2.06	483.92	179.10
	9.960	1220.00	.00	.00	799.90	1580.00	806.13	.00	806.22	24.16	3.09	715.52	321.42
	9.960	1220.00	.00	.00	799.90	1580.00	806.23	.00	806.32	24.27	3.14	677.15	320.71
	9.960	1220.00	.00	.00	799.90	970.00	805.45	.00	805.53	25.57	2.87	496.95	191.83
	9.960	1220.00	.00	.00	799.90	1380.00	805.92	.00	806.01	24.70	3.03	646.90	277.67
	9.960	1220.00	.00	.00	799.90	2030.00	806.55	.00	806.65	23.38	3.22	857.45	419.81
	9.960	1220.00	.00	.00	799.90	705.00	805.07	.00	805.14	26.60	2.78	380.72	136.70

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	10.380	2220.00	.00	.00	802.10	1580.00	809.07	.00	809.11	9.87	2.18	967.55	502.85

*	10.380	2220.00	.00	.00	802.10	1580.00	809.17	.00	809.22	9.82	2.20	934.15	504.18
*	10.380	2220.00	.00	.00	802.10	970.00	808.33	.00	808.37	9.03	1.89	717.58	322.77
*	10.380	2220.00	.00	.00	802.10	1380.00	808.84	.00	808.89	9.60	2.09	892.08	445.32
	10.380	2220.00	.00	.00	802.10	2030.00	809.52	.00	809.57	10.35	2.35	1125.27	631.02
	10.380	2220.00	.00	.00	802.10	705.00	807.93	.00	807.96	8.57	1.74	585.40	240.76
	10.760	2000.00	.00	.00	804.20	1580.00	811.60	.00	811.70	19.44	3.05	764.40	358.34
	10.760	2000.00	.00	.00	804.20	1580.00	811.70	.00	811.81	19.51	3.09	689.67	357.69
*	10.760	2000.00	.00	.00	804.20	970.00	810.81	.00	810.91	20.92	2.85	451.66	212.09
*	10.760	2000.00	.00	.00	804.20	1380.00	811.37	.00	811.47	20.07	3.01	663.89	308.04
	10.760	2000.00	.00	.00	804.20	2030.00	812.05	.00	812.15	18.16	3.12	982.43	476.35
*	10.760	2000.00	.00	.00	804.20	705.00	810.32	.00	810.42	20.37	2.61	324.48	156.21

EAR FLOOD

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	4.430	2280.00	780.42	.00	.00	.00	841.93	.00
	4.430	2280.00	780.52	.10	.00	.10	615.89	.00
	4.430	1400.00	778.91	-1.61	.00	.00	695.47	.00
	4.430	2000.00	779.96	1.05	.00	.00	805.00	.00
	4.430	2930.00	781.43	1.47	.00	.00	903.25	.00
	4.430	1017.00	778.15	-3.28	.00	.00	620.28	.00
*	4.850	2280.00	781.02	.00	.60	.00	1048.08	2218.00
*	4.850	2280.00	781.12	.10	.60	.10	732.15	2218.00
*	4.850	1400.00	779.79	-1.33	.88	.00	735.99	2218.00
*	4.850	2000.00	780.63	.85	.67	.00	972.30	2218.00
*	4.850	2930.00	781.88	1.25	.45	.00	1284.43	2218.00
*	4.850	1017.00	779.19	-2.70	1.04	.00	598.13	2218.00
	5.620	2280.00	782.79	.00	1.77	.00	968.18	4060.00
	5.620	2280.00	782.90	.11	1.78	.11	780.12	4060.00
	5.620	1400.00	782.06	-.83	2.28	.00	927.37	4060.00
	5.620	2000.00	782.57	.51	1.94	.00	955.85	4060.00
	5.620	2930.00	783.30	.73	1.41	.00	996.42	4060.00
	5.620	1017.00	781.67	-1.62	2.48	.00	886.34	4060.00
	5.640	2280.00	783.04	.00	.25	.00	926.27	100.00
	5.640	2280.00	783.15	.11	.25	.11	777.67	100.00
	5.640	1400.00	782.29	-.86	.22	.00	890.45	100.00
	5.640	2000.00	782.82	.53	.25	.00	915.62	100.00
	5.640	2930.00	783.55	.73	.25	.00	950.52	100.00
*	5.640	1017.00	781.94	-1.61	.27	.00	69.00	100.00
	5.640	2280.00	783.27	.00	.23	.00	937.55	26.80
	5.640	2280.00	783.38	.11	.23	.11	793.07	26.80
	5.640	1400.00	782.51	-.87	.23	.00	901.58	26.80
	5.640	2000.00	783.07	.56	.25	.00	928.20	26.80
	5.640	2930.00	783.70	.63	.16	.00	954.37	26.80
	5.640	1017.00	781.95	-1.76	.01	.00	69.00	26.80
	5.660	2280.00	783.31	.00	.04	.00	997.62	100.00

5.660	2280.00	783.41	.11	.04	.11	821.26	100.00
5.660	1400.00	782.54	-.87	.03	.00	954.73	100.00
5.660	2000.00	783.10	.56	.03	.00	986.24	100.00
5.660	2930.00	783.74	.64	.04	.00	1017.00	100.00
5.660	1017.00	782.23	-1.51	.28	.00	936.69	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	5.850	2280.00	783.59	.00	.28	.00	1185.23	1000.00
	5.850	2280.00	783.69	.11	.28	.11	1036.63	1000.00
*	5.850	1400.00	782.84	-.85	.30	.00	1151.49	1000.00
*	5.850	2000.00	783.38	.54	.28	.00	1176.46	1000.00
	5.850	2930.00	784.03	.65	.28	.00	1202.06	1000.00
*	5.850	1017.00	782.50	-1.53	.27	.00	1117.77	1000.00
	5.870	2280.00	783.65	.00	.07	.00	1145.41	100.00
	5.870	2280.00	783.76	.11	.07	.11	1015.85	100.00
	5.870	1400.00	782.92	-.84	.08	.00	1132.02	100.00
	5.870	2000.00	783.45	.53	.07	.00	1141.68	100.00
	5.870	2930.00	784.09	.64	.06	.00	1152.00	100.00
	5.870	1017.00	782.58	-1.51	.08	.00	1106.87	100.00
	5.870	2280.00	783.73	.00	.08	.00	1147.15	28.00
	5.870	2280.00	783.84	.11	.08	.11	1031.20	28.00
	5.870	1400.00	783.15	-.69	.23	.00	1136.39	28.00
	5.870	2000.00	783.56	.42	.11	.00	1144.01	28.00
	5.870	2930.00	784.14	.58	.05	.00	1152.00	28.00
	5.870	1017.00	782.80	-1.34	.22	.00	1124.57	28.00
	5.890	2280.00	783.78	.00	.05	.00	1193.14	100.00
	5.890	2280.00	783.89	.11	.05	.11	1044.32	100.00
	5.890	1400.00	783.19	-.70	.05	.00	1169.48	100.00
	5.890	2000.00	783.61	.42	.05	.00	1186.35	100.00
	5.890	2930.00	784.20	.58	.05	.00	1205.77	100.00
	5.890	1017.00	782.84	-1.35	.04	.00	1152.72	100.00
*	6.170	1740.00	784.91	.00	1.12	.00	946.08	1480.00
*	6.170	1740.00	785.02	.11	1.12	.11	712.69	1480.00
*	6.170	1080.00	784.27	-.75	1.07	.00	885.21	1480.00
*	6.170	1520.00	784.72	.45	1.10	.00	928.22	1480.00
*	6.170	2280.00	785.31	.59	1.11	.00	984.23	1480.00
*	6.170	790.00	783.89	-1.42	1.05	.00	731.18	1480.00
*	6.450	1740.00	786.02	.00	1.11	.00	1277.39	1480.00
*	6.450	1740.00	786.12	.10	1.11	.10	1020.40	1480.00
*	6.450	1080.00	785.47	-.65	1.21	.00	1204.47	1480.00
*	6.450	1520.00	785.85	.38	1.13	.00	1253.64	1480.00
*	6.450	2280.00	786.39	.54	1.08	.00	1359.21	1480.00
*	6.450	790.00	785.16	-1.23	1.28	.00	1153.15	1480.00
	6.980	1740.00	788.42	.00	2.40	.00	495.77	2800.00
	6.980	1740.00	788.52	.10	2.40	.10	378.56	2800.00
*	6.980	1080.00	787.67	-.85	2.19	.00	433.02	2800.00
*	6.980	1520.00	788.19	.53	2.34	.00	482.44	2800.00
*	6.980	2280.00	788.90	.70	2.50	.00	524.33	2800.00
*	6.980	790.00	787.24	-1.66	2.08	.00	384.61	2800.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	6.990	1740.00	788.46	.00	.04	.00	485.38	25.00
	6.990	1740.00	788.56	.10	.04	.10	372.27	25.00
*	6.990	1080.00	787.69	-.87	.03	.00	52.00	25.00
	6.990	1520.00	788.23	.54	.04	.00	473.28	25.00
	6.990	2280.00	788.94	.70	.04	.00	511.27	25.00
*	6.990	790.00	787.28	-1.66	.04	.00	52.00	25.00
	6.990	1740.00	788.67	.00	.21	.00	497.35	26.00
	6.990	1740.00	788.77	.10	.21	.10	381.19	26.00
	6.990	1080.00	787.69	-1.08	.00	.00	52.00	26.00
	6.990	1520.00	788.49	.80	.25	.00	487.47	26.00
	6.990	2280.00	789.03	.55	.10	.00	517.00	26.00
	6.990	790.00	787.29	-1.74	.02	.00	52.00	26.00
	7.000	1740.00	788.70	.00	.03	.00	512.97	25.00
	7.000	1740.00	788.81	.10	.03	.10	388.97	25.00
*	7.000	1080.00	788.21	-.60	.51	.00	483.14	25.00
	7.000	1520.00	788.52	.31	.03	.00	501.99	25.00
	7.000	2280.00	789.07	.55	.04	.00	534.89	25.00
*	7.000	790.00	787.63	-1.44	.34	.00	428.99	25.00
	7.130	1740.00	789.00	.00	.29	.00	1052.49	690.00
	7.130	1740.00	789.10	.11	.30	.11	751.51	690.00
	7.130	1080.00	788.45	-.66	.24	.00	940.41	690.00
	7.130	1520.00	788.81	.36	.29	.00	1013.45	690.00
*	7.130	2280.00	789.39	.58	.31	.00	1385.94	690.00
	7.130	790.00	787.95	-1.44	.31	.00	841.15	690.00
	7.660	1740.00	790.99	.00	1.99	.00	724.49	2800.00
	7.660	1740.00	791.08	.10	1.98	.10	637.82	2800.00
	7.660	1080.00	790.34	-.75	1.89	.00	683.78	2800.00
	7.660	1520.00	790.80	.46	1.99	.00	699.68	2800.00
	7.660	2280.00	791.39	.60	2.01	.00	819.75	2800.00
	7.660	790.00	790.05	-1.34	2.11	.00	673.65	2800.00
*	7.670	1740.00	790.81	.00	-.18	.00	61.18	50.00
*	7.670	1740.00	790.92	.11	-.17	.11	61.85	50.00
*	7.670	1080.00	790.30	-.61	-.03	.00	58.13	50.00
*	7.670	1520.00	790.67	.37	-.13	.00	60.36	50.00
*	7.670	2280.00	791.06	.39	-.34	.00	62.72	50.00
*	7.670	790.00	790.06	-1.00	.01	.00	56.62	50.00
	7.670	1740.00	790.85	.00	.04	.00	61.42	16.00
	7.670	1740.00	790.96	.11	.04	.11	62.09	16.00
	7.670	1080.00	790.33	-.62	.03	.00	58.32	16.00
	7.670	1520.00	790.71	.38	.04	.00	60.59	16.00
	7.670	2280.00	791.10	.39	.04	.00	62.95	16.00
	7.670	790.00	790.08	-1.02	.02	.00	56.75	16.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	7.680	1740.00	791.48	.00	.63	.00	838.03	50.00
	7.680	1740.00	791.59	.11	.63	.11	658.51	50.00
	7.680	1080.00	790.63	-.96	.29	.00	693.79	50.00
*	7.680	1520.00	791.22	.59	.51	.00	780.11	50.00
*	7.680	2280.00	792.10	.88	1.00	.00	1116.43	50.00
*	7.680	790.00	790.25	-1.85	.17	.00	680.68	50.00
*	8.300	1580.00	794.51	.00	3.03	.00	411.23	3270.00
*	8.300	1580.00	794.56	.05	2.97	.05	346.43	3270.00
*	8.300	970.00	793.75	-.81	3.12	.00	80.41	3270.00
*	8.300	1380.00	794.32	.57	3.10	.00	401.02	3270.00
*	8.300	2030.00	794.77	.45	2.68	.00	430.52	3270.00
*	8.300	705.00	793.14	-1.63	2.89	.00	76.28	3270.00
*	8.500	1580.00	796.47	.00	1.96	.00	828.83	1060.00
*	8.500	1580.00	796.57	.10	2.01	.10	533.30	1060.00
	8.500	970.00	795.44	-1.13	1.68	.00	341.62	1060.00
*	8.500	1380.00	796.23	.80	1.91	.00	802.06	1060.00
*	8.500	2030.00	796.88	.65	2.11	.00	852.96	1060.00
	8.500	705.00	794.57	-2.32	1.43	.00	78.90	1060.00
*	8.880	1580.00	799.41	.00	2.94	.00	417.73	2010.00
*	8.880	1580.00	799.46	.05	2.89	.05	347.85	2010.00
	8.880	970.00	798.47	-.99	3.03	.00	86.05	2010.00
	8.880	1380.00	799.20	.73	2.97	.00	362.18	2010.00
*	8.880	2030.00	799.79	.59	2.91	.00	498.29	2010.00
	8.880	705.00	797.47	-2.33	2.90	.00	75.99	2010.00
*	9.060	1580.00	800.15	.00	.75	.00	969.16	950.00
*	9.060	1580.00	800.26	.11	.80	.11	653.28	950.00
*	9.060	970.00	799.52	-.74	1.05	.00	727.21	950.00
*	9.060	1380.00	799.95	.43	.75	.00	942.23	950.00
*	9.060	2030.00	800.53	.58	.74	.00	970.86	950.00
	9.060	705.00	799.35	-1.19	1.88	.00	45.00	950.00
*	9.070	1580.00	800.08	.00	-.07	.00	61.00	50.00
*	9.070	1580.00	800.19	.11	-.07	.11	61.00	50.00
*	9.070	970.00	799.51	-.68	-.01	.00	61.00	50.00
*	9.070	1380.00	799.90	.39	-.05	.00	61.00	50.00
	9.070	2030.00	800.56	.66	.02	.00	932.00	50.00
*	9.070	705.00	799.51	-1.04	.16	.00	61.00	50.00
	9.070	1580.00	800.15	.00	.07	.00	61.00	28.50
	9.070	1580.00	800.26	.11	.07	.11	61.00	28.50
	9.070	970.00	799.54	-.72	.04	.00	61.00	28.50
	9.070	1380.00	799.96	.41	.06	.00	61.00	28.50
*	9.070	2030.00	800.36	.40	-.19	.00	932.00	28.50
	9.070	705.00	799.53	-.83	.02	.00	61.00	28.50

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	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	9.080	1580.00	800.56	.00	.41	.00	970.99	50.00
*	9.080	1580.00	800.59	.03	.33	.03	773.31	50.00
*	9.080	970.00	799.74	-.86	.19	.00	835.30	50.00

*	9.080	1380.00	800.29	.56	.33	.00	969.78	50.00
*	9.080	2030.00	800.99	.70	.63	.00	972.94	50.00
*	9.080	705.00	799.63	-1.36	.10	.00	782.86	50.00
	9.340	1580.00	801.25	.00	.69	.00	656.24	1373.00
*	9.340	1580.00	801.32	.08	.73	.08	507.04	1373.00
*	9.340	970.00	800.54	-.78	.81	.00	590.54	1373.00
*	9.340	1380.00	801.03	.48	.74	.00	626.47	1373.00
*	9.340	2030.00	801.66	.64	.67	.00	713.01	1373.00
*	9.340	705.00	800.21	-1.46	.57	.00	549.89	1373.00
	9.350	1580.00	801.31	.00	.06	.00	548.08	50.00
	9.350	1580.00	801.39	.08	.06	.08	476.46	50.00
*	9.350	970.00	800.60	-.79	.05	.00	64.00	50.00
	9.350	1380.00	801.09	.50	.06	.00	545.92	50.00
	9.350	2030.00	801.72	.63	.06	.00	552.21	50.00
	9.350	705.00	800.27	-1.45	.06	.00	63.35	50.00
	9.350	1580.00	801.49	.00	.19	.00	549.94	28.00
	9.350	1580.00	801.57	.08	.19	.08	482.96	28.00
	9.350	970.00	800.61	-.96	.01	.00	64.00	28.00
	9.350	1380.00	801.28	.67	.19	.00	547.79	28.00
	9.350	2030.00	801.90	.62	.18	.00	554.01	28.00
	9.350	705.00	800.28	-1.62	.01	.00	63.38	28.00
	9.360	1580.00	801.54	.00	.05	.00	696.60	50.00
	9.360	1580.00	801.62	.08	.05	.08	528.01	50.00
*	9.360	970.00	800.88	-.75	.27	.00	607.90	50.00
	9.360	1380.00	801.33	.45	.05	.00	667.69	50.00
	9.360	2030.00	801.95	.62	.05	.00	726.11	50.00
*	9.360	705.00	800.45	-1.50	.18	.00	582.79	50.00
*	9.730	1580.00	803.75	.00	2.20	.00	336.89	1950.00
	9.730	1580.00	803.86	.12	2.24	.12	285.48	1950.00
	9.730	970.00	803.06	-.80	2.18	.00	322.02	1950.00
	9.730	1380.00	803.54	.48	2.21	.00	332.59	1950.00
*	9.730	2030.00	804.16	.62	2.21	.00	345.78	1950.00
	9.730	705.00	802.71	-1.45	2.25	.00	314.30	1950.00
	9.960	1580.00	806.13	.00	2.38	.00	329.88	1220.00
	9.960	1580.00	806.23	.10	2.37	.10	273.01	1220.00
	9.960	970.00	805.45	-.77	2.39	.00	315.19	1220.00
	9.960	1380.00	805.92	.47	2.38	.00	325.34	1220.00
	9.960	2030.00	806.55	.63	2.39	.00	339.07	1220.00
	9.960	705.00	805.07	-1.49	2.36	.00	288.64	1220.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	10.380	1580.00	809.07	.00	2.94	.00	346.04	2220.00
*	10.380	1580.00	809.17	.10	2.95	.10	294.84	2220.00
	10.380	970.00	808.33	-.84	2.88	.00	330.01	2220.00
	10.380	1380.00	808.84	.51	2.92	.00	341.28	2220.00
*	10.380	2030.00	809.52	.68	2.97	.00	355.78	2220.00
*	10.380	705.00	807.93	-1.59	2.87	.00	321.22	2220.00
	10.760	1580.00	811.60	.00	2.53	.00	447.21	2000.00

10.760	1580.00	811.70	.10	2.53	.10	281.95	2000.00
* * 10.760	970.00	810.81	-.89	2.47	.00	326.13	2000.00
* 10.760	1380.00	811.37	.56	2.52	.00	415.91	2000.00
10.760	2030.00	812.05	.69	2.53	.00	511.76	2000.00
10.760	705.00	810.32	-1.74	2.39	.00	211.70	2000.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 4.850 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 4.850 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 4.850 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 4.850 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 4.850 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 4.850 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 5.640 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 5.660 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 5.850 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 5.850 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 5.850 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.170 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.170 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.170 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.170 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.170 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.170 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.450 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.450 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.450 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.450 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.450 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.450 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.980 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.980 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.980 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.980 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.980 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.980 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 6.990 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 6.990 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

ING SECNO= 7.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
ING SECNO= 7.000 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 7.130 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 7.670 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

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WARNING SECNO=      7.670  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.670  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.670  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       7.670  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       7.670  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      7.680  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      7.680  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=      7.680  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.680  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.680  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.680  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      7.680  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      8.300  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.300  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.300  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.300  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.300  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.300  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      8.500  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      8.500  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=      8.500  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      8.500  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       8.500  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      8.880  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.880  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      8.880  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.060  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      9.060  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=      9.060  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO=      9.060  PROFILE=  3  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=      9.060  PROFILE=  3  20 TRIALS ATTEMPTED TO BALANCE WSEL
WARNING SECNO=      9.060  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.060  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.070  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.070  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.070  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.070  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.070  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.070  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.080  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.080  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.080  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       9.080  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       9.080  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.080  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.340  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.340  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      9.340  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.340  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.340  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      9.340  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      9.350  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.360  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.360  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      9.730  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      9.730  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.380  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.380  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.380  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.380  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.380  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.380  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     10.760  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.760  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     10.760  PROFILE=  6  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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FLOODWAY DATA, EAR FLOOD
PROFILE NO. 2

STATION	------- FLOODWAY ------- WIDTH	SECTION AREA	MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
4.430	616.	2874.	.8	780.5	780.4	.1
4.850	732.	2342.	1.0	781.1	781.0	.1
5.620	780.	2343.	1.0	782.9	782.8	.1
5.640	778.	2539.	.9	783.1	783.0	.1
5.640	793.	2759.	.8	783.4	783.3	.1
5.660	821.	2853.	.8	783.4	783.3	.1
5.850	1037.	2524.	.9	783.7	783.6	.1
5.870	1016.	2540.	.9	783.8	783.7	.1
5.870	1031.	2662.	.9	783.8	783.7	.1
5.890	1044.	2865.	.8	783.9	783.8	.1
6.170	713.	1243.	1.4	785.0	784.9	.1
6.450	1020.	2528.	.7	786.1	786.0	.1
6.980	379.	1114.	1.6	788.5	788.4	.1
6.990	372.	1116.	1.6	788.6	788.5	.1
6.990	381.	1217.	1.4	788.8	788.7	.1
7.000	389.	1245.	1.4	788.8	788.7	.1
7.130	752.	1921.	.9	789.1	789.0	.1
7.660	641.	1339.	1.3	791.1	791.0	.1

7.670	62.	337.	5.2	790.9	790.8	.1
7.670	62.	339.	5.1	790.9	790.8	.1
7.680	659.	1701.	1.0	791.6	791.5	.1
8.300	346.	509.	3.1	794.6	794.5	.1
8.500	533.	982.	1.6	796.6	796.5	.1
8.880	348.	648.	2.4	799.4	799.4	.0
9.060	653.	1591.	1.0	800.3	800.2	.1
9.070	61.	395.	4.0	800.2	800.1	.1
9.070	61.	399.	4.0	800.2	800.1	.1
9.080	773.	1939.	.8	800.6	800.6	.0
9.340	507.	1143.	1.4	801.3	801.2	.1
9.350	476.	1118.	1.4	801.4	801.3	.1
9.350	483.	1222.	1.3	801.6	801.5	.1
9.360	528.	1333.	1.2	801.6	801.5	.1
9.730	285.	795.	2.0	803.8	803.7	.1
9.960	273.	677.	2.3	806.2	806.1	.1
10.380	295.	934.	1.7	809.2	809.1	.1
10.760	282.	690.	2.3	811.7	811.6	.1

FLOODWAY DATA, EAR FLOOD
PROFILE NO. 3

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
4.430	695.	1915.	.7	778.9	780.4	-1.5
4.850	736.	1406.	1.0	779.8	781.0	-1.2
5.620	927.	1797.	.8	782.1	782.8	-.7
5.640	890.	1975.	.7	782.3	783.0	-.7
5.640	902.	2184.	.6	782.5	783.3	-.8
5.660	955.	2254.	.6	782.5	783.3	-.8
5.850	1155.	1745.	.8	782.8	783.6	-.8
5.870	1132.	1822.	.8	782.9	783.7	-.8
5.870	1136.	2090.	.7	783.1	783.7	-.6
5.890	1169.	2287.	.6	783.2	783.8	-.6
6.170	885.	765.	1.4	784.3	784.9	-.6
6.450	1204.	2008.	.5	785.5	786.0	-.5
6.980	451.	838.	1.3	787.7	788.4	-.7
6.990	52.	242.	4.5	787.7	788.5	-.8
6.990	52.	242.	4.5	787.7	788.7	-1.0
7.000	483.	1088.	1.0	788.2	788.7	-.5
7.130	1385.	1553.	.7	788.4	789.0	-.6
7.660	704.	937.	1.2	790.3	791.0	-.7
7.670	58.	300.	3.6	790.3	790.8	-.5
7.670	58.	278.	3.9	790.3	790.8	-.5
7.680	707.	1137.	1.0	790.6	791.5	-.9
8.300	80.	359.	2.7	793.8	794.5	-.7
8.500	549.	469.	2.1	795.4	796.5	-1.1
8.880	86.	374.	2.6	798.5	799.4	-.9
9.060	727.	1148.	.8	799.5	800.2	-.7
9.070	61.	353.	2.7	799.5	800.1	-.6
9.070	61.	328.	3.0	799.5	800.1	-.6
9.080	835.	1315.	.7	799.7	800.6	-.9

9.340	591.	792.	1.2	800.5	801.2	-.7
9.350	64.	294.	3.3	800.6	801.3	-.7
9.350	64.	296.	3.3	800.6	801.5	-.9
9.360	608.	997.	1.0	800.9	801.5	-.6
9.730	322.	597.	1.6	803.1	803.7	-.6
9.960	315.	497.	2.0	805.5	806.1	-.6
10.380	330.	718.	1.4	808.3	809.1	-.8
10.760	326.	452.	2.1	810.8	811.6	-.8

FLOODWAY DATA, EAR FLOOD
PROFILE NO. 4

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
4.430	805.	2705.	.7	780.0	780.4	-.4
4.850	972.	2148.	.9	780.6	781.0	-.4
5.620	956.	2273.	.9	782.6	782.8	-.2
5.640	916.	2452.	.8	782.8	783.0	-.2
5.640	928.	2696.	.7	783.1	783.3	-.2
5.660	986.	2797.	.7	783.1	783.3	-.2
5.850	1176.	2369.	.8	783.4	783.6	-.2
5.870	1142.	2416.	.8	783.5	783.7	-.2
5.870	1144.	2560.	.8	783.6	783.7	-.1
5.890	1186.	2784.	.7	783.6	783.8	-.2
6.170	928.	1175.	1.3	784.7	784.9	-.2
6.450	1254.	2472.	.6	785.8	786.0	-.2
6.980	482.	1082.	1.4	788.2	788.4	-.2
6.990	473.	1086.	1.4	788.2	788.5	-.3
6.990	487.	1212.	1.3	788.5	788.7	-.2
7.000	502.	1243.	1.2	788.5	788.7	-.2
7.130	1403.	1900.	.8	788.8	789.0	-.2
7.660	709.	1256.	1.2	790.8	791.0	-.2
7.670	60.	322.	4.7	790.7	790.8	-.1
7.670	61.	291.	5.2	790.7	790.8	-.1
7.680	1160.	1561.	1.0	791.2	791.5	-.3
8.300	401.	427.	3.2	794.3	794.5	-.2
8.500	815.	894.	1.5	796.2	796.5	-.3
8.880	362.	557.	2.5	799.2	799.4	-.2
9.060	942.	1504.	.9	799.9	800.2	-.3
9.070	61.	377.	3.7	799.9	800.1	-.2
9.070	61.	349.	4.0	800.0	800.1	-.1
9.080	970.	1836.	.8	800.3	800.6	-.3
9.340	626.	1091.	1.3	801.0	801.2	-.2
9.350	546.	1063.	1.3	801.1	801.3	-.2
9.350	548.	1165.	1.2	801.3	801.5	-.2
9.360	668.	1288.	1.1	801.3	801.5	-.2
9.730	333.	757.	1.8	803.5	803.7	-.2
9.960	325.	647.	2.1	805.9	806.1	-.2
10.380	341.	892.	1.5	808.8	809.1	-.3
10.760	416.	664.	2.1	811.4	811.6	-.2

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WAY DATA, EAR FLOOD
PROFILE NO. 5

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
4.430	903.	3966.	.7	781.4	780.4	1.0
4.850	1284.	3571.	.8	781.9	781.0	.9
5.620	996.	2976.	1.0	783.3	782.8	.5
5.640	951.	3136.	.9	783.5	783.0	.5
5.640	954.	3291.	.9	783.7	783.3	.4
5.660	1017.	3437.	.9	783.7	783.3	.4
5.850	1202.	3145.	.9	784.0	783.6	.4
5.870	1152.	3152.	.9	784.1	783.7	.4
5.870	1152.	3226.	.9	784.1	783.7	.4
5.890	1206.	3475.	.8	784.2	783.8	.4
6.170	984.	1739.	1.3	785.3	784.9	.4
6.450	1359.	3178.	.7	786.4	786.0	.4
6.980	524.	1435.	1.6	788.9	788.4	.5
6.990	511.	1432.	1.6	788.9	788.5	.4
6.990	517.	1487.	1.5	789.0	788.7	.3
7.000	535.	1528.	1.5	789.1	788.7	.4
7.130	1431.	2554.	.9	789.4	789.0	.4
7.660	1187.	1704.	1.3	791.4	791.0	.4
7.670	63.	346.	6.6	791.1	790.8	.3
7.670	63.	304.	7.5	791.1	790.8	.3
7.680	1271.	2382.	1.0	792.1	791.5	.6
8.300	431.	614.	3.3	794.8	794.5	.3
8.500	853.	1436.	1.4	796.9	796.5	.4
8.880	498.	816.	2.5	799.8	799.4	.4
9.060	971.	2068.	1.0	800.5	800.2	.3
9.070	932.	2043.	1.0	800.6	800.1	.5
9.070	932.	369.	5.5	800.4	800.1	.3
9.080	973.	2516.	.8	801.0	800.6	.4
9.340	713.	1520.	1.3	801.7	801.2	.5
9.350	552.	1409.	1.4	801.7	801.3	.4
9.350	554.	1508.	1.3	801.9	801.5	.4
9.360	726.	1725.	1.2	802.0	801.5	.5
9.730	346.	963.	2.1	804.2	803.7	.5
9.960	339.	857.	2.4	806.6	806.1	.5
10.380	356.	1125.	1.8	809.5	809.1	.4
10.760	512.	982.	2.1	812.1	811.6	.5

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DWAY DATA, EAR FLOOD
ILE NO. 6

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE

4.430	620.	1417.	.7	778.1	780.4	-2.3
4.850	598.	1017.	1.0	779.2	781.0	-1.8
5.620	886.	1443.	.7	781.7	782.8	-1.1
5.640	69.	334.	3.0	781.9	783.0	-1.1
5.640	69.	335.	3.0	781.9	783.3	-1.4
5.660	937.	1951.	.5	782.2	783.3	-1.1
5.850	1141.	1359.	.7	782.5	783.6	-1.1
5.870	1126.	1441.	.7	782.6	783.7	-1.1
5.870	1130.	1696.	.6	782.8	783.7	-.9
5.890	1156.	1882.	.5	782.8	783.8	-1.0
6.170	731.	445.	1.8	783.9	784.9	-1.0
6.450	1164.	1643.	.5	785.2	786.0	-.8
6.980	425.	664.	1.2	787.2	788.4	-1.2
6.990	52.	220.	3.6	787.3	788.5	-1.2
6.990	52.	221.	3.6	787.3	788.7	-1.4
7.000	449.	823.	1.0	787.6	788.7	-1.1
7.130	852.	1108.	.7	787.9	789.0	-1.1
7.660	700.	738.	1.1	790.1	791.0	-.9
7.670	57.	286.	2.8	790.1	790.8	-.7
7.670	57.	268.	2.9	790.1	790.8	-.7
7.680	703.	876.	.9	790.2	791.5	-1.3
8.300	76.	311.	2.3	793.1	794.5	-1.4
8.500	79.	351.	2.0	794.6	796.5	-1.9
8.880	76.	293.	2.4	797.5	799.4	-1.9
9.060	45.	234.	3.0	799.3	800.2	-.9
9.070	61.	354.	2.0	799.5	800.1	-.6
9.070	61.	327.	2.2	799.5	800.1	-.6
9.080	783.	1231.	.6	799.6	800.6	-1.0
9.340	574.	604.	1.2	800.2	801.2	-1.0
9.350	63.	274.	2.6	800.3	801.3	-1.0
9.350	63.	274.	2.6	800.3	801.5	-1.2
9.360	586.	745.	.9	800.5	801.5	-1.0
9.730	314.	484.	1.5	802.7	803.7	-1.0
9.960	307.	381.	1.9	805.1	806.1	-1.0
10.380	321.	585.	1.2	807.9	809.1	-1.2
10.760	212.	324.	2.2	810.3	811.6	-1.3

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1*****************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
   ersion   4.6.2;  May 1991              *
                                          *
*  RUN DATE    13FEB97    TIME   14:15:26 *
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*          (916) 756-1104           *
*************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX             XXXXXXX
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13FEB97 14:15:26 PAGE 1

THIS RUN EXECUTED 13FEB97 14:15:26

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*************************************
    2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
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  SAND CREEK-NOBLESVILLE FIS   RM 0.00-5.78
T1 NOBLESVILLE FLOOD INSURANCE STUDY
T2 SAND CREEK
T3  100 YEAR FLOOD

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

      -1       4                        .0012                -1              782

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

      1                -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

      1        34        4        27       21       22       28       110      150      200

J5  LPRNT    NUMSEC                  ********REQUESTED SECTION NUMBERS********

    -10      -10

ET                                                        1.4
QT        5      1360      1960      2220      2880      2220
NC     .045      .045      .050        .1        .3
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X1	0.02	22	185	250	100	100	100			
X4	2	779.9	331	775.0	337					
GR	790.3	0	781.7	185	775.9	194	774.8	205	775.9	214
	777.6	217	777.6	232	782.9	250	782.0	300	782.0	355
	781.6	400	780.6	500	781.3	560	781.0	600	781.4	700
GR	781.3	800	781.4	900	781.9	1000	781.7	1100	781.4	1200
GR	782.0	1300	784.0	1337						
QT	5	610	870	990	1280	990				
X1	.39	21	647	670	2150	1400	1950			
X3	10							781.9	786.9	
X5	1					785.10				
GR	795.5	0	793.7	100	793.6	200	794.1	254	787.7	300
GR	788.8	358	790.7	400	787.9	490	788.0	500	787.5	515
GR	782.7	600	781.9	647	779.9	652	779.5	662	779.8	667
GR	782.3	670	786.9	700	787.4	731	784.9	743	785.6	800
GR	795.2	840								

1

NC				.3	.5					
ET						1.4				
X1	.41	0			100	100	100			
X3	10							784.7	786.4	
SB	1.0	1.3	2.8		13.6	1.0	145	1.1	779.6	779.6
	.41	0			24.6	24.6	24.6			
			1	786.4	785.6					
X3	10							785.6	787.3	
BT	16	320	791.7	0	380	790.8	0	450	788.6	0
BT	510	786.9	0	580	789.5	0	640	785.8	0	710
BT	785.6	0	770	785.8	0	840	786.2	0	890	787.7
BT	0	900	787.0	0	914	787.8	0	960	787.3	0
BT	1030	788.0	0	1090	791.3	0	1160	796.3	0	
X1	.43	0			100	100	100			
X3	10							781.9	786.9	
NC	.050	.050	.055							
NC				.1	.3					
ET						7.1	199.34	419.36		
X1	.94	15	249	286	1810	3340	2690			
GR	795.5	0	790.5	100	791.0	127	791.4	136	791.2	145
GR	789.5	161	789.4	200	786.3	249	783.9	263	782.7	272
GR	789.1	286	789.0	300	788.1	400	790.8	500	795.8	591
NC				.3	.5					
ET						1.4				
X1	.96	0			100	100	100			
X3	10							789.8	789.8	
SB	1.25	1.3	2.8		16	2.6	161	1.0	782.6	782.6
	.96	0			18	18	18			
[illegible]			1	789.6	790.5					
X3	10							791.4	790.5	
BT	13	110	795.8	0	180	793.2	0	240	791.7	0
BT	275	791.4	0	310	791.6	0	323	791.6	0	343
BT	791.5	0	380	791.2	0	440	790.5	0	510	791.0

BT	0	570	791.7	0	640	793.3	0	700	796.1	0
X1	.98				100	100	100			
	5	560	800	920	1190	920				
NC			.060							
NC				.1	.3					
X1	1.08	15	100	140	570	345	527			
GR	794.4	0	790.3	50	787.1	100	784.7	110	783.3	120
GR	786.8	130	789.3	140	789.2	150	788.9	200	788.7	250
GR	789.9	300	791.0	350	793.5	400	796.4	450	799.2	500

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X1	1.18	15	100	140	570	345	527			
GR	799.2	0	791.7	50	788.8	100	786.0	110	784.4	120
GR	787.3	130	789.9	140	789.9	150	789.9	200	789.9	250
GR	790.8	300	791.8	350	794.0	400	796.7	450	799.7	500
X1	1.28	15	100	140	570	345	527			
GR	804.1	0	793.0	50	790.4	100	787.2	110	785.4	120
GR	787.8	130	790.6	140	790.7	150	790.8	200	791.0	250
GR	791.6	300	792.7	350	794.5	400	797.1	450	800.2	500
X1	1.38	14	86	112	2570	345	528			
X5	1					793.42				
GR	801.8	0	794.8	19	792.0	79	791.6	86	786.7	92
	786.6	102	786.7	109.1	791.3	112	791.8	174	792.3	234
GR	792.6	300	795.5	400	796.4	414	800.3	475		
NC				.3	.5					
ET						1.4				
X1	1.40	0			100	100	100			
X3	10							795.5	794.5	
SB		1.3	2.8		17		198	.77	786.6	786.6
X1	1.40	0			24	24	24			
X2			1	795.5	794.5					
X3	10							798.3	794.5	
BT	12	0	801.8	801.8	19	800.4	794.8	79	798.3	792.0
BT	79.1	798.3	795.5	109	797.5	794.4	109.1	797.5	786.7	112
BT	797.2	791.3	174	795.1	791.8	234	794.5	792.3	300	795.1
BT	792.6	414	798.9	796.4	475	801.8	800.3			
X1	1.42	0			100	100	100			
X5	1					794.86				
NC	.060	.060	.065							
NC				.1	.3					
ET						1.4				
X1	1.59	15	100	140	900	900	910			
GR	806.7	0	795.2	50	793.0	100	789.9	110	787.8	120
	789.9	130	792.9	140	793.1	150	793.5	200	794.0	250
	794.8	300	796.2	350	797.4	400	799.5	450	802.1	500
X1	1.76	15	100	140	900	900	910			
GR	804.5	0	796.0	50	794.1	100	791.2	110	789.0	120
GR	791.4	130	794.5	140	794.8	150	795.2	200	795.9	250

GR	797.1	300	798.9	350	799.9	400	801.5	450	803.5	500
X1	1.94	15	100	140	900	900	910			
	802.2	0	796.7	50	795.2	100	792.6	110	790.2	120
	792.8	130	796.1	140	796.5	150	796.9	200	797.8	250
GR	799.4	300	801.5	350	802.3	400	803.6	450	804.9	500

X1	2.11	11	167	207	900	900	910			
GR	805.0	0	797.5	100	797.3	167	793.0	177	791.5	185
GR	792.8	192	798.1	207	798.9	300	801.1	357	803.8	400
GR	805.2	500								
NC				.3	.5					
X1	2.13	0			100	100	100			
X3	10							801.2	801.1	
SB	1.0	1.3	2.8		19.2	2.5	362	2.0	791.7	791.7
X1	2.13	0			22	22	22			
X2			1	801.2	801.1					
X3	10							802.5	801.1	
BT	8	0	805.0	0	100	802.6	0	175	802.5	0
BT	232	802.4	0	300	801.3	0	370	801.1	0	415
BT	803.8	0	500	805.2	0					
[illegible]	2.15	0			100	100	100			
Qr	5	530	750	860	1110	860				
NC	.065	.065	.060							
NC				.1	.3					
X1	2.58	16	324	370	2270	2270	2270			
GR	810.2	0	807.7	100	807.5	200	802.8	300	802.9	313
GR	802.2	324	796.9	344	795.4	352	799.8	370	800.1	400
GR	801.0	500	801.3	511	801.8	600	807.4	700	809.1	800
GR	812.6	861								
NC				.3	.5					
X1	2.60	0			100	100	100			
X3	10							806.8	806.2	
SB	0.90	1.3	2.8		18.0	3.0	534	2.8	795.6	795.6
X1	2.60	0			39.7	39.7	39.7			
X2			1	806.8	808.3					
X3	10							809.0	808.3	
BT	4	0	809.0	0	350	809.0	0	440	808.3	0
BT	900	808.3	0							
X1	2.605	0			25	25	25			
X1	2.61	0			25	25	25			
X3	10							807.8	806.9	
	0.90	1.3	2.8		18	3.0	565	2.7	795.9	795.9
X1	2.61	0			39.7	39.7	39.7			
X2			1	807.8	808.6					
X3	10							809.5	808.6	
BT	4	0	809.5	0	350	809.5	0	440	808.6	0

```
BT      900      808.6        0
1
   13FEB97      14:15:26                                                                                    PAGE    5


X1     2.63        0                          100        100        100

NC                                     .1       .3
X1     2.74       18       294       334       580        580        580
GR    815.4        0     805.4       100     802.4        200      801.4        294      800.6        300
GR    797.8      307     796.9       321     797.8        324      801.9        334      802.7        400
GR    803.5      500     805.3       600     807.7        700      811.3        800      811.9        810
GR    820.3      880     821.5       900     821.0        963

NC                                     .3       .5
X1     2.76        0                          100        100        100
X3       10                                                                    805.3      805.0

SB      1.0      1.3       2.8                10.6        2.0      249.3        2.2      796.8      796.8
X1     2.76        0                           27         27         27
X2                          1     805.3     805.0
X3       10                                                                    806.6      805.0
BT       11        0     811.8         0       100      809.0          0        200      806.6          0
BT      300    806.6         0       400     806.5          0        500      805.0          0        600
BT    805.3        0       700     806.9         0        800      809.9          0        900      816.7
BT        0      963     819.0

       2.78        0                          100        100        100

NC     .045     .045      .065
NC                                     .1       .3
X1     3.19       18       335       390      1720       2670       2160
X4        2    802.0     358.1     803.0       381
GR    812.1        0     810.3       100     807.6        200      806.3        300      805.9        335
GR    802.0      358     800.0       368     800.8        375      803.0      381.1      804.8        390
GR    804.8      400     804.8       500     805.5        600      807.7        700      809.8        800
GR    811.6      900     810.4      1000     809.6       1063

NC                                     .3       .5
X1     3.20        0                           25         25         25
X3       10                                                                    807.5     806.25

SB               1.3       2.8                 5.7                   113.5        1.1      800.0      800.0
X1     3.20        0                           20         20         20
X2                          1     807.9     806.4
X3       10                                                                    807.5      806.4
BT       18        0     812.1     812.1       100      810.3      810.3        200      807.6      807.6
BT      300    807.5     806.3     358.0     809.0      802.0      358.1      809.0      803.5        368
BT    809.4    807.9       381     809.0     803.5      381.1      809.0      803.0        390      808.0
BT    804.8      400     806.6     804.8       500      806.4      804.8        600      807.1      805.5
BT      700    808.4     807.7       800     809.8      809.8        900      812.4      811.6       1000
BT    811.0    810.4      1063     811.3     809.6

    3FEB97      14:15:26                                                                                    PAGE    6


X1     3.21        0                           25         25         25
X5        1                                            807.58
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QT	5	500	710	810	1050	810				
NC	.050	.050	.070							
				.1	.3					
						1.4				
X1	3.36	22	327	366	1250	375	790			
GR	817.8	0	817.9	47	814.8	65	811.3	89	810.9	100
GR	809.8	200	807.7	265	806.7	300	806.5	315	806.3	327
GR	802.5	336	801.3	341	802.6	356	805.7	366	805.5	400
GR	806.5	500	807.4	600	808.0	700	808.8	800	810.3	895
GR	810.9	900	810.8	903						
NC				.3	.5					
X1	3.38	22	315	366	100	100	100			
X3	10							808.9	808.2	
X4	2	802.1	345	802.1	345.1					
GR	817.8	0	817.9	47	814.8	65	811.3	89	810.9	100
GR	809.8	200	807.7	265	806.7	300	806.5	315	804.5	315.1
GR	802.5	336	801.3	341	802.6	356	805.7	366	805.5	400
GR	806.5	500	807.4	600	808.0	700	808.8	800	810.3	895
GR	810.9	900	810.8	903						
SB		1.3	2.8		16.5		172	.91	801.3	801.3
X1	3.38	0			21	21	21			
X2			1	808.9	808.2					
X3	10							809.0	808.2	
BT	21	0	817.8	817.8	47	817.9	817.9	65	814.8	814.8
BT	89	814.1	811.3	100	813.9	810.9	200	810.7	809.8	265
[illegible]	809.0	807.7	315.0	810.4	806.5	315.1	810.4	808.9	332	810.4
[illegible]	808.7	345	810.1	808.6	345.1	810.1	802.1	366	809.8	805.7
BT	400	809.5	805.5	500	808.5	806.5	600	808.2	807.4	700
BT	809.2	808.0	800	809.4	808.8	895	811.0	810.3	900	811.3
BT	810.9	903	811.3	810.8						
X1	3.40	22	327	366	100	100	100			
X5	1					808.55				
GR	817.8	0	817.9	47	814.8	65	811.3	89	810.9	100
GR	809.8	200	807.7	265	806.7	300	806.5	315	806.3	327
GR	802.5	336	801.3	341	802.6	356	805.7	366	805.5	400
GR	806.5	500	807.4	600	808.0	700	808.8	800	810.3	895
GR	810.9	900	810.8	903						
ET						1.4				
QT	5	430	620	700	910	700				
NC				.1	.3					
X1	3.6	19	400	450	1098	1073	1083			
GR	818.2	0	817.3	100	811.0	200	809.2	300	807.5	400
GR	805.0	410	802.3	420	803.8	430	804.5	440	805.8	450
GR	806.9	500	807.6	600	808.3	700	808.9	800	810.0	900
GR	812.3	1000	816.5	1100	820.0	1200	823.0	1300		

	3.81	19	400	450	1098	1073	1083			
GR	818.6	0	817.0	100	811.5	200	809.5	300	808.8	400
GR	806.5	410	803.3	420	805.4	430	805.0	440	806.1	450
GR	808.1	500	808.6	600	809.1	700	809.7	800	810.7	900
GR	813.2	1000	818.2	1100	821.9	1200	824.5	1300		

```
X1    4.01      19      400      450     1098     1073     1083
GR    819.1      0    816.6      100    812.0      200    809.8      300    810.0      400
      808.0    410    804.3      420    806.9      430    805.5      440    806.4      450
      809.3    500    809.6      600    810.0      700    810.4      800    811.5      900
GR    814.2   1000    819.9     1100    823.7     1200    825.9     1300

X1    4.22      16      495      532     1097     1072     1082
GR    820.7      0    819.4      100    811.3      300    809.9      400    811.4      495
GR    805.2    510    811.9      532    810.4      600    810.5      700    811.1      900
GR    812.4   1000    815.2     1100    822.1     1200    825.9     1300    827.3     1400
GR    828.2   1424

NC                            .3      .5
X1    4.24       0                   100      100      100
X3      10                                                      813.3    813.3

SB    1.25     1.3      2.8            10.5      2.5    204.4      1.5    804.7    804.7
X1    4.24       0                    18       18       18
X2                       1    813.3   813.3
X3      10                                                      813.5    813.3
BT      14       0    820.7        0     120    819.4        0      280    813.7        0
BT     400   813.5        0      500   813.7        0      537    813.7        0      600
BT   813.4       0      700    813.3       0      900    814.3        0     1000    815.3
BT       0    1100    817.5        0    1200    821.0        0     1320    825.9        0
BT    1424   827.3        0

X1    4.26       7       95      132     100      100      100
GR    813.5       0    811.4       10    811.4       95    805.2      110    811.9      132
      815.0     200    820.0      280

QT       5     410      580      660     850      660
NC    .050    .050     .065
NC                            .1      .3
X1    4.52      10       75      129    1370     1400     1370
GR    817.6       0    810.6       75    807.8       95    806.4      100    807.7      106
GR    811.8     129    813.0      200    814.3      300    817.3      400    822.6      500

NC                            .3      .5
X1    4.53       0                    25       25       25
X3      10                                                      815.6    815.1

SB    1.25     1.3      2.8            24.5      1.5    286      .70    805.9    805.9
X1    4.53       0                    18       18       18
X2                       1    815.6   815.6
X3      10                                                      816.6    815.6
BT       7       0    817.4        0      70    816.6        0      107    816.1        0
BT     200   815.6        0      300   816.3        0      400    819.0        0      500
```



```
BT    822.1

      4.54       0                    25       25       25

QT       5     340      480      550     710      550
NC    .055    .055     .070
NC                            .1      .3
X1    5.32      19      410      442    4070     4440     4120
```

X4	2	810.4	424.5	810.4	431.5					
GR	814.1	0	813.6	100	813.6	200	814.4	300	817.4	397
GR	817.2	400	816.9	410	810.4	424.4	809.5	428	810.4	431.4
	818.0	442	815.1	500	813.5	600	813.5	700	813.2	800
	813.5	900	814.0	1000	814.2	1100	814.2	1185		
NC				.3	.5					
X1	5.33	0			25	25	25			
X3	10							814.0	814.5	
SB	.5	1.3	2.8		7	.1	51	0	809.5	809.5
X1	5.33	0			15	15	15			
X2			1	817.2	814.5					
X3	10							814.5	814.9	
BT	17	0	814.7	814.1	100	814.5	813.6	200	814.8	813.6
BT	300	815.8	814.4	400	818.4	817.2	424.4	818.7	810.4	424.5
BT	818.7	817.2	431.4	818.7	817.2	431.5	818.7	810.4	442	818.7
BT	818.0	500	817.0	815.1	600	815.3	813.5	700	814.9	813.5
BT	800	814.9	813.2	900	815.0	813.5	1000	815.2	814.0	1100
BT	815.2	814.2								
X1	5.34	0			25	25	25			
QT	5	300	430	490	640	490				
NC	.045	.045	.080							
NC				.1	.3					
X1	5.39	19	480	520	85	63	86			
GR	815.3	0	814.5	100	814.2	200	814.3	300	815.5	400
GR	817.1	460	817.2	470	816.9	480	813.5	490	810.0	500
	816.0	510	817.6	520	815.0	600	813.9	700	814.0	800
GR	814.1	900	814.5	1000	815.0	1100	815.2	1200		
X1	5.43	19	480	520	85	63	86			
GR	816.3	0	815.2	100	814.8	200	814.8	300	815.7	400
GR	817.1	460	817.2	470	817.0	480	813.5	490	810.3	500
GR	816.0	510	817.8	520	815.3	600	814.4	700	814.6	800
GR	814.9	900	815.3	1000	815.9	1100	816.1	1200		
X1	5.48	19	480	520	85	63	86			
GR	817.3	0	815.9	100	815.5	200	815.4	300	815.9	400
GR	817.1	460	817.2	470	817.0	480	813.5	490	810.5	500
GR	816.0	510	817.9	520	815.7	600	814.8	700	815.2	800
GR	815.7	900	816.2	1000	816.8	1100	817.1	1200		

X1	5.63	19	480	520	256	189	258			
GR	820.2	0	817.9	100	817.6	200	817.1	300	816.5	400
GR	817.1	463	817.2	470	817.2	480	813.5	490	811.3	500
GR	816.0	510	818.4	520	816.9	600	816.2	700	816.9	800
GR	818.1	900	818.9	1000	819.5	1100	820.1	1200		
	5.78	17	529	559	255	189	257			
	825.3	0	820.8	100	819.3	200	820.1	300	817.3	400
GR	817.0	500	817.4	529	812.4	535	811.8	541	812.4	548
GR	818.9	559	818.7	600	817.2	700	817.8	800	820.0	900
GR	821.1	1000	821.8	1072						

T1 NOBLESVILLE FLOOD INSURANCE STUDY
ND CREEK
T3 100 YEAR ENCROACHMENT

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10	6					-1		782.48	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2		-1							

T1 NOBLESVILLE FLOOD INSURANCE STUDY
T2 SAND CREEK
T3 10 YEAR FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-1	2			.0012		-1		782	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3		-1							

T1 NOBLESVILLE FLOOD INSURANCE STUDY
T2 SAND CREEK
T3 50 YEAR FLOOD

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-1	3			.0012		-1		782	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4		-1							

T1 NOBLESVILLE FLOOD INSURANCE STUDY
T2 SAND CREEK
T3 500 YEAR FLOOD

	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-10	5			.0012		-1		782	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE

THIS RUN EXECUTED 13FEB97 14:15:34

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

YEAR FLOOD

SUMMARY PRINTOUT

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	782.383	642.33	1106.31	.00	185.00	250.00	.00
	782.480	638.69	822.78	185.00	185.00	250.00	1032.54
	781.907	390.18	1038.50	.00	185.00	250.00	.00
	782.259	566.72	1094.04	.00	185.00	250.00	.00
	782.660	833.56	1133.68	.00	185.00	250.00	.00
*	785.001	191.01	110.82	.00	647.00	670.00	.00
*	785.100	183.79	78.34	591.66	647.00	670.00	670.00
*	784.451	139.50	101.02	.00	647.00	670.00	.00
*	784.849	175.84	108.11	.00	647.00	670.00	.00
*	785.322	225.57	116.56	.00	647.00	670.00	.00
	785.285	220.74	115.79	.00	647.00	670.00	.00
	785.407	214.34	81.37	588.63	647.00	670.00	670.00
*	784.548	78.50	23.00	.00	647.00	670.00	.00
	785.106	201.47	112.61	.00	647.00	670.00	.00
	785.670	265.56	122.60	.00	647.00	670.00	.00
*	786.164	330.14	131.34	.00	647.00	670.00	.00
*	786.286	319.49	91.48	578.52	647.00	670.00	670.00
	784.638	81.18	23.00	.00	647.00	670.00	.00
*	786.001	307.93	128.46	.00	647.00	670.00	.00
*	786.474	374.96	136.84	.00	647.00	670.00	.00
	786.257	343.23	132.99	.00	647.00	670.00	.00
	786.385	332.01	92.53	577.47	647.00	670.00	670.00
*	785.410	234.73	117.99	.00	647.00	670.00	.00
	786.083	319.02	129.91	.00	647.00	670.00	.00
	786.597	393.46	139.00	.00	647.00	670.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	789.507	192.03	291.15	.00	249.00	286.00	.00
	789.614	205.83	220.02	199.34	249.00	286.00	419.36
	788.532	97.48	135.81	.00	249.00	286.00	.00
*	789.232	155.74	239.26	.00	249.00	286.00	.00
	790.036	285.13	315.66	.00	249.00	286.00	.00
*	789.714	130.23	37.00	.00	249.00	286.00	.00
*	789.802	125.56	37.00	249.00	249.00	286.00	286.00
	788.900	96.06	36.56	.00	249.00	286.00	.00
	789.508	120.94	37.00	.00	249.00	286.00	.00
	790.246	329.98	325.49	.00	249.00	286.00	.00
	790.047	146.04	37.00	.00	249.00	286.00	.00
	790.136	147.45	37.00	249.00	249.00	286.00	286.00
	788.988	99.26	36.76	.00	249.00	286.00	.00
	789.717	130.55	37.00	.00	249.00	286.00	.00
	791.218	450.54	258.60	.00	249.00	286.00	.00
*	790.678	434.61	358.78	.00	249.00	286.00	.00
*	790.745	427.01	246.50	184.95	249.00	286.00	431.45
*	789.432	181.28	261.94	.00	249.00	286.00	.00
*	790.295	341.04	327.79	.00	249.00	286.00	.00
*	791.317	634.25	421.02	.00	249.00	286.00	.00
	790.951	352.12	305.71	.00	100.00	140.00	.00
	791.026	346.16	217.28	72.09	100.00	140.00	289.37
	789.987	175.13	249.05	.00	100.00	140.00	.00
	790.632	284.52	287.35	.00	100.00	140.00	.00
	791.530	498.84	325.60	.00	100.00	140.00	.00
*	791.390	225.71	274.18	.00	100.00	140.00	.00
*	791.475	223.22	186.20	87.54	100.00	140.00	273.74
	790.647	123.89	223.32	.00	100.00	140.00	.00
*	791.143	186.85	257.58	.00	100.00	140.00	.00
*	791.885	320.32	303.16	.00	100.00	140.00	.00
	792.236	202.05	264.11	.00	100.00	140.00	.00
	792.332	200.16	177.97	96.81	100.00	140.00	274.78
	791.647	124.74	226.06	.00	100.00	140.00	.00
	792.056	175.43	252.47	.00	100.00	140.00	.00
	792.609	265.86	288.30	.00	100.00	140.00	.00
	793.317	209.42	274.11	.00	86.00	112.00	.00
*	793.420	209.79	192.21	82.88	86.00	112.00	275.09
	792.689	126.77	239.04	.00	86.00	112.00	.00
	793.132	181.57	263.80	.00	86.00	112.00	.00
	793.684	273.35	294.56	.00	86.00	112.00	.00

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	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
*	793.417	112.94	26.00	.00	86.00	112.00	.00
*	793.536	111.36	26.00	86.00	86.00	112.00	112.00
	792.869	96.36	26.00	.00	86.00	112.00	.00

*	793.267	108.22	26.00	.00	86.00	112.00	.00
*	793.674	121.24	26.00	.00	86.00	112.00	.00
	793.495	71.39	26.00	.00	86.00	112.00	.00
	793.614	113.57	26.00	86.00	86.00	112.00	112.00
*	792.920	62.95	26.00	.00	86.00	112.00	.00
*	793.336	69.07	26.00	.00	86.00	112.00	.00
*	793.771	75.44	26.00	.00	86.00	112.00	.00
*	794.706	513.04	351.58	.00	86.00	112.00	.00
*	794.860	526.16	248.70	65.31	86.00	112.00	314.01
*	793.517	242.46	285.14	.00	86.00	112.00	.00
*	794.318	411.26	329.94	.00	86.00	112.00	.00
*	795.589	803.43	384.53	.00	86.00	112.00	.00
*	795.222	229.85	265.54	.00	100.00	140.00	.00
*	795.351	233.33	176.46	86.34	100.00	140.00	262.80
*	794.325	123.14	200.47	.00	100.00	140.00	.00
*	794.922	187.87	248.41	.00	100.00	140.00	.00
*	795.941	356.39	294.32	.00	100.00	140.00	.00
	796.701	224.72	237.39	.00	100.00	140.00	.00
	796.803	225.08	160.71	71.47	100.00	140.00	232.18
	795.982	140.26	203.10	.00	100.00	140.00	.00
	796.489	197.19	227.54	.00	100.00	140.00	.00
	797.141	291.47	257.74	.00	100.00	140.00	.00
	798.161	234.07	224.71	.00	100.00	140.00	.00
	798.262	234.22	156.41	55.87	100.00	140.00	212.28
	797.384	145.14	183.02	.00	100.00	140.00	.00
	797.933	203.97	215.36	.00	100.00	140.00	.00
	798.609	299.83	242.59	.00	100.00	140.00	.00
	799.543	237.81	243.91	.00	167.00	207.00	.00
	799.644	237.56	168.23	99.13	167.00	207.00	267.37
	798.743	144.29	199.13	.00	167.00	207.00	.00
	799.313	206.63	234.89	.00	167.00	207.00	.00
	800.000	309.04	261.83	.00	167.00	207.00	.00
*	799.669	152.13	40.00	.00	167.00	207.00	.00
*	799.778	153.10	40.00	167.00	167.00	207.00	207.00
	798.893	118.10	40.00	.00	167.00	207.00	.00
*	799.451	142.53	40.00	.00	167.00	207.00	.00
*	800.090	171.96	40.00	.00	167.00	207.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	799.698	153.45	40.00	.00	167.00	207.00	.00
	799.798	158.09	40.00	.00	167.00	207.00	.00
	798.905	118.62	40.00	.00	167.00	207.00	.00
	799.473	143.18	40.00	.00	167.00	207.00	.00
	800.137	174.25	40.00	.00	167.00	207.00	.00
*	800.134	332.31	267.10	.00	167.00	207.00	.00
*	800.216	328.87	196.09	93.98	167.00	207.00	290.07
*	799.157	187.22	228.75	.00	167.00	207.00	.00

*	799.844	283.29	255.70	.00	167.00	207.00	.00
*	800.728	448.15	290.39	.00	167.00	207.00	.00
	802.378	232.73	289.15	.00	324.00	370.00	.00
	802.484	233.13	194.05	324.00	324.00	370.00	518.05
	801.678	139.41	252.36	.00	324.00	370.00	.00
	802.167	200.35	282.48	.00	324.00	370.00	.00
*	802.810	309.48	305.80	.00	324.00	370.00	.00
*	802.487	126.53	46.00	.00	324.00	370.00	.00
*	802.602	127.36	46.00	324.00	324.00	370.00	370.00
	801.826	98.11	44.59	.00	324.00	370.00	.00
*	802.295	116.90	46.00	.00	324.00	370.00	.00
*	802.869	145.96	46.00	.00	324.00	370.00	.00
	802.519	128.20	46.00	.00	324.00	370.00	.00
	802.619	133.18	46.00	.00	324.00	370.00	.00
	801.840	98.61	44.64	.00	324.00	370.00	.00
	802.319	118.47	46.00	.00	324.00	370.00	.00
	802.920	148.63	46.00	.00	324.00	370.00	.00
*	802.892	324.69	320.33	.00	324.00	370.00	.00
*	802.971	319.57	229.76	324.00	324.00	370.00	553.76
*	802.034	181.87	279.57	.00	324.00	370.00	.00
*	802.630	275.70	297.61	.00	324.00	370.00	.00
*	803.441	443.74	342.96	.00	324.00	370.00	.00
*	802.814	143.11	46.00	.00	324.00	370.00	.00
*	802.900	141.49	46.00	324.00	324.00	370.00	370.00
	802.014	105.38	45.30	.00	324.00	370.00	.00
	802.572	130.85	46.00	.00	324.00	370.00	.00
*	803.317	170.04	46.00	.00	324.00	370.00	.00
	802.839	144.42	46.00	.00	324.00	370.00	.00
	802.939	149.64	46.00	.00	324.00	370.00	.00
	802.026	105.84	45.34	.00	324.00	370.00	.00
	802.592	131.86	46.00	.00	324.00	370.00	.00
	803.354	172.11	46.00	.00	324.00	370.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
*	803.238	397.11	334.99	.00	324.00	370.00	.00
*	803.322	391.36	246.78	324.00	324.00	370.00	570.78
*	802.286	216.64	285.75	.00	324.00	370.00	.00
*	802.944	334.96	323.49	.00	324.00	370.00	.00
*	803.862	549.11	359.40	.00	324.00	370.00	.00
*	803.649	223.89	349.73	.00	294.00	334.00	.00
*	803.740	222.69	205.11	207.02	294.00	334.00	412.13
*	802.814	119.88	228.25	.00	294.00	334.00	.00
	803.387	184.98	318.93	.00	294.00	334.00	.00
	804.209	328.62	399.07	.00	294.00	334.00	.00
*	803.763	136.89	40.00	.00	294.00	334.00	.00
*	803.864	137.73	40.00	294.00	294.00	334.00	334.00
	803.005	103.87	40.00	.00	294.00	334.00	.00

*	803.534	126.80	40.00	.00	294.00	334.00	.00
*	804.238	160.09	40.00	.00	294.00	334.00	.00
	803.801	139.07	40.00	.00	294.00	334.00	.00
	803.901	143.78	40.00	.00	294.00	334.00	.00
	803.022	104.59	40.00	.00	294.00	334.00	.00
	803.564	128.17	40.00	.00	294.00	334.00	.00
	804.296	163.00	40.00	.00	294.00	334.00	.00
*	804.268	342.82	404.89	.00	294.00	334.00	.00
*	804.348	338.72	268.75	194.42	294.00	334.00	463.17
*	803.312	174.89	306.96	.00	294.00	334.00	.00
*	803.972	281.78	378.60	.00	294.00	334.00	.00
*	804.898	500.06	460.87	.00	294.00	334.00	.00
*	806.336	227.50	340.89	.00	335.00	390.00	.00
*	806.441	227.71	224.07	335.00	335.00	390.00	559.07
	805.841	140.97	280.66	.00	335.00	390.00	.00
	806.183	198.55	321.84	.00	335.00	390.00	.00
*	806.654	300.32	380.01	.00	335.00	390.00	.00
	806.373	232.57	304.42	.00	335.00	390.00	.00
	806.477	232.68	221.36	335.00	335.00	390.00	556.36
*	805.842	82.63	54.66	.00	335.00	390.00	.00
*	806.146	96.11	55.00	.00	335.00	390.00	.00
	806.688	301.50	318.76	.00	335.00	390.00	.00
*	807.032	57.64	334.64	.00	335.00	390.00	.00
	807.136	296.49	165.41	335.00	335.00	390.00	500.41
	805.827	39.77	54.62	.00	335.00	390.00	.00
	806.547	41.88	312.58	.00	335.00	390.00	.00
*	807.254	72.97	344.74	.00	335.00	390.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
*	807.597	591.24	494.04	.00	335.00	390.00	.00
*	807.580	553.93	316.61	300.79	335.00	390.00	617.40
*	806.463	254.23	356.07	.00	335.00	390.00	.00
*	807.615	601.30	496.65	.00	335.00	390.00	.00
*	807.788	672.78	511.18	.00	335.00	390.00	.00
*	807.800	266.72	406.18	.00	327.00	366.00	.00
*	807.803	249.42	239.28	310.37	327.00	366.00	549.65
*	806.900	118.84	251.33	.00	327.00	366.00	.00
*	807.768	258.73	399.00	.00	327.00	366.00	.00
*	808.042	323.05	450.82	.00	327.00	366.00	.00
*	807.888	143.04	51.00	.00	315.00	366.00	.00
*	807.913	140.44	51.00	315.00	315.00	366.00	366.00
	807.079	105.17	51.00	.00	315.00	366.00	.00
	807.841	140.73	51.00	.00	315.00	366.00	.00
	808.125	154.57	51.00	.00	315.00	366.00	.00
*	807.921	54.25	51.00	.00	315.00	366.00	.00
	807.946	141.99	51.00	315.00	315.00	366.00	366.00
*	807.121	42.11	51.00	.00	315.00	366.00	.00

*	807.869	53.43	51.00	.00	315.00	366.00	.00
*	808.162	58.10	51.00	.00	315.00	366.00	.00
*	808.506	460.93	523.21	.00	327.00	366.00	.00
	808.550	444.89	336.96	295.38	327.00	366.00	632.34
*	807.520	207.20	347.04	.00	327.00	366.00	.00
*	808.342	406.11	496.51	.00	327.00	366.00	.00
*	809.008	650.89	588.69	.00	327.00	366.00	.00
*	808.912	313.62	484.27	.00	400.00	450.00	.00
*	808.981	306.90	274.68	393.74	400.00	450.00	668.43
	808.184	167.71	324.86	.00	400.00	450.00	.00
*	808.751	274.24	448.80	.00	400.00	450.00	.00
*	809.350	445.68	549.70	.00	400.00	450.00	.00
	809.584	245.07	484.77	.00	400.00	450.00	.00
	809.675	242.29	244.36	400.00	400.00	450.00	644.36
	809.004	143.39	310.00	.00	400.00	450.00	.00
	809.440	214.23	447.76	.00	400.00	450.00	.00
	809.929	335.32	544.20	.00	400.00	450.00	.00
	810.483	239.80	538.58	.00	400.00	450.00	.00
	810.584	239.86	296.58	360.13	400.00	450.00	656.71
	809.970	144.03	385.40	.00	400.00	450.00	.00
	810.357	211.06	514.45	.00	400.00	450.00	.00
	810.769	316.66	577.42	.00	400.00	450.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	811.598	196.65	632.45	.00	495.00	532.00	.00
	811.698	196.82	454.86	363.46	495.00	532.00	828.12
	811.230	107.85	561.08	.00	495.00	532.00	.00
	811.508	169.35	617.34	.00	495.00	532.00	.00
	811.828	265.35	666.10	.00	495.00	532.00	.00
*	811.652	53.44	36.19	.00	495.00	532.00	.00
*	811.764	56.17	36.55	495.00	495.00	532.00	532.00
*	811.428	48.21	35.45	.00	495.00	532.00	.00
*	811.614	52.62	36.07	.00	495.00	532.00	.00
*	811.725	55.26	36.43	.00	495.00	532.00	.00
	811.888	59.25	36.96	.00	495.00	532.00	.00
	811.988	62.11	37.00	.00	495.00	532.00	.00
	811.501	49.89	35.69	.00	495.00	532.00	.00
	811.784	56.65	36.62	.00	495.00	532.00	.00
	812.228	69.28	37.00	.00	495.00	532.00	.00
*	812.867	140.88	150.21	.00	95.00	132.00	.00
*	812.931	136.18	113.81	18.19	95.00	132.00	132.00
*	812.112	80.27	130.02	.00	95.00	132.00	.00
	812.659	121.09	144.42	.00	95.00	132.00	.00
	813.419	200.21	164.99	.00	95.00	132.00	.00
*	814.257	298.30	260.91	.00	75.00	129.00	.00
*	814.357	298.09	159.52	60.70	75.00	129.00	220.22
*	813.497	191.50	193.61	.00	75.00	129.00	.00

*	814.053	265.97	243.03	.00	75.00	129.00	.00
*	814.724	387.14	283.31	.00	75.00	129.00	.00
*	814.247	193.41	54.00	.00	75.00	129.00	.00
	814.350	193.82	54.00	75.00	75.00	129.00	129.00
	813.501	149.77	54.00	.00	75.00	129.00	.00
*	814.048	181.33	54.00	.00	75.00	129.00	.00
*	814.698	221.95	54.00	.00	75.00	129.00	.00
	814.255	193.89	54.00	.00	75.00	129.00	.00
	814.354	200.08	54.00	.00	75.00	129.00	.00
	813.505	149.99	54.00	.00	75.00	129.00	.00
	814.054	181.72	54.00	.00	75.00	129.00	.00
	814.710	222.69	54.00	.00	75.00	129.00	.00
*	814.348	314.02	266.76	.00	75.00	129.00	.00
*	814.440	312.52	165.76	60.33	75.00	129.00	226.08
	813.548	198.27	198.73	.00	75.00	129.00	.00
*	814.130	277.78	249.76	.00	75.00	129.00	.00
*	814.847	413.56	288.75	.00	75.00	129.00	.00

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	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
*	815.234	537.05	1039.01	.00	410.00	442.00	.00
*	815.334	536.28	889.01	64.70	410.00	442.00	1094.05
	814.679	265.21	990.56	.00	410.00	442.00	.00
	815.068	445.34	1028.35	.00	410.00	442.00	.00
*	815.609	774.71	1060.05	.00	410.00	442.00	.00
	815.237	542.31	1039.51	.00	410.00	442.00	.00
	815.337	542.23	898.42	61.23	410.00	442.00	1099.78
	814.683	266.77	990.93	.00	410.00	442.00	.00
	815.071	449.64	1029.16	.00	410.00	442.00	.00
	815.611	779.84	1060.47	.00	410.00	442.00	.00
*	815.293	574.26	1042.54	.00	410.00	442.00	.00
*	815.393	574.19	904.30	60.32	410.00	442.00	1101.57
*	815.030	426.66	1024.82	.00	410.00	442.00	.00
*	815.207	523.50	1037.69	.00	410.00	442.00	.00
	815.622	785.66	1060.94	.00	410.00	442.00	.00
	815.295	574.59	1042.57	.00	410.00	442.00	.00
	815.396	574.47	902.28	61.14	410.00	442.00	1100.26
	815.031	427.54	1024.99	.00	410.00	442.00	.00
	815.209	523.99	1037.74	.00	410.00	442.00	.00
	815.624	785.61	1060.94	.00	410.00	442.00	.00
*	815.304	279.50	1016.99	.00	480.00	520.00	.00
*	815.403	281.11	672.26	144.51	480.00	520.00	987.28
*	815.037	172.19	870.45	.00	480.00	520.00	.00
	815.217	240.85	996.03	.00	480.00	520.00	.00
	815.631	455.25	1049.92	.00	480.00	520.00	.00
*	815.337	88.58	699.99	.00	480.00	520.00	.00
*	815.430	87.50	415.29	230.31	480.00	520.00	846.81
*	815.066	42.93	528.83	.00	480.00	520.00	.00

*	815.251	70.92	655.32	.00	480.00	520.00	.00
*	815.651	176.23	826.94	.00	480.00	520.00	.00
*	815.648	51.24	495.17	.00	480.00	520.00	.00
	815.738	50.37	203.84	480.00	480.00	520.00	776.55
	815.477	35.80	361.11	.00	480.00	520.00	.00
*	815.604	46.41	461.94	.00	480.00	520.00	.00
*	815.794	73.42	603.77	.00	480.00	520.00	.00
*	817.120	72.38	434.36	.00	480.00	520.00	.00
*	817.226	72.96	274.34	396.34	480.00	520.00	738.19
	816.835	43.64	304.73	.00	480.00	520.00	.00
	817.050	63.25	404.01	.00	480.00	520.00	.00
	817.224	87.68	484.76	.00	480.00	520.00	.00

	CWSEL	.01K	TOPWID	STENCL	STCHL	STCHR	STENCR
	817.944	95.73	336.86	.00	529.00	559.00	.00
	818.049	95.52	217.75	422.36	529.00	559.00	726.45
*	817.636	63.73	270.74	.00	529.00	559.00	.00
	817.866	86.02	325.01	.00	529.00	559.00	.00
	818.127	121.46	364.03	.00	529.00	559.00	.00

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YEAR FLOOD

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	.020	782.38	.38	782.45	1106.31	2.80	845.72	1371.49	.00	.00	185.00	250.00	.00
	.020	782.48	.10	782.55	822.78	.00	869.91	1350.09	.09	185.00	185.00	250.00	1032.54
	.020	781.91	-.09	781.98	1038.50	.12	729.37	630.51	.00	.00	185.00	250.00	.00
	.020	782.26	.26	782.32	1094.04	1.64	813.51	1144.84	.00	.00	185.00	250.00	.00
	.020	782.66	.66	782.72	1133.68	6.92	920.65	1952.42	.00	.00	185.00	250.00	.00
*	.390	785.00	.00	785.21	110.82	510.76	479.24	.00	.00	.00	647.00	670.00	.00
*	.390	785.10	.10	785.32	78.34	511.71	478.29	.00	.05	591.66	647.00	670.00	670.00
*	.390	784.45	.00	784.58	101.02	279.18	330.82	.00	.00	.00	647.00	670.00	.00
*	.390	784.85	.00	785.03	108.11	436.17	433.83	.00	.00	.00	647.00	670.00	.00
*	.390	785.32	.00	785.59	116.56	695.91	584.08	.00	.00	.00	647.00	670.00	.00
	.410	785.29	.00	785.45	115.79	534.78	455.22	.00	.00	.00	647.00	670.00	.00
	.410	785.41	.12	785.59	81.37	540.23	449.77	.00	.05	588.63	647.00	670.00	670.00
*	.410	784.55	.00	785.11	23.00	.00	610.00	.00	.00	.00	647.00	670.00	.00
	.410	785.11	.00	785.25	112.61	456.78	413.22	.00	.00	.00	647.00	670.00	.00
	.410	785.67	.00	785.88	122.60	728.45	551.55	.00	.00	.00	647.00	670.00	.00
*	.410	786.16	.00	786.25	131.34	594.42	395.58	.00	.00	.00	647.00	670.00	.00
*	.410	786.29	.12	786.38	91.48	608.12	381.88	.00	.04	578.52	647.00	670.00	670.00
	.410	784.64	.00	785.17	23.00	.00	610.00	.00	.00	.00	647.00	670.00	.00
*	.410	786.00	.00	786.08	128.46	513.92	356.08	.00	.00	.00	647.00	670.00	.00

*	.410	786.47	.00	786.60	136.84	790.42	489.58	.00	.00	.00	647.00	670.00	.00
	.430	786.26	.00	786.34	132.99	599.68	390.32	.00	.00	.00	647.00	670.00	.00
	.430	786.39	.13	786.48	92.53	614.08	375.92	.00	.04	577.47	647.00	670.00	670.00
	.430	785.41	.00	785.47	117.99	335.53	274.47	.00	.00	.00	647.00	670.00	.00
	.430	786.08	.00	786.16	129.91	518.24	351.76	.00	.00	.00	647.00	670.00	.00
	.430	786.60	.00	786.71	139.00	798.41	481.59	.00	.00	.00	647.00	670.00	.00
*	.940	789.51	.00	789.66	291.15	174.36	623.22	192.42	.00	.00	249.00	286.00	.00
*	.940	789.61	.11	789.75	220.02	180.22	604.59	205.20	220.02	199.34	249.00	286.00	419.36
*	.940	788.53	.00	788.75	135.81	79.11	521.36	9.52	.00	.00	249.00	286.00	.00
*	.940	789.23	.00	789.41	239.26	145.36	608.64	116.00	.00	.00	249.00	286.00	.00
	.940	790.04	.00	790.16	315.66	262.02	651.80	366.18	.00	.00	249.00	286.00	.00
*	.960	789.71	.00	790.21	37.00	.00	990.00	.00	.00	.00	249.00	286.00	.00
*	.960	789.80	.09	790.28	37.00	.00	990.00	.00	.45	249.00	249.00	286.00	286.00
	.960	788.90	.00	789.17	36.56	.00	610.00	.00	.00	.00	249.00	286.00	.00
	.960	789.51	.00	789.92	37.00	.00	870.00	.00	.00	.00	249.00	286.00	.00
	.960	790.25	.00	790.34	325.49	274.28	602.96	402.76	.00	.00	249.00	286.00	.00
	.960	790.05	.00	790.48	37.00	.00	990.00	.00	.00	.00	249.00	286.00	.00
	.960	790.14	.09	790.55	37.00	.00	990.00	.00	.00	249.00	249.00	286.00	286.00
	.960	788.99	.00	789.25	36.76	.00	610.00	.00	.00	.00	249.00	286.00	.00
	.960	789.72	.00	790.10	37.00	.00	870.00	.00	.00	.00	249.00	286.00	.00
	.960	791.22	.00	791.28	258.60	.00	585.21	694.79	.00	.00	249.00	286.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	.980	790.68	.00	790.71	358.78	227.84	403.71	358.45	.00	.00	249.00	286.00	.00
*	.980	790.74	.07	790.78	246.50	213.86	418.81	357.33	.06	184.95	249.00	286.00	431.45
*	.980	789.43	.00	789.50	261.94	105.16	395.78	109.06	.00	.00	249.00	286.00	.00
*	.980	790.30	.00	790.34	327.79	188.21	402.73	279.06	.00	.00	249.00	286.00	.00
*	.980	791.32	.00	791.35	421.02	318.87	427.70	533.43	.00	.00	249.00	286.00	.00
	1.080	790.95	.00	790.99	305.71	150.85	395.71	373.44	.00	.00	100.00	140.00	.00
	1.080	791.03	.08	791.07	217.28	132.67	411.29	376.04	.06	72.09	100.00	140.00	289.37
	1.080	789.99	.00	790.03	249.05	78.92	344.11	136.96	.00	.00	100.00	140.00	.00
	1.080	790.63	.00	790.67	287.35	125.29	383.29	291.42	.00	.00	100.00	140.00	.00
	1.080	791.53	.00	791.57	325.60	205.15	430.78	554.07	.00	.00	100.00	140.00	.00
*	1.180	791.39	.00	791.47	274.18	83.16	508.38	328.46	.00	.00	100.00	140.00	.00
*	1.180	791.47	.08	791.56	186.20	55.99	529.76	334.25	.07	87.54	100.00	140.00	273.74
	1.180	790.65	.00	790.74	223.32	37.40	421.02	101.58	.00	.00	100.00	140.00	.00
*	1.180	791.14	.00	791.23	257.58	66.89	487.40	245.71	.00	.00	100.00	140.00	.00
*	1.180	791.88	.00	791.96	303.16	125.14	548.80	516.06	.00	.00	100.00	140.00	.00
	1.280	792.24	.00	792.33	264.11	41.29	543.26	335.45	.00	.00	100.00	140.00	.00
	1.280	792.33	.10	792.44	177.97	8.98	566.81	344.21	.07	96.81	100.00	140.00	274.78
	1.280	791.65	.00	791.74	226.06	14.52	424.33	121.16	.00	.00	100.00	140.00	.00
	1.280	792.06	.00	792.15	252.47	31.40	508.37	260.22	.00	.00	100.00	140.00	.00
	1.280	792.61	.00	792.71	288.30	66.58	609.87	513.56	.00	.00	100.00	140.00	.00
	1.380	793.32	.00	793.42	274.11	36.80	482.70	400.50	.00	.00	86.00	112.00	.00
*	1.380	793.42	.10	793.53	192.21	7.65	495.72	416.62	.07	82.88	86.00	112.00	275.09
	1.380	792.69	.00	792.79	239.04	10.92	401.51	147.57	.00	.00	86.00	112.00	.00
	1.380	793.13	.00	793.23	263.80	27.23	458.89	313.88	.00	.00	86.00	112.00	.00

	1.380	793.68	.00	793.79	294.56	61.16	529.40	599.43	.00	.00	86.00	112.00	.00
*	1.400	793.42	.00	793.97	26.00	.00	920.00	.00	.00	.00	86.00	112.00	.00
	1.400	793.54	.12	794.07	26.00	.00	920.00	.00	.00	86.00	86.00	112.00	112.00
	1.400	792.87	.00	793.12	26.00	.00	560.00	.00	.00	.00	86.00	112.00	.00
*	1.400	793.27	.00	793.71	26.00	.00	800.00	.00	.00	.00	86.00	112.00	.00
*	1.400	793.67	.00	794.52	26.00	.00	1190.00	.00	.00	.00	86.00	112.00	.00
*	1.400	793.49	.00	794.37	26.00	.00	920.00	.00	.00	.00	86.00	112.00	.00
	1.400	793.61	.12	794.13	26.00	.00	920.00	.00	.00	86.00	86.00	112.00	112.00
*	1.400	792.92	.00	793.30	26.00	.00	560.00	.00	.00	.00	86.00	112.00	.00
*	1.400	793.34	.00	794.03	26.00	.00	800.00	.00	.00	.00	86.00	112.00	.00
*	1.400	793.77	.00	795.13	26.00	.00	1190.00	.00	.00	.00	86.00	112.00	.00
*	1.420	794.71	.00	794.73	351.58	73.14	281.11	565.76	.00	.00	86.00	112.00	.00
*	1.420	794.86	.15	794.88	248.70	53.85	283.94	582.21	.05	65.31	86.00	112.00	314.01
*	1.420	793.52	.00	793.55	285.14	25.89	268.25	265.86	.00	.00	86.00	112.00	.00
*	1.420	794.32	.00	794.34	329.94	55.56	278.17	466.27	.00	.00	86.00	112.00	.00
*	1.420	795.59	.00	795.61	384.53	125.96	281.48	782.56	.00	.00	86.00	112.00	.00

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	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	1.590	795.22	.00	795.30	265.54	60.84	539.94	319.22	.00	.00	100.00	140.00	.00
*	1.590	795.35	.13	795.43	176.46	40.72	552.92	326.36	.06	86.34	100.00	140.00	262.80
*	1.590	794.33	.00	794.41	200.47	17.08	442.65	100.27	.00	.00	100.00	140.00	.00
	1.590	794.92	.00	795.00	248.41	43.46	518.63	237.91	.00	.00	100.00	140.00	.00
	1.590	795.94	.00	796.00	294.32	115.69	561.21	513.10	.00	.00	100.00	140.00	.00
	1.760	796.70	.00	796.78	237.39	117.32	575.40	227.28	.00	.00	100.00	140.00	.00
	1.760	796.80	.10	796.89	160.71	100.50	593.71	225.79	.06	71.47	100.00	140.00	232.18
	1.760	795.98	.00	796.06	203.10	44.37	439.16	76.46	.00	.00	100.00	140.00	.00
	1.760	796.49	.00	796.57	227.54	92.66	533.02	174.32	.00	.00	100.00	140.00	.00
	1.760	797.14	.00	797.23	257.74	174.95	656.43	358.62	.00	.00	100.00	140.00	.00
	1.940	798.16	.00	798.24	224.71	190.78	574.56	154.66	.00	.00	100.00	140.00	.00
	1.940	798.26	.10	798.35	156.41	179.90	591.63	148.47	.05	55.87	100.00	140.00	212.28
	1.940	797.38	.00	797.46	183.02	87.95	433.47	38.58	.00	.00	100.00	140.00	.00
	1.940	797.93	.00	798.01	215.36	156.81	532.56	110.63	.00	.00	100.00	140.00	.00
	1.940	798.61	.00	798.70	242.59	266.26	662.42	261.32	.00	.00	100.00	140.00	.00
	2.110	799.54	.00	799.62	243.91	255.72	566.24	98.03	.00	.00	167.00	207.00	.00
	2.110	799.64	.10	799.73	168.23	248.47	584.63	86.90	.06	99.13	167.00	207.00	267.37
	2.110	798.74	.00	798.81	199.13	113.40	435.47	11.12	.00	.00	167.00	207.00	.00
	2.110	799.31	.00	799.39	234.89	209.11	526.95	63.94	.00	.00	167.00	207.00	.00
	2.110	800.00	.00	800.08	261.83	360.15	645.49	184.35	.00	.00	167.00	207.00	.00
*	2.130	799.67	.00	799.94	40.00	.00	920.00	.00	.00	.00	167.00	207.00	.00
*	2.130	799.78	.11	800.04	40.00	.00	920.00	.00	.00	167.00	167.00	207.00	207.00
	2.130	798.89	.00	799.03	40.00	.00	560.00	.00	.00	.00	167.00	207.00	.00
*	2.130	799.45	.00	799.67	40.00	.00	800.00	.00	.00	.00	167.00	207.00	.00
	2.130	800.09	.00	800.48	40.00	.00	1190.00	.00	.00	.00	167.00	207.00	.00
	2.130	799.70	.00	799.97	40.00	.00	920.00	.00	.00	.00	167.00	207.00	.00
	2.130	799.80	.10	800.06	40.00	.00	920.00	.00	.00	.00	167.00	207.00	.00
	2.130	798.91	.00	799.04	40.00	.00	560.00	.00	.00	.00	167.00	207.00	.00
	2.130	799.47	.00	799.69	40.00	.00	800.00	.00	.00	.00	167.00	207.00	.00

	2.130	800.14	.00	800.52	40.00	.00	1190.00	.00	.00	.00	167.00	207.00	.00
*	2.150	800.13	.00	800.18	267.10	283.64	481.99	154.37	.00	.00	167.00	207.00	.00
*	2.150	800.22	.08	800.26	196.09	276.03	498.17	145.81	.05	93.98	167.00	207.00	290.07
	2.150	799.16	.00	799.20	228.75	138.91	386.72	34.37	.00	.00	167.00	207.00	.00
*	2.150	799.84	.00	799.89	255.70	236.19	452.48	111.33	.00	.00	167.00	207.00	.00
*	2.150	800.73	.00	800.77	290.39	389.53	541.30	259.16	.00	.00	167.00	207.00	.00
	2.580	802.38	.00	802.43	289.15	.04	448.45	411.50	.00	.00	324.00	370.00	.00
	2.580	802.48	.11	802.54	194.05	.00	465.08	394.92	.07	324.00	324.00	370.00	518.05
	2.580	801.68	.00	801.73	252.36	.00	351.89	178.11	.00	.00	324.00	370.00	.00
	2.580	802.17	.00	802.22	282.48	.00	417.68	332.32	.00	.00	324.00	370.00	.00
*	2.580	802.81	.00	802.87	305.80	1.10	513.24	595.66	.00	.00	324.00	370.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	2.600	802.49	.00	802.78	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
*	2.600	802.60	.11	802.88	46.00	.00	860.00	.00	.00	324.00	324.00	370.00	370.00
	2.600	801.83	.00	801.98	44.59	.00	530.00	.00	.00	.00	324.00	370.00	.00
*	2.600	802.29	.00	802.54	46.00	.00	750.00	.00	.00	.00	324.00	370.00	.00
*	2.600	802.87	.00	803.28	46.00	.00	1110.00	.00	.00	.00	324.00	370.00	.00
	2.600	802.52	.00	802.81	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
	2.600	802.62	.10	802.90	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
	2.600	801.84	.00	801.99	44.64	.00	530.00	.00	.00	.00	324.00	370.00	.00
	2.600	802.32	.00	802.56	46.00	.00	750.00	.00	.00	.00	324.00	370.00	.00
	2.600	802.92	.00	803.33	46.00	.00	1110.00	.00	.00	.00	324.00	370.00	.00
*	2.605	802.89	.00	802.92	320.33	1.17	389.83	469.01	.00	.00	324.00	370.00	.00
*	2.605	802.97	.08	803.01	229.76	.00	402.92	457.08	.06	324.00	324.00	370.00	553.76
*	2.605	802.03	.00	802.07	279.57	.00	309.47	220.53	.00	.00	324.00	370.00	.00
*	2.605	802.63	.00	802.66	297.61	.33	363.93	385.74	.00	.00	324.00	370.00	.00
*	2.605	803.44	.00	803.47	342.96	9.46	442.70	657.84	.00	.00	324.00	370.00	.00
*	2.610	802.81	.00	803.07	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
*	2.610	802.90	.09	803.15	46.00	.00	860.00	.00	.00	324.00	324.00	370.00	370.00
*	2.610	802.01	.00	802.16	45.30	.00	530.00	.00	.00	.00	324.00	370.00	.00
*	2.610	802.57	.00	802.79	46.00	.00	750.00	.00	.00	.00	324.00	370.00	.00
*	2.610	803.32	.00	803.66	46.00	.00	1110.00	.00	.00	.00	324.00	370.00	.00
	2.610	802.84	.00	803.09	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
	2.610	802.94	.10	803.18	46.00	.00	860.00	.00	.00	.00	324.00	370.00	.00
	2.610	802.03	.00	802.17	45.34	.00	530.00	.00	.00	.00	324.00	370.00	.00
	2.610	802.59	.00	802.81	46.00	.00	750.00	.00	.00	.00	324.00	370.00	.00
	2.610	803.35	.00	803.69	46.00	.00	1110.00	.00	.00	.00	324.00	370.00	.00
*	2.630	803.24	.00	803.26	334.99	4.61	358.79	496.60	.00	.00	324.00	370.00	.00
*	2.630	803.32	.08	803.35	246.78	.00	368.40	491.60	.05	324.00	324.00	370.00	570.78
*	2.630	802.29	.00	802.31	285.75	.00	285.02	244.98	.00	.00	324.00	370.00	.00
*	2.630	802.94	.00	802.97	323.49	1.34	335.61	413.05	.00	.00	324.00	370.00	.00
	2.630	803.86	.00	803.88	359.40	17.73	406.75	685.52	.00	.00	324.00	370.00	.00
*	2.740	803.65	.00	803.72	349.73	225.77	506.80	127.43	.00	.00	294.00	334.00	.00
*	2.740	803.74	.09	803.82	205.11	216.98	526.04	116.99	.07	207.02	294.00	334.00	412.13
*	2.740	802.81	.00	802.91	228.25	82.98	424.81	22.21	.00	.00	294.00	334.00	.00
*	2.740	803.39	.00	803.47	318.93	178.40	487.73	83.87	.00	.00	294.00	334.00	.00

*	2.740	804.21	.00	804.27	399.07	330.31	534.82	244.87	.00	.00	294.00	334.00	.00
*	2.760	803.76	.00	804.06	40.00	.00	860.00	.00	.00	.00	294.00	334.00	.00
*	2.760	803.86	.10	804.15	40.00	.00	860.00	.00	.00	294.00	294.00	334.00	334.00
	2.760	803.01	.00	803.16	40.00	.00	530.00	.00	.00	.00	294.00	334.00	.00
*	2.760	803.53	.00	803.78	40.00	.00	750.00	.00	.00	.00	294.00	334.00	.00
*	2.760	804.24	.00	804.65	40.00	.00	1110.00	.00	.00	.00	294.00	334.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	2.760	803.80	.00	804.09	40.00	.00	860.00	.00	.00	.00	294.00	334.00	.00
	2.760	803.90	.10	804.18	40.00	.00	860.00	.00	.00	.00	294.00	334.00	.00
	2.760	803.02	.00	803.18	40.00	.00	530.00	.00	.00	.00	294.00	334.00	.00
	2.760	803.56	.00	803.81	40.00	.00	750.00	.00	.00	.00	294.00	334.00	.00
	2.760	804.30	.00	804.70	40.00	.00	1110.00	.00	.00	.00	294.00	334.00	.00
*	2.780	804.27	.00	804.30	404.89	258.55	405.32	196.13	.00	.00	294.00	334.00	.00
*	2.780	804.35	.08	804.38	268.75	250.11	420.35	189.54	.06	194.42	294.00	334.00	463.17
*	2.780	803.31	.00	803.36	306.96	121.47	354.48	54.05	.00	.00	294.00	334.00	.00
*	2.780	803.97	.00	804.01	378.60	213.91	391.67	144.42	.00	.00	294.00	334.00	.00
*	2.780	804.90	.00	804.92	460.87	358.38	430.75	320.87	.00	.00	294.00	334.00	.00
*	3.190	806.34	.00	806.38	340.89	3.97	397.72	458.31	.00	.00	335.00	390.00	.00
*	3.190	806.44	.10	806.49	224.07	.00	414.05	445.95	.09	335.00	335.00	390.00	559.07
	3.190	805.84	.00	805.88	280.66	.00	311.88	218.12	.00	.00	335.00	390.00	.00
	3.190	806.18	.00	806.23	321.84	1.28	370.95	377.78	.00	.00	335.00	390.00	.00
	3.190	806.65	.00	806.71	380.01	17.98	448.00	644.02	.00	.00	335.00	390.00	.00
	3.200	806.37	.00	806.42	304.42	.00	394.51	465.49	.00	.00	335.00	390.00	.00
	3.200	806.48	.10	806.53	221.36	.00	413.67	446.33	.09	335.00	335.00	390.00	556.36
*	3.200	805.84	.00	805.99	54.66	.00	530.00	.00	.00	.00	335.00	390.00	.00
*	3.200	806.15	.00	806.39	55.00	.00	750.00	.00	.00	.00	335.00	390.00	.00
	3.200	806.69	.00	806.74	318.76	.00	451.18	658.82	.00	.00	335.00	390.00	.00
*	3.200	807.03	.00	807.46	334.64	.00	621.54	238.46	.00	.00	335.00	390.00	.00
	3.200	807.14	.10	807.18	165.41	.00	426.06	433.94	.10	335.00	335.00	390.00	500.41
*	3.200	805.83	.00	806.31	54.62	.00	530.00	.00	.00	.00	335.00	390.00	.00
*	3.200	806.55	.00	807.37	312.58	.00	742.83	7.17	.00	.00	335.00	390.00	.00
*	3.200	807.25	.00	807.66	344.74	.00	631.11	478.88	.00	.00	335.00	390.00	.00
*	3.210	807.60	.00	807.61	494.04	55.50	251.42	553.09	.00	.00	335.00	390.00	.00
*	3.210	807.58	-.02	807.59	316.61	33.06	267.58	559.36	.07	300.79	335.00	390.00	617.40
*	3.210	806.46	.00	806.48	356.07	4.54	232.05	293.41	.00	.00	335.00	390.00	.00
*	3.210	807.61	.00	807.62	496.65	49.63	217.52	482.85	.00	.00	335.00	390.00	.00
*	3.210	807.79	.00	807.80	511.18	86.33	305.00	718.67	.00	.00	335.00	390.00	.00
*	3.360	807.80	.00	807.83	406.18	51.44	327.61	430.95	.00	.00	327.00	366.00	.00
*	3.360	807.80	.00	807.84	239.28	26.06	349.84	434.10	.07	310.37	327.00	366.00	549.65
*	3.360	806.90	.00	806.95	251.33	7.41	318.29	174.30	.00	.00	327.00	366.00	.00
*	3.360	807.77	.00	807.79	399.00	43.68	292.26	374.06	.00	.00	327.00	366.00	.00
	3.360	808.04	.00	808.08	450.82	79.06	380.08	590.87	.00	.00	327.00	366.00	.00
*	3.380	807.89	.00	808.06	51.00	.00	810.00	.00	.00	.00	315.00	366.00	.00
*	3.380	807.91	.02	808.08	51.00	.00	810.00	.00	.00	315.00	315.00	366.00	366.00
	3.380	807.08	.00	807.17	51.00	.00	500.00	.00	.00	.00	315.00	366.00	.00
*	3.380	807.84	.00	807.97	51.00	.00	710.00	.00	.00	.00	315.00	366.00	.00

*	3.380	808.13	.00	808.38	51.00	.00	1050.00	.00	.00	.00	315.00	366.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	3.380	807.92	.00	808.31	51.00	.00	810.00	.00	.00	.00	315.00	366.00	.00
	3.380	807.95	.02	808.11	51.00	.00	810.00	.00	.00	315.00	315.00	366.00	366.00
*	3.380	807.12	.00	807.32	51.00	.00	500.00	.00	.00	.00	315.00	366.00	.00
*	3.380	807.87	.00	808.17	51.00	.00	710.00	.00	.00	.00	315.00	366.00	.00
*	3.380	808.16	.00	808.76	51.00	.00	1050.00	.00	.00	.00	315.00	366.00	.00
*	3.400	808.51	.00	808.52	523.21	76.02	238.48	495.50	.00	.00	327.00	366.00	.00
*	3.400	808.55	.04	808.57	336.96	53.27	250.42	506.31	.07	295.38	327.00	366.00	632.34
*	3.400	807.52	.00	807.54	347.04	24.02	233.82	242.16	.00	.00	327.00	366.00	.00
*	3.400	808.34	.00	808.35	496.51	62.21	224.93	422.87	.00	.00	327.00	366.00	.00
*	3.400	809.01	.00	809.02	588.69	114.14	253.68	682.18	.00	.00	327.00	366.00	.00
*	3.600	808.91	.00	808.93	484.27	30.89	283.28	385.84	.00	.00	400.00	450.00	.00
*	3.600	808.98	.07	809.00	274.68	6.72	296.87	396.40	.08	393.74	400.00	450.00	668.43
	3.600	808.18	.00	808.20	324.86	5.25	242.39	182.37	.00	.00	400.00	450.00	.00
*	3.600	808.75	.00	808.77	448.80	22.63	269.82	327.55	.00	.00	400.00	450.00	.00
*	3.600	809.35	.00	809.37	549.70	61.07	303.13	545.80	.00	.00	400.00	450.00	.00
	3.810	809.58	.00	809.61	484.77	21.10	308.16	370.74	.00	.00	400.00	450.00	.00
	3.810	809.67	.09	809.70	244.36	.00	319.84	380.16	.09	400.00	400.00	450.00	644.36
	3.810	809.00	.00	809.03	310.00	.58	250.18	179.24	.00	.00	400.00	450.00	.00
	3.810	809.44	.00	809.47	447.76	11.72	293.89	314.39	.00	.00	400.00	450.00	.00
	3.810	809.93	.00	809.95	544.20	54.40	335.42	520.19	.00	.00	400.00	450.00	.00
	4.010	810.48	.00	810.51	538.58	39.78	294.57	365.65	.00	.00	400.00	450.00	.00
	4.010	810.58	.10	810.61	296.58	15.57	307.30	377.13	.10	360.13	400.00	450.00	656.71
	4.010	809.97	.00	810.00	385.40	1.36	238.74	189.90	.00	.00	400.00	450.00	.00
	4.010	810.36	.00	810.38	514.45	26.26	280.63	313.11	.00	.00	400.00	450.00	.00
	4.010	810.77	.00	810.79	577.42	78.63	326.13	505.24	.00	.00	400.00	450.00	.00
	4.220	811.60	.00	811.62	632.45	201.04	186.46	312.50	.00	.00	495.00	532.00	.00
	4.220	811.70	.10	811.72	454.86	186.38	194.04	319.57	.12	363.46	495.00	532.00	828.12
	4.220	811.23	.00	811.25	561.08	107.45	176.03	146.52	.00	.00	495.00	532.00	.00
	4.220	811.51	.00	811.53	617.34	172.57	183.12	264.31	.00	.00	495.00	532.00	.00
	4.220	811.83	.00	811.85	666.10	273.60	198.33	438.07	.00	.00	495.00	532.00	.00
*	4.240	811.65	.00	812.19	36.19	.00	700.00	.00	.00	.00	495.00	532.00	.00
*	4.240	811.76	.11	812.27	36.55	.00	700.00	.00	.00	495.00	495.00	532.00	532.00
*	4.240	811.43	.00	811.66	35.45	.00	430.00	.00	.00	.00	495.00	532.00	.00
*	4.240	811.61	.00	812.05	36.07	.00	620.00	.00	.00	.00	495.00	532.00	.00
*	4.240	811.72	.00	812.60	36.43	.00	910.00	.00	.00	.00	495.00	532.00	.00
	4.240	811.89	.00	812.36	36.96	.00	700.00	.00	.00	.00	495.00	532.00	.00
	4.240	811.99	.10	812.43	37.00	.00	700.00	.00	.00	.00	495.00	532.00	.00
	4.240	811.50	.00	811.73	35.69	.00	430.00	.00	.00	.00	495.00	532.00	.00
	4.240	811.78	.00	812.18	36.62	.00	620.00	.00	.00	.00	495.00	532.00	.00
	4.240	812.23	.00	812.89	37.00	.00	910.00	.00	.00	.00	495.00	532.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	4.260	812.87	.00	812.96	150.21	243.98	446.68	9.34	.00	.00	95.00	132.00	.00
	4.260	812.93	.06	813.03	113.81	235.16	464.84	.00	.06	18.19	95.00	132.00	132.00
	4.260	812.11	.00	812.20	130.02	77.64	352.19	.17	.00	.00	95.00	132.00	.00
*	4.260	812.66	.00	812.75	144.42	191.87	423.24	4.89	.00	.00	95.00	132.00	.00
*	4.260	813.42	.00	813.51	164.99	384.03	497.43	28.54	.00	.00	95.00	132.00	.00
*	4.520	814.26	.00	814.28	260.91	70.26	429.38	160.36	.00	.00	75.00	129.00	.00
*	4.520	814.36	.10	814.39	159.52	55.45	443.41	161.14	.05	60.70	75.00	129.00	220.22
*	4.520	813.50	.00	813.52	193.61	36.27	319.33	54.40	.00	.00	75.00	129.00	.00
*	4.520	814.05	.00	814.08	243.03	59.42	396.17	124.40	.00	.00	75.00	129.00	.00
*	4.520	814.72	.00	814.75	283.31	96.03	490.95	263.03	.00	.00	75.00	129.00	.00
*	4.530	814.25	.00	814.33	54.00	.00	660.00	.00	.00	.00	75.00	129.00	.00
*	4.530	814.35	.10	814.43	54.00	.00	660.00	.00	.00	75.00	75.00	129.00	129.00
	4.530	813.50	.00	813.54	54.00	.00	410.00	.00	.00	.00	75.00	129.00	.00
*	4.530	814.05	.00	814.12	54.00	.00	580.00	.00	.00	.00	75.00	129.00	.00
*	4.530	814.70	.00	814.82	54.00	.00	850.00	.00	.00	.00	75.00	129.00	.00
	4.530	814.25	.00	814.34	54.00	.00	660.00	.00	.00	.00	75.00	129.00	.00
	4.530	814.35	.10	814.44	54.00	.00	660.00	.00	.00	.00	75.00	129.00	.00
	4.530	813.50	.00	813.55	54.00	.00	410.00	.00	.00	.00	75.00	129.00	.00
	4.530	814.05	.00	814.12	54.00	.00	580.00	.00	.00	.00	75.00	129.00	.00
	4.530	814.71	.00	814.83	54.00	.00	850.00	.00	.00	.00	75.00	129.00	.00
*	4.540	814.35	.00	814.37	266.76	71.25	419.68	169.07	.00	.00	75.00	129.00	.00
*	4.540	814.44	.09	814.47	165.76	56.21	433.84	169.95	.06	60.33	75.00	129.00	226.08
	4.540	813.55	.00	813.57	198.73	36.95	315.15	57.90	.00	.00	75.00	129.00	.00
	4.540	814.13	.00	814.15	249.76	60.33	388.99	130.68	.00	.00	75.00	129.00	.00
	4.540	814.85	.00	814.87	288.75	97.26	476.24	276.50	.00	.00	75.00	129.00	.00
*	5.320	815.23	.00	815.24	1039.01	150.54	35.16	364.30	.00	.00	410.00	442.00	.00
*	5.320	815.33	.10	815.34	889.01	138.10	36.69	375.21	.10	64.70	410.00	442.00	1094.05
	5.320	814.68	.00	814.68	990.56	83.41	34.70	221.88	.00	.00	410.00	442.00	.00
*	5.320	815.07	.00	815.07	1028.35	128.68	34.53	316.79	.00	.00	410.00	442.00	.00
*	5.320	815.61	.00	815.61	1060.05	200.73	36.58	472.69	.00	.00	410.00	442.00	.00
	5.330	815.24	.00	815.24	1039.51	150.69	34.95	364.36	.00	.00	410.00	442.00	.00
	5.330	815.34	.10	815.34	898.42	139.15	36.35	374.50	.10	61.23	410.00	442.00	1099.78
	5.330	814.68	.00	814.69	990.93	83.52	34.56	221.92	.00	.00	410.00	442.00	.00
	5.330	815.07	.00	815.07	1029.16	128.84	34.32	316.84	.00	.00	410.00	442.00	.00
	5.330	815.61	.00	815.61	1060.47	200.83	36.45	472.72	.00	.00	410.00	442.00	.00
*	5.330	815.29	.00	815.29	1042.54	151.53	33.74	364.73	.00	.00	410.00	442.00	.00
*	5.330	815.39	.10	815.40	904.30	140.16	35.12	374.72	.09	60.32	410.00	442.00	1101.57
*	5.330	815.03	.00	815.03	1024.82	90.62	25.14	224.24	.00	.00	410.00	442.00	.00
*	5.330	815.21	.00	815.21	1037.69	131.04	31.17	317.78	.00	.00	410.00	442.00	.00
	5.330	815.62	.00	815.62	1060.94	200.94	36.30	472.76	.00	.00	410.00	442.00	.00

SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
5.340	815.30	.00	815.30	1042.57	151.54	33.73	364.73	.00	.00	410.00	442.00	.00
5.340	815.40	.10	815.40	902.28	139.93	35.13	374.93	.10	61.14	410.00	442.00	1100.26
5.340	815.03	.00	815.03	1024.99	90.65	25.11	224.24	.00	.00	410.00	442.00	.00
5.340	815.21	.00	815.21	1037.74	131.06	31.15	317.79	.00	.00	410.00	442.00	.00

	5.340	815.62	.00	815.63	1060.94	200.94	36.30	472.76	.00	.00	410.00	442.00	.00
*	5.390	815.30	.00	815.31	1016.99	144.42	37.26	308.32	.00	.00	480.00	520.00	.00
	5.390	815.40	.10	815.41	672.26	131.71	39.04	319.25	.15	144.51	480.00	520.00	987.28
	5.390	815.04	.00	815.04	870.45	80.20	32.26	187.54	.00	.00	480.00	520.00	.00
*	5.390	815.22	.00	815.22	996.03	123.61	36.29	270.10	.00	.00	480.00	520.00	.00
*	5.390	815.63	.00	815.63	1049.92	204.41	35.07	400.52	.00	.00	480.00	520.00	.00
*	5.430	815.34	.00	815.37	699.99	103.44	110.85	275.70	.00	.00	480.00	520.00	.00
*	5.430	815.43	.09	815.47	415.29	78.38	118.37	293.25	.23	230.31	480.00	520.00	846.81
*	5.430	815.07	.00	815.11	528.83	31.29	121.03	147.68	.00	.00	480.00	520.00	.00
*	5.430	815.25	.00	815.29	655.32	77.90	116.03	236.07	.00	.00	480.00	520.00	.00
*	5.430	815.65	.00	815.67	826.94	177.50	85.38	377.12	.00	.00	480.00	520.00	.00
*	5.480	815.65	.00	815.75	495.17	27.34	215.60	247.06	.00	.00	480.00	520.00	.00
*	5.480	815.74	.09	815.86	203.84	.00	229.62	260.38	.21	480.00	480.00	520.00	776.55
	5.480	815.48	.00	815.56	361.11	1.50	173.81	124.69	.00	.00	480.00	520.00	.00
*	5.480	815.60	.00	815.70	461.94	16.82	204.33	208.85	.00	.00	480.00	520.00	.00
*	5.480	815.79	.00	815.88	603.77	74.26	212.06	353.68	.00	.00	480.00	520.00	.00
*	5.630	817.12	.00	817.19	434.36	55.55	255.71	178.74	.00	.00	480.00	520.00	.00
*	5.630	817.23	.11	817.30	274.34	38.09	265.41	186.50	.17	396.34	480.00	520.00	738.19
	5.630	816.83	.00	816.91	304.73	10.48	228.76	60.76	.00	.00	480.00	520.00	.00
	5.630	817.05	.00	817.12	404.01	39.06	248.77	142.16	.00	.00	480.00	520.00	.00
	5.630	817.22	.00	817.30	484.76	95.54	288.42	256.04	.00	.00	480.00	520.00	.00
	5.780	817.94	.00	818.00	336.86	151.64	277.92	60.44	.00	.00	529.00	559.00	.00
	5.780	818.05	.10	818.11	217.75	151.58	287.94	50.48	.12	422.36	529.00	559.00	726.45
*	5.780	817.64	.00	817.69	270.74	59.06	228.41	12.53	.00	.00	529.00	559.00	.00
	5.780	817.87	.00	817.92	325.01	123.27	263.89	42.84	.00	.00	529.00	559.00	.00
	5.780	818.13	.00	818.19	364.03	224.02	304.66	111.32	.00	.00	529.00	559.00	.00

YEAR FLOOD

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	.020	.00	.00	.00	774.80	2220.00	782.38	.00	782.45	11.94	2.82	1352.82	642.33
	.020	.00	.00	.00	774.80	2220.00	782.48	.00	782.55	12.08	2.84	1232.72	638.69
	.020	.00	.00	.00	774.80	1360.00	781.91	.00	781.98	12.15	2.69	838.25	390.18
	.020	.00	.00	.00	774.80	1960.00	782.26	.00	782.32	11.96	2.78	1216.44	566.72
	.020	.00	.00	.00	774.80	2880.00	782.66	.00	782.72	11.94	2.89	1662.56	833.56
*	.390	1950.00	.00	.00	779.50	990.00	785.00	.00	785.21	26.86	4.27	286.38	191.01
*	.390	1950.00	.00	.00	779.50	990.00	785.10	.00	785.32	29.01	4.18	264.05	183.79
*	.390	1950.00	.00	.00	779.50	610.00	784.45	.00	784.58	19.12	3.33	227.76	139.50
*	.390	1950.00	.00	.00	779.50	870.00	784.85	.00	785.03	24.48	3.99	269.63	175.84
*	.390	1950.00	.00	.00	779.50	1280.00	785.32	.00	785.59	32.20	4.88	323.23	225.57
	.410	100.00	.00	.00	779.50	990.00	785.29	.00	785.45	20.11	3.84	318.18	220.74
	.410	100.00	.00	.00	779.50	990.00	785.41	.00	785.59	21.33	3.70	294.61	214.34
*	.410	100.00	.00	.00	779.50	610.00	784.55	.00	785.11	60.39	6.00	101.71	78.50
	.410	100.00	.00	.00	779.50	870.00	785.11	.00	785.25	18.65	3.61	297.71	201.47
	.410	100.00	.00	.00	779.50	1280.00	785.67	.00	785.88	23.23	4.33	364.05	265.56

*	.410	24.60	785.60	786.40	779.50	990.00	786.16	.00	786.25	8.99	2.85	426.74	330.14
*	.410	24.60	999999.00	.00	779.50	990.00	786.29	.00	786.38	9.60	2.70	392.98	319.49
	.410	24.60	785.60	786.40	779.50	610.00	784.64	.00	785.17	56.47	5.88	103.78	81.18
	.410	24.60	785.60	786.40	779.50	870.00	786.00	.00	786.08	7.98	2.64	405.58	307.93
*	.410	24.60	785.60	786.40	779.50	1280.00	786.47	.00	786.60	11.65	3.35	468.39	374.96
	.430	100.00	.00	.00	779.50	990.00	786.26	.00	786.34	8.32	2.77	439.05	343.23
	.430	100.00	.00	.00	779.50	990.00	786.39	.00	786.48	8.89	2.61	404.02	332.01
*	.430	100.00	.00	.00	779.50	610.00	785.41	.00	785.47	6.75	2.26	332.74	234.73
	.430	100.00	.00	.00	779.50	870.00	786.08	.00	786.16	7.44	2.57	416.19	319.02
	.430	100.00	.00	.00	779.50	1280.00	786.60	.00	786.71	10.58	3.24	485.21	393.46
*	.940	2690.00	.00	.00	782.70	990.00	789.51	.00	789.66	26.58	3.71	390.06	192.03
*	.940	2690.00	.00	.00	782.70	990.00	789.61	.00	789.75	23.13	3.51	397.16	205.83
*	.940	2690.00	.00	.00	782.70	610.00	788.53	.00	788.75	39.16	3.93	186.16	97.48
*	.940	2690.00	.00	.00	782.70	870.00	789.23	.00	789.41	31.21	3.86	320.27	155.74
	.940	2690.00	.00	.00	782.70	1280.00	790.04	.00	790.16	20.15	3.48	550.17	285.13
*	.960	100.00	.00	.00	782.70	990.00	789.71	.00	790.21	57.79	5.63	175.71	130.23
*	.960	100.00	.00	.00	782.70	990.00	789.80	.00	790.28	62.17	5.53	179.17	125.56
	.960	100.00	.00	.00	782.70	610.00	788.90	.00	789.17	40.33	4.19	145.66	96.06
	.960	100.00	.00	.00	782.70	870.00	789.51	.00	789.92	51.75	5.18	168.08	120.94
	.960	100.00	.00	.00	782.70	1280.00	790.25	.00	790.34	15.05	3.09	618.03	329.98
	.960	18.00	790.50	789.60	782.70	990.00	790.05	.00	790.48	45.95	5.26	188.22	146.04
	.960	18.00	999999.00	.00	782.70	990.00	790.14	.00	790.55	45.08	5.17	191.32	147.45
	.960	18.00	790.50	789.60	782.70	610.00	788.99	.00	789.25	37.77	4.10	148.88	99.26
	.960	18.00	790.50	789.60	782.70	870.00	789.72	.00	790.10	44.41	4.94	175.97	130.55
	.960	18.00	790.50	789.60	782.70	1280.00	791.22	.00	791.28	8.07	2.53	706.82	450.54

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	.980	100.00	.00	.00	782.70	990.00	790.68	.00	790.71	5.19	1.91	764.32	434.61
*	.980	100.00	.00	.00	782.70	990.00	790.74	.00	790.78	5.38	1.96	688.50	427.01
*	.980	100.00	.00	.00	782.70	610.00	789.43	.00	789.50	11.32	2.39	369.49	181.28
*	.980	100.00	.00	.00	782.70	870.00	790.30	.00	790.34	6.51	2.04	634.16	341.04
*	.980	100.00	.00	.00	782.70	1280.00	791.32	.00	791.35	4.07	1.82	1017.69	634.25
	1.080	527.00	.00	.00	783.30	920.00	790.95	.00	790.99	6.83	1.90	650.41	352.12
	1.080	527.00	.00	.00	783.30	920.00	791.03	.00	791.07	7.06	1.95	594.91	346.16
	1.080	527.00	.00	.00	783.30	560.00	789.99	.00	790.03	10.23	2.03	382.64	175.13
	1.080	527.00	.00	.00	783.30	800.00	790.63	.00	790.67	7.91	1.96	556.01	284.52
	1.080	527.00	.00	.00	783.30	1190.00	791.53	.00	791.57	5.69	1.86	833.48	498.84
*	1.180	527.00	.00	.00	784.40	920.00	791.39	.00	791.47	16.61	2.75	467.62	225.71
*	1.180	527.00	.00	.00	784.40	920.00	791.47	.00	791.56	16.99	2.81	422.82	223.22
	1.180	527.00	.00	.00	784.40	560.00	790.65	.00	790.74	20.43	2.71	282.37	123.89
*	1.180	527.00	.00	.00	784.40	800.00	791.14	.00	791.23	18.33	2.78	402.01	186.85
*	1.180	527.00	.00	.00	784.40	1190.00	791.88	.00	791.96	13.80	2.68	611.16	320.32
	1.280	527.00	.00	.00	785.40	920.00	792.24	.00	792.33	20.73	3.01	425.38	202.05
	1.280	527.00	.00	.00	785.40	920.00	792.33	.00	792.44	21.13	3.08	385.72	200.16
	1.280	527.00	.00	.00	785.40	560.00	791.65	.00	791.74	20.16	2.71	281.20	124.74
	1.280	527.00	.00	.00	785.40	800.00	792.06	.00	792.15	20.79	2.94	378.90	175.43
	1.280	527.00	.00	.00	785.40	1190.00	792.61	.00	792.71	20.03	3.12	528.67	265.86

	1.380	528.00	.00	.00	786.60	920.00	793.32	.00	793.42	19.30	3.18	433.18	209.42
*	1.380	528.00	.00	.00	786.60	920.00	793.42	.00	793.53	19.23	3.21	399.93	209.79
	1.380	528.00	.00	.00	786.60	560.00	792.69	.00	792.79	19.51	2.97	272.26	126.77
	1.380	528.00	.00	.00	786.60	800.00	793.13	.00	793.23	19.41	3.13	383.61	181.57
	1.380	528.00	.00	.00	786.60	1190.00	793.68	.00	793.79	18.95	3.29	537.21	273.35
*	1.400	100.00	.00	.00	786.60	920.00	793.42	.00	793.97	66.36	5.97	154.12	112.94
*	1.400	100.00	.00	.00	786.60	920.00	793.54	.00	794.07	68.25	5.85	157.25	111.36
	1.400	100.00	.00	.00	786.60	560.00	792.87	.00	793.12	33.77	4.00	140.12	96.36
*	1.400	100.00	.00	.00	786.60	800.00	793.27	.00	793.71	54.64	5.33	150.23	108.22
*	1.400	100.00	.00	.00	786.60	1190.00	793.67	.00	794.52	96.34	7.40	160.82	121.24
*	1.400	24.00	794.50	795.50	786.60	920.00	793.49	.00	794.37	166.09	7.51	122.52	71.39
	1.400	24.00	999999.00	.00	786.60	920.00	793.61	.00	794.13	65.62	5.78	159.26	113.57
*	1.400	24.00	794.50	795.50	786.60	560.00	792.92	.00	793.30	79.14	4.97	112.57	62.95
*	1.400	24.00	794.50	795.50	786.60	800.00	793.34	.00	794.03	134.16	6.68	119.81	69.07
*	1.400	24.00	794.50	795.50	786.60	1190.00	793.77	.00	795.13	248.86	9.36	127.19	75.44
*	1.420	100.00	.00	.00	786.60	920.00	794.71	.00	794.73	3.22	1.50	866.67	513.04
*	1.420	100.00	.00	.00	786.60	920.00	794.86	.00	794.88	3.06	1.48	809.54	526.16
*	1.420	100.00	.00	.00	786.60	560.00	793.52	.00	793.55	5.33	1.71	488.34	242.46
*	1.420	100.00	.00	.00	786.60	800.00	794.32	.00	794.34	3.78	1.57	734.78	411.26
*	1.420	100.00	.00	.00	786.60	1190.00	795.59	.00	795.61	2.19	1.34	1193.29	803.43

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	1.590	910.00	.00	.00	787.80	920.00	795.22	.00	795.30	16.02	2.65	498.14	229.85
*	1.590	910.00	.00	.00	787.80	920.00	795.35	.00	795.43	15.55	2.65	458.67	233.33
*	1.590	910.00	.00	.00	787.80	560.00	794.33	.00	794.41	20.68	2.64	284.10	123.14
*	1.590	910.00	.00	.00	787.80	800.00	794.92	.00	795.00	18.13	2.71	420.20	187.87
*	1.590	910.00	.00	.00	787.80	1190.00	795.94	.00	796.00	11.15	2.41	699.25	356.39
	1.760	910.00	.00	.00	789.00	920.00	796.70	.00	796.78	16.76	2.75	468.97	224.72
	1.760	910.00	.00	.00	789.00	920.00	796.80	.00	796.89	16.71	2.79	430.78	225.08
	1.760	910.00	.00	.00	789.00	560.00	795.98	.00	796.06	15.94	2.43	311.50	140.26
	1.760	910.00	.00	.00	789.00	800.00	796.49	.00	796.57	16.46	2.66	420.83	197.19
	1.760	910.00	.00	.00	789.00	1190.00	797.14	.00	797.23	16.67	2.90	577.73	291.47
	1.940	910.00	.00	.00	790.20	920.00	798.16	.00	798.24	15.45	2.68	469.26	234.07
	1.940	910.00	.00	.00	790.20	920.00	798.26	.00	798.35	15.43	2.71	436.91	234.22
	1.940	910.00	.00	.00	790.20	560.00	797.38	.00	797.46	14.89	2.37	307.98	145.14
	1.940	910.00	.00	.00	790.20	800.00	797.93	.00	798.01	15.38	2.60	418.27	203.97
	1.940	910.00	.00	.00	790.20	1190.00	798.61	.00	798.70	15.75	2.86	572.80	299.83
	2.110	910.00	.00	.00	791.50	920.00	799.54	.00	799.62	14.97	2.63	489.25	237.81
	2.110	910.00	.00	.00	791.50	920.00	799.64	.00	799.73	15.00	2.66	449.19	237.56
	2.110	910.00	.00	.00	791.50	560.00	798.74	.00	798.81	15.06	2.37	308.98	144.29
	2.110	910.00	.00	.00	791.50	800.00	799.31	.00	799.39	14.99	2.56	434.21	206.63
	2.110	910.00	.00	.00	791.50	1190.00	800.00	.00	800.08	14.83	2.76	604.74	309.04
	2.130	100.00	.00	.00	791.50	920.00	799.67	.00	799.94	36.57	4.17	220.48	152.13
*	2.130	100.00	.00	.00	791.50	920.00	799.78	.00	800.04	36.11	4.09	224.81	153.10
	2.130	100.00	.00	.00	791.50	560.00	798.89	.00	799.03	22.49	2.96	189.40	118.10
*	2.130	100.00	.00	.00	791.50	800.00	799.45	.00	799.67	31.51	3.77	212.02	142.53
*	2.130	100.00	.00	.00	791.50	1190.00	800.09	.00	800.48	47.89	5.01	237.30	171.96

	2.130	22.00	801.10	801.20	791.50	920.00	799.70	.00	799.97	35.95	4.15	221.62	153.45
	2.130	22.00	801.10	801.20	791.50	920.00	799.80	.00	800.06	33.87	4.08	225.62	158.09
	2.130	22.00	801.10	801.20	791.50	560.00	798.91	.00	799.04	22.29	2.95	189.90	118.62
	2.130	22.00	801.10	801.20	791.50	800.00	799.47	.00	799.69	31.22	3.76	212.61	143.18
	2.130	22.00	801.10	801.20	791.50	1190.00	800.14	.00	800.52	46.64	4.98	239.19	174.25
*	2.150	100.00	.00	.00	791.50	920.00	800.13	.00	800.18	7.66	2.02	640.22	332.31
*	2.150	100.00	.00	.00	791.50	920.00	800.22	.00	800.26	7.83	2.06	592.04	328.87
*	2.150	100.00	.00	.00	791.50	560.00	799.16	.00	799.20	8.95	1.93	397.96	187.22
*	2.150	100.00	.00	.00	791.50	800.00	799.84	.00	799.89	7.97	1.99	564.33	283.29
*	2.150	100.00	.00	.00	791.50	1190.00	800.73	.00	800.77	7.05	2.06	805.64	448.15
	2.580	2270.00	.00	.00	795.40	860.00	802.38	.00	802.43	13.66	2.33	538.72	232.73
	2.580	2270.00	.00	.00	795.40	860.00	802.48	.00	802.54	13.61	2.36	489.95	233.13
	2.580	2270.00	.00	.00	795.40	530.00	801.68	.00	801.73	14.45	2.19	343.92	139.41
	2.580	2270.00	.00	.00	795.40	750.00	802.17	.00	802.22	14.01	2.29	478.82	200.35
*	2.580	2270.00	.00	.00	795.40	1110.00	802.81	.00	802.87	12.86	2.42	667.60	309.48

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	2.600	100.00	.00	.00	795.40	860.00	802.49	.00	802.78	46.20	4.36	197.31	126.53
*	2.600	100.00	.00	.00	795.40	860.00	802.60	.00	802.88	45.60	4.24	202.69	127.36
	2.600	100.00	.00	.00	795.40	530.00	801.83	.00	801.98	29.18	3.17	167.27	98.11
*	2.600	100.00	.00	.00	795.40	750.00	802.29	.00	802.54	41.16	3.99	188.16	116.90
	2.600	100.00	.00	.00	795.40	1110.00	802.87	.00	803.28	57.83	5.16	214.97	145.96
	2.600	39.70	808.30	806.80	795.40	860.00	802.52	.00	802.81	45.00	4.32	198.86	128.20
	2.600	39.70	808.30	806.80	795.40	860.00	802.62	.00	802.90	41.70	4.23	203.46	133.18
	2.600	39.70	808.30	806.80	795.40	530.00	801.84	.00	801.99	28.88	3.16	167.86	98.61
	2.600	39.70	808.30	806.80	795.40	750.00	802.32	.00	802.56	40.08	3.95	189.67	118.47
	2.600	39.70	808.30	806.80	795.40	1110.00	802.92	.00	803.33	55.78	5.11	217.31	148.63
*	2.605	25.00	.00	.00	795.40	860.00	802.89	.00	802.92	7.02	1.80	692.21	324.69
*	2.605	25.00	.00	.00	795.40	860.00	802.97	.00	803.01	7.24	1.83	638.85	319.57
*	2.605	25.00	.00	.00	795.40	530.00	802.03	.00	802.07	8.49	1.75	441.05	181.87
*	2.605	25.00	.00	.00	795.40	750.00	802.63	.00	802.66	7.40	1.78	612.62	275.70
*	2.605	25.00	.00	.00	795.40	1110.00	803.44	.00	803.47	6.26	1.83	874.70	443.74
*	2.610	25.00	.00	.00	795.40	860.00	802.81	.00	803.07	36.11	4.05	212.44	143.11
*	2.610	25.00	.00	.00	795.40	860.00	802.90	.00	803.15	36.94	3.97	216.41	141.49
*	2.610	25.00	.00	.00	795.40	530.00	802.01	.00	802.16	25.30	3.02	175.71	105.38
*	2.610	25.00	.00	.00	795.40	750.00	802.57	.00	802.79	32.85	3.73	201.32	130.85
*	2.610	25.00	.00	.00	795.40	1110.00	803.32	.00	803.66	42.61	4.71	235.59	170.04
	2.610	39.70	808.60	807.80	795.40	860.00	802.84	.00	803.09	35.46	4.03	213.60	144.42
	2.610	39.70	808.60	807.80	795.40	860.00	802.94	.00	803.18	33.03	3.94	218.20	149.64
	2.610	39.70	808.60	807.80	795.40	530.00	802.03	.00	802.17	25.07	3.01	176.24	105.84
	2.610	39.70	808.60	807.80	795.40	750.00	802.59	.00	802.81	32.35	3.71	202.25	131.86
	2.610	39.70	808.60	807.80	795.40	1110.00	803.35	.00	803.69	41.60	4.68	237.31	172.11
	2.630	100.00	.00	.00	795.40	860.00	803.24	.00	803.26	4.69	1.55	805.68	397.11
*	2.630	100.00	.00	.00	795.40	860.00	803.32	.00	803.35	4.83	1.56	748.82	391.36
*	2.630	100.00	.00	.00	795.40	530.00	802.29	.00	802.31	5.99	1.52	509.62	216.64
*	2.630	100.00	.00	.00	795.40	750.00	802.94	.00	802.97	5.01	1.54	708.86	334.96
*	2.630	100.00	.00	.00	795.40	1110.00	803.86	.00	803.88	4.09	1.56	1022.19	549.11

*	2.740	580.00	.00	.00	796.90	860.00	803.65	.00	803.72	14.75	2.64	526.35	223.89
*	2.740	580.00	.00	.00	796.90	860.00	803.74	.00	803.82	14.91	2.69	466.03	222.69
	2.740	580.00	.00	.00	796.90	530.00	802.81	.00	802.91	19.55	2.68	282.50	119.88
	2.740	580.00	.00	.00	796.90	750.00	803.39	.00	803.47	16.44	2.68	439.20	184.98
*	2.740	580.00	.00	.00	796.90	1110.00	804.21	.00	804.27	11.41	2.50	734.19	328.62
*	2.760	100.00	.00	.00	796.90	860.00	803.76	.00	804.06	39.47	4.38	196.32	136.89
*	2.760	100.00	.00	.00	796.90	860.00	803.86	.00	804.15	38.99	4.28	200.71	137.73
	2.760	100.00	.00	.00	796.90	530.00	803.01	.00	803.16	26.03	3.19	166.36	103.87
*	2.760	100.00	.00	.00	796.90	750.00	803.53	.00	803.78	34.98	4.00	187.51	126.80
*	2.760	100.00	.00	.00	796.90	1110.00	804.24	.00	804.65	48.07	5.15	215.65	160.09

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	2.760	27.00	805.00	805.30	796.90	860.00	803.80	.00	804.09	38.24	4.34	198.19	139.07
	2.760	27.00	805.00	805.30	796.90	860.00	803.90	.00	804.18	35.78	4.25	202.19	143.78
	2.760	27.00	805.00	805.30	796.90	530.00	803.02	.00	803.18	25.68	3.17	167.04	104.59
	2.760	27.00	805.00	805.30	796.90	750.00	803.56	.00	803.81	34.24	3.97	188.72	128.17
	2.760	27.00	805.00	805.30	796.90	1110.00	804.30	.00	804.70	46.38	5.09	218.00	163.00
*	2.780	100.00	.00	.00	796.90	860.00	804.27	.00	804.30	6.29	1.87	760.49	342.82
*	2.780	100.00	.00	.00	796.90	860.00	804.35	.00	804.38	6.45	1.91	683.74	338.72
*	2.780	100.00	.00	.00	796.90	530.00	803.31	.00	803.36	9.18	1.98	415.53	174.89
*	2.780	100.00	.00	.00	796.90	750.00	803.97	.00	804.01	7.08	1.91	644.64	281.78
	2.780	100.00	.00	.00	796.90	1110.00	804.90	.00	804.92	4.93	1.78	1033.13	500.06
*	3.190	2160.00	.00	.00	800.00	860.00	806.34	.00	806.38	14.29	2.00	510.41	227.50
*	3.190	2160.00	.00	.00	800.00	860.00	806.44	.00	806.49	14.26	2.03	469.42	227.71
	3.190	2160.00	.00	.00	800.00	530.00	805.84	.00	805.88	14.13	1.82	360.15	140.97
	3.190	2160.00	.00	.00	800.00	750.00	806.18	.00	806.23	14.27	1.95	461.95	198.55
*	3.190	2160.00	.00	.00	800.00	1110.00	806.65	.00	806.71	13.66	2.07	625.64	300.32
	3.200	25.00	.00	.00	800.00	860.00	806.37	.00	806.42	13.67	1.97	511.27	232.57
	3.200	25.00	.00	.00	800.00	860.00	806.48	.00	806.53	13.66	2.01	473.13	232.68
*	3.200	25.00	.00	.00	800.00	530.00	805.84	.00	805.99	41.14	3.10	171.19	82.63
*	3.200	25.00	.00	.00	800.00	750.00	806.15	.00	806.39	60.90	3.99	187.89	96.11
	3.200	25.00	.00	.00	800.00	1110.00	806.69	.00	806.74	13.55	2.08	609.54	301.50
*	3.200	20.00	806.40	807.90	800.00	860.00	807.03	807.03	807.46	222.62	5.94	186.96	57.64
	3.200	20.00	999999.00	.00	800.00	860.00	807.14	.00	807.18	8.41	1.76	500.32	296.49
*	3.200	20.00	806.40	807.90	800.00	530.00	805.83	.00	806.31	177.61	5.55	95.43	39.77
*	3.200	20.00	806.40	807.90	800.00	750.00	806.55	806.55	807.37	320.78	7.30	108.68	41.88
*	3.200	20.00	806.40	807.90	800.00	1110.00	807.25	807.25	807.66	231.40	5.99	233.74	72.97
*	3.210	25.00	.00	.00	800.00	860.00	807.60	.00	807.61	2.12	.94	1032.85	591.24
*	3.210	25.00	.00	.00	800.00	860.00	807.58	.00	807.59	2.41	1.00	899.20	553.93
*	3.210	25.00	.00	.00	800.00	530.00	806.46	.00	806.48	4.35	1.13	553.65	254.23
*	3.210	25.00	.00	.00	800.00	750.00	807.61	.00	807.62	1.56	.81	1045.76	601.30
*	3.210	25.00	.00	.00	800.00	1110.00	807.79	.00	807.80	2.72	1.10	1133.35	672.78
	3.360	790.00	.00	.00	801.30	810.00	807.80	.00	807.83	9.22	1.77	596.35	266.72
*	3.360	790.00	.00	.00	801.30	810.00	807.80	.00	807.84	10.55	1.90	516.05	249.42
*	3.360	790.00	.00	.00	801.30	500.00	806.90	.00	806.95	17.70	2.13	303.35	118.84
*	3.360	790.00	.00	.00	801.30	710.00	807.77	.00	807.79	7.53	1.60	581.73	258.73
*	3.360	790.00	.00	.00	801.30	1050.00	808.04	.00	808.08	10.56	1.96	697.08	323.05

*	3.380	100.00	.00	.00	801.30	810.00	807.89	.00	808.06	32.07	3.31	244.96	143.04
*	3.380	100.00	.00	.00	801.30	810.00	807.91	.00	808.08	33.27	3.29	246.22	140.44
	3.380	100.00	.00	.00	801.30	500.00	807.08	.00	807.17	22.60	2.45	203.69	105.17
	3.380	100.00	.00	.00	801.30	710.00	807.84	.00	807.97	25.45	2.93	242.59	140.73
*	3.380	100.00	.00	.00	801.30	1050.00	808.13	.00	808.38	46.15	4.09	256.62	154.57

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	3.380	21.00	808.20	808.90	801.30	810.00	807.92	.00	808.31	222.92	4.99	162.30	54.25
	3.380	21.00	999999.00	.00	801.30	810.00	807.95	.00	808.11	32.54	3.27	247.91	141.99
*	3.380	21.00	808.20	808.90	801.30	500.00	807.12	.00	807.32	141.01	3.61	138.32	42.11
*	3.380	21.00	808.20	808.90	801.30	710.00	807.87	.00	808.17	176.59	4.42	160.74	53.43
*	3.380	21.00	808.20	808.90	801.30	1050.00	808.16	.00	808.76	326.60	6.19	169.52	58.10
*	3.400	100.00	.00	.00	801.30	810.00	808.51	.00	808.52	3.09	1.13	923.14	460.93
*	3.400	100.00	.00	.00	801.30	810.00	808.55	.00	808.57	3.31	1.17	826.25	444.89
*	3.400	100.00	.00	.00	801.30	500.00	807.52	.00	807.54	5.82	1.35	485.06	207.20
*	3.400	100.00	.00	.00	801.30	710.00	808.34	.00	808.35	3.06	1.10	835.85	406.11
*	3.400	100.00	.00	.00	801.30	1050.00	809.01	.00	809.02	2.60	1.10	1204.25	650.89
*	3.600	1083.00	.00	.00	802.30	700.00	808.91	.00	808.93	4.98	1.27	703.85	313.62
*	3.600	1083.00	.00	.00	802.30	700.00	808.98	.00	809.00	5.20	1.31	618.23	306.90
	3.600	1083.00	.00	.00	802.30	430.00	808.18	.00	808.20	6.57	1.30	411.85	167.71
*	3.600	1083.00	.00	.00	802.30	620.00	808.75	.00	808.77	5.11	1.25	628.38	274.24
	3.600	1083.00	.00	.00	802.30	910.00	809.35	.00	809.37	4.17	1.24	931.56	445.68
	3.810	1083.00	.00	.00	803.30	700.00	809.58	.00	809.61	8.16	1.52	586.59	245.07
	3.810	1083.00	.00	.00	803.30	700.00	809.67	.00	809.70	8.35	1.54	511.22	242.29
	3.810	1083.00	.00	.00	803.30	430.00	809.00	.00	809.03	8.99	1.44	353.65	143.39
	3.810	1083.00	.00	.00	803.30	620.00	809.44	.00	809.47	8.38	1.50	518.91	214.23
	3.810	1083.00	.00	.00	803.30	910.00	809.93	.00	809.95	7.36	1.53	764.67	335.32
	4.010	1083.00	.00	.00	804.30	700.00	810.48	.00	810.51	8.52	1.51	595.87	239.80
	4.010	1083.00	.00	.00	804.30	700.00	810.58	.00	810.61	8.52	1.54	524.47	239.86
	4.010	1083.00	.00	.00	804.30	430.00	809.97	.00	810.00	8.91	1.41	352.65	144.03
	4.010	1083.00	.00	.00	804.30	620.00	810.36	.00	810.38	8.63	1.49	529.09	211.06
	4.010	1083.00	.00	.00	804.30	910.00	810.77	.00	810.79	8.26	1.56	754.82	316.66
	4.220	1082.00	.00	.00	805.20	700.00	811.60	.00	811.62	12.67	1.59	630.28	196.65
	4.220	1082.00	.00	.00	805.20	700.00	811.70	.00	811.72	12.65	1.61	568.28	196.82
	4.220	1082.00	.00	.00	805.20	430.00	811.23	.00	811.25	15.90	1.70	402.78	107.85
	4.220	1082.00	.00	.00	805.20	620.00	811.51	.00	811.53	13.40	1.61	567.43	169.35
	4.220	1082.00	.00	.00	805.20	910.00	811.83	.00	811.85	11.76	1.58	775.68	265.35
*	4.240	100.00	.00	.00	805.20	700.00	811.65	.00	812.19	171.61	5.90	118.62	53.44
*	4.240	100.00	.00	.00	805.20	700.00	811.76	.00	812.27	155.33	5.70	122.71	56.17
*	4.240	100.00	.00	.00	805.20	430.00	811.43	.00	811.66	79.55	3.89	110.63	48.21
*	4.240	100.00	.00	.00	805.20	620.00	811.61	.00	812.05	138.84	5.28	117.38	52.62
*	4.240	100.00	.00	.00	805.20	910.00	811.72	.00	812.60	271.16	7.50	121.36	55.26
	4.240	18.00	813.30	813.30	805.20	700.00	811.89	.00	812.36	139.58	5.50	127.27	59.25
	4.240	18.00	813.30	813.30	805.20	700.00	811.99	.00	812.43	127.04	5.34	130.97	62.11
	4.240	18.00	813.30	813.30	805.20	430.00	811.50	.00	811.73	74.30	3.80	113.21	49.89
	4.240	18.00	813.30	813.30	805.20	620.00	811.78	.00	812.18	119.80	5.02	123.42	56.65
	4.240	18.00	813.30	813.30	805.20	910.00	812.23	.00	812.89	172.55	6.51	139.84	69.28

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	4.260	100.00	.00	.00	805.20	700.00	812.87	.00	812.96	24.69	2.73	303.64	140.88
*	4.260	100.00	.00	.00	805.20	700.00	812.93	.00	813.03	26.42	2.80	283.28	136.18
*	4.260	100.00	.00	.00	805.20	430.00	812.11	.00	812.20	28.70	2.60	197.67	80.27
*	4.260	100.00	.00	.00	805.20	620.00	812.66	.00	812.75	26.22	2.72	271.69	121.09
*	4.260	100.00	.00	.00	805.20	910.00	813.42	.00	813.51	20.66	2.70	390.88	200.21
*	4.520	1370.00	.00	.00	806.40	660.00	814.26	.00	814.28	4.90	1.51	548.19	298.30
*	4.520	1370.00	.00	.00	806.40	660.00	814.36	.00	814.39	4.90	1.53	497.22	298.09
*	4.520	1370.00	.00	.00	806.40	410.00	813.50	.00	813.52	4.58	1.32	373.67	191.50
*	4.520	1370.00	.00	.00	806.40	580.00	814.05	.00	814.08	4.76	1.45	496.78	265.97
*	4.520	1370.00	.00	.00	806.40	850.00	814.72	.00	814.75	4.82	1.59	675.49	387.14
*	4.530	25.00	.00	.00	806.40	660.00	814.25	.00	814.33	11.65	2.33	283.27	193.41
*	4.530	25.00	.00	.00	806.40	660.00	814.35	.00	814.43	11.60	2.29	288.83	193.82
	4.530	25.00	.00	.00	806.40	410.00	813.50	.00	813.54	7.49	1.69	242.98	149.77
*	4.530	25.00	.00	.00	806.40	580.00	814.05	.00	814.12	10.23	2.13	272.52	181.33
*	4.530	25.00	.00	.00	806.40	850.00	814.70	.00	814.82	14.67	2.76	307.66	221.95
	4.530	18.00	815.60	815.60	806.40	660.00	814.25	.00	814.34	11.59	2.33	283.69	193.89
	4.530	18.00	815.60	815.60	806.40	660.00	814.35	.00	814.44	10.88	2.28	289.09	200.08
	4.530	18.00	815.60	815.60	806.40	410.00	813.50	.00	813.55	7.47	1.69	243.19	149.99
	4.530	18.00	815.60	815.60	806.40	580.00	814.05	.00	814.12	10.19	2.13	272.87	181.72
	4.530	18.00	815.60	815.60	806.40	850.00	814.71	.00	814.83	14.57	2.76	308.27	222.69
*	4.540	25.00	.00	.00	806.40	660.00	814.35	.00	814.37	4.42	1.45	572.17	314.02
*	4.540	25.00	.00	.00	806.40	660.00	814.44	.00	814.47	4.46	1.48	517.98	312.52
	4.540	25.00	.00	.00	806.40	410.00	813.55	.00	813.57	4.28	1.28	385.13	198.27
*	4.540	25.00	.00	.00	806.40	580.00	814.13	.00	814.15	4.36	1.40	515.70	277.78
*	4.540	25.00	.00	.00	806.40	850.00	814.85	.00	814.87	4.22	1.51	710.84	413.56
*	5.320	4120.00	.00	.00	809.50	550.00	815.23	.00	815.24	1.05	.44	1507.03	537.05
*	5.320	4120.00	.00	.00	809.50	550.00	815.33	.00	815.34	1.05	.45	1418.88	536.28
	5.320	4120.00	.00	.00	809.50	340.00	814.68	.00	814.68	1.64	.52	948.61	265.21
*	5.320	4120.00	.00	.00	809.50	480.00	815.07	.00	815.07	1.16	.46	1336.21	445.34
*	5.320	4120.00	.00	.00	809.50	710.00	815.61	.00	815.61	.84	.41	1901.82	774.71
	5.330	25.00	.00	.00	809.50	550.00	815.24	.00	815.24	1.03	.44	1516.42	542.31
	5.330	25.00	.00	.00	809.50	550.00	815.34	.00	815.34	1.03	.44	1434.28	542.23
	5.330	25.00	.00	.00	809.50	340.00	814.68	.00	814.69	1.62	.52	952.36	266.77
	5.330	25.00	.00	.00	809.50	480.00	815.07	.00	815.07	1.14	.45	1344.63	449.64
	5.330	25.00	.00	.00	809.50	710.00	815.61	.00	815.61	.83	.41	1909.78	779.84
*	5.330	15.00	814.50	817.20	809.50	550.00	815.29	.00	815.29	.92	.42	1572.78	574.26
*	5.330	15.00	999999.00	.00	809.50	550.00	815.39	.00	815.40	.92	.42	1488.96	574.19
*	5.330	15.00	814.50	817.20	809.50	340.00	815.03	.00	815.03	.64	.34	1299.37	426.66
*	5.330	15.00	814.50	817.20	809.50	480.00	815.21	.00	815.21	.84	.40	1482.63	523.50
	5.330	15.00	814.50	817.20	809.50	710.00	815.62	.00	815.62	.82	.41	1918.78	785.66

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K

	5.340	25.00	.00	.00	809.50	550.00	815.30	.00	815.30	.92	.42	1573.35	574.59
	5.340	25.00	.00	.00	809.50	550.00	815.40	.00	815.40	.92	.42	1487.95	574.47
	5.340	25.00	.00	.00	809.50	340.00	815.03	.00	815.03	.63	.34	1301.12	427.54
	5.340	25.00	.00	.00	809.50	480.00	815.21	.00	815.21	.84	.40	1483.52	523.99
	5.340	25.00	.00	.00	809.50	710.00	815.62	.00	815.63	.82	.41	1918.72	785.61
*	5.390	86.00	.00	.00	810.00	490.00	815.30	.00	815.31	3.07	.58	869.26	279.50
*	5.390	86.00	.00	.00	810.00	490.00	815.40	.00	815.41	3.04	.59	774.45	281.11
*	5.390	86.00	.00	.00	810.00	300.00	815.04	.00	815.04	3.04	.56	613.65	172.19
*	5.390	86.00	.00	.00	810.00	430.00	815.22	.00	815.22	3.19	.59	781.39	240.85
*	5.390	86.00	.00	.00	810.00	640.00	815.63	.00	815.63	1.98	.49	1208.44	455.25
*	5.430	86.00	.00	.00	810.30	490.00	815.34	.00	815.37	30.60	1.81	374.47	88.58
*	5.430	86.00	.00	.00	810.30	490.00	815.43	.00	815.47	31.36	1.86	316.82	87.50
*	5.430	86.00	.00	.00	810.30	300.00	815.07	.00	815.11	48.84	2.20	206.68	42.93
*	5.430	86.00	.00	.00	810.30	430.00	815.25	.00	815.29	36.76	1.96	315.56	70.92
*	5.430	86.00	.00	.00	810.30	640.00	815.65	.00	815.67	13.19	1.24	613.61	176.23
*	5.480	86.00	.00	.00	810.50	490.00	815.65	.00	815.75	91.44	3.21	220.19	51.24
*	5.480	86.00	.00	.00	810.50	490.00	815.74	.00	815.86	94.62	3.31	178.36	50.37
	5.480	86.00	.00	.00	810.50	300.00	815.48	.00	815.56	70.23	2.75	150.40	35.80
*	5.480	86.00	.00	.00	810.50	430.00	815.60	.00	815.70	85.86	3.09	199.42	46.41
*	5.480	86.00	.00	.00	810.50	640.00	815.79	.00	815.88	75.98	2.98	303.59	73.42
*	5.630	258.00	.00	.00	811.30	490.00	817.12	.00	817.19	45.83	2.50	273.25	72.38
*	5.630	258.00	.00	.00	811.30	490.00	817.23	.00	817.30	45.10	2.51	240.68	72.96
	5.630	258.00	.00	.00	811.30	300.00	816.83	.00	816.91	47.25	2.47	165.42	43.64
	5.630	258.00	.00	.00	811.30	430.00	817.05	.00	817.12	46.22	2.49	242.57	63.25
	5.630	258.00	.00	.00	811.30	640.00	817.22	.00	817.30	53.29	2.72	320.05	87.68
	5.780	257.00	.00	.00	811.80	490.00	817.94	.00	818.00	26.20	2.31	292.70	95.73
	5.780	257.00	.00	.00	811.80	490.00	818.05	.00	818.11	26.31	2.34	263.04	95.52
*	5.780	257.00	.00	.00	811.80	300.00	817.64	.00	817.69	22.16	2.05	197.16	63.73
	5.780	257.00	.00	.00	811.80	430.00	817.87	.00	817.92	24.99	2.24	266.48	86.02
	5.780	257.00	.00	.00	811.80	640.00	818.13	.00	818.19	27.76	2.43	356.37	121.46

YEAR FLOOD

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	.020	2220.00	782.38	.00	.00	.38	1106.31	.00
	.020	2220.00	782.48	.10	.00	.10	822.78	.00
	.020	1360.00	781.91	-.57	.00	-.09	1038.50	.00
	.020	1960.00	782.26	.35	.00	.26	1094.04	.00
	.020	2880.00	782.66	.40	.00	.66	1133.68	.00
	.390	990.00	785.00	.00	2.62	.00	110.82	1950.00
	.390	90.00	785.10	.10	2.62	.10	78.34	1950.00
*	.390	610.00	784.45	-.65	2.54	.00	101.02	1950.00
*	.390	870.00	784.85	.40	2.59	.00	108.11	1950.00
*	.390	1280.00	785.32	.47	2.66	.00	116.56	1950.00

	.410	990.00	785.29	.00	.28	.00	115.79	100.00
	.410	990.00	785.41	.12	.31	.12	81.37	100.00
*	.410	610.00	784.55	-.86	.10	.00	23.00	100.00
	.410	870.00	785.11	.56	.26	.00	112.61	100.00
	.410	1280.00	785.67	.56	.35	.00	122.60	100.00
*	.410	990.00	786.16	.00	.88	.00	131.34	24.60
*	.410	990.00	786.29	.12	.88	.12	91.48	24.60
	.410	610.00	784.64	-1.65	.09	.00	23.00	24.60
*	.410	870.00	786.00	1.36	.90	.00	128.46	24.60
*	.410	1280.00	786.47	.47	.80	.00	136.84	24.60
	.430	990.00	786.26	.00	.09	.00	132.99	100.00
	.430	990.00	786.39	.13	.10	.13	92.53	100.00
*	.430	610.00	785.41	-.97	.77	.00	117.99	100.00
	.430	870.00	786.08	.67	.08	.00	129.91	100.00
	.430	1280.00	786.60	.51	.12	.00	139.00	100.00
*	.940	990.00	789.51	.00	3.25	.00	291.15	2690.00
*	.940	990.00	789.61	.11	3.23	.11	220.02	2690.00
*	.940	610.00	788.53	-1.08	3.12	.00	135.81	2690.00
*	.940	870.00	789.23	.70	3.15	.00	239.26	2690.00
	.940	1280.00	790.04	.80	3.44	.00	315.66	2690.00
*	.960	990.00	789.71	.00	.21	.00	37.00	100.00
*	.960	990.00	789.80	.09	19	.09	37.00	100.00
	.960	610.00	788.90	-.90	.37	.00	36.56	100.00
	.960	870.00	789.51	.61	.28	.00	37.00	100.00
	.960	1280.00	790.25	.74	.21	.00	325.49	100.00
	.960	990.00	790.05	.00	.33	.00	37.00	18.00
	.960	990.00	790.14	.09	.33	.09	37.00	18.00
	.960	610.00	788.99	-1.15	.09	.00	36.76	18.00
	.960	870.00	789.72	.73	.21	.00	37.00	18.00
	.960	1280.00	791.22	1.50	.97	.00	258.60	18.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	.980	990.00	790.68	.00	.63	.00	358.78	100.00
*	.980	990.00	790.74	.07	.61	.07	246.50	100.00
*	.980	610.00	789.43	-1.31	.44	.00	261.94	100.00
*	.980	870.00	790.30	.86	.58	.00	327.79	100.00
*	.980	1280.00	791.32	1.02	.10	.00	421.02	100.00
	1.080	920.00	790.95	.00	.27	.00	305.71	527.00
	1.080	920.00	791.03	.08	.28	.08	217.28	527.00
	1.080	560.00	789.99	-1.04	.55	.00	249.05	527.00
	1.080	800.00	790.63	.65	.34	.00	287.35	527.00
	1.080	1190.00	791.53	.90	.21	.00	325.60	527.00
	1.180	920.00	791.39	.00	.44	.00	274.18	527.00
	1.180	920.00	791.47	.08	.45	.08	186.20	527.00
	1.180	560.00	790.65	-.83	.66	.00	223.32	527.00
*	1.180	800.00	791.14	.50	.51	.00	257.58	527.00
*	1.180	1190.00	791.88	.74	.36	.00	303.16	527.00

	1.280	920.00	792.24	.00	.85	.00	264.11	527.00
	1.280	920.00	792.33	.10	.86	.10	177.97	527.00
	1.280	560.00	791.65	-.69	1.00	.00	226.06	527.00
	1.280	800.00	792.06	.41	.91	.00	252.47	527.00
	1.280	1190.00	792.61	.55	.72	.00	288.30	527.00
	1.380	920.00	793.32	.00	1.08	.00	274.11	528.00
*	1.380	920.00	793.42	.10	1.09	.10	192.21	528.00
	1.380	560.00	792.69	-.73	1.04	.00	239.04	528.00
	1.380	800.00	793.13	.44	1.08	.00	263.80	528.00
	1.380	1190.00	793.68	.55	1.08	.00	294.56	528.00
*	1.400	920.00	793.42	.00	.10	.00	26.00	100.00
*	1.400	920.00	793.54	.12	.12	.12	26.00	100.00
	1.400	560.00	792.87	-.67	.18	.00	26.00	100.00
*	1.400	800.00	793.27	.40	.14	.00	26.00	100.00
*	1.400	1190.00	793.67	.41	-.01	.00	26.00	100.00
*	1.400	920.00	793.49	.00	.08	.00	26.00	24.00
	1.400	920.00	793.61	.12	.08	.12	26.00	24.00
*	1.400	560.00	792.92	-.69	.05	.00	26.00	24.00
*	1.400	800.00	793.34	.42	.07	.00	26.00	24.00
*	1.400	1190.00	793.77	.43	.10	.00	26.00	24.00
*	1.420	920.00	794.71	.00	1.21	.00	351.58	100.00
*	1.420	920.00	794.86	.15	1.25	.15	248.70	100.00
*	1.420	560.00	793.52	-1.34	.60	.00	285.14	100.00
*	1.420	800.00	794.32	.80	.98	.00	329.94	100.00
*	1.420	1190.00	795.59	1.27	1.82	.00	384.53	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1.590	920.00	795.22	.00	.52	.00	265.54	910.00
*	1.590	920.00	795.35	.13	.49	.13	176.46	910.00
*	1.590	560.00	794.33	-1.03	.81	.00	200.47	910.00
*	1.590	800.00	794.92	.60	.60	.00	248.41	910.00
*	1.590	1190.00	795.94	1.02	.35	.00	294.32	910.00
	1.760	920.00	796.70	.00	1.48	.00	237.39	910.00
	1.760	920.00	796.80	.10	1.45	.10	160.71	910.00
	1.760	560.00	795.98	-.82	1.66	.00	203.10	910.00
	1.760	800.00	796.49	.51	1.57	.00	227.54	910.00
	1.760	1190.00	797.14	.65	1.20	.00	257.74	910.00
	1.940	920.00	798.16	.00	1.46	.00	224.71	910.00
	1.940	920.00	798.26	.10	1.46	.10	156.41	910.00
	1.940	560.00	797.38	-.88	1.40	.00	183.02	910.00
	1.940	800.00	797.93	.55	1.44	.00	215.36	910.00
	1.940	1190.00	798.61	.68	1.47	.00	242.59	910.00
	2.110	920.00	799.54	.00	1.38	.00	243.91	910.00
	2.110	920.00	799.64	.10	1.38	.10	168.23	910.00
	2.110	560.00	798.74	-.90	1.36	.00	199.13	910.00
	2.110	800.00	799.31	.57	1.38	.00	234.89	910.00
	2.110	1190.00	800.00	.69	1.39	.00	261.83	910.00

*	2.130	920.00	799.67	.00	.13	.00	40.00	100.00
*	2.130	920.00	799.78	.11	.13	.11	40.00	100.00
	2.130	560.00	798.89	-.88	.15	.00	40.00	100.00
	2.130	800.00	799.45	.56	.14	.00	40.00	100.00
	2.130	1190.00	800.09	.64	.09	.00	40.00	100.00
	2.130	920.00	799.70	.00	.03	.00	40.00	22.00
	2.130	920.00	799.80	.10	.02	.10	40.00	22.00
	2.130	560.00	798.91	-.89	.01	.00	40.00	22.00
	2.130	800.00	799.47	.57	.02	.00	40.00	22.00
	2.130	1190.00	800.14	.66	.05	.00	40.00	22.00
*	2.150	920.00	800.13	.00	.44	.00	267.10	100.00
*	2.150	920.00	800.22	.08	.42	.08	196.09	100.00
*	2.150	560.00	799.16	-1.06	.25	.00	228.75	100.00
*	2.150	800.00	799.84	.69	.37	.00	255.70	100.00
*	2.150	1190.00	800.73	.88	.59	.00	290.39	100.00
	2.580	860.00	802.38	.00	2.24	.00	289.15	2270.00
	2.580	860.00	802.48	.11	2.27	.11	194.05	2270.00
	2.580	530.00	801.68	-.81	2.52	.00	252.36	2270.00
	2.580	750.00	802.17	.49	2.32	.00	282.48	2270.00
*	2.580	1110.00	802.81	.64	2.08	.00	305.80	2270.00

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	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	2.600	860.00	802.49	.00	.11	.00	46.00	100.00
*	2.600	860.00	802.60	.11	.12	.11	46.00	100.00
	2.600	530.00	801.83	-.78	.15	.00	44.59	100.00
*	2.600	750.00	802.29	.47	.13	.00	46.00	100.00
*	2.600	1110.00	802.87	.57	.06	.00	46.00	100.00
	2.600	860.00	802.52	.00	.03	.00	46.00	39.70
	2.600	860.00	802.62	.10	.02	.10	46.00	39.70
	2.600	530.00	801.84	-.78	.01	.00	44.64	39.70
	2.600	750.00	802.32	.48	.02	.00	46.00	39.70
	2.600	1110.00	802.92	.60	.05	.00	46.00	39.70
*	2.605	860.00	802.89	.00	.37	.00	320.33	25.00
*	2.605	860.00	802.97	.08	.35	.08	229.76	25.00
*	2.605	530.00	802.03	-.94	.19	.00	279.57	25.00
*	2.605	750.00	802.63	.60	.31	.00	297.61	25.00
*	2.605	1110.00	803.44	.81	.52	.00	342.96	25.00
*	2.610	860.00	802.81	.00	-.08	.00	46.00	25.00
*	2.610	860.00	802.90	.09	-.07	.09	46.00	25.00
*	2.610	530.00	802.01	-.89	-.02	.00	45.30	25.00
*	2.610	750.00	802.57	.56	-.06	.00	46.00	25.00
*	2.610	1110.00	803.32	.74	-.12	.00	46.00	25.00
	2.610	860.00	802.84	.00	.03	.00	46.00	39.70
	2.610	860.00	802.94	.10	.04	.10	46.00	39.70
	2.610	530.00	802.03	-.91	.01	.00	45.34	39.70
	2.610	750.00	802.59	.57	.02	.00	46.00	39.70
	2.610	1110.00	803.35	.76	.04	.00	46.00	39.70

*	2.630	860.00	803.24	.00	.40	.00	334.99	100.00
*	2.630	860.00	803.32	.08	.38	.08	246.78	100.00
*	2.630	530.00	802.29	-1.04	.26	.00	285.75	100.00
	2.630	750.00	802.94	.66	.35	.00	323.49	100.00
	2.630	1110.00	803.86	.92	.51	.00	359.40	100.00
*	2.740	860.00	803.65	.00	.41	.00	349.73	580.00
*	2.740	860.00	803.74	.09	.42	.09	205.11	580.00
*	2.740	530.00	802.81	-.93	.53	.00	228.25	580.00
*	2.740	750.00	803.39	.57	.44	.00	318.93	580.00
*	2.740	1110.00	804.21	.82	.35	.00	399.07	580.00
*	2.760	860.00	803.76	.00	.11	.00	40.00	100.00
*	2.760	860.00	803.86	.10	.12	.10	40.00	100.00
	2.760	530.00	803.01	-.86	.19	.00	40.00	100.00
*	2.760	750.00	803.53	.53	.15	.00	40.00	100.00
*	2.760	1110.00	804.24	.70	.03	.00	40.00	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	2.760	860.00	803.80	.00	.04	.00	40.00	27.00
	2.760	860.00	803.90	.10	.04	.10	40.00	27.00
	2.760	530.00	803.02	-.88	.02	.00	40.00	27.00
	2.760	750.00	803.56	.54	.03	.00	40.00	27.00
	2.760	1110.00	804.30	.73	.06	.00	40.00	27.00
	2.780	860.00	804.27	.00	.47	.00	404.89	100.00
*	2.780	860.00	804.35	.08	.45	.08	268.75	100.00
*	2.780	530.00	803.31	-1.04	.29	.00	306.96	100.00
*	2.780	750.00	803.97	.66	.41	.00	378.60	100.00
*	2.780	1110.00	804.90	.93	.60	.00	460.87	100.00
*	3.190	860.00	806.34	.00	2.07	.00	340.89	2160.00
*	3.190	860.00	806.44	.10	2.09	.10	224.07	2160.00
	3.190	530.00	805.84	-.60	2.53	.00	280.66	2160.00
	3.190	750.00	806.18	.34	2.21	.00	321.84	2160.00
*	3.190	1110.00	806.65	.47	1.76	.00	380.01	2160.00
	3.200	860.00	806.37	.00	.04	.00	304.42	25.00
	3.200	860.00	806.48	.10	.04	.10	221.36	25.00
*	3.200	530.00	805.84	-.63	.00	.00	54.66	25.00
*	3.200	750.00	806.15	.30	-.04	.00	55.00	25.00
	3.200	1110.00	806.69	.54	.03	.00	318.76	25.00
*	3.200	860.00	807.03	.00	.66	.00	334.64	20.00
	3.200	860.00	807.14	.10	.66	.10	165.41	20.00
*	3.200	530.00	805.83	-1.31	-.02	.00	54.62	20.00
*	3.200	750.00	806.55	.72	.40	.00	312.58	20.00
*	3.200	1110.00	807.25	.71	.57	.00	344.74	20.00
	3.210	860.00	807.60	.00	.56	.00	494.04	25.00
	3.210	860.00	807.58	-.02	.44	-.02	316.61	25.00
*	3.210	530.00	806.46	-1.12	.64	.00	356.07	25.00
*	3.210	750.00	807.61	1.15	1.07	.00	496.65	25.00
*	3.210	1110.00	807.79	.17	.53	.00	511.18	25.00

*	3.360	810.00	807.80	.00	.20	.00	406.18	790.00
*	3.360	810.00	807.80	.00	.22	.00	239.28	790.00
*	3.360	500.00	806.90	-.90	.44	.00	251.33	790.00
*	3.360	710.00	807.77	.87	.15	.00	399.00	790.00
	3.360	1050.00	808.04	.27	.25	.00	450.82	790.00
*	3.380	810.00	807.89	.00	.09	.00	51.00	100.00
*	3.380	810.00	807.91	.02	.11	.02	51.00	100.00
	3.380	500.00	807.08	-.83	.18	.00	51.00	100.00
*	3.380	710.00	807.84	.76	.07	.00	51.00	100.00
*	3.380	1050.00	808.13	.28	.08	.00	51.00	100.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	3.380	810.00	807.92	.00	.03	.00	51.00	21.00
	3.380	810.00	807.95	.02	.03	.02	51.00	21.00
*	3.380	500.00	807.12	-.82	.04	.00	51.00	21.00
*	3.380	710.00	807.87	.75	.03	.00	51.00	21.00
*	3.380	1050.00	808.16	.29	.04	.00	51.00	21.00
*	3.400	810.00	808.51	.00	.58	.00	523.21	100.00
*	3.400	810.00	808.55	.04	.60	.04	336.96	100.00
*	3.400	500.00	807.52	-1.03	.40	.00	347.04	100.00
*	3.400	710.00	808.34	.82	.47	.00	496.51	100.00
*	3.400	1050.00	809.01	.67	.85	.00	588.69	100.00
	3.600	700.00	808.91	.00	.41	.00	484.27	1083.00
*	3.600	700.00	808.98	.07	.43	.07	274.68	1083.00
	3.600	430.00	808.18	-.80	.66	.00	324.86	1083.00
*	3.600	620.00	808.75	.57	.41	.00	448.80	1083.00
*	3.600	910.00	809.35	.60	.34	.00	549.70	1083.00
	3.810	700.00	809.58	.00	.67	.00	484.77	1083.00
	3.810	700.00	809.67	.09	.69	.09	244.36	1083.00
	3.810	430.00	809.00	-.67	.82	.00	310.00	1083.00
	3.810	620.00	809.44	.44	.69	.00	447.76	1083.00
	3.810	910.00	809.93	.49	.58	.00	544.20	1083.00
	4.010	700.00	810.48	.00	.90	.00	538.58	1083.00
	4.010	700.00	810.58	.10	.91	.10	296.58	1083.00
	4.010	430.00	809.97	-.61	.97	.00	385.40	1083.00
	4.010	620.00	810.36	.39	.92	.00	514.45	1083.00
	4.010	910.00	810.77	.41	.84	.00	577.42	1083.00
	4.220	700.00	811.60	.00	1.11	.00	632.45	1082.00
	4.220	700.00	811.70	.10	1.11	.10	454.86	1082.00
	4.220	430.00	811.23	-.47	1.26	.00	561.08	1082.00
	4.220	620.00	811.51	.28	1.15	.00	617.34	1082.00
	4.220	910.00	811.83	.32	1.06	.00	666.10	1082.00
	4.240	700.00	811.65	.00	.05	.00	36.19	100.00
	4.240	700.00	811.76	.11	.07	.11	36.55	100.00
*	4.240	430.00	811.43	-.34	.20	.00	35.45	100.00
*	4.240	620.00	811.61	.19	.11	.00	36.07	100.00
*	4.240	910.00	811.72	.11	-.10	.00	36.43	100.00

4.240	700.00	811.89	.00	.24	.00	36.96	18.00
4.240	700.00	811.99	.10	.22	.10	37.00	18.00
4.240	430.00	811.50	-.49	.07	.00	35.69	18.00
4.240	620.00	811.78	.28	.17	.00	36.62	18.00
4.240	910.00	812.23	.44	.50	.00	37.00	18.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	4.260	700.00	812.87	.00	.98	.00	150.21	100.00
*	4.260	700.00	812.93	.06	.94	.06	113.81	100.00
*	4.260	430.00	812.11	-.82	.61	.00	130.02	100.00
*	4.260	620.00	812.66	.55	.87	.00	144.42	100.00
*	4.260	910.00	813.42	.76	1.19	.00	164.99	100.00
*	4.520	660.00	814.26	.00	1.39	.00	260.91	1370.00
*	4.520	660.00	814.36	.10	1.43	.10	159.52	1370.00
*	4.520	410.00	813.50	-.86	1.39	.00	193.61	1370.00
*	4.520	580.00	814.05	.56	1.39	.00	243.03	1370.00
*	4.520	850.00	814.72	.67	1.30	.00	283.31	1370.00
*	4.530	660.00	814.25	.00	-.01	.00	54.00	25.00
*	4.530	660.00	814.35	.10	-.01	.10	54.00	25.00
	4.530	410.00	813.50	-.85	.00	.00	54.00	25.00
*	4.530	580.00	814.05	.55	-.01	.00	54.00	25.00
*	4.530	850.00	814.70	.65	-.03	.00	54.00	25.00
	4.530	660.00	814.25	.00	.01	.00	54.00	18.00
	4.530	660.00	814.35	.10	.00	.10	54.00	18.00
	4.530	410.00	813.50	-.85	.00	.00	54.00	18.00
	4.530	580.00	814.05	.55	.01	.00	54.00	18.00
	4.530	850.00	814.71	.66	.01	.00	54.00	18.00
*	4.540	660.00	814.35	.00	.09	.00	266.76	25.00
*	4.540	660.00	814.44	.09	.09	.09	165.76	25.00
	4.540	410.00	813.55	-.89	.04	.00	198.73	25.00
*	4.540	580.00	814.13	.58	.08	.00	249.76	25.00
*	4.540	850.00	814.85	.72	.14	.00	288.75	25.00
*	5.320	550.00	815.23	.00	.89	.00	1039.01	4120.00
*	5.320	550.00	815.33	.10	.89	.10	889.01	4120.00
	5.320	340.00	814.68	-.66	1.13	.00	990.56	4120.00
*	5.320	480.00	815.07	.39	.94	.00	1028.35	4120.00
*	5.320	710.00	815.61	.54	.76	.00	1060.05	4120.00
	5.330	550.00	815.24	.00	.00	.00	1039.51	25.00
	5.330	550.00	815.34	.10	.00	.10	898.42	25.00
	5.330	340.00	814.68	-.65	.00	.00	990.93	25.00
	5.330	480.00	815.07	.39	.00	.00	1029.16	25.00
	5.330	710.00	815.61	.54	.00	.00	1060.47	25.00
	5.330	550.00	815.29	.00	.06	.00	1042.54	15.00
	5.330	550.00	815.39	.10	.06	.10	904.30	15.00
*	5.330	340.00	815.03	-.36	.35	.00	1024.82	15.00
*	5.330	480.00	815.21	.18	.14	.00	1037.69	15.00
	5.330	710.00	815.62	.42	.01	.00	1060.94	15.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	5.340	550.00	815.30	.00	.00	.00	1042.57	25.00
	5.340	550.00	815.40	.10	.00	.10	902.28	25.00
	5.340	340.00	815.03	-.36	.00	.00	1024.99	25.00
	5.340	480.00	815.21	.18	.00	.00	1037.74	25.00
	5.340	710.00	815.62	.42	.00	.00	1060.94	25.00
*	5.390	490.00	815.30	.00	.01	.00	1016.99	86.00
*	5.390	490.00	815.40	.10	.01	.10	672.26	86.00
*	5.390	300.00	815.04	-.37	.01	.00	870.45	86.00
*	5.390	430.00	815.22	.18	.01	.00	996.03	86.00
*	5.390	640.00	815.63	.41	.01	.00	1049.92	86.00
*	5.430	490.00	815.34	.00	.03	.00	699.99	86.00
*	5.430	490.00	815.43	.09	.03	.09	415.29	86.00
*	5.430	300.00	815.07	-.36	.03	.00	528.83	86.00
*	5.430	430.00	815.25	.19	.03	.00	655.32	86.00
*	5.430	640.00	815.65	.40	.02	.00	826.94	86.00
*	5.480	490.00	815.65	.00	.31	.00	495.17	86.00
*	5.480	490.00	815.74	.09	.31	.09	203.84	86.00
	5.480	300.00	815.48	-.26	.41	.00	361.11	86.00
*	5.480	430.00	815.60	.13	.35	.00	461.94	86.00
*	5.480	640.00	815.79	.19	.14	.00	603.77	86.00
	5.630	490.00	817.12	.00	1.47	.00	434.36	258.00
*	5.630	490.00	817.23	.11	1.49	.11	274.34	258.00
	5.630	300.00	816.83	-.39	1.36	.00	304.73	258.00
	5.630	430.00	817.05	.22	1.45	.00	404.01	258.00
	5.630	640.00	817.22	.17	1.43	.00	484.76	258.00
	5.780	490.00	817.94	.00	.82	.00	336.86	257.00
	5.780	490.00	818.05	.10	.82	.10	217.75	257.00
*	5.780	300.00	817.64	-.41	.80	.00	270.74	257.00
	5.780	430.00	817.87	.23	.82	.00	325.01	257.00
	5.780	640.00	818.13	.26	.90	.00	364.03	257.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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WARNING SECNO=      .390  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      .390  PROFILE=  2  WSEL BASED ON X5 CARD
 PNING SECNO=       .390  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      .390  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      .390  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .390  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .410  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      .410  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .410  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .410  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
TION SECNO=         .410  PROFILE=  5  HYDRAULIC JUMP D.S.
NG SECNO=           .410  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .430  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .940  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .940  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .940  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .940  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .960  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .960  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .980  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .980  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .980  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .980  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .980  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.180  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.180  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.180  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.180  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

NOTE    SECNO=     1.380  PROFILE=  2  WSEL BASED ON X5 CARD

NG SECNO=          1.400  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
ING SECNO=         1.400  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.400  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.400  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.400  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.400  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.400  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.400  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
1
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WARNING SECNO=     1.420  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=     1.420  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=     1.420  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.420  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.420  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.420  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     1.590  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.590  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.590  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     1.590  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
ING SECNO=         1.590  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=     2.130  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     2.130  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     2.130  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=     2.130  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      2.150  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.150  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.150  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    NG SECNO=       2.150  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.150  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.580  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.600  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.600  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.600  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.600  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.605  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.605  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.605  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.605  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.605  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.610  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.610  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.610  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.610  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.610  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.630  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.630  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.630  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      2.630  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.630  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.740  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      2.740  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.740  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.740  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.740  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.760  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.760  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.760  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.760  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      2.780  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.780  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.780  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.780  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      2.780  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.190  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      3.190  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
    ING SECNO=      3.190  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.200  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.200  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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CAUTION SECNO=      3.200  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      3.200  PROFILE=  1  MINIMUM SPECIFIC ENERGY
WARNING SECNO=      3.200  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 ION SECNO=         3.200  PROFILE=  4  CRITICAL DEPTH ASSUMED
 ON SECNO=          3.200  PROFILE=  4  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      3.200  PROFILE=  5  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      3.200  PROFILE=  5  MINIMUM SPECIFIC ENERGY

WARNING SECNO=      3.210  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      3.210  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=      3.210  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.210  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.210  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.210  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.360  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.360  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.360  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.360  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.360  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.380  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.380  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.380  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.380  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.380  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.380  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      3.380  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.380  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.400  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
NOTE    SECNO=      3.400  PROFILE=  2  WSEL BASED ON X5 CARD
WARNING SECNO=      3.400  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.400  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.400  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.400  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      3.600  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.600  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.600  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      3.600  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      4.240  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      4.240  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.240  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.240  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 NING SECNO=        4.260  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 ING SECNO=         4.260  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 ING SECNO=         4.260  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.260  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.260  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      4.520  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      4.520  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.520  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.520  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.520  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      4.530  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.530  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.530  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      4.530  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      4.540  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=      4.540  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.320  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.320  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.320  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.320  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      5.330  PROFILE=  1  HYDRAULIC JUMP D.S.
CAUTION SECNO=      5.330  PROFILE=  2  HYDRAULIC JUMP D.S.
WARNING SECNO=      5.330  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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CAUTION SECNO=      5.330  PROFILE=  4  HYDRAULIC JUMP D.S.

WARNING SECNO=      5.390  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.390  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.390  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.390  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.390  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.430  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.430  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.430  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.430  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.430  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.480  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.480  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.480  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.480  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.630  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      5.630  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      5.780  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

1
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FLOODWAY DATA,   YEAR FLOOD
PROFILE NO.  2
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STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
.020	848.	1233.	1.8	782.5	782.4	.1
.390	78.	264.	3.7	785.1	785.0	.1
.410	81.	295.	3.4	785.4	785.3	.1
.410	91.	393.	2.5	786.3	786.2	.1
.430	93.	404.	2.5	786.4	786.3	.1
.940	220.	397.	2.5	789.6	789.5	.1
.960	37.	179.	5.5	789.8	789.7	.1
.960	37.	191.	5.2	790.1	790.0	.1
.980	247.	688.	1.4	790.8	790.7	.1
1.080	217.	595.	1.5	791.1	791.0	.1
1.180	186.	423.	2.2	791.5	791.4	.1
1.280	178.	386.	2.4	792.3	792.2	.1
1.380	192.	400.	2.3	793.4	793.3	.1
1.400	26.	157.	5.9	793.5	793.4	.1
1.400	26.	159.	5.8	793.6	793.5	.1
1.420	249.	810.	1.1	794.9	794.7	.2
1.590	176.	459.	2.0	795.3	795.2	.1
1.760	161.	431.	2.1	796.8	796.7	.1
1.940	156.	437.	2.1	798.3	798.2	.1
2.110	168.	449.	2.0	799.6	799.5	.1
2.130	40.	225.	4.1	799.8	799.7	.1
2.130	40.	226.	4.1	799.8	799.7	.1
2.150	196.	592.	1.6	800.2	800.1	.1
2.580	194.	490.	1.8	802.5	802.4	.1
2.600	46.	203.	4.2	802.6	802.5	.1
2.600	46.	203.	4.2	802.6	802.5	.1
2.605	230.	639.	1.3	803.0	802.9	.1
2.610	46.	216.	4.0	802.9	802.8	.1
2.610	46.	218.	3.9	802.9	802.8	.1
2.630	247.	749.	1.1	803.3	803.2	.1
2.740	205.	466.	1.8	803.7	803.6	.1
2.760	40.	201.	4.3	803.9	803.8	.1
2.760	40.	202.	4.3	803.9	803.8	.1
2.780	269.	684.	1.3	804.4	804.3	.1
3.190	224.	469.	1.8	806.4	806.3	.1
3.200	221.	473.	1.8	806.5	806.4	.1
3.200	165.	500.	1.7	807.1	807.0	.1
3.210	317.	899.	1.0	807.6	807.6	.0
3.360	239.	516.	1.6	807.8	807.8	.0
3.380	51.	246.	3.3	807.9	807.9	.0
3.380	51.	248.	3.3	807.9	807.9	.0
3.400	337.	826.	1.0	808.5	808.5	.0

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STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE

3.600	275.	618.	1.1	809.0	808.9	.1
3.810	244.	511.	1.4	809.7	809.6	.1
4.010	297.	524.	1.3	810.6	810.5	.1
4.220	465.	568.	1.2	811.7	811.6	.1
4.240	37.	123.	5.7	811.8	811.7	.1
4.240	37.	131.	5.3	812.0	811.9	.1
4.260	114.	283.	2.5	813.0	812.9	.1
4.520	160.	497.	1.3	814.4	814.3	.1
4.530	54.	289.	2.3	814.3	814.2	.1
4.530	54.	289.	2.3	814.4	814.3	.1
4.540	166.	518.	1.3	814.4	814.3	.1
5.320	1029.	1419.	.4	815.3	815.2	.1
5.330	1039.	1434.	.4	815.3	815.2	.1
5.330	1041.	1489.	.4	815.4	815.3	.1
5.340	1039.	1488.	.4	815.4	815.3	.1
5.390	843.	774.	.6	815.4	815.3	.1
5.430	616.	317.	1.5	815.4	815.3	.1
5.480	293.	178.	2.7	815.7	815.6	.1
5.630	342.	241.	2.0	817.2	817.1	.1
5.780	304.	263.	1.9	818.0	817.9	.1

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FLOODWAY DATA, YEAR FLOOD
FILE NO. 3

STATION	------- FLOODWAY ------- WIDTH	SECTION AREA	MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
.020	1104.	838.	1.6	781.9	782.4	-.5
.390	101.	228.	2.7	784.5	785.0	-.5
.410	23.	102.	6.0	784.5	785.3	-.8
.410	23.	104.	5.9	784.6	786.2	-1.6
.430	118.	333.	1.8	785.4	786.3	-.9
.940	203.	186.	3.3	788.5	789.5	-1.0
.960	37.	146.	4.2	788.9	789.7	-.8
.960	37.	149.	4.1	789.0	790.0	-1.0
.980	262.	369.	1.7	789.4	790.7	-1.3
1.080	249.	383.	1.5	790.0	791.0	-1.0
1.180	223.	282.	2.0	790.6	791.4	-.8
1.280	226.	281.	2.0	791.6	792.2	-.6
1.380	239.	272.	2.1	792.7	793.3	-.6
1.400	26.	140.	4.0	792.9	793.4	-.5
1.400	26.	113.	5.0	792.9	793.5	-.6
1.420	285.	488.	1.1	793.5	794.7	-1.2
1.590	200.	284.	2.0	794.3	795.2	-.9
1.760	203.	312.	1.8	796.0	796.7	-.7
1.940	183.	308.	1.8	797.4	798.2	-.8
2.110	199.	309.	1.8	798.7	799.5	-.8
2.130	40.	189.	3.0	798.9	799.7	-.8
2.130	40.	190.	2.9	798.9	799.7	-.8
2.150	229.	398.	1.4	799.2	800.1	-.9
2.580	252.	344.	1.5	801.7	802.4	-.7
2.600	45.	167.	3.2	801.8	802.5	-.7

2.600	45.	168.	3.2	801.8	802.5	-.7
2.605	280.	441.	1.2	802.0	802.9	-.9
2.610	45.	176.	3.0	802.0	802.8	-.8
2.610	45.	176.	3.0	802.0	802.8	-.8
2.630	286.	510.	1.0	802.3	803.2	-.9
2.740	228.	282.	1.9	802.8	803.6	-.8
2.760	40.	166.	3.2	803.0	803.8	-.8
2.760	40.	167.	3.2	803.0	803.8	-.8
2.780	307.	416.	1.3	803.3	804.3	-1.0
3.190	281.	360.	1.5	805.8	806.3	-.5
3.200	55.	171.	3.1	805.8	806.4	-.6
3.200	55.	95.	5.6	805.8	807.0	-1.2
3.210	356.	554.	1.0	806.5	807.6	-1.1
3.360	251.	303.	1.6	806.9	807.8	-.9
3.380	51.	204.	2.5	807.1	807.9	-.8
3.380	51.	138.	3.6	807.1	807.9	-.8
3.400	347.	485.	1.0	807.5	808.5	-1.0

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FLOODWAY DATA, YEAR FLOOD
PROFILE NO. 3

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WATER SURFACE ELEVATION WITHOUT FLOODWAY	DIFFERENCE
3.600	325.	412.	1.0	808.2	808.9	-.7
3.810	310.	354.	1.2	809.0	809.6	-.6
4.010	400.	353.	1.2	810.0	810.5	-.5
4.220	605.	403.	1.1	811.2	811.6	-.4
4.240	35.	111.	3.9	811.4	811.7	-.3
4.240	36.	113.	3.8	811.5	811.9	-.4
4.260	130.	198.	2.2	812.1	812.9	-.8
4.520	194.	374.	1.1	813.5	814.3	-.8
4.530	54.	243.	1.7	813.5	814.2	-.7
4.530	54.	243.	1.7	813.5	814.3	-.8
4.540	199.	385.	1.1	813.5	814.3	-.8
5.320	1185.	949.	.4	814.7	815.2	-.5
5.330	1185.	952.	.4	814.7	815.2	-.5
5.330	1185.	1299.	.3	815.0	815.3	-.3
5.340	1185.	1301.	.3	815.0	815.3	-.3
5.390	1085.	614.	.5	815.0	815.3	-.3
5.430	804.	207.	1.5	815.1	815.3	-.2
5.480	643.	150.	2.0	815.5	815.6	-.1
5.630	446.	165.	1.8	816.8	817.1	-.3
5.780	385.	197.	1.5	817.6	817.9	-.3

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FLOODWAY DATA, YEAR FLOOD
PROFILE NO. 4

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
.020	1132.	1216.	1.6	782.3	782.4	-.1
.390	108.	270.	3.2	784.8	785.0	-.2
.410	113.	298.	2.9	785.1	785.3	-.2
.410	128.	406.	2.1	786.0	786.2	-.2
.430	130.	416.	2.1	786.1	786.3	-.2
.940	239.	320.	2.7	789.2	789.5	-.3
.960	37.	168.	5.2	789.5	789.7	-.2
.960	37.	176.	4.9	789.7	790.0	-.3
.980	328.	634.	1.4	790.3	790.7	-.4
1.080	287.	556.	1.4	790.6	791.0	-.4
1.180	258.	402.	2.0	791.1	791.4	-.3
1.280	252.	379.	2.1	792.1	792.2	-.1
1.380	264.	384.	2.1	793.1	793.3	-.2
1.400	26.	150.	5.3	793.3	793.4	-.1
1.400	26.	120.	6.7	793.3	793.5	-.2
1.420	330.	735.	1.1	794.3	794.7	-.4
1.590	248.	420.	1.9	794.9	795.2	-.3
1.760	228.	421.	1.9	796.5	796.7	-.2
1.940	215.	418.	1.9	797.9	798.2	-.3
2.110	235.	434.	1.8	799.3	799.5	-.2
2.130	40.	212.	3.8	799.5	799.7	-.2
2.130	40.	213.	3.8	799.5	799.7	-.2
2.150	256.	564.	1.4	799.8	800.1	-.3
2.580	282.	479.	1.6	802.2	802.4	-.2
2.600	46.	188.	4.0	802.3	802.5	-.2
2.600	46.	190.	4.0	802.3	802.5	-.2
2.605	298.	613.	1.2	802.6	802.9	-.3
2.610	46.	201.	3.7	802.6	802.8	-.2
2.610	46.	202.	3.7	802.6	802.8	-.2
2.630	323.	709.	1.1	802.9	803.2	-.3
2.740	319.	439.	1.7	803.4	803.6	-.2
2.760	40.	188.	4.0	803.5	803.8	-.3
2.760	40.	189.	4.0	803.6	803.8	-.2
2.780	379.	645.	1.2	804.0	804.3	-.3
3.190	322.	462.	1.6	806.2	806.3	-.1
3.200	55.	188.	4.0	806.1	806.4	-.3
3.200	313.	109.	6.9	806.5	807.0	-.5
3.210	497.	1046.	.7	807.6	807.6	.0
3.360	399.	582.	1.2	807.8	807.8	.0
3.380	51.	243.	2.9	807.8	807.9	-.1
3.380	51.	161.	4.4	807.9	807.9	.0
3.400	497.	836.	.8	808.3	808.5	-.2

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STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE

3.600	449.	628.	1.0	808.8	808.9	-.1
3.810	448.	519.	1.2	809.4	809.6	-.2
4.010	514.	529.	1.2	810.4	810.5	-.1
4.220	636.	567.	1.1	811.5	811.6	-.1
4.240	36.	117.	5.3	811.6	811.7	-.1
4.240	37.	123.	5.0	811.8	811.9	-.1
4.260	144.	272.	2.3	812.7	812.9	-.2
4.520	243.	497.	1.2	814.1	814.3	-.2
4.530	54.	273.	2.1	814.0	814.2	-.2
4.530	54.	273.	2.1	814.1	814.3	-.2
4.540	250.	516.	1.1	814.1	814.3	-.2
5.320	1185.	1336.	.4	815.1	815.2	-.1
5.330	1185.	1345.	.4	815.1	815.2	-.1
5.330	1185.	1483.	.3	815.2	815.3	-.1
5.340	1185.	1484.	.3	815.2	815.3	-.1
5.390	1189.	781.	.6	815.2	815.3	-.1
5.430	889.	316.	1.4	815.3	815.3	.0
5.480	707.	199.	2.2	815.6	815.6	.0
5.630	504.	243.	1.8	817.1	817.1	.0
5.780	423.	266.	1.6	817.9	817.9	.0

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FLOODWAY DATA, YEAR FLOOD
FILE NO. 5

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
.020	1148.	1663.	1.7	782.7	782.4	.3
.390	117.	323.	4.0	785.3	785.0	.3
.410	123.	364.	3.5	785.7	785.3	.4
.410	137.	468.	2.7	786.5	786.2	.3
.430	139.	485.	2.6	786.6	786.3	.3
.940	316.	550.	2.3	790.0	789.5	.5
.960	325.	618.	2.1	790.2	789.7	.5
.960	259.	707.	1.8	791.2	790.0	1.2
.980	426.	1018.	1.3	791.3	790.7	.6
1.080	326.	833.	1.4	791.5	791.0	.5
1.180	303.	611.	1.9	791.9	791.4	.5
1.280	288.	529.	2.3	792.6	792.2	.4
1.380	295.	537.	2.2	793.7	793.3	.4
1.400	26.	161.	7.4	793.7	793.4	.3
1.400	26.	127.	9.4	793.8	793.5	.3
1.420	385.	1193.	1.0	795.6	794.7	.9
1.590	294.	699.	1.7	795.9	795.2	.7
1.760	258.	578.	2.1	797.1	796.7	.4
1.940	243.	573.	2.1	798.6	798.2	.4
2.110	262.	605.	2.0	800.0	799.5	.5
2.130	40.	237.	5.0	800.1	799.7	.4
2.130	40.	239.	5.0	800.1	799.7	.4
2.150	290.	806.	1.5	800.7	800.1	.6
2.580	318.	668.	1.7	802.8	802.4	.4
2.600	46.	215.	5.2	802.9	802.5	.4

2.600	46.	217.	5.1	802.9	802.5	.4
2.605	343.	875.	1.3	803.4	802.9	.5
2.610	46.	236.	4.7	803.3	802.8	.5
2.610	46.	237.	4.7	803.4	802.8	.6
2.630	359.	1022.	1.1	803.9	803.2	.7
2.740	399.	734.	1.5	804.2	803.6	.6
2.760	40.	216.	5.1	804.2	803.8	.4
2.760	40.	218.	5.1	804.3	803.8	.5
2.780	461.	1033.	1.1	804.9	804.3	.6
3.190	380.	626.	1.8	806.7	806.3	.4
3.200	319.	610.	1.8	806.7	806.4	.3
3.200	345.	234.	4.7	807.3	807.0	.3
3.210	511.	1133.	1.0	807.8	807.6	.2
3.360	451.	697.	1.5	808.0	807.8	.2
3.380	51.	257.	4.1	808.1	807.9	.2
3.380	51.	170.	6.2	808.2	807.9	.3
3.400	589.	1204.	.9	809.0	808.5	.5

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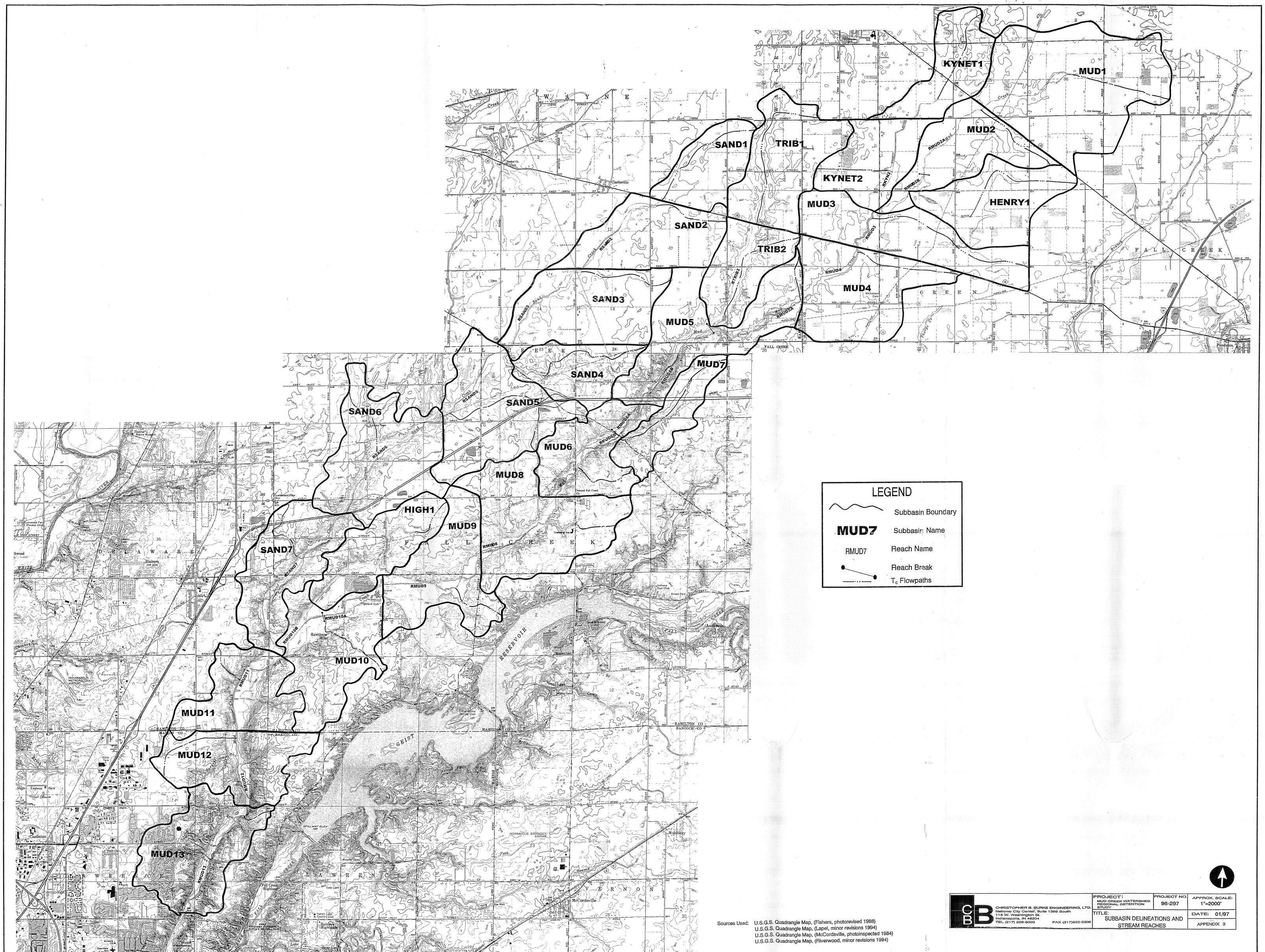
FLOODWAY DATA, YEAR FLOOD
PROFILE NO. 5

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
3.600	550.	932.	1.0	809.3	808.9	.4
3.810	544.	765.	1.2	809.9	809.6	.3
4.010	577.	755.	1.2	810.8	810.5	.3
4.220	669.	776.	1.2	811.8	811.6	.2
4.240	36.	121.	7.5	811.7	811.7	.0
4.240	37.	140.	6.5	812.2	811.9	.3
4.260	165.	391.	2.3	813.4	812.9	.5
4.520	283.	675.	1.3	814.7	814.3	.4
4.530	54.	308.	2.8	814.7	814.2	.5
4.530	54.	308.	2.8	814.7	814.3	.4
4.540	289.	711.	1.2	814.8	814.3	.5
5.320	1185.	1902.	.4	815.6	815.2	.4
5.330	1185.	1910.	.4	815.6	815.2	.4
5.330	1185.	1919.	.4	815.6	815.3	.3
5.340	1185.	1919.	.4	815.6	815.3	.3
5.390	1200.	1208.	.5	815.6	815.3	.3
5.430	997.	614.	1.0	815.7	815.3	.4
5.480	794.	304.	2.1	815.8	815.6	.2
5.630	552.	320.	2.0	817.2	817.1	.1
5.780	444.	356.	1.8	818.1	817.9	.2

APPENDIX 3

Subbasin Delineations and Stream Reaches



Sources Used: U.S.G.S. Quadrangle Map, (Fishers, photorevised 1988)
U.S.G.S. Quadrangle Map, (Lapel, minor revisions 1994)
U.S.G.S. Quadrangle Map, (McCordsville, photoinspected 1984)
U.S.G.S. Quadrangle Map, (Riverwood, minor revisions 1994)

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PROJECT: MUD CREEK WATERSHED REGIONAL DETENTION STUDY	PROJECT NO 96-297	APPROX. SCALE: 1"=2000'
TITLE: SUBBASIN DELINEATIONS AND STREAM REACHES		DATE: 01/97
		APPENDIX 3

APPENDIX 4

Time-of-Concentration Calculations

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SUBAREA TIMES OF CONCENTRATION

Subarea ID	Predeveloped T_c (hours)	Developed T_c (hours)
MUD1 (1)	5.04	5.04
MUD2 (1)	3.99	3.99
MUD3 (1)	7.13	7.13
MUD4 (1)	4.26	4.26
MUD5	3.23	1.94
MUD6	2.89	1.73
MUD7	3.19	1.91
MUD8	2.19	1.31
MUD9	2.72	1.63
MUD10	3.66	2.20
MUD11	2.28	1.37
MUD12 (2)	4.11	4.11
MUD13 (2)	2.30	2.30
SAND1 (1)	3.70	3.70
SAND2	3.36	2.02
SAND3	3.36	2.02
SAND4	3.43	2.06
SAND5	4.15	2.49
SAND6	2.78	1.67
SAND7	2.71	1.63
TRIB1 (1)	5.56	5.56
TRIB2	3.76	2.26
HENRY1 (1)	6.31	6.31
KYNET1 (1)	4.42	4.42
KYNET2 (1)	3.10	3.10
HIGH1	3.03	1.82

(1) - Assumes no significant development of this subarea under proposed conditions
(2) - Assumes that subarea is fully developed under existing conditions

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked UMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea

SUBAREA MUD1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0015		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.28	+	= 1.28

$\frac{880-870}{6500} = 0.0015$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		6500		
9. Watercourse slope, s	ft/ft		0.0015		
10. Average velocity, V (figure 3-1)	ft/s		0.64		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		2.82	+	= 2.82

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0007		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		6800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.94	+	= 0.94

$\frac{870-865}{6800} = 7.4\times10^{-4}$

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 5.04

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0037		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		0.90	+	= 0.90

$\frac{881-870}{3000} = 0.0037$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		5900		
9. Watercourse slope, s	ft/ft		0.0037		
10. Average velocity, V (figure 3-1)	ft/s		0.98		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		1.67	+	= 1.67

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0014		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		10200		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		1.42	+	= 1.42

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 3.99

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project: MUD CREEK WATERSHED STUDY By: DLM Date: 1/2/97

Location: MARION, HAMILTON & MADISON COS. Checked: MMR Date: 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_t through subarea) SUBAREA MUD3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL, RES >20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		$\frac{873-870}{1400} = 0.0016$
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0016		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.25	÷	= 1.25

Shallow concentrated flow

		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		$\frac{370-360}{8000} = 0.0013$
8. Flow length, L	ft		11700		
9. Watercourse slope, s	ft/ft		0.0013		
10. Average velocity, V (figure 3-1)	ft/s		0.58		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		5.60	-	= 5.60

Channel flow

		Segment ID	C		
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0011		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow Length, L	ft		2000		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.28	-	= 0.28

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 7.6

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/3/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_c through subarea

SUBAREA MUD4

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.002		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.14	+	= 1.14

$\frac{870-860}{4450} = 0.0020$

Shallow concentrated flow		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	
8. Flow length, L	ft		4600	2200	
9. Watercourse slope, s	ft/ft		0.0020	0.0045	
10. Average velocity, V (figure 3-1)	ft/s		0.72	1.08	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.77	+ 0.57	= 2.34

$\frac{860-350}{2200} = 0.0045$

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0010		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		5600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.78	+	= 0.78

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.26

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD5

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		CULT SOIL, RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0077		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.67	+	= 0.67

$\frac{870-860}{1300} = 0.0077$

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)		B		
8. Flow length, L	ft	UNPAVED		
9. Watercourse slope, s	ft/ft	2500		
10. Average velocity, V (figure 3-1)	ft/s	0.008		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.44		
		0.48	+	= 0.48

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2	C		
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n		0.0017		
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft	2.0*		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	15000		
		2.08	+	= 2.08
20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19)	hr			3.23

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_t through subarea) SUBAREA MUD6

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1) ..		0.40		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0042		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.69	+	= 1.69

$\frac{850-845}{1200} = 0.0042$

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	
8. Flow length, L	ft	2500	1400	
9. Watercourse slope, s	ft/ft	0.0042	0.021	
10. Average velocity, V (figure 3-1)	ft/s	1.04	2.34	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.67	+ 0.17	= 0.84

$\frac{840-810}{1400} = 0.021$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0017		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	2600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.36	+	= 0.36

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.39

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MNR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD7

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES ≥ 20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.79	+	= 0.79

$\frac{860-855}{1000} = 0.005$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	8800		
9. Watercourse slope, s	ft/ft	0.004		
10. Average velocity, V (figure 3-1)	ft/s	1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	2.40	+	= 2.40

$\frac{855-825}{7500} = 0.004$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 3.19

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/3/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD8

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

$\frac{845-840}{400} = 0.0050$

Sheet flow (Applicable to T_c only)	Segment ID	A	
1. Surface description (table 3-1)		CULT SOIL, RES >20%	
2. Manning's roughness coeff., n (table 3-1) ..		0.17	
3. Flow length, L (total L ≤ 300 ft)	ft	300	
4. Two-yr 24-hr rainfall, P_2	in	2.91	
5. Land slope, s	ft/ft	0.0056	
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.76	+ ___ = 0.76

$\frac{843-825}{2200} = 0.008$

Shallow concentrated flow	Segment ID	B	
7. Surface description (paved or unpaved)		UNPAVED	
8. Flow length, L	ft	2200	
9. Watercourse slope, s	ft/ft	0.0082	
10. Average velocity, V (figure 3-1)	ft/s	1.46	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.42	+ ___ = 0.42

Channel flow	Segment ID		
12. Cross sectional flow area, a	ft^2		
13. Wetted perimeter, P_w	ft		
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft		
15. Channel slope, s	ft/ft		
16. Manning's roughness coeff., n			
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*	
18. Flow length, L	ft	7300	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.01	+ ___ = 1.01

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.19

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked NMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD9

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1) ..			0.40		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.01		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.19	÷	= 1.19

Shallow concentrated flow		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	
8. Flow length, L	ft		2800	1100	
9. Watercourse slope, s	ft/ft		0.009	0.0045	
10. Average velocity, V (figure 3-1)	ft/s		1.53	1.08	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.51	+ 0.28	= 0.79

$\frac{825-800}{2800} = 0.009$

$\frac{800-795}{1100} = 0.0045$

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		1.9 *		
18. Flow length, L	ft		5100		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.74	+	= 0.74

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.72

* BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD 10

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			GRASS, DENSE		
2. Manning's roughness coeff., n (table 3-1) ..			0.24		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.003		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.28	+	= 1.28

$\frac{830-825}{1600} = 0.003$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		2000		
9. Watercourse slope, s	ft/ft		0.004		
10. Average velocity, V (figure 3-1)	ft/s		1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.54	+	= 0.54

$\frac{828-820}{2000} = 0.004$

Channel flow		Segment ID	C	D
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		1.18*	
18. Flow length, L	ft		7800	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.84	+ = 1.84

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.66

*BASED ON FIS HEC-1 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD11

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0045		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.83	+	= 0.83

$\frac{815-810}{1100} = 0.0045$

Shallow concentrated flow		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	
8. Flow length, L	ft		800	1500	
9. Watercourse slope, s	ft/ft		0.0045	0.027	
10. Average velocity, V (figure 3-1)	ft/s		1.08	2.63	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.21	+ 0.16	= 0.37

$\frac{815-775}{1500} = 0.027$

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		0.98*		
18. Flow Length, L	ft		3800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.08	+	= 1.08

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.28

* BASED ON EIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD12

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1) ..		0.40		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.003		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.93	+	= 1.93

$0.003 = \frac{830-825}{1500}$

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	
8. Flow length, L	ft	4200	1900	
9. Watercourse slope, s	ft/ft	0.002	0.024	
10. Average velocity, V (figure 3-1)	ft/s	0.72	2.50	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.62	+ 0.21	= 1.83

$\frac{825-820}{4200} = 0.002$

$\frac{820-775}{1900} = 0.024$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	3.85*		
18. Flow length, L	ft	4800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.35	+	= 0.35

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.11

* BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea

SUBAREA MUD13

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		DENSE GRASS		
2. Manning's roughness coeff., n (table 3-1) ..		0.24		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0033		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.23	÷	= 1.23

$\frac{840-835}{1500} = 0.0033$

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	
8. Flow length, L	ft	1000	800	
9. Watercourse slope, s	ft/ft	0.0033	0.081	
10. Average velocity, V (figure 3-1)	ft/s	0.93	4.59	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.30	− 0.05	= 0.35

$\frac{835-770}{800} = 0.081$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.93*		
18. Flow length, L	ft	7600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.72	−	= 0.72

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.30

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES>20%		$\frac{860-850}{2400} = 0.0042$
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0042		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.85	+	= 0.85

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	$\frac{850-840}{5600} = 0.0018$
8. Flow length, L	ft	2100	5600	
9. Watercourse slope, s	ft/ft	0.0042	0.0018	
10. Average velocity, V (figure 3-1)	ft/s	1.04	0.68	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.56	+ 2.29	= 2.85

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.70

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA SAND2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOILS RES >20%		$\frac{862-860}{600} = 0.003$
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.003		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.97	+	= 0.97

Shallow concentrated flow

		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	$\frac{860-850}{3200} = 0.003$
8. Flow length, L	ft		3500	1500	$\frac{850-840}{1000} = 0.01$
9. Watercourse slope, s	ft/ft		0.003	0.01	
10. Average velocity, V (figure 3-1)	ft/s		0.88	1.61	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.10	+ 0.26	= 1.36

Channel flow

		Segment ID	D	
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft		0.0019	
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*	
18. Flow length, L	ft		7400	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.03	+ = 1.03

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 3.36

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		$\frac{860-850}{1300} = 0.0077$
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0077		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.67	+	= 0.67

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		$\frac{850-830}{5000} = 0.004$
8. Flow length, L	ft	5900		
9. Watercourse slope, s	ft/ft	0.004		
10. Average velocity, V (figure 3-1)	ft/s	1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.61	+	= 1.61

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0013		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	7800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.08	+	= 1.08

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.36

Worksheet 3: Time of Concentration (T_c) or Travel Time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND4

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL IRES >20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow Length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0029		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.99	÷	= 0.99

$\frac{854-850}{1000} = 0.0029$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		7300		
9. Watercourse slope, s	ft/ft		0.0034		
10. Average velocity, V (figure 3-1)	ft/s		0.94		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		2.16	÷	= 2.16

$\frac{850-825}{7300} = 0.0034$

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.003		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow Length, L	ft		2000		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.28	÷	= 0.28

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.43

*ASSUMED CHANNEL VELOCITY

Worksheet 3: T_c

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked UMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea

SUBAREA SAND5

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES > 20%		$\frac{840-835}{250} = 0.02$
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.02		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.46	+	= 0.46

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	$\frac{835-825}{4300} = 0.002$
8. Flow length, L	ft	4300	5400	$\frac{825-815}{5400} = 0.0019$
9. Watercourse slope, s	ft/ft	0.0023	0.0019	
10. Average velocity, V (figure 3-1)	ft/s	0.77	0.70	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.55	+ 2.14	= 3.69

Channel flow	Segment ID		
12. Cross sectional flow area, a	ft^2		
13. Wetted perimeter, p_w	ft		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		
15. Channel slope, s	ft/ft		
16. Manning's roughness coeff., n			
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		
18. Flow length, L	ft		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.15

Worksheet 3: Time of Concentration (T_c) or T_t

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND6

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.006		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.74	÷	= 0.74

$\frac{833-830}{500} = 0.006$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	5000		
9. Watercourse slope, s	ft/ft	0.005		
10. Average velocity, V (figure 3-1)	ft/s	1.14		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.22	÷	= 1.22

$\frac{830-505}{5000} = 0.005$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.001		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	1.45*		
18. Flow length, L	ft	4300		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.82	÷	= 0.82

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.78

*BASED ON FIS HEC-2 MODEL

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea)

SUBAREA SWD7

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0062		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.73	÷	= 0.73

$\frac{830-825}{800} = 0.0062$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	4800		
9. Watercourse slope, s	ft/ft	0.0069		
10. Average velocity, V (figure 3-1)	ft/s	1.34		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	1.00	÷	= 1.00

$\frac{825-795}{4800} = 0.006$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	3.24*		
18. Flow length, L	ft	7900		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.98	÷	= 0.98

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr 2.71

*BASED ON HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA TRIB1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow Length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.79	÷	= 0.79

$\frac{870-360}{3000} = 0.005$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow Length, L	ft	10300		
9. Watercourse slope, s	ft/ft	0.0014		
10. Average velocity, V (figure 3-1)	ft/s	0.60		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	4.77	÷	= 4.77

$\frac{850-840}{7200} = 0.0014$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow Length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		÷	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 5.56

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked ____ Date ____

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea)

SUBAREA TR132

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A	
1. Surface description (table 3-1)			CULT SOIL RES >20%	
2. Manning's roughness coeff., n (table 3-1) ..			0.17	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		2.91	
5. Land slope, s	ft/ft		0.004	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		0.87	+ ____ = 0.87

$\frac{870-860}{2300} = 0.004$

Shallow concentrated flow

		Segment ID	B	C
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED
8. Flow length, L	ft		3100	4700
9. Watercourse slope, s	ft/ft		0.0086	0.0014
10. Average velocity, V (figure 3-1)	ft/s		1.50	0.60
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		0.57	+ 2.17 = 2.74

$0.0086 = \frac{870-840}{3500}$

$0.0014 = \frac{839-828}{7800}$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft		0.0014	
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*	
18. Flow length, L	ft		1100	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		0.15	+ ____ = 0.15

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 3.76

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or T_t

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked WMR Date [illegible]

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA HENRY1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow Length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	0.0013		
5. Land slope, s	ft/ft	0.0013		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.36	÷	= 1.36

$\frac{875-870}{3900} = 0.0013$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow Length, L	ft	9000		
9. Watercourse slope, s	ft/ft	0.0013		
10. Average velocity, V (figure 3-1)	ft/s	0.58		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	4.31	-	= 4.31

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0022		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow Length, L	ft	7600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.64	-	= 0.64

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 6.31

* ASSUMED CHANNEL VELOCITY

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked NMR Date 1/14/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA KYNET1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A	
1. Surface description (table 3-1)			CULT SOIL, RES >20%	
2. Manning's roughness coeff., n (table 3-1) ..			0.17	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		2.91	
5. Land slope, s	ft/ft		0.01	
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.60 +	= 0.60

Shallow concentrated flow		Segment ID	B	
7. Surface description (paved or unpaved)			UNPAVED	
8. Flow Length, L	ft		7300	$\frac{870-360}{3000} = 0.0013$
9. Watercourse slope, s	ft/ft		0.0013	
10. Average velocity, V (figure 3-1)	ft/s		0.58	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		3.50 +	= 3.50

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft		0.0013	
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*	
18. Flow length, L	ft		2300	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.32 +	= 0.32
20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19)	hr			4.42

* ASSUMED CHANNEL VELOCITY

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked WWR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA KYNETZ

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		$\frac{870-360}{4200} = 0.0024$
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0024		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	1.06	÷	= 1.06

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	4800		
9. Watercourse slope, s	ft/ft	0.0024		
10. Average velocity, V (figure 3-1)	ft/s	0.79		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	1.69	÷	= 1.69

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0013		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	2500		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.35	÷	= 0.35

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 3.10

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of Concentration (T_c) or T_t

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_t through subarea) SUBAREA H16H1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES > 20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow Length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.79	÷	= 0.79

$\frac{835-830}{500} = 0.005$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	2900		
9. Watercourse slope, s	ft/ft	0.0041		
10. Average velocity, V (figure 3-1)	ft/s	1.03		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.78	÷	= 0.78

$\frac{835-826}{2900} = 0.0041$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0037		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.04		
18. Flow length, L	ft	10500		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	1.46	÷	= 1.46

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 3.03

APPENDIX 5

Spring 1964 Storm Event Hydrologic Model Input/Output

```
****************************************
*                                      *
     LOOD HYDROGRAPH PACKAGE  (HEC-1)   *
            SEPTEMBER 1990              *
*            VERSION 4.0               *
*                                      *
*  RUN DATE  01/26/1997  TIME  17:00:35 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 72 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 21JAN97  ** APRIL1964 EVENT **  FILE: SCS64-15.HC1
              *DIAGRAM
  3           IT      15                    300
  4           IN     120
  5           IO       5
  6           JR    PREC    1.00
              *
              *  ***************************************************************
              *  *                                                             *
              *  * RAINFALL DISTRIBUTION FROM INDIANAPOLIS RIVERSIDE GAGE      *
              *  * APPLIED TO ON A DAILY BASIS TO THE  AVERAGE DEPTH FROM THE  *
              *  * ANDERSON WATERWORKS AND OAKLANDON GEIST GAGES               *
              *  *                                                             *
              *  ***************************************************************
              *
              *

  7           KK   HNRY1
  8           KM   SUBAREA HNRY1 (HENRY DITCH)
  9           PB    6.15
 10           PC     0.0     7.6     9.4    18.5    20.2    20.7    21.5    23.1    23.3    23.3
```

```
11        PC    23.4    23.7    36.7    37.9    41.0    45.2    47.8    50.4    53.0    53.2
12        PC    54.1    55.8    57.4    59.0    75.1    75.3    75.4    75.6    75.9    81.5
13        PC    82.6    83.6    89.1    89.4    89.8    90.9   100.0
14        BA  1.5211
15        LS       0      78
16        UD    3.79
          *

17        KK    MUD1
18        KM   SUBAREA MUD1 (MUD CREEK)
19        BA  3.3292
20        LS       0      78
21        UD    3.02
          *

22        KK  RMUD2A
23        KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
24        RT                      4
          *

25        KK    ADD1
26        KM        COMBINE RMUD2A AND HENRY1
27        HC       2
          *

28        KK  RMUD2B
29        KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
30        RT                      2
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

31        KK    MUD2
32        KM   SUBAREA MUD2 (MUD CREEK)
33        BA  1.3655
34        LS       0      80
35        UD    2.39
          *

36        KK  SR13US
37        KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
38        HC       2
          *

39        KK  KYNET1
40        KM   SUBAREA KYNET1 (KYNETT DITCH)
41        BA  1.1386
42        LS       0      79
43        UD    2.65
          *

44        KK   RKYN2
45        KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
46        RT                      4
          *

47        KK  KYNET2
48        KM   SUBAREA KNET2 (KYNETT DITCH)
```

```
 49          BA  1.1498
 50          LS       0      79
 51          UD    1.86
             *

 52          KK  KYNETT
 53          KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
 54          HC       2
             *

 55          KK  SR13DS
 56          KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
 57          HC       2
             *

 58          KK   RMUD3
 59          KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
 60          RT                       2
             *

 61          KK    MUD3
 62          KM   SUBAREA MUD3 (MUD CREEK)
 63          BA  1.7324
 64          LS       0      79
 65          UD    4.28
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 66          KK    SR38
 67          KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
 68          HC       2
             *

 69          KK   RMUD4
 70          KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
 71          RT                       3
             *

 72          KK    MUD4
 73          KM   SUBAREA MUD4 (MUD CREEK)
 74          BA  1.8948
 75          LS       0      80
 76          UD    2.56
             *

 77          KK   HAMCO
 78          KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
 79          HC       2
             *

 80          KK  RMUD5A
 81          KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
 82          RT                       4
             *

 83          KK   TRIB1
 84          KM   SUBAREA TRIB1 (UNNAMED TRIB)
```

```
 85          BA  1.7235
 86          LS       0      80
 87          UD    3.34
             *

 88          KK  RTRIB2
 89          KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
 90          RT                      4
             *

 91          KK   TRIB2
 92          KM   SUBAREA TRIB2 (UNNAMED TRIB)
 93          BA  1.0964
 94          LS       0      80
 95          UD    2.26
             *

 96          KK    TRIB
 97          KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
 98          HC       2
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 99          KK    ADD2
100          KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
101          HC       2
             *

102          KK  RMUD5B
103          KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
104          RT                      4
             *

105          KK    MUD5
106          KM   SUBAREA  MUD5 (MUD CREEK)
107          BA  2.0442
108          LS       0      77
109          UD    1.94
             *

110          KK  I69MUD
111          KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
112          HC       2
             *

113          KK  RMUD6A
114          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
115          RT                      1
             *

116          KK    MUD7
117          KM   SUBAREA  MUD7 (MUD CREEK)
118          BA  0.8429
119          LS       0      80
120          UD    1.91
             *
```

```
121          KK  SR238M
122          KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
123          HC       2
             *

124          KK  RMUD6B
125          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
126          RT                      3
             *

127          KK    MUD6
128          KM   SUBAREA  MUD6 (MUD CREEK)
129          BA  1.3121
130          LS       0      75
131          UD    1.73
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

132          KK   126TH
133          KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
134          HC       2
             *

135          KK   RMUD8
136          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
137          RT                      4
             *

138          KK    MUD8
139          KM   SUBAREA  MUD8 (MUD CREEK)
140          BA  2.2573
141          LS       0      79
142          UD    1.31
             *

143          KK   BROOK
144          KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
145          HC       2
             *

146          KK   RMUD9
147          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
148          RT                      5
             *

149          KK    MUD9
150          KM   SUBAREA  MUD9 (MUD CREEK)
151          BA  1.6690
152          LS       0      79
153          UD    1.63
             *

154          KK  KLEPFR
155          KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
156          HC       2
             *
```

```
157          KK  RMD10A
158          KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
159          RT                      5
             *

160          KK   HIGH1
161          KM   SUBAREA HIGH1 (HIGH DITCH)
162          BA  1.2943
163          LS       0      81
164          UD    1.82
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

165          KK    HIGH
166          KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
167          HC       2
             *

168          KK  RMD10B
169          KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
170          RT                      4
             *

171          KK   MUD10
172          KM   SUBAREA MUD10 (MUD CREEK)
173          BA  1.8169
174          LS       0      75
175          UD    2.19
             *

176          KK   SAND1
177          KM   SUBAREA SAND1 (SAND CREEK)
178          BA  0.9822
179          LS       0      79
180          UD    2.22
             *

181          KK  RSAND2
182          KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
183          RT                      4
             *

184          KK   SAND2
185          KM   SUBAREA SAND2 (SAND CREEK)
186          BA  1.5520
187          LS       0      79
188          UD    2.02
             *

189          KK   156TH
190          KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
191          HC       2
             *

192          KK  RSAND3
193          KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
194          RT                      4
```

```
            *

195         KK   SAND3
196         KM   SUBAREA SAND3 (SAND CREEK)
197         BA  1.9192
198         LS       0       79
199         UD    2.02
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

200         KK  SR238S
201         KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
202         HC       2
            *

203         KK   SAND4
204         KM   SUBAREA SAND4 (SAND CREEK)
205         BA  1.0401
206         LS       0       79
207         UD    2.06
            *

208         KK   238DS
209         KM        COMBINE SR238S AND SAND4 (SAND CREEK)
210         HC       2
            *

211         KK  RSAND5
212         KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
213         RT                      13
            *

214         KK   SAND5
215         KM   SUBAREA SAND5 (SAND CREEK)
216         BA  2.0438
217         LS       0       79
218         UD    2.49
            *

219         KK   MARIL
220         KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
221         HC       2
            *

222         KK  RSAND6
223         KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
224         RT                       8
            *

225         KK   SAND6
226         KM   SUBAREA SAND6 (SAND CREEK)
227         BA  2.1594
228         LS       0       79
229         UD    1.67
            *

230         KK  I69SAN
```

```
231          KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
232          HC       2
             *
1                                    HEC-1 INPUT                                                    PAGE  8

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


233          KK  RSAND7
234          KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
235          RT                      7
             *

236          KK   SAND7
237          KM   SUBAREA SAND7 (SAND CREEK)
238          BA  1.6857
239          LS       0      76
240          UD    1.63
             *

241          KK    SAND
242          KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
243          HC       2
             *

244          KK   106TH
245          KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
246          HC       3
             *

247          KK  RMUD11
248          KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
249          RT                      9
             *

250          KK   MUD11
251          KM   SUBAREA MUD11 (MUD CREEK)
252          BA  1.4567
253          LS       0      74
254          UD    1.37
             *

255          KK    96TH
256          KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
257          HC       2
             *

258          KK  RMUD12
259          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
260          RT                      2
             *

261          KK   MUD12
262          KM   SUBAREA MUD12 (MUD CREEK)
263          BA  1.5478
264          LS       0      71
265          UD    2.47
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 266          KK    86TH
 267          KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
 268          HC       2
              *

 269          KK  RMUD13
 270          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
 271          RT                      4
              *

 272          KK   MUD13
 273          KM   SUBAREA MUD13 (MUD CREEK)
 274          BA  1.8392
 275          LS       0      76
 276          UD    1.38
              *

 277          KK    GAGE
 278          KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
 279          HC       2
              *
 280          ZZ

      SCHEMATIC DIAGRAM OF STREAM NETWORK

      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

NO.   (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  7    HNRY1
          .
          .
 17       .        MUD1
          .           V
          .           V
 22       .      RMUD2A
          .           .
          .           .
 25     ADD1............
         V
         V
 28   RMUD2B
          .
          .
 31       .        MUD2
          .           .
          .           .
 36   SR13US............
          .
          .
          .      KYNET1
          .           V
          .           V
 44       .       RKYN2
          .           .
          .           .
 47       .           .      KYNET2
```

```
          .           .           .
          .           .           .
          .      KYNETT............
          .           .
          .           .
 55     SR13DS............
          V
          V
 58      RMUD3
          .
          .
 61       .        MUD3
          .           .
          .           .
 66       SR38............
          V
          V
 69      RMUD4
          .
          .
 72       .        MUD4
          .           .
          .           .
 77      HAMCO............
          V
          V
 80     RMUD5A
          .
          .
 83       .       TRIB1
          .           V
          .           V
 88       .      RTRIB2
          .           .
          .           .
 91       .           .       TRIB2
          .           .           .
          .           .           .
 96       .        TRIB............
          .           .
          .           .
 99       ADD2............
          V
          V
102     RMUD5B
          .
          .
105       .        MUD5
          .           .
          .           .
110     I69MUD............
          V
          V
        RMUD6A
          .
          .
116       .        MUD7
          .           .
          .           .
121     SR238M............
```

```
            V
            V
        RMUD6B
            .
            .
127         .        MUD6
            .           .
            .           .
132      126TH............
            V
            V
135      RMUD8
            .
            .
138         .        MUD8
            .           .
            .           .
143      BROOK............
            V
            V
146      RMUD9
            .
            .
149         .        MUD9
            .           .
            .           .
154     KLEPFR............
            V
            V
157     RMD10A
            .
            .
160         .       HIGH1
            .           .
            .           .
165       HIGH............
            V
            V
168     RMD10B
            .
            .
171         .       MUD10
            .           .
            .           .
176         .           .       SAND1
            .           .          V
            .           .          V
181         .           .      RSAND2
            .           .          .
            .           .          .
184         .           .          .       SAND2
            .           .          .          .
            .           .          .          .
            .           .      156TH............
            .           .          V
            .           .          V
192         .           .      RSAND3
            .           .          .
            .           .          .
195         .           .          .       SAND3
```

```
        .         .         .         .
        .         .         .         .
        .         .     SR238S............
        .         .         .
        .         .         .
203     .         .         .       SAND4
        .         .         .         .
        .         .         .         .
208     .         .     238DS............
        .         .         V
        .         .         V
211     .         .     RSAND5
        .         .         .
        .         .         .
214     .         .         .       SAND5
        .         .         .         .
        .         .         .         .
219     .         .     MARIL............
        .         .         V
        .         .         V
222     .         .     RSAND6
        .         .         .
        .         .         .
225     .         .         .       SAND6
        .         .         .         .
        .         .         .         .
230     .         .     I69SAN............
        .         .         V
        .         .         V
233     .         .     RSAND7
        .         .         .
        .         .         .
236     .         .         .       SAND7
        .         .         .         .
        .         .         .         .
241     .         .      SAND............
        .         .         .
        .         .         .
244   106TH......................
        V
        V
247   RMUD11
        .
        .
250     .       MUD11
        .         .
        .         .
255    96TH............
        V
        V
258   RMUD12
        .
        .
        .       MUD12
        .         .
        .         .
266    86TH............
        V
        V
269   RMUD13
```

```
              .
              .
              .       MUD13
              .          .
              .          .
 277        GAGE............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  01/26/1997  TIME  17:00:35 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    MUD CREEK WATERSHED HYDROLOGIC MODEL - 72 HOUR EVENT
                    CBBEL: 96-297 DLM 21JAN97  ** APRIL1964 EVENT **  FILE: SCS64-15.HC1

  5 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      4    0  ENDING DATE
                   NDTIME       0245  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .25 HOURS
                   TOTAL TIME BASE   74.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT

   JP         MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

   JR         MULTI-RATIO OPTION
                 RATIOS OF PRECIPITATION
                1.00


            PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
```

FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00
HYDROGRAPH AT					
+	HNRY1	1.52	1	FLOW	161.
				TIME	50.75
HYDROGRAPH AT					
+	MUD1	3.33	1	FLOW	416.
				TIME	50.00
ROUTED TO					
	RMUD2A	3.33	1	FLOW	416.
				TIME	51.00
2 COMBINED AT					
	ADD1	4.85	1	FLOW	575.
				TIME	51.00
ROUTED TO					
	RMUD2B	4.85	1	FLOW	575.
				TIME	51.50
GRAPH AT					
+	MUD2	1.37	1	FLOW	209.
				TIME	49.50
2 COMBINED AT					
+	SR13US	6.22	1	FLOW	683.
				TIME	51.00
HYDROGRAPH AT					
	KYNET1	1.14	1	FLOW	159.
				TIME	49.75
ROUTED TO					
	RKYN2	1.14	1	FLOW	159.
				TIME	50.75
HYDROGRAPH AT					
	KYNET2	1.15	1	FLOW	203.
				TIME	49.00
2 COMBINED AT					
+	KYNETT	2.29	1	FLOW	298.
				TIME	49.50
2 COMBINED AT					
+	SR13DS	8.50	1	FLOW	917.
				TIME	50.75
ROUTED TO					
	RMUD3	8.50	1	FLOW	917.
				TIME	51.25

IYDROGRAPH AT					
	MUD3	1.73	1	FLOW	170.
				TIME	51.25
2 COMBINED AT					
	SR38	10.24	1	FLOW	1087.
				TIME	51.25
ROUTED TO					
+	RMUD4	10.24	1	FLOW	1087.
				TIME	52.00
HYDROGRAPH AT					
+	MUD4	1.89	1	FLOW	276.
				TIME	49.50
2 COMBINED AT					
	HAMCO	12.13	1	FLOW	1217.
				TIME	51.50
ROUTED TO					
	RMUD5A	12.13	1	FLOW	1217.
				TIME	52.50
IYDROGRAPH AT					
	TRIB1	1.72	1	FLOW	207.
				TIME	50.25
D TO					
+	RTRIB2	1.72	1	FLOW	207.
				TIME	51.25
HYDROGRAPH AT					
+	TRIB2	1.10	1	FLOW	174.
				TIME	49.25
2 COMBINED AT					
	TRIB	2.82	1	FLOW	314.
				TIME	50.25
2 COMBINED AT					
	ADD2	14.95	1	FLOW	1440.
				TIME	52.00
ROUTED TO					
	RMUD5B	14.95	1	FLOW	1440.
				TIME	53.00
HYDROGRAPH AT					
+	MUD5	2.04	1	FLOW	339.
				TIME	49.00
2 COMBINED AT					
+	I69MUD	17.00	1	FLOW	1469.
				TIME	53.00
ROUTED TO					
	RMUD6A	17.00	1	FLOW	1469.
				TIME	53.25

```
HYDROGRAPH AT
                    MUD7       .84    1   FLOW        149.
                                           TIME      49.00

 2 COMBINED AT
                   SR238M     17.84    1   FLOW       1479.
                                           TIME      53.25

 OUTED TO
+                  RMUD6B     17.84    1   FLOW       1479.
                                           TIME      54.00

..YDROGRAPH AT
+                    MUD6      1.31    1   FLOW        222.
                                           TIME      48.75

 2 COMBINED AT
                   126TH      19.15    1   FLOW       1487.
                                           TIME      54.00

ROUTED TO
                   RMUD8      19.15    1   FLOW       1487.
                                           TIME      55.00

 YDROGRAPH AT
                    MUD8       2.26    1   FLOW        474.
                                           TIME      48.50

      BINED AT
+                  BROOK      21.41    1   FLOW       1495.
                                           TIME      55.00

..OUTED TO
+                  RMUD9      21.41    1   FLOW       1495.
                                           TIME      56.25

HYDROGRAPH AT
                    MUD9       1.67    1   FLOW        317.
                                           TIME      48.75

 2 COMBINED AT
                  KLEPFR      23.08    1   FLOW       1503.
                                           TIME      56.25

 OUTED TO
                  RMD10A      23.08    1   FLOW       1503.
                                           TIME      57.50

 YDROGRAPH AT
+                  HIGH1       1.29    1   FLOW        239.
                                           TIME      49.00

 2 COMBINED AT
+                   HIGH      24.37    1   FLOW       1547.
                                           TIME      57.75

ROUTED TO
+                  RMD10B      24.37    1   FLOW       1547.
                                           TIME      58.75
```

YDROGRAPH AT					
	MUD10	1.82	1	FLOW	268.
				TIME	49.25
YDROGRAPH AT					
	SAND1	.98	1	FLOW	155.
				TIME	49.25
OUTED TO					
+	RSAND2	.98	1	FLOW	155.
				TIME	50.25
HYDROGRAPH AT					
+	SAND2	1.55	1	FLOW	259.
				TIME	49.00
2 COMBINED AT					
	156TH	2.53	1	FLOW	376.
				TIME	49.50
OUTED TO					
	RSAND3	2.53	1	FLOW	376.
				TIME	50.50
YDROGRAPH AT					
	SAND3	1.92	1	FLOW	321.
				TIME	49.00
BINED AT					
+	SR238S	4.45	1	FLOW	607.
				TIME	50.00
HYDROGRAPH AT					
+	SAND4	1.04	1	FLOW	172.
				TIME	49.25
2 COMBINED AT					
	238DS	5.49	1	FLOW	761.
				TIME	49.75
ROUTED TO					
	RSAND5	5.49	1	FLOW	761.
				TIME	53.00
YDROGRAPH AT					
	SAND5	2.04	1	FLOW	299.
				TIME	49.50
2 COMBINED AT					
+	MARIL	7.54	1	FLOW	830.
				TIME	52.75
ROUTED TO					
+	RSAND6	7.54	1	FLOW	830.
				TIME	54.75
HYDROGRAPH AT					
	SAND6	2.16	1	FLOW	405.
				TIME	48.75

2 COMBINED AT					
	I69SAN	9.70	1	FLOW	839.
				TIME	54.75
OUTED TO					
	RSAND7	9.70	1	FLOW	839.
				TIME	56.50
YDROGRAPH AT					
+	SAND7	1.69	1	FLOW	303.
				TIME	48.75
2 COMBINED AT					
+	SAND	11.38	1	FLOW	850.
				TIME	56.50
3 COMBINED AT					
	106TH	37.57	1	FLOW	2252.
				TIME	57.75
ROUTED TO					
	RMUD11	37.57	1	FLOW	2252.
				TIME	60.00
YDROGRAPH AT					
	MUD11	1.46	1	FLOW	272.
				TIME	48.50
BINED AT					
+	96TH	39.03	1	FLOW	2308.
				TIME	60.00
ROUTED TO					
+	RMUD12	39.03	1	FLOW	2308.
				TIME	60.50
HYDROGRAPH AT					
	MUD12	1.55	1	FLOW	192.
				TIME	49.50
2 COMBINED AT					
	86TH	40.57	1	FLOW	2378.
				TIME	60.25
OUTED TO					
	RMUD13	40.57	1	FLOW	2378.
				TIME	61.25
YDROGRAPH AT					
+	MUD13	1.84	1	FLOW	357.
				TIME	48.50
2 COMBINED AT					
+	GAGE	42.41	1	FLOW	2421.
				TIME	61.25

** NORMAL END OF HEC-1 ***

APPENDIX 6

Existing-Condition Hydrologic Model Input/Output

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
          SEPTEMBER 1990               *
           VERSION 4.0                 *
*                                       *
* RUN DATE  01/29/1997  TIME  11:40:26 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*         609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104               *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 21JAN97  ** EXISTING COND. **  FILE: EXIST.HC1
              *DIAGRAM
  3           IT      15                    300
  4           IN      72
  5           IO       5
  6           JR    PREC    0.51    0.64    0.73    0.83    0.93    1.00
              *
              *  ************************************************************
              *  *                                                          *
              *  * HUFF 3RD QUARTILE DISTRIBUTION                           *
              *  * ---------------------------------------------------      *
              *  *   RATIO 1:    2-YEAR STORM FREQUENCY                     *
              *  *   RATIO 2:    5-YEAR STORM FREQUENCY                     *
              *  *   RATIO 3:   10-YEAR STORM FREQUENCY                     *
              *  *   RATIO 4:   25-YEAR STORM FREQUENCY                     *
              *  *   RATIO 5:   50-YEAR STORM FREQUENCY                     *
              *  *   RATIO 6:  100-YEAR STORM FREQUENCY                     *
              *  ************************************************************
              *

  7           KK   HNRY1
```

```
 8        KM   SUBAREA HNRY1 (HENRY DITCH)
 9        PB    5.75
10        PC     0.0     2.6     5.3     8.4    11.6    14.3    17.1    20.7    24.2    31.0
11        PC    37.8    48.1    58.3    68.2    78.0    83.4    88.7    92.0    95.3    97.7
12        PC   100.0
13        BA  1.5211
14        LS       0      78
15        UD    3.79
          *

16        KK    MUD1
17        KM   SUBAREA MUD1 (MUD CREEK)
18        BA  3.3292
19        LS       0      78
20        UD    3.02
          *

21        KK  RMUD2A
22        KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
23        RT                      4
          *

24        KK    ADD1
25        KM        COMBINE RMUD2A AND HENRY1
26        HC       2
          *

27        KK  RMUD2B
28        KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
29        RT                      2
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

30        KK    MUD2
31        KM   SUBAREA MUD2 (MUD CREEK)
32        BA  1.3655
33        LS       0      80
34        UD    2.39
          *

35        KK  SR13US
36        KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
37        HC       2
          *

38        KK  KYNET1
39        KM   SUBAREA KYNET1 (KYNETT DITCH)
40        BA  1.1386
41        LS       0      79
42        UD    2.65
          *

43        KK   RKYN2
44        KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
45        RT                      4
          *
```

```
46          KK  KYNET2
47          KM   SUBAREA KNET2 (KYNETT DITCH)
48          BA  1.1498
49          LS       0       79
50          UD    1.86
            *

51          KK  KYNETT
52          KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
53          HC       2
            *

54          KK  SR13DS
55          KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
56          HC       2
            *

57          KK   RMUD3
58          KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
59          RT                      2
            *

60          KK    MUD3
61          KM   SUBAREA MUD3 (MUD CREEK)
62          BA  1.7324
63          LS       0       79
64          UD    4.28
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

65          KK    SR38
66          KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
67          HC       2
            *

68          KK   RMUD4
69          KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
70          RT                      3
            *

71          KK    MUD4
72          KM   SUBAREA MUD4 (MUD CREEK)
73          BA  1.8948
74          LS       0       80
75          UD    2.56
            *

76          KK   HAMCO
77          KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
78          HC       2
            *

79          KK  RMUD5A
80          KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
81          RT                      4
            *
```

```
 82          KK   TRIB1
 83          KM   SUBAREA TRIB1 (UNNAMED TRIB)
 84          BA  1.7235
 85          LS       0      80
 86          UD    3.34
             *

 87          KK  RTRIB2
 88          KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
 89          RT                      4
             *

 90          KK   TRIB2
 91          KM   SUBAREA TRIB2 (UNNAMED TRIB)
 92          BA  1.0964
 93          LS       0      80
 94          UD    2.26
             *

 95          KK    TRIB
 96          KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
 97          HC       2
             *
1                                   HEC-1 INPUT                                    PAGE  4

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 98          KK    ADD2
 99          KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
100          HC       2
             *

101          KK  RMUD5B
102          KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
103          RT                      4
             *

104          KK    MUD5
105          KM   SUBAREA  MUD5 (MUD CREEK)
106          BA  2.0442
107          LS       0      77
108          UD    1.94
             *

109          KK  I69MUD
110          KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
111          HC       2
             *

112          KK  RMUD6A
113          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
114          RT                      1
             *

115          KK    MUD7
116          KM   SUBAREA  MUD7 (MUD CREEK)
117          BA  0.8429
118          LS       0      80
119          UD    1.91
```

```
*

KK  SR238M
KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
HC       2
*

KK  RMUD6B
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
RT                      3
*

KK    MUD6
KM   SUBAREA  MUD6 (MUD CREEK)
BA  1.3121
LS       0      75
UD    1.73
*
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK   126TH
KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
HC       2
*

KK   RMUD8
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
RT                      4
*

KK    MUD8
KM   SUBAREA  MUD8 (MUD CREEK)
BA  2.2573
LS       0      79
UD    1.31
*

KK   BROOK
KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
HC       2
*

KK   RMUD9
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
RT                      5
*

KK    MUD9
KM   SUBAREA  MUD9 (MUD CREEK)
BA  1.6690
LS       0      79
UD    1.63
*

KK  KLEPFR
KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
HC       2
```

```
*

KK  RMD10A
KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
RT                     5
*

KK   HIGH1
KM   SUBAREA HIGH1 (HIGH DITCH)
BA  1.2943
LS       0      81
UD    1.82
*
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK   PHIGH
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH HIGH DITCH POND
RS       1    ELEV   780.8
SQ     0.0     20.     40.     70.    100.    130.    160.    200.
SV     0.0    163.    227.    309.    355.    367.    375.    383.
SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
*

KK    HIGH
KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
HC       2
*

KK  RMD10B
KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
RT                     4
*

KK   MUD10
KM   SUBAREA MUD10 (MUD CREEK)
BA  1.8169
LS       0      75
UD    2.19
*

KK   MD106
KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
HC       2
*

KK   SAND1
KM   SUBAREA SAND1 (SAND CREEK)
BA  0.9822
LS       0      79
UD    2.22
*

KK  RSAND2
KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
RT                     4
*
```

```
192        KK   SAND2
193        KM   SUBAREA SAND2 (SAND CREEK)
194        BA  1.5520
195        LS       0      79
196        UD    2.02
           *
```



```
LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

197        KK   156TH
198        KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
199        HC       2
           *

200        KK  RSAND3
201        KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
202        RT                      4
           *

203        KK   SAND3
204        KM   SUBAREA SAND3 (SAND CREEK)
205        BA  1.9192
206        LS       0      79
207        UD    2.02
           *

208        KK  SR238S
209        KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
210        HC       2
           *

211        KK   SAND4
212        KM   SUBAREA SAND4 (SAND CREEK)
213        BA  1.0401
214        LS       0      79
215        UD    2.06
           *

216        KK   238DS
217        KM        COMBINE SR238S AND SAND4 (SAND CREEK)
218        HC       2
           *

219        KK  RSAND5
220        KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
221        RT                     13
           *

222        KK   SAND5
223        KM   SUBAREA SAND5 (SAND CREEK)
224        BA  2.0438
225        LS       0      79
226        UD    2.49
           *

227        KK   MARIL
228        KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
229        HC       2
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 230        KK  RSAND6
 231        KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
 232        RT                     8
            *

 233        KK   SAND6
 234        KM   SUBAREA SAND6 (SAND CREEK)
 235        BA  2.1594
 236        LS       0      79
 237        UD    1.67
            *

 238        KK  I69SAN
 239        KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
 240        HC       2
            *

 241        KK  RSAND7
 242        KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
 243        RT                     7
            *

 244        KK   SAND7
 245        KM   SUBAREA SAND7 (SAND CREEK)
 246        BA  1.6857
 247        LS       0      76
 248        UD    1.63
            *

 249        KK    SAND
 250        KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
 251        HC       2
            *

 252        KK   106TH
 253        KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
 254        HC       2
            *

 255        KK  RMUD11
 256        KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
 257        RT                     9
            *

 258        KK   MUD11
 259        KM   SUBAREA MUD11 (MUD CREEK)
 260        BA  1.4567
 261        LS       0      74
 262        UD    1.37
            *
```



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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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263          KK    96TH
264          KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
265          HC       2
             *

266          KK  RMUD12
267          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
268          RT                      2
             *

269          KK   MUD12
270          KM   SUBAREA MUD12 (MUD CREEK)
271          BA  1.5478
272          LS       0      71
273          UD    2.47
             *

274          KK    86TH
275          KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
276          HC       2
             *

277          KK  RMUD13
278          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
279          RT                      4
             *

280          KK   MUD13
281          KM   SUBAREA MUD13 (MUD CREEK)
282          BA  1.8392
283          LS       0      76
284          UD    1.38
             *

285          KK    GAGE
286          KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
287          HC       2
             *
288          ZZ
```

1

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     SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7      HNRY1
               .
               .
   16          .        MUD1
               .           V
               .           V
               .      RMUD2A
               .           .
               .           .
   24        ADD1............
               V
               V
   27      RMUD2B
```

```
          .
          .
30        .        MUD2
          .           .
          .           .
35    SR13US............
          .
          .
38        .      KYNET1
          .           V
          .           V
43        .       RKYN2
          .           .
          .           .
46        .           .      KYNET2
          .           .           .
          .           .           .
51        .      KYNETT............
          .           .
          .           .
54    SR13DS............
          V
          V
57     RMUD3
          .
          .
60        .        MUD3
          .           .
          .           .
       SR38............
          V
          V
68     RMUD4
          .
          .
71        .        MUD4
          .           .
          .           .
76     HAMCO............
          V
          V
79    RMUD5A
          .
          .
82        .       TRIB1
          .           V
          .           V
87        .      RTRIB2
          .           .
          .           .
90        .           .       TRIB2
          .           .           .
          .           .           .
          .        TRIB............
          .           .
          .           .
98       ADD2............
          V
          V
101   RMUD5B
```

```
            .
            .
104         .        MUD5
            .           .
            .           .
109     I69MUD............
            V
            V
112     RMUD6A
            .
            .
115         .        MUD7
            .           .
            .           .
120     SR238M............
            V
            V
123     RMUD6B
            .
            .
126         .        MUD6
            .           .
            .           .
131      126TH............
            V
            V
134      RMUD8
            .
            .
            .        MUD8
            .           .
            .           .
142      BROOK............
            V
            V
145      RMUD9
            .
            .
148         .        MUD9
            .           .
            .           .
153     KLEPFR............
            V
            V
156     RMD10A
            .
            .
159         .       HIGH1
            .           V
            .           V
164         .       PHIGH
            .           .
            .           .
          HIGH............
            V
            V
173     RMD10B
            .
            .
176         .       MUD10
```

```
        .          .
        .          .
181     MD106............
        .
        .
184     .     SAND1
        .         V
        .         V
189     .    RSAND2
        .         .
        .         .
192     .         .      SAND2
        .         .         .
        .         .         .
197     .     156TH............
        .         V
        .         V
200     .    RSAND3
        .         .
        .         .
203     .         .      SAND3
        .         .         .
        .         .         .
208     .    SR238S...........
        .         .
        .         .
211     .         .      SAND4
        .         .         .
        .         .         .
        .     238DS............
        .         V
        .         V
219     .    RSAND5
        .         .
        .         .
222     .         .      SAND5
        .         .         .
        .         .         .
227     .     MARIL............
        .         V
        .         V
230     .    RSAND6
        .         .
        .         .
233     .         .      SAND6
        .         .         .
        .         .         .
238     .    I69SAN...........
        .         V
        .         V
241     .    RSAND7
        .         .
        .         .
        .         .      SAND7
        .         .         .
        .         .         .
249     .      SAND...........
        .         .
        .         .
252     106TH............
```

```
              V
              V
         RMUD11
              .
              .
  258         .       MUD11
              .           .
              .           .
  263       96TH............
              V
              V
  266     RMUD12
              .
              .
  269         .       MUD12
              .           .
              .           .
  274       86TH............
              V
              V
  277     RMUD13
              .
              .
  280         .       MUD13
              .           .
              .           .
  285       GAGE............

     RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*           SEPTEMBER 1990              *
*            VERSION 4.0                *
*                                       *
* RUN DATE  01/29/1997  TIME  11:40:26  *
*                                       *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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                    MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
                    CBBEL: 96-297 DLM 21JAN97  ** EXISTING COND. **  FILE: EXIST.HC1

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT           HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      4    0  ENDING DATE
                     NDTIME       0245  ENDING TIME
                      ICENT         19  CENTURY MARK
```

COMPUTATION INTERVAL .25 HOURS
TOTAL TIME BASE 74.75 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.51 .64 .73 .83 .93 1.00

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .51	RATIO 2 .64	RATIO 3 .73	RATIO 4 .83	RATIO 5 .93	RATIO 6 1.00
HYDROGRAPH AT										
	HNRY1	1.52	1	FLOW	101.	150.	185.	226.	268.	297.
				TIME	19.75	19.50	19.50	19.25	19.25	19.25
HYDROGRAPH AT										
	MUD1	3.33	1	FLOW	237.	351.	434.	529.	625.	693.
				TIME	18.75	18.75	18.50	18.50	18.50	18.50
ROUTED TO										
	RMUD2A	3.33	1	FLOW	237.	351.	434.	529.	625.	693.
				TIME	19.75	19.75	19.50	19.50	19.50	19.50
2 COMBINED AT										
+	ADD1	4.85	1	FLOW	338.	501.	620.	755.	892.	990.
				TIME	19.75	19.50	19.50	19.50	19.25	19.25
ROUTED TO										
+	RMUD2B	4.85	1	FLOW	338.	501.	620.	755.	892.	990.
				TIME	20.25	20.00	20.00	20.00	19.75	19.75
HYDROGRAPH AT										
	MUD2	1.37	1	FLOW	113.	164.	201.	242.	284.	313.
				TIME	18.00	18.00	18.00	17.75	17.75	17.75
MBINED AT										
	SR13US	6.22	1	FLOW	432.	638.	787.	958.	1131.	1254.
				TIME	20.00	19.75	19.50	19.50	19.50	19.25
HYDROGRAPH AT										
	KYNET1	1.14	1	FLOW	88.	129.	159.	192.	226.	250.
				TIME	18.25	18.25	18.25	18.00	18.00	18.00

ROUTED TO										
+	RKYN2	1.14	1	FLOW	88.	129.	159.	192.	226.	250.
				TIME	19.25	19.25	19.25	19.00	19.00	19.00
HYDROGRAPH AT										
+	KYNET2	1.15	1	FLOW	96.	140.	171.	207.	243.	268.
				TIME	17.75	17.50	17.50	17.50	17.50	17.25
2 COMBINED AT										
	KYNETT	2.29	1	FLOW	174.	256.	316.	383.	451.	499.
				TIME	18.25	18.00	18.00	18.00	18.00	18.00
2 COMBINED AT										
	SR13DS	8.50	1	FLOW	594.	877.	1081.	1315.	1552.	1720.
				TIME	19.50	19.25	19.25	19.00	19.00	19.00
ROUTED TO										
	RMUD3	8.50	1	FLOW	594.	877.	1081.	1315.	1552.	1720.
				TIME	20.00	19.75	19.75	19.50	19.50	19.50
HYDROGRAPH AT										
+	MUD3	1.73	1	FLOW	115.	170.	210.	255.	301.	333.
				TIME	20.25	20.00	19.75	19.75	19.75	19.75
2 COMBINED AT										
+	SR38	10.24	1	FLOW	709.	1047.	1291.	1569.	1853.	2053.
				TIME	20.00	19.75	19.75	19.50	19.50	19.50
ROUTED TO										
	RMUD4	10.24	1	FLOW	709.	1047.	1291.	1569.	1853.	2053.
				TIME	20.75	20.50	20.50	20.25	20.25	20.25
HYDROGRAPH AT										
	MUD4	1.89	1	FLOW	155.	224.	275.	331.	388.	429.
				TIME	18.25	18.00	18.00	18.00	18.00	18.00
2 COMBINED AT										
	HAMCO	12.13	1	FLOW	834.	1228.	1515.	1840.	2172.	2407.
				TIME	20.50	20.25	20.00	20.00	19.75	19.75
ROUTED TO										
+	RMUD5A	12.13	1	FLOW	834.	1228.	1515.	1840.	2172.	2407.
				TIME	21.50	21.25	21.00	21.00	20.75	20.75
HYDROGRAPH AT										
+	TRIB1	1.72	1	FLOW	131.	190.	233.	282.	331.	366.
				TIME	19.00	19.00	18.75	18.75	18.75	18.50
ROUTED TO										
+	RTRIB2	1.72	1	FLOW	131.	190.	233.	282.	331.	366.
				TIME	20.00	20.00	19.75	19.75	19.75	19.50
JGRAPH AT										
+	TRIB2	1.10	1	FLOW	92.	133.	163.	196.	230.	254.
				TIME	18.00	17.75	17.75	17.75	17.75	17.75
2 COMBINED AT										
+	TRIB	2.82	1	FLOW	210.	306.	375.	454.	534.	590.
				TIME	19.25	19.00	18.75	18.75	18.75	18.50

2 COMBINED AT										
	ADD2	14.95	1	FLOW	1021.	1502.	1850.	2247.	2650.	2936.
				TIME	21.00	20.75	20.75	20.50	20.50	20.50
ROUTED TO										
+	RMUD5B	14.95	1	FLOW	1021.	1502.	1850.	2247.	2650.	2936.
				TIME	22.00	21.75	21.75	21.50	21.50	21.50
HYDROGRAPH AT										
+	MUD5	2.04	1	FLOW	155.	230.	284.	346.	409.	454.
				TIME	17.75	17.75	17.50	17.50	17.50	17.50
2 COMBINED AT										
	I69MUD	17.00	1	FLOW	1107.	1630.	2008.	2439.	2878.	3187.
				TIME	21.75	21.50	21.50	21.25	21.25	21.25
ROUTED TO										
	RMUD6A	17.00	1	FLOW	1107.	1630.	2008.	2439.	2878.	3187.
				TIME	22.00	21.75	21.75	21.50	21.50	21.50
HYDROGRAPH AT										
	MUD7	.84	1	FLOW	73.	106.	129.	155.	181.	200.
				TIME	17.75	17.50	17.50	17.50	17.50	17.50
2 COMBINED AT										
+	SR238M	17.84	1	FLOW	1146.	1685.	2076.	2521.	2973.	3294.
				TIME	22.00	21.75	21.50	21.50	21.25	21.25
ROUTED TO										
+	RMUD6B	17.84	1	FLOW	1146.	1685.	2076.	2521.	2973.	3294.
				TIME	22.75	22.50	22.25	22.25	22.00	22.00
HYDROGRAPH AT										
	MUD6	1.31	1	FLOW	92.	139.	174.	213.	253.	282.
				TIME	17.75	17.50	17.50	17.50	17.50	17.25
2 COMBINED AT										
	126TH	19.15	1	FLOW	1190.	1751.	2158.	2620.	3092.	3425.
				TIME	22.50	22.25	22.25	22.00	22.00	22.00
ROUTED TO										
	RMUD8	19.15	1	FLOW	1190.	1751.	2158.	2620.	3092.	3425.
				TIME	23.50	23.25	23.25	23.00	23.00	23.00
HYDROGRAPH AT										
+	MUD8	2.26	1	FLOW	199.	287.	350.	421.	493.	544.
				TIME	17.25	17.25	17.00	17.00	17.00	17.00
2 COMBINED AT										
+	BROOK	21.41	1	FLOW	1259.	1851.	2279.	2766.	3263.	3614.
				TIME	23.50	23.25	23.00	23.00	22.75	22.75
ROUTED TO										
	RMUD9	21.41	1	FLOW	1259.	1851.	2279.	2766.	3263.	3614.
				TIME	24.75	24.50	24.25	24.25	24.00	24.00
HYDROGRAPH AT										
+	MUD9	1.67	1	FLOW	143.	207.	253.	305.	358.	395.
				TIME	17.50	17.50	17.25	17.25	17.25	17.25

MBINED AT										
	KLEPFR	23.08	1	FLOW	1306.	1918.	2360.	2865.	3378.	3740.
				TIME	24.50	24.25	24.25	24.00	24.00	23.75
ROUTED TO										
	RMD10A	23.08	1	FLOW	1306.	1918.	2360.	2865.	3378.	3740.
				TIME	25.75	25.50	25.50	25.25	25.25	25.00
HYDROGRAPH AT										
	HIGH1	1.29	1	FLOW	118.	169.	205.	245.	286.	315.
				TIME	17.50	17.50	17.50	17.25	17.25	17.25
ROUTED TO										
	PHIGH	1.29	1	FLOW	10.	14.	18.	23.	32.	39.
				TIME	27.00	26.75	26.75	26.75	26.50	26.25
			** PEAK STAGES IN FEET **							
			1	STAGE	782.06	782.65	783.08	783.56	784.02	784.34
				TIME	27.00	26.75	26.75	26.75	26.50	26.25
2 COMBINED AT										
	HIGH	24.37	1	FLOW	1316.	1932.	2378.	2888.	3409.	3778.
				TIME	25.75	25.50	25.50	25.25	25.25	25.00
ROUTED TO										
	RMD10B	24.37	1	FLOW	1316.	1932.	2378.	2888.	3409.	3778.
				TIME	26.75	26.50	26.50	26.25	26.25	26.00
HYDROGRAPH AT										
	MUD10	1.82	1	FLOW	121.	185.	231.	284.	339.	377.
				TIME	18.00	18.00	17.75	17.75	17.75	17.75
2 COMBINED AT										
	MD106	26.19	1	FLOW	1338.	1970.	2426.	2949.	3484.	3862.
				TIME	26.50	26.25	26.25	26.00	26.00	26.00
HYDROGRAPH AT										
	SAND1	.98	1	FLOW	79.	116.	142.	172.	202.	223.
				TIME	18.00	17.75	17.75	17.75	17.75	17.75
ROUTED TO										
	RSAND2	.98	1	FLOW	79.	116.	142.	172.	202.	223.
				TIME	19.00	18.75	18.75	18.75	18.75	18.75
HYDROGRAPH AT										
	SAND2	1.55	1	FLOW	128.	186.	228.	276.	324.	358.
				TIME	17.75	17.75	17.50	17.50	17.50	17.50
2 COMBINED AT										
	156TH	2.53	1	FLOW	202.	296.	363.	439.	517.	571.
				TIME	18.25	18.00	18.00	18.00	17.75	17.75
ROUTED TO										
	RSAND3	2.53	1	FLOW	202.	296.	363.	439.	517.	571.
				TIME	19.25	19.00	19.00	19.00	18.75	18.75
HYDROGRAPH AT										
	SAND3	1.92	1	FLOW	158.	230.	282.	341.	401.	443.
				TIME	17.75	17.75	17.50	17.50	17.50	17.50

2 COMBINED AT										
+	SR238S	4.45	1	FLOW	348.	509.	626.	758.	893.	988.
				TIME	18.50	18.25	18.25	18.25	18.00	18.00
HYDROGRAPH AT										
+	SAND4	1.04	1	FLOW	85.	124.	152.	184.	217.	239.
				TIME	17.75	17.75	17.75	17.50	17.50	17.50
2 COMBINED AT										
	238DS	5.49	1	FLOW	430.	631.	776.	940.	1106.	1223.
				TIME	18.25	18.25	18.00	18.00	18.00	18.00
ROUTED TO										
	RSAND5	5.49	1	FLOW	430.	631.	776.	940.	1106.	1223.
				TIME	21.50	21.50	21.25	21.25	21.25	21.25
HYDROGRAPH AT										
	SAND5	2.04	1	FLOW	161.	235.	289.	350.	411.	455.
				TIME	18.25	18.00	18.00	18.00	18.00	17.75
2 COMBINED AT										
+	MARIL	7.54	1	FLOW	544.	796.	977.	1182.	1391.	1538.
				TIME	21.25	21.00	21.00	20.75	20.75	20.75
ROUTED TO										
+	RSAND6	7.54	1	FLOW	544.	796.	977.	1182.	1391.	1538.
				TIME	23.25	23.00	23.00	22.75	22.75	22.75
HYDROGRAPH AT										
	SAND6	2.16	1	FLOW	184.	267.	326.	394.	462.	510.
				TIME	17.50	17.50	17.25	17.25	17.25	17.25
2 COMBINED AT										
	I69SAN	9.70	1	FLOW	621.	905.	1110.	1342.	1577.	1744.
				TIME	23.00	22.75	22.75	22.50	22.50	22.50
ROUTED TO										
	RSAND7	9.70	1	FLOW	621.	905.	1110.	1342.	1577.	1744.
				TIME	24.75	24.50	24.50	24.25	24.25	24.25
HYDROGRAPH AT										
+	SAND7	1.69	1	FLOW	126.	188.	233.	284.	337.	374.
				TIME	17.50	17.50	17.50	17.25	17.25	17.25
2 COMBINED AT										
+	SAND	11.38	1	FLOW	663.	967.	1186.	1434.	1686.	1864.
				TIME	24.50	24.25	24.25	24.00	24.00	24.00
2 COMBINED AT										
	106TH	37.57	1	FLOW	1940.	2859.	3524.	4281.	5058.	5607.
				TIME	25.50	25.25	25.25	25.00	25.00	25.00
ROUTED TO										
	RMUD11	37.57	1	FLOW	1940.	2859.	3524.	4281.	5058.	5607.
				TIME	27.75	27.50	27.50	27.25	27.25	27.25
HYDROGRAPH AT										
	MUD11	1.46	1	FLOW	101.	154.	193.	237.	282.	313.
				TIME	17.50	17.25	17.25	17.25	17.25	17.25

MBINED AT										
	96TH	39.03	1	FLOW	1942.	2862.	3527.	4287.	5065.	5615.
				TIME	27.75	27.50	27.50	27.25	27.25	27.25
ROUTED TO										
	RMUD12	39.03	1	FLOW	1942.	2862.	3527.	4287.	5065.	5615.
				TIME	28.25	28.00	28.00	27.75	27.75	27.75
HYDROGRAPH AT										
	MUD12	1.55	1	FLOW	80.	129.	165.	207.	250.	282.
				TIME	18.50	18.25	18.25	18.25	18.00	18.00
2 COMBINED AT										
	86TH	40.57	1	FLOW	1950.	2875.	3545.	4310.	5092.	5648.
				TIME	28.25	28.00	27.75	27.75	27.75	27.50
ROUTED TO										
+	RMUD13	40.57	1	FLOW	1950.	2875.	3545.	4310.	5092.	5648.
				TIME	29.25	29.00	28.75	28.75	28.75	28.50
HYDROGRAPH AT										
+	MUD13	1.84	1	FLOW	140.	210.	259.	316.	373.	414.
				TIME	17.25	17.25	17.25	17.25	17.25	17.00
2 COMBINED AT										
	GAGE	42.41	1	FLOW	1950.	2876.	3546.	4311.	5094.	5650.
				TIME	29.25	29.00	28.75	28.75	28.50	28.50

*** NORMAL END OF HEC-1 ***

APPENDIX 7

Future-Condition Hydrologic Model Input/Output - Alternative 1

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  02/10/1997  TIME  16:41:19 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 27JAN97  ** FUTURE COND. **  FILE: ALT1.HC1
              *DIAGRAM
  3           IT      15 01JAN00    0000     300
  4           IN      72
  5           IO       5
  6           JR    PREC    1.00
              *
              *  ****************************************************************
              *  *                                                              *
              *  * HUFF 3RD QUARTILE DISTRIBUTION                               *
              *  * ---------------------------------------------------------    *
              *  *   RATIO 1:  100-YEAR STORM FREQUENCY                         *
              *  ****************************************************************
              *

  7           KK   HNRY1
  8           KM   SUBAREA HNRY1 (HENRY DITCH)
  9           PB    5.75
 10           PC     0.0     2.6     5.3     8.4    11.6    14.3    17.1    20.7    24.2    31.0
 11           PC    37.8    48.1    58.3    68.2    78.0    83.4    88.7    92.0    95.3    97.7
 12           PC   100.0
```

```
13          BA  1.5211
14          LS       0      78
15          UD    3.79
            *

16          KK    MUD1
17          KM   SUBAREA MUD1 (MUD CREEK)
18          BA  3.3292
19          LS       0      78
20          UD    3.02
            *

21          KK  RMUD2A
22          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
23          RT                      4
            *

24          KK    ADD1
25          KM        COMBINE RMUD2A AND HENRY1
26          HC       2
            *

27          KK  RMUD2B
28          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
29          RT                      2
            *

30          KK    MUD2
31          KM   SUBAREA MUD2 (MUD CREEK)
32          BA  1.3655
33          LS       0      80
34          UD    2.39
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

35          KK  SR13US
36          KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
37          HC       2
            *

38          KK  KYNET1
39          KM   SUBAREA KYNET1 (KYNETT DITCH)
40          BA  1.1386
41          LS       0      79
42          UD    2.65
            *

43          KK   RKYN2
44          KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
45          RT                      4
            *

46          KK  KYNET2
47          KM   SUBAREA KNET2 (KYNETT DITCH)
48          BA  1.1498
49          LS       0      79
50          UD    1.86
```

```
          *

 51       KK  KYNETT
 52       KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
 53       HC       2
          *

 54       KK  SR13DS
 55       KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
 56       HC       2
          *

 57       KK   RMUD3
 58       KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
 59       RT                      2
          *

 60       KK    MUD3
 61       KM   SUBAREA MUD3 (MUD CREEK)
 62       BA  1.7324
 63       LS       0      79
 64       UD    4.28
          *

 65       KK    SR38
 66       KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
 67       HC       2
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 68       KK   RMUD4
 69       KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
 70       RT                      3
          *

 71       KK    MUD4
 72       KM   SUBAREA MUD4 (MUD CREEK)
 73       BA  1.8948
 74       LS       0      80
 75       UD    2.56
          *

 76       KK   HAMCO
 77       KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
 78       HC       2
          *

 79       KK  RMUD5A
 80       KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
 81       RT                      4
          *

 82       KK   TRIB1
 83       KM   SUBAREA TRIB1 (UNNAMED TRIB)
 84       BA  1.7235
 85       LS       0      80
 86       UD    3.34
```

```
          *

 87       KK  RTRIB2
 88       KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
 89       RT                      4
          *

 90       KK   TRIB2
 91       KM   SUBAREA TRIB2 (UNNAMED TRIB)
 92       BA  1.0964
 93       LS       0      81
 94       UD    1.36
          *

 95       KK    TRIB
 96       KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
 97       HC       2
          *

 98       KK    ADD2
 99       KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
100       HC       2
          *
                                HEC-1 INPUT                                          PAGE  4

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


101       KK  RMUD5B
102       KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
103       RT                      4
          *

104       KK    MUD5
105       KM   SUBAREA  MUD5 (MUD CREEK)
106       BA  2.0442
107       LS       0      82
108       UD    1.16
          *

109       KK  I69MUD
110       KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
111       HC       2
          *

112       KK  RMUD6A
113       KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
114       RT                      1
          *

115       KK    MUD7
116       KM   SUBAREA  MUD7 (MUD CREEK)
117       BA  0.8429
118       LS       0      80
119       UD    1.15
          *

120       KK  SR238M
121       KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
122       HC       2
```

```
*

KK  RMUD6B
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
RT                      3
*

KK    MUD6
KM   SUBAREA  MUD6 (MUD CREEK)
BA  1.3121
LS       0      79
UD    1.04
*

KK   126TH
KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
HC       2
*
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK   RMUD8
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
RT                      4
*

KK    MUD8
KM   SUBAREA  MUD8 (MUD CREEK)
BA  2.2573
LS       0      79
UD    0.79
*

KK   BROOK
KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
HC       2
*

KK   RMUD9
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
RT                      5
*

KK    MUD9
KM   SUBAREA  MUD9 (MUD CREEK)
BA  1.6690
LS       0      81
UD    0.98
*

KK  KLEPFR
KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
HC       2
*

KK  RMD10A
KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
RT                      5
```

```
*

KK   HIGH1
KM   SUBAREA HIGH1 (HIGH DITCH)
BA  1.2943
LS       0      81
UD    1.09
*

KK   PHIGH
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH HIGH DITCH POND
RS       1    ELEV   780.8
SQ     0.0     20.     40.     70.    100.    130.    160.    200.
SV     0.0    163.    227.    309.    355.    367.    375.    383.
SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK    HIGH
KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
HC       2
*

KK  RMD10B
KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
RT                      4
*

KK   MUD10
KM   SUBAREA MUD10 (MUD CREEK)
BA  1.8169
LS       0      79
UD    1.32
*

KK   MD106
KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
HC       2
*

KK   SAND1
KM   SUBAREA SAND1 (SAND CREEK)
BA  0.9822
LS       0      79
UD    2.22
*

KK  RSAND2
KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
RT                      4
*

KK   SAND2
KM   SUBAREA SAND2 (SAND CREEK)
BA  1.5520
LS       0      79
UD    1.21
```

```
*

KK   156TH
KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
HC       2
*

KK  RSAND3
KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
RT                     4
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK   SAND3
KM   SUBAREA SAND3 (SAND CREEK)
BA  1.9192
LS       0      85
UD    1.21
*

KK  SR238S
KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
HC       2
*

KK   SAND4
KM   SUBAREA SAND4 (SAND CREEK)
BA  1.0401
LS       0      83
UD    1.24
*

KK   238DS
KM        COMBINE SR238S AND SAND4 (SAND CREEK)
HC       2
*

KK  RSAND5
KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
RT                    13
*

KK   SAND5
KM   SUBAREA SAND5 (SAND CREEK)
BA  2.0438
LS       0      86
UD    1.49
*

KK   MARIL
KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
HC       2
*

KK  RSAND6
KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
RT                     8
```

```
*

KK   SAND6
KM   SUBAREA SAND6 (SAND CREEK)
BA  2.1594
LS       0      84
UD    1.00
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  I69SAN
KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
HC       2
*

KK  RSAND7
KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
RT                      7
*

KK   SAND7
KM   SUBAREA SAND7 (SAND CREEK)
BA  1.6857
LS       0      79
UD    0.98
*

KK    SAND
KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
HC       2
*

KK   106TH
KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
HC       2
*

KK  RMUD11
KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
RT                      9
*

KK   MUD11
KM   SUBAREA MUD11 (MUD CREEK)
BA  1.4567
LS       0      79
UD    0.82
*

KK    96TH
KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
HC       2
*

KK  RMUD12
KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
RT                      2
```

```
                 *
LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 269             KK   MUD12
 270             KM   SUBAREA MUD12 (MUD CREEK)
 271             BA  1.5478
 272             LS       0      71
 273             UD    2.47
                 *

 274             KK    86TH
 275             KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
 276             HC       2
                 *

 277             KK  RMUD13
 278             KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
 279             RT                      4
                 *

 280             KK   MUD13
 281             KM   SUBAREA MUD13 (MUD CREEK)
 282             BA  1.8392
 283             LS       0      76
 284             UD    1.38
                 *

 285             KK    GAGE
 286             KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
 287             HC       2
                 *
 288             ZZ

          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7       HNRY1
              .
              .
  16          .        MUD1
              .           V
              .           V
  21          .      RMUD2A
              .           .
              .           .
  24        ADD1............
               V
               V
         RMUD2B
              .
              .
  30          .        MUD2
              .           .
              .           .
```

```
35      SR13US............
             .
             .
38           .      KYNET1
             .           V
             .           V
43           .       RKYN2
             .           .
             .           .
46           .           .      KYNET2
             .           .           .
             .           .           .
51           .      KYNETT............
             .           .
             .           .
54      SR13DS............
             V
             V
57       RMUD3
             .
             .
60           .        MUD3
             .           .
             .           .
65        SR38............
             V
             V
68       RMUD4
             .
             .
71           .        MUD4
             .           .
             .           .
76       HAMCO............
             V
             V
79      RMUD5A
             .
             .
82           .       TRIB1
             .           V
             .           V
87           .      RTRIB2
             .           .
             .           .
90           .           .       TRIB2
             .           .           .
             .           .           .
95           .        TRIB............
             .           .
             .           .
98        ADD2............
             V
             V
        RMUD5B
             .
             .
104          .        MUD5
             .           .
             .           .
```

```
109     169MUD............
            V
            V
112     RMUD6A
            .
            .
115         .        MUD7
            .           .
            .           .
120     SR238M............
            V
            V
123     RMUD6B
            .
            .
126         .        MUD6
            .           .
            .           .
131      126TH............
            V
            V
134      RMUD8
            .
            .
137         .        MUD8
            .           .
            .           .
142      BROOK............
            V
            V
145      RMUD9
            .
            .
148         .        MUD9
            .           .
            .           .
153     KLEPFR............
            V
            V
156     RMD10A
            .
            .
159         .       HIGH1
            .           V
            .           V
164         .       PHIGH
            .           .
            .           .
170       HIGH............
            V
            V
173     RMD10B
            .
            .
            .       MUD10
            .           .
            .           .
181      MD106............
            .
            .
```

```
184          .        SAND1
             .           V
             .           V
189          .      RSAND2
             .           .
             .           .
192          .           .       SAND2
             .           .           .
             .           .           .
197          .       156TH............
             .           V
             .           V
200          .      RSAND3
             .           .
             .           .
203          .           .       SAND3
             .           .           .
             .           .           .
208          .      SR238S...........
             .           .
             .           .
211          .           .       SAND4
             .           .           .
             .           .           .
216          .       238DS............
             .           V
             .           V
219          .      RSAND5
             .           .
             .           .
222          .           .       SAND5
             .           .           .
             .           .           .
227          .       MARIL............
             .           V
             .           V
230          .      RSAND6
             .           .
             .           .
233          .           .       SAND6
             .           .           .
             .           .           .
238          .      I69SAN...........
             .           V
             .           V
241          .      RSAND7
             .           .
             .           .
244          .           .       SAND7
             .           .           .
             .           .           .
249          .        SAND............
             .           .
             .           .
?        106TH............
             V
             V
255      RMUD11
             .
             .
```

```
258          .       MUD11
             .           .
             .           .
263       96TH............
             V
             V
266     RMUD12
             .
             .
269          .       MUD12
             .           .
             .           .
274       86TH............
             V
             V
277     RMUD13
             .
             .
280          .       MUD13
             .           .
             .           .
285       GAGE............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  02/10/1997  TIME  16:41:19 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
CBBEL: 96-297 DLM 27JAN97 ** FUTURE COND. ** FILE: ALT1.HC1

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1JAN 0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     4JAN 0  ENDING DATE
                     NDTIME       0245  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .25 HOURS
                      TOTAL TIME BASE   74.75 HOURS

         ENGLISH UNITS
              DRAINAGE AREA        SQUARE MILES
```

PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00
HYDROGRAPH AT					
	HNRY1	1.52	1	FLOW	297.
				TIME	19.25
HYDROGRAPH AT					
	MUD1	3.33	1	FLOW	693.
				TIME	18.50
ROUTED TO					
	RMUD2A	3.33	1	FLOW	693.
				TIME	19.50
2 COMBINED AT					
+	ADD1	4.85	1	FLOW	990.
				TIME	19.25
ROUTED TO					
+	RMUD2B	4.85	1	FLOW	990.
				TIME	19.75
HYDROGRAPH AT					
+	MUD2	1.37	1	FLOW	313.
				TIME	17.75
2 COMBINED AT					
	SR13US	6.22	1	FLOW	1254.
				TIME	19.25
HYDROGRAPH AT					
	KYNET1	1.14	1	FLOW	250.
				TIME	18.00
ROUTED TO					
+	RKYN2	1.14	1	FLOW	250.
				TIME	19.00

HYDROGRAPH AT					
+	KYNET2	1.15	1	FLOW	268.
				TIME	17.25
MBINED AT					
	KYNETT	2.29	1	FLOW	499.
				TIME	18.00
2 COMBINED AT					
	SR13DS	8.50	1	FLOW	1720.
				TIME	19.00
ROUTED TO					
	RMUD3	8.50	1	FLOW	1720.
				TIME	19.50
HYDROGRAPH AT					
+	MUD3	1.73	1	FLOW	333.
				TIME	19.75
2 COMBINED AT					
+	SR38	10.24	1	FLOW	2053.
				TIME	19.50
ROUTED TO					
	RMUD4	10.24	1	FLOW	2053.
				TIME	20.25
HYDROGRAPH AT					
	MUD4	1.89	1	FLOW	429.
				TIME	18.00
2 COMBINED AT					
	HAMCO	12.13	1	FLOW	2407.
				TIME	19.75
ROUTED TO					
+	RMUD5A	12.13	1	FLOW	2407.
				TIME	20.75
HYDROGRAPH AT					
+	TRIB1	1.72	1	FLOW	366.
				TIME	18.50
ROUTED TO					
+	RTRIB2	1.72	1	FLOW	366.
				TIME	19.50
HYDROGRAPH AT					
	TRIB2	1.10	1	FLOW	274.
				TIME	17.00
2 COMBINED AT					
	TRIB	2.82	1	FLOW	576.
				TIME	17.75
2 COMBINED AT					
+	ADD2	14.95	1	FLOW	2902.
				TIME	20.50

ROUTED TO					
+	RMUD5B	14.95	1	FLOW	2902.
				TIME	21.50
GRAPH AT					
	MUD5	2.04	1	FLOW	524.
				TIME	17.00
2 COMBINED AT					
	I69MUD	17.00	1	FLOW	3114.
				TIME	21.25
ROUTED TO					
	RMUD6A	17.00	1	FLOW	3114.
				TIME	21.50
HYDROGRAPH AT					
+	MUD7	.84	1	FLOW	208.
				TIME	17.00
2 COMBINED AT					
+	SR238M	17.84	1	FLOW	3197.
				TIME	21.50
ROUTED TO					
	RMUD6B	17.84	1	FLOW	3197.
				TIME	22.25
HYDROGRAPH AT					
	MUD6	1.31	1	FLOW	320.
				TIME	17.00
2 COMBINED AT					
	126TH	19.15	1	FLOW	3315.
				TIME	22.00
ROUTED TO					
+	RMUD8	19.15	1	FLOW	3315.
				TIME	23.00
HYDROGRAPH AT					
+	MUD8	2.26	1	FLOW	555.
				TIME	16.75
2 COMBINED AT					
+	BROOK	21.41	1	FLOW	3474.
				TIME	23.00
ROUTED TO					
-	RMUD9	21.41	1	FLOW	3474.
				TIME	24.25
HYDROGRAPH AT					
-	MUD9	1.67	1	FLOW	423.
				TIME	16.75
2 COMBINED AT					
+	KLEPFR	23.08	1	FLOW	3587.
				TIME	24.00

```
ROUTED TO
+                RMD10A     23.08     1   FLOW        3587.
                                          TIME       25.25

     GRAPH AT
                 HIGH1       1.29     1   FLOW         327.
                                          TIME       17.00

ROUTED TO
                 PHIGH       1.29     1   FLOW          39.
                                          TIME       25.25

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE      784.36
                                          TIME       25.25

 2 COMBINED AT
+                 HIGH      24.37     1   FLOW        3626.
                                          TIME       25.25

ROUTED TO
+                RMD10B     24.37     1   FLOW        3626.
                                          TIME       26.25

HYDROGRAPH AT
                 MUD10       1.82     1   FLOW         438.
                                          TIME       17.00

 COMBINED AT
                 MD106      26.19     1   FLOW        3662.
                                          TIME       25.75

HYDROGRAPH AT
                 SAND1        .98     1   FLOW         223.
                                          TIME       17.75

ROUTED TO
+                RSAND2       .98     1   FLOW         223.
                                          TIME       18.75

HYDROGRAPH AT
+                 SAND2       1.55     1   FLOW         376.
                                          TIME       17.00

 2 COMBINED AT
                 156TH       2.53     1   FLOW         578.
                                          TIME       17.25

ROUTED TO
                 RSAND3      2.53     1   FLOW         578.
                                          TIME       18.25

HYDROGRAPH AT
                 SAND3       1.92     1   FLOW         516.
                                          TIME       16.75

 2 COMBINED AT
+                SR238S      4.45     1   FLOW        1056.
                                          TIME       17.25
```

```
HYDROGRAPH AT
                 SAND4      1.04     1   FLOW        270.
                                         TIME       17.00

     MBINED AT
                 238DS      5.49     1   FLOW       1323.
                                         TIME       17.25

ROUTED TO
                RSAND5      5.49     1   FLOW       1323.
                                         TIME       20.50

HYDROGRAPH AT
                 SAND5      2.04     1   FLOW        553.
                                         TIME       17.00

 2 COMBINED AT
+                MARIL      7.54     1   FLOW       1637.
                                         TIME       20.00

ROUTED TO
+               RSAND6      7.54     1   FLOW       1637.
                                         TIME       22.00

HYDROGRAPH AT
                 SAND6      2.16     1   FLOW        575.
                                         TIME       16.75

  COMBINED AT
                I69SAN      9.70     1   FLOW       1891.
                                         TIME       20.00

ROUTED TO
                RSAND7      9.70     1   FLOW       1891.
                                         TIME       21.75

HYDROGRAPH AT
+                SAND7      1.69     1   FLOW        411.
                                         TIME       16.75

 2 COMBINED AT
+                 SAND     11.38     1   FLOW       2047.
                                         TIME       21.50

 2 COMBINED AT
                 106TH     37.57     1   FLOW       5446.
                                         TIME       24.25

ROUTED TO
                RMUD11     37.57     1   FLOW       5446.
                                         TIME       26.50

HYDROGRAPH AT
                 MUD11      1.46     1   FLOW        358.
                                         TIME       16.75

 2 COMBINED AT
+                 96TH     39.03     1   FLOW       5449.
                                         TIME       26.50
```

```
ROUTED TO
+                RMUD12     39.03     1   FLOW        5449.
                                          TIME       27.00

     GRAPH AT
                 MUD12       1.55     1   FLOW         282.
                                          TIME       18.00

  2 COMBINED AT
                  86TH      40.57     1   FLOW        5497.
                                          TIME       27.00

ROUTED TO
                RMUD13      40.57     1   FLOW        5497.
                                          TIME       28.00

HYDROGRAPH AT
+                MUD13       1.84     1   FLOW         414.
                                          TIME       17.00

  2 COMBINED AT
+                 GAGE      42.41     1   FLOW        5501.
                                          TIME       28.00


*** NORMAL END OF HEC-1 ***
```

APPENDIX 8

Future-Condition Hydrologic Model Input/Output - Alternative 2

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            SEPTEMBER 1990             *
             VERSION 4.0               *
*                                      *
*  RUN DATE  02/11/1997  TIME  14:43:35 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                                    PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT2.HC1
              *DIAGRAM
  3           IT      15 01JAN00    0000     300
  4           IN      72
  5           IO       5
  6           JR    PREC    1.00
              *
              *  ***************************************************************
              *  *                                                             *
              *  * HUFF 3RD QUARTILE DISTRIBUTION                              *
              *  * ---------------------------------------------------------   *
              *  *   RATIO 1:  100-YEAR STORM FREQUENCY                        *
              *  ***************************************************************
              *

  7           KK   HNRY1
  8           KM   SUBAREA HNRY1 (HENRY DITCH)
  9           PB    5.75
 10           PC     0.0     2.6     5.3     8.4    11.6    14.3    17.1    20.7    24.2    31.0
 11           PC    37.8    48.1    58.3    68.2    78.0    83.4    88.7    92.0    95.3    97.7
 12           PC   100.0
```

```
13          BA  1.5211
14          LS       0      78
15          UD    3.79
            *

16          KK    MUD1
17          KM   SUBAREA MUD1 (MUD CREEK)
18          BA  3.3292
19          LS       0      78
20          UD    3.02
            *

21          KK  RMUD2A
22          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
23          RT                      4
            *

24          KK    ADD1
25          KM        COMBINE RMUD2A AND HENRY1
26          HC       2
            *

27          KK  RMUD2B
28          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
29          RT                      2
            *

30          KK    MUD2
31          KM   SUBAREA MUD2 (MUD CREEK)
32          BA  1.3655
33          LS       0      80
34          UD    2.39
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

35          KK  SR13US
36          KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
37          HC       2
            *

38          KK  KYNET1
39          KM   SUBAREA KYNET1 (KYNETT DITCH)
40          BA  1.1386
41          LS       0      79
42          UD    2.65
            *

43          KK   RKYN2
44          KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
45          RT                      4
            *

46          KK  KYNET2
47          KM   SUBAREA KNET2 (KYNETT DITCH)
48          BA  1.1498
49          LS       0      79
50          UD    1.86
```

```
          *

51        KK  KYNETT
52        KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
53        HC       2
          *

54        KK  SR13DS
55        KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
56        HC       2
          *

57        KK   RMUD3
58        KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
59        RT                      2
          *

60        KK    MUD3
61        KM   SUBAREA MUD3 (MUD CREEK)
62        BA  1.7324
63        LS       0      79
64        UD    4.28
          *

65        KK    SR38
66        KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
67        HC       2
          *
1                                   HEC-1 INPUT                                          PAGE  3

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


68        KK   RMUD4
69        KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
70        RT                      3
          *

71        KK    MUD4
72        KM   SUBAREA MUD4 (MUD CREEK)
73        BA  1.8948
74        LS       0      80
75        UD    2.56
          *

76        KK   HAMCO
77        KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
78        HC       2
          *

79        KK  RMUD5A
80        KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
81        RT                      4
          *

82        KK   TRIB1
83        KM   SUBAREA TRIB1 (UNNAMED TRIB)
84        BA  1.7235
85        LS       0      80
86        UD    3.34
```

```
          *

 87       KK  RTRIB2
 88       KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
 89       RT                      4
          *

 90       KK   TRIB2
 91       KM   SUBAREA TRIB2 (UNNAMED TRIB)
 92       BA  1.0964
 93       LS       0      81
 94       UD    1.36
          *

 95       KK    TRIB
 96       KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
 97       HC       2
          *

 98       KK    ADD2
 99       KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
100       HC       2
          *
                                   HEC-1 INPUT                                          PAGE  4

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


101       KK  RMUD5B
102       KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
103       RT                      4
          *

104       KK    MUD5
105       KM   SUBAREA  MUD5 (MUD CREEK)
106       BA  2.0442
107       LS       0      82
108       UD    1.16
          *

109       KK  I69MUD
110       KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
111       HC       2
          *

112       KK  RMUD6A
113       KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
114       RT                      1
          *

115       KK    MUD7
116       KM   SUBAREA  MUD7 (MUD CREEK)
117       BA  0.8429
118       LS       0      80
119       UD    1.15
          *

120       KK  SR238M
121       KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
122       HC       2
```

```
*

KK  ONLINE
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH ON-LINE DETENTION
RS       1    ELEV      0.
SQ     0.0     54.    190.    420.    756.   1238.   1918.
SV     0.0    219.    438.    656.    875.   1312.   1750.
SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
*

KK  RMUD6B
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
RT                      3
*

KK    MUD6
KM   SUBAREA  MUD6 (MUD CREEK)
BA  1.3121
LS       0      79
UD    1.04
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


KK   126TH
KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
HC       2
*

KK   RMUD8
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
RT                      4
*

KK    MUD8
KM   SUBAREA  MUD8 (MUD CREEK)
BA  2.2573
LS       0      79
UD    0.79
*

KK   BROOK
KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
HC       2
*

KK   RMUD9
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
RT                      5
*

KK    MUD9
KM   SUBAREA  MUD9 (MUD CREEK)
BA  1.6690
LS       0      81
UD    0.98
*
```

```
159        KK  KLEPFR
160        KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
161        HC       2
           *

162        KK  RMD10A
163        KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
164        RT                      5
           *

165        KK   HIGH1
166        KM   SUBAREA HIGH1 (HIGH DITCH)
167        BA  1.2943
168        LS       0      81
169        UD    1.09
           *
```



```
LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

170        KK   PHIGH
171        KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH HIGH DITCH POND
172        RS       1    ELEV   780.8
173        SQ     0.0     20.     40.     70.    100.    130.    160.    200.
174        SV     0.0    163.    227.    309.    355.    367.    375.    383.
175        SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
           *

176        KK    HIGH
177        KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
178        HC       2
           *

179        KK  RMD10B
180        KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
181        RT                      4
           *

182        KK   MUD10
183        KM   SUBAREA MUD10 (MUD CREEK)
184        BA  1.8169
185        LS       0      79
186        UD    1.32
           *

187        KK   MD106
188        KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
189        HC       2
           *

190        KK   SAND1
191        KM   SUBAREA SAND1 (SAND CREEK)
192        BA  0.9822
193        LS       0      79
194        UD    2.22
           *

195        KK  RSAND2
196        KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
```

```
197          RT                        4
             *

198          KK   SAND2
199          KM   SUBAREA SAND2 (SAND CREEK)
200          BA  1.5520
201          LS       0      79
202          UD    1.21
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

203          KK   156TH
204          KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
205          HC       2
             *

206          KK  RSAND3
207          KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
208          RT                        4
             *

209          KK   SAND3
210          KM   SUBAREA SAND3 (SAND CREEK)
211          BA  1.9192
212          LS       0      85
213          UD    1.21
             *

214          KK  SR238S
215          KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
216          HC       2
             *

217          KK   SAND4
218          KM   SUBAREA SAND4 (SAND CREEK)
219          BA  1.0401
220          LS       0      83
221          UD    1.24
             *

222          KK   238DS
223          KM        COMBINE SR238S AND SAND4 (SAND CREEK)
224          HC       2
             *

225          KK  RSAND5
226          KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
227          RT                       13
             *

228          KK   SAND5
229          KM   SUBAREA SAND5 (SAND CREEK)
230          BA  2.0438
231          LS       0      86
232          UD    1.49
             *
```

```
233          KK   MARIL
234          KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
235          HC       2
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


236          KK  RSAND6
237          KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
238          RT                      8
             *

239          KK   SAND6
240          KM   SUBAREA SAND6 (SAND CREEK)
241          BA  2.1594
242          LS       0      84
243          UD    1.00
             *

244          KK  I69SAN
245          KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
246          HC       2
             *

247          KK  RSAND7
248          KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
249          RT                      7
             *

250          KK   SAND7
251          KM   SUBAREA SAND7 (SAND CREEK)
252          BA  1.6857
253          LS       0      79
254          UD    0.98
             *

255          KK    SAND
256          KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
257          HC       2
             *

258          KK   106TH
259          KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
260          HC       2
             *

261          KK  RMUD11
262          KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
263          RT                      9
             *

264          KK   MUD11
265          KM   SUBAREA MUD11 (MUD CREEK)
266          BA  1.4567
267          LS       0      79
268          UD    0.82
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 269          KK    96TH
 270          KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
 271          HC       2
              *

 272          KK  RMUD12
 273          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
 274          RT                      2
              *

 275          KK   MUD12
 276          KM   SUBAREA MUD12 (MUD CREEK)
 277          BA  1.5478
 278          LS       0      71
 279          UD    2.47
              *

 280          KK    86TH
 281          KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
 282          HC       2
              *

 283          KK  RMUD13
 284          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
 285          RT                      4
              *

 286          KK   MUD13
 287          KM   SUBAREA MUD13 (MUD CREEK)
 288          BA  1.8392
 289          LS       0      76
 290          UD    1.38
              *

 291          KK    GAGE
 292          KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
 293          HC       2
              *
              *
              *
 294          ZZ

          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7       HNRY1
              .
              .
   ?          .        MUD1
              .           V
              .           V
  21          .      RMUD2A
              .           .
```

```
          .           .
24      ADD1............
          V
          V
      RMUD2B
          .
          .
30        .        MUD2
          .           .
          .           .
35    SR13US............
          .
          .
38        .      KYNET1
          .           V
          .           V
43        .       RKYN2
          .           .
          .           .
46        .           .      KYNET2
          .           .           .
          .           .           .
51        .      KYNETT............
          .           .
          .           .
54    SR13DS............
          V
          V
57     RMUD3
          .
          .
60        .        MUD3
          .           .
          .           .
65      SR38............
          V
          V
68     RMUD4
          .
          .
71        .        MUD4
          .           .
          .           .
76     HAMCO............
          V
          V
79    RMUD5A
          .
          .
82        .       TRIB1
          .           V
          .           V
87        .      RTRIB2
          .           .
          .           .
          .           .       TRIB2
          .           .           .
          .           .           .
95        .        TRIB............
          .           .
```

```
          .           .
98      ADD2............
          V
          V
      RMUD5B
          .
          .
104       .        MUD5
          .           .
          .           .
109   I69MUD............
          V
          V
112   RMUD6A
          .
          .
115       .        MUD7
          .           .
          .           .
120   SR238M............
          V
          V
123   ONLINE
          V
          V
129   RMUD6B
          .
          .
132       .        MUD6
          .           .
          .           .
137     126TH............
          V
          V
140     RMUD8
          .
          .
143       .        MUD8
          .           .
          .           .
148     BROOK............
          V
          V
151     RMUD9
          .
          .
154       .        MUD9
          .           .
          .           .
159   KLEPFR............
          V
          V
162   RMD10A
          .
          .
          .       HIGH1
          .           V
          .           V
170       .       PHIGH
          .           .
```

```
          .          .
176     HIGH............
          V
          V
      RMD10B
          .
          .
182       .      MUD10
          .          .
          .          .
187     MD106...........
          .
          .
190       .      SAND1
          .          V
          .          V
195       .     RSAND2
          .          .
          .          .
198       .          .       SAND2
          .          .          .
          .          .          .
203       .      156TH...........
          .          V
          .          V
206       .     RSAND3
          .          .
          .          .
209       .          .       SAND3
          .          .          .
          .          .          .
214       .     SR238S..........
          .          .
          .          .
217       .          .       SAND4
          .          .          .
          .          .          .
222       .      238DS...........
          .          V
          .          V
225       .     RSAND5
          .          .
          .          .
228       .          .       SAND5
          .          .          .
          .          .          .
233       .      MARIL...........
          .          V
          .          V
236       .     RSAND6
          .          .
          .          .
239       .          .       SAND6
          .          .          .
          .          .          .
          .     169SAN...........
          .          V
          .          V
247       .     RSAND7
          .          .
```

```
                .           .
250             .           .       SAND7
                .           .           .
                .           .           .
                .        SAND............
                .           .
                .           .
258        106TH............
               V
               V
261       RMUD11
                .
                .
264             .       MUD11
                .           .
                .           .
269         96TH............
               V
               V
272       RMUD12
                .
                .
275             .       MUD12
                .           .
                .           .
280         86TH............
               V
               V
283       RMUD13
                .
                .
286             .       MUD13
                .           .
                .           .
291         GAGE............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  02/11/1997  TIME  14:43:35 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
                    MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
                    CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT2.HC1

  IO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
```

NMIN	15	MINUTES IN COMPUTATION INTERVAL
IDATE	1JAN 0	STARTING DATE
ITIME	0000	STARTING TIME
NQ	300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	4JAN 0	ENDING DATE
NDTIME	0245	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL .25 HOURS
TOTAL TIME BASE 74.75 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00
HYDROGRAPH AT					
+	HNRY1	1.52	1	FLOW	297.
				TIME	19.25
HYDROGRAPH AT					
	MUD1	3.33	1	FLOW	693.
				TIME	18.50
ROUTED TO					
	RMUD2A	3.33	1	FLOW	693.
				TIME	19.50
2 COMBINED AT					
	ADD1	4.85	1	FLOW	990.
				TIME	19.25
ROUTED TO					
	RMUD2B	4.85	1	FLOW	990.
				TIME	19.75
HYDROGRAPH AT					
+	MUD2	1.37	1	FLOW	313.
				TIME	17.75

2 COMBINED AT					
	SR13US	6.22	1	FLOW	1254.
				TIME	19.25
HYDROGRAPH AT					
	KYNET1	1.14	1	FLOW	250.
				TIME	18.00
ROUTED TO					
+	RKYN2	1.14	1	FLOW	250.
				TIME	19.00
HYDROGRAPH AT					
+	KYNET2	1.15	1	FLOW	268.
				TIME	17.25
2 COMBINED AT					
+	KYNETT	2.29	1	FLOW	499.
				TIME	18.00
2 COMBINED AT					
	SR13DS	8.50	1	FLOW	1720.
				TIME	19.00
ROUTED TO					
	RMUD3	8.50	1	FLOW	1720.
				TIME	19.50
HYDROGRAPH AT					
	MUD3	1.73	1	FLOW	333.
				TIME	19.75
2 COMBINED AT					
+	SR38	10.24	1	FLOW	2053.
				TIME	19.50
ROUTED TO					
+	RMUD4	10.24	1	FLOW	2053.
				TIME	20.25
HYDROGRAPH AT					
	MUD4	1.89	1	FLOW	429.
				TIME	18.00
2 COMBINED AT					
	HAMCO	12.13	1	FLOW	2407.
				TIME	19.75
ROUTED TO					
	RMUD5A	12.13	1	FLOW	2407.
				TIME	20.75
HYDROGRAPH AT					
	TRIB1	1.72	1	FLOW	366.
				TIME	18.50
ROUTED TO					
+	RTRIB2	1.72	1	FLOW	366.
				TIME	19.50

```
HYDROGRAPH AT
                    TRIB2      1.10     1   FLOW        274.
                                            TIME       17.00

 2 COMBINED AT
                    TRIB       2.82     1   FLOW        576.
                                            TIME       17.75

 2 COMBINED AT
+                   ADD2      14.95     1   FLOW       2902.
                                            TIME       20.50

ROUTED TO
+                 RMUD5B      14.95     1   FLOW       2902.
                                            TIME       21.50

HYDROGRAPH AT
+                   MUD5       2.04     1   FLOW        524.
                                            TIME       17.00

 2 COMBINED AT
                  I69MUD      17.00     1   FLOW       3114.
                                            TIME       21.25

ROUTED TO
                  RMUD6A      17.00     1   FLOW       3114.
                                            TIME       21.50

    GRAPH AT
                    MUD7        .84     1   FLOW        208.
                                            TIME       17.00

 2 COMBINED AT
+                 SR238M      17.84     1   FLOW       3197.
                                            TIME       21.50

ROUTED TO
+                 ONLINE      17.84     1   FLOW       1891.
                                            TIME       26.25

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE         5.96
                                            TIME       26.25

ROUTED TO
                  RMUD6B      17.84     1   FLOW       1891.
                                            TIME       27.00

HYDROGRAPH AT
                    MUD6       1.31     1   FLOW        320.
                                            TIME       17.00

 2 COMBINED AT
                   126TH      19.15     1   FLOW       1894.
                                            TIME       27.00

ROUTED TO
+                 RMUD8      19.15     1   FLOW       1894.
                                            TIME       28.00
```

```
HYDROGRAPH AT
                    MUD8      2.26     1   FLOW        555.
                                           TIME       16.75

 2 COMBINED AT
                   BROOK     21.41     1   FLOW       1894.
                                           TIME       28.00

ROUTED TO
+                  RMUD9     21.41     1   FLOW       1894.
                                           TIME       29.25

HYDROGRAPH AT
+                   MUD9      1.67     1   FLOW        423.
                                           TIME       16.75

 2 COMBINED AT
+                 KLEPFR     23.08     1   FLOW       1894.
                                           TIME       29.25

ROUTED TO
                  RMD10A     23.08     1   FLOW       1894.
                                           TIME       30.50

HYDROGRAPH AT
                   HIGH1      1.29     1   FLOW        327.
                                           TIME       17.00

    D TO
                   PHIGH      1.29     1   FLOW         39.
                                           TIME       25.25

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE      784.36
                                           TIME       25.25

 2 COMBINED AT
+                   HIGH     24.37     1   FLOW       1929.
                                           TIME       30.50

ROUTED TO
                  RMD10B     24.37     1   FLOW       1929.
                                           TIME       31.50

HYDROGRAPH AT
                   MUD10      1.82     1   FLOW        438.
                                           TIME       17.00

 2 COMBINED AT
                   MD106     26.19     1   FLOW       1929.
                                           TIME       31.50

HYDROGRAPH AT
                   SAND1       .98     1   FLOW        223.
                                           TIME       17.75

ROUTED TO
+                 RSAND2       .98     1   FLOW        223.
                                           TIME       18.75
```

HYDROGRAPH AT					
	SAND2	1.55	1	FLOW	376.
				TIME	17.00
2 COMBINED AT					
	156TH	2.53	1	FLOW	578.
				TIME	17.25
ROUTED TO					
+	RSAND3	2.53	1	FLOW	578.
				TIME	18.25
HYDROGRAPH AT					
+	SAND3	1.92	1	FLOW	516.
				TIME	16.75
2 COMBINED AT					
+	SR238S	4.45	1	FLOW	1056.
				TIME	17.25
HYDROGRAPH AT					
	SAND4	1.04	1	FLOW	270.
				TIME	17.00
2 COMBINED AT					
	238DS	5.49	1	FLOW	1323.
				TIME	17.25
ED TO					
+	RSAND5	5.49	1	FLOW	1323.
				TIME	20.50
HYDROGRAPH AT					
+	SAND5	2.04	1	FLOW	553.
				TIME	17.00
2 COMBINED AT					
+	MARIL	7.54	1	FLOW	1637.
				TIME	20.00
ROUTED TO					
	RSAND6	7.54	1	FLOW	1637.
				TIME	22.00
HYDROGRAPH AT					
	SAND6	2.16	1	FLOW	575.
				TIME	16.75
2 COMBINED AT					
	I69SAN	9.70	1	FLOW	1891.
				TIME	20.00
ROUTED TO					
	RSAND7	9.70	1	FLOW	1891.
				TIME	21.75
HYDROGRAPH AT					
+	SAND7	1.69	1	FLOW	411.
				TIME	16.75

```
 2 COMBINED AT
                    SAND      11.38     1   FLOW        2047.
                                              TIME       21.50

 2 COMBINED AT
                   106TH      37.57     1   FLOW        3483.
                                              TIME       20.75

ROUTED TO
                  RMUD11      37.57     1   FLOW        3483.
                                              TIME       23.00

HYDROGRAPH AT
+                  MUD11       1.46     1   FLOW         358.
                                              TIME       16.75

 2 COMBINED AT
+                   96TH      39.03     1   FLOW        3612.
                                              TIME       21.75

ROUTED TO
                  RMUD12      39.03     1   FLOW        3612.
                                              TIME       22.25

HYDROGRAPH AT
                   MUD12       1.55     1   FLOW         282.
                                              TIME       18.00

    OMBINED AT
                    86TH      40.57     1   FLOW        3780.
                                              TIME       22.00

ROUTED TO
+                 RMUD13      40.57     1   FLOW        3780.
                                              TIME       23.00

HYDROGRAPH AT
+                  MUD13       1.84     1   FLOW         414.
                                              TIME       17.00

 2 COMBINED AT
                    GAGE      42.41     1   FLOW        3927.
                                              TIME       22.75


*** NORMAL END OF HEC-1 ***
```

APPENDIX 9

Future-Condition Hydrologic Model Input/Output - Alternative 3

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            SEPTEMBER 1990             *
             VERSION 4.0               *
*                                      *
* RUN DATE  02/11/1997  TIME  14:44:49 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT3.HC1
              *DIAGRAM
  3           IT      15 01JAN00    0000     300
  4           IN      72
  5           IO       5
  6           JR    PREC    1.00
              *
              *  ***************************************************************
              *  *                                                             *
              *  * HUFF 3RD QUARTILE DISTRIBUTION                              *
              *  * ------------------------------------------------------      *
              *  *   RATIO 1:  100-YEAR STORM FREQUENCY                        *
              *  ***************************************************************
              *

  7           KK   HNRY1
  8           KM   SUBAREA HNRY1 (HENRY DITCH)
  9           PB    5.75
 10           PC     0.0     2.6     5.3     8.4    11.6    14.3    17.1    20.7    24.2    31.0
 11           PC    37.8    48.1    58.3    68.2    78.0    83.4    88.7    92.0    95.3    97.7
 12           PC   100.0
```

```
13          BA  1.5211
14          LS       0      78
15          UD    3.79
            *

16          KK    MUD1
17          KM   SUBAREA MUD1 (MUD CREEK)
18          BA  3.3292
19          LS       0      78
20          UD    3.02
            *

21          KK  RMUD2A
22          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
23          RT                      4
            *

24          KK    ADD1
25          KM        COMBINE RMUD2A AND HENRY1
26          HC       2
            *

27          KK  RMUD2B
28          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
29          RT                      2
            *

30          KK    MUD2
31          KM   SUBAREA MUD2 (MUD CREEK)
32          BA  1.3655
33          LS       0      80
34          UD    2.39
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

35          KK  SR13US
36          KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
37          HC       2
            *

38          KK  KYNET1
39          KM   SUBAREA KYNET1 (KYNETT DITCH)
40          BA  1.1386
41          LS       0      79
42          UD    2.65
            *

43          KK   RKYN2
44          KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
45          RT                      4
            *

46          KK  KYNET2
47          KM   SUBAREA KNET2 (KYNETT DITCH)
48          BA  1.1498
49          LS       0      79
50          UD    1.86
```

```
          *

 51       KK  KYNETT
 52       KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
 53       HC       2
          *

 54       KK  SR13DS
 55       KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
 56       HC       2
          *

 57       KK   RMUD3
 58       KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
 59       RT                      2
          *

 60       KK    MUD3
 61       KM   SUBAREA MUD3 (MUD CREEK)
 62       BA  1.7324
 63       LS       0      79
 64       UD    4.28
          *

 65       KK    SR38
 66       KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
 67       HC       2
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 68       KK   RMUD4
 69       KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
 70       RT                      3
          *

 71       KK    MUD4
 72       KM   SUBAREA MUD4 (MUD CREEK)
 73       BA  1.8948
 74       LS       0      80
 75       UD    2.56
          *

 76       KK   HAMCO
 77       KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
 78       HC       2
          *

 79       KK  RMUD5A
 80       KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
 81       RT                      4
          *

 82       KK   TRIB1
 83       KM   SUBAREA TRIB1 (UNNAMED TRIB)
 84       BA  1.7235
 85       LS       0      80
 86       UD    3.34
```

```
*

KK  RTRIB2
KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
RT                      4
*

KK   TRIB2
KM   SUBAREA TRIB2 (UNNAMED TRIB)
BA  1.0964
LS       0      81
UD    1.36
*

KK    TRIB
KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
HC       2
*

KK    ADD2
KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
HC       2
*
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  ONLINE
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH ON-LINE DETENTION
RS       1    ELEV      0.
SQ     0.0     54.    190.    420.    810.   1389.   2182.
SV     0.0    150.    300.    450.    600.   1092.   1200.
SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
*

KK  RMUD5B
KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
RT                      4
*

KK    MUD5
KM   SUBAREA  MUD5 (MUD CREEK)
BA  2.0442
LS       0      82
UD    1.16
*

KK  I69MUD
KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
HC       2
*

KK  RMUD6A
KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
RT                      1
*

KK    MUD7
KM   SUBAREA  MUD7 (MUD CREEK)
```

```
123          BA  0.8429
124          LS       0      80
125          UD    1.15
             *

126          KK  SR238M
127          KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
128          HC       2
             *

129          KK  RMUD6B
130          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
131          RT                      3
             *

132          KK    MUD6
133          KM   SUBAREA  MUD6 (MUD CREEK)
134          BA  1.3121
135          LS       0      79
136          UD    1.04
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

137          KK   126TH
138          KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
139          HC       2
             *

140          KK   RMUD8
141          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
142          RT                      4
             *

143          KK    MUD8
144          KM   SUBAREA  MUD8 (MUD CREEK)
145          BA  2.2573
146          LS       0      79
147          UD    0.79
             *

148          KK   BROOK
149          KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
150          HC       2
             *

151          KK   RMUD9
152          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
153          RT                      5
             *

154          KK    MUD9
155          KM   SUBAREA  MUD9 (MUD CREEK)
156          BA  1.6690
157          LS       0      81
158          UD    0.98
             *
```

```
159          KK  KLEPFR
160          KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
161          HC       2
             *

162          KK  RMD10A
163          KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
164          RT                      5
             *

165          KK   HIGH1
166          KM   SUBAREA HIGH1 (HIGH DITCH)
167          BA  1.2943
168          LS       0      81
169          UD    1.09
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

170          KK   PHIGH
171          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH HIGH DITCH POND
172          RS       1    ELEV   780.8
173          SQ     0.0     20.     40.     70.    100.    130.    160.    200.
174          SV     0.0    163.    227.    309.    355.    367.    375.    383.
175          SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
             *

176          KK    HIGH
177          KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
178          HC       2
             *

179          KK  RMD10B
180          KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
181          RT                      4
             *

182          KK   MUD10
183          KM   SUBAREA MUD10 (MUD CREEK)
184          BA  1.8169
185          LS       0      79
186          UD    1.32
             *

187          KK   MD106
188          KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
189          HC       2
*** FIX ***
             *

190          KK   SAND1
191          KM   SUBAREA SAND1 (SAND CREEK)
192          BA  0.9822
193          LS       0      79
194          UD    2.22
             *

195          KK  RSAND2
```

```
196          KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
197          RT                      4
             *

198          KK   SAND2
199          KM   SUBAREA SAND2 (SAND CREEK)
200          BA  1.5520
201          LS       0      79
202          UD    1.21
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

203          KK   156TH
204          KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
205          HC       2
             *

206          KK     156
207          KM        DIVERT FLOW ABOVE 100 CFS TO OFF-LINE DETENTION POND US OF 156TH ST
208          DT    D156
209          DI       0     100    1000
210          DQ       0     0.1     900
             *

211          KK  SNDPN1
212          KM        RETRIEVE FLOW DIVERTED TO OFF-LINE DETENTION FACILITY ON SAND CREEK
213          DR    D156
             *

214          KK   P1561
215          KM        ROUTE DIVERTED FLOWS THROUGH DETENTION FACILITY
216          RS       1    ELEV     0.0
217          SQ     0.0       1       2       3
218          SV     0.0    103.    206.    309.
219          SE     0.0     1.0     2.0     3.0
             *

220          KK   P1562
221          KM        DEWATERING SIMULATION
222          RS       1    ELEV     3.0
223          SQ     0.0     33.     67.    100.
224          SV     0.0    103.    206.    309.
225          SE     0.0     1.0     2.0     3.0
             *

226          KK   P1563
227          KM        LAG SIMULATION PREPARATION
228          RS       1    ELEV     0.0
229          SQ     0.0      15     40.    150.
230          SV     0.0     1.0     2.0     3.0
231          SE     0.0     1.0     2.0     3.0
             *
             *

232          KK   RP156
233          KM        LAG OUTFLOWS FROM OFF-LINE RESERVOIR TO REFLECT FLAP GATES, TW CONDITION
234          RT                      110
```

```
*

KK    ADD1
KM        RETURN OFF-LINE RESERVOIR OUTFLOW TO SAND CREEK MAINSTEM
HC       2
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


KK  RSAND3
KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
RT                      4
*

KK   SAND3
KM   SUBAREA SAND3 (SAND CREEK)
BA  1.9192
LS       0      85
UD    1.21
*

KK  SR238S
KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
HC       2
*

KK   SAND4
KM   SUBAREA SAND4 (SAND CREEK)
BA  1.0401
LS       0      83
UD    1.24
*

KK   238DS
KM        COMBINE SR238S AND SAND4 (SAND CREEK)
HC       2
*

KK  RSAND5
KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
RT                     13
*

KK   SAND5
KM   SUBAREA SAND5 (SAND CREEK)
BA  2.0438
LS       0      86
UD    1.49
*

KK   MARIL
KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
HC       2
*

KK  LEHRPN
KM        DIVERT FLOW ABOVE 300 CFS TO OFF-LINE DETENTION POND N OF 136TH ST
DT   DLEHR
```

```
271        DI       0     300    1500
272        DQ       0     0.1    1200
           *
```



```
LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

273        KK  SNDPN2
274        KM        RETRIEVE FLOW DIVERTED TO OFF-LINE DETENTION FACILITY ON SAND CREEK
275        DR   DLEHR
           *

276        KK  PLEHR1
277        KM        ROUTE FLOWS THROUGH OFF-LINE DETENTION FACILITY
278        RS       1    ELEV     0.0
279        SQ     0.0       1       2       3      4.
280        SV     0.0    239.    477.    716.    955.
281        SE     0.0     1.0     2.0     3.0     4.0
           *

282        KK  PLEHR2
283        KM        DEWATER DETENTION FACILITY
284        RS       1    ELEV     3.0
285        SQ     0.0    172.    245.    300.
286        SV     0.0    239.    477.    716.
287        SE     0.0     1.0     2.0     3.0
           *

288        KK  PLEHR3
289        KM        LAG SIMULATION PREPARATION
290        RS       1    ELEV     0.0
291        SQ     0.0     85.    120.    350.
292        SV     0.0     2.0     4.0     6.0
293        SE     0.0     1.0     2.0     3.0
           *

294        KK  RPLEHR
295        KM        LAG OUTFLOWS FROM OFF-LINE RESERVOIR TO REFLECT FLAP GATES, TW CONDITION
296        RT                     130
           *
           *

297        KK    ADD2
298        KM        RETURN OFF-LINE RESERVOIR OUTFLOW TO SAND CREEK MAINSTEM
299        HC       2
           *
           *

300        KK  RSAND6
301        KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
302        RT                       8
           *

303        KK   SAND6
304        KM   SUBAREA SAND6 (SAND CREEK)
305        BA  2.1594
306        LS       0      84
307        UD    1.00
           *
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 308        KK  I69SAN
 309        KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
 310        HC       2
            *

 311        KK  RSAND7
 312        KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
 313        RT                      7
            *

 314        KK   SAND7
 315        KM   SUBAREA SAND7 (SAND CREEK)
 316        BA  1.6857
 317        LS       0      79
 318        UD    0.98
            *

 319        KK   SAND
 320        KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
 321        HC       2
            *

 322        KK   106TH
 323        KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
 324        HC       2
            *

 325        KK  RMUD11
 326        KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
 327        RT                      9
            *

 328        KK   MUD11
 329        KM   SUBAREA MUD11 (MUD CREEK)
 330        BA  1.4567
 331        LS       0      79
 332        UD    0.82
            *

 333        KK    96TH
 334        KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
 335        HC       2
            *

 336        KK  RMUD12
 337        KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
 338        RT                      2
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 339        KK   MUD12
 340        KM   SUBAREA MUD12 (MUD CREEK)
```

```
341          BA  1.5478
342          LS       0      71
343          UD    2.47
             *

344          KK    86TH
345          KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
346          HC       2
             *

347          KK  RMUD13
348          KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
349          RT                       4
             *

350          KK   MUD13
351          KM   SUBAREA MUD13 (MUD CREEK)
352          BA  1.8392
353          LS       0      76
354          UD    1.38
             *

355          KK    GAGE
356          KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
357          HC       2
             *
358          ZZ
```

```
          SCHEMATIC DIAGRAM OF STREAM NETWORK
  T
 NE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  7      HNRY1
             .
             .
 16          .        MUD1
             .           V
             .           V
 21          .      RMUD2A
             .           .
             .           .
 24       ADD1............
             V
             V
 27     RMUD2B
             .
             .
 30          .        MUD2
             .           .
             .           .
 35     SR13US............
             .
             .
  3          .      KYNET1
             .           V
             .           V
 43          .       RKYN2
             .           .
```

```
          .           .
46        .           .      KYNET2
          .           .           .
          .           .           .
          .      KYNETT............
          .           .
          .           .
54     SR13DS............
          V
          V
57      RMUD3
          .
          .
60        .        MUD3
          .           .
          .           .
65       SR38............
          V
          V
68      RMUD4
          .
          .
71        .        MUD4
          .           .
          .           .
76      HAMCO............
          V
          V
79     RMUD5A
          .
          .
82        .       TRIB1
          .           V
          .           V
87        .      RTRIB2
          .           .
          .           .
90        .           .      TRIB2
          .           .           .
          .           .           .
95        .        TRIB............
          .           .
          .           .
98       ADD2............
          V
          V
101    ONLINE
          V
          V
107    RMUD5B
          .
          .
110       .        MUD5
          .           .
          .           .
       I69MUD............
          V
          V
118    RMUD6A
          .
```

```
          .
121       .        MUD7
          .           .
          .           .
     SR238M............
          V
          V
129  RMUD6B
          .
          .
132       .        MUD6
          .           .
          .           .
137   126TH............
          V
          V
140   RMUD8
          .
          .
143       .        MUD8
          .           .
          .           .
148   BROOK............
          V
          V
151   RMUD9
          .
          .
154       .        MUD9
          .           .
          .           .
159  KLEPFR............
          V
          V
162  RMD10A
          .
          .
165       .       HIGH1
          .           V
          .           V
170       .       PHIGH
          .           .
          .           .
176    HIGH............
          V
          V
179  RMD10B
          .
          .
182       .       MUD10
          .           .
          .           .
187   MD106............
          .
          .
          .       SAND1
          .           V
          .           V
195       .      RSAND2
          .           .
```

```
.          .
198        .          .       SAND2
           .          .          .
           .          .          .
           .     156TH............
           .          .
           .          .
208        .          .------->    D156
206        .       156
           .          .
           .          .
213        .          .          .<-------    D156
211        .          .     SNDPN1
           .          .          V
           .          .          V
214        .          .      P1561
           .          .          V
           .          .          V
220        .          .      P1562
           .          .          V
           .          .          V
226        .          .      P1563
           .          .          V
           .          .          V
232        .          .      RP156
           .          .          .
           .          .          .
235        .      ADD1............
           .         V
           .         V
 8         .    RSAND3
           .          .
           .          .
241        .          .      SAND3
           .          .          .
           .          .          .
246        .    SR238S............
           .          .
           .          .
249        .          .      SAND4
           .          .          .
           .          .          .
254        .     238DS............
           .         V
           .         V
257        .    RSAND5
           .          .
           .          .
260        .          .      SAND5
           .          .          .
           .          .          .
265        .     MARIL............
           .          .
           .          .
 70        .          .------->   DLEHR
           .    LEHRPN
           .          .
           .          .
275        .          .          .<-------   DLEHR
273        .          .     SNDPN2
```

```
            .           .           V
            .           .           V
276         .           .      PLEHR1
           .           .           V
            .           .           V
282         .           .      PLEHR2
            .           .           V
            .           .           V
288         .           .      PLEHR3
            .           .           V
            .           .           V
294         .           .      RPLEHR
            .           .           .
            .           .           .
297         .        ADD2............
            .           V
            .           V
300         .      RSAND6
            .           .
            .           .
303         .           .       SAND6
            .           .           .
            .           .           .
308         .      I69SAN............
            .           V
            .           V
311         .      RSAND7
            .           .
            .           .
            .           .       SAND7
            .           .           .
            .           .           .
319         .        SAND............
            .           .
            .           .
322      106TH............
            V
            V
325      RMUD11
            .
            .
328         .       MUD11
            .           .
            .           .
333       96TH............
            V
            V
336      RMUD12
            .
            .
339         .       MUD12
            .           .
            .           .
344       86TH............
            V
            V
347      RMUD13
            .
            .
350         .       MUD13
```

```
355        GAGE............

     RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  02/11/1997  TIME  14:44:49 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                    MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
                    CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT3.HC1

  5 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                   NMIN         15  MINUTES IN COMPUTATION INTERVAL
                  IDATE     1JAN 0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     4JAN 0  ENDING DATE
                 NDTIME       0245  ENDING TIME
                  ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL     .25 HOURS
                  TOTAL TIME BASE   74.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

   JP         MULTI-PLAN OPTION
                  NPLAN          1  NUMBER OF PLANS

   JR         MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
               1.00


          PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                          FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                          TIME TO PEAK IN HOURS
```

RATIOS APPLIED TO PRECIPITATION

OPERATION	STATION	AREA	PLAN		RATIO 1
					1.00
HYDROGRAPH AT					
	HNRY1	1.52	1	FLOW	297.
				TIME	19.25
HYDROGRAPH AT					
+	MUD1	3.33	1	FLOW	693.
				TIME	18.50
ROUTED TO					
+	RMUD2A	3.33	1	FLOW	693.
				TIME	19.50
2 COMBINED AT					
+	ADD1	4.85	1	FLOW	990.
				TIME	19.25
ROUTED TO					
	RMUD2B	4.85	1	FLOW	990.
				TIME	19.75
HYDROGRAPH AT					
	MUD2	1.37	1	FLOW	313.
				TIME	17.75
MBINED AT					
	SR13US	6.22	1	FLOW	1254.
				TIME	19.25
HYDROGRAPH AT					
+	KYNET1	1.14	1	FLOW	250.
				TIME	18.00
ROUTED TO					
+	RKYN2	1.14	1	FLOW	250.
				TIME	19.00
HYDROGRAPH AT					
	KYNET2	1.15	1	FLOW	268.
				TIME	17.25
2 COMBINED AT					
	KYNETT	2.29	1	FLOW	499.
				TIME	18.00
2 COMBINED AT					
	SR13DS	8.50	1	FLOW	1720.
				TIME	19.00
ROUTED TO					
	RMUD3	8.50	1	FLOW	1720.
				TIME	19.50
HYDROGRAPH AT					
+	MUD3	1.73	1	FLOW	333.
				TIME	19.75

```
 2 COMBINED AT
                    SR38      10.24     1   FLOW        2053.
                                            TIME       19.50

ROUTED TO
                   RMUD4      10.24     1   FLOW        2053.
                                            TIME       20.25

HYDROGRAPH AT
                    MUD4       1.89     1   FLOW         429.
                                            TIME       18.00

 2 COMBINED AT
+                  HAMCO      12.13     1   FLOW        2407.
                                            TIME       19.75

ROUTED TO
+                 RMUD5A      12.13     1   FLOW        2407.
                                            TIME       20.75

HYDROGRAPH AT
                   TRIB1       1.72     1   FLOW         366.
                                            TIME       18.50

ROUTED TO
                  RTRIB2       1.72     1   FLOW         366.
                                            TIME       19.50

    DGRAPH AT
                   TRIB2       1.10     1   FLOW         274.
                                            TIME       17.00

 2 COMBINED AT
+                   TRIB       2.82     1   FLOW         576.
                                            TIME       17.75

 2 COMBINED AT
+                   ADD2      14.95     1   FLOW        2902.
                                            TIME       20.50

ROUTED TO
                  ONLINE      14.95     1   FLOW        2177.
                                            TIME       24.00

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE        5.99
                                            TIME       24.00

ROUTED TO
                  RMUD5B      14.95     1   FLOW        2177.
                                            TIME       25.00

HYDROGRAPH AT
                    MUD5       2.04     1   FLOW         524.
                                            TIME       17.00

 2 COMBINED AT
+                 I69MUD      17.00     1   FLOW        2289.
                                            TIME       24.75
```

ROUTED TO					
	RMUD6A	17.00	1	FLOW	2289.
				TIME	25.00
HYDROGRAPH AT					
	MUD7	.84	1	FLOW	208.
				TIME	17.00
2 COMBINED AT					
+	SR238M	17.84	1	FLOW	2331.
				TIME	24.75
ROUTED TO					
+	RMUD6B	17.84	1	FLOW	2331.
				TIME	25.50
HYDROGRAPH AT					
+	MUD6	1.31	1	FLOW	320.
				TIME	17.00
2 COMBINED AT					
	126TH	19.15	1	FLOW	2361.
				TIME	25.50
ROUTED TO					
	RMUD8	19.15	1	FLOW	2361.
				TIME	26.50
HYDROGRAPH AT					
	MUD8	2.26	1	FLOW	555.
				TIME	16.75
2 COMBINED AT					
+	BROOK	21.41	1	FLOW	2365.
				TIME	26.50
ROUTED TO					
+	RMUD9	21.41	1	FLOW	2365.
				TIME	27.75
HYDROGRAPH AT					
	MUD9	1.67	1	FLOW	423.
				TIME	16.75
2 COMBINED AT					
	KLEPFR	23.08	1	FLOW	2366.
				TIME	27.75
ROUTED TO					
	RMD10A	23.08	1	FLOW	2366.
				TIME	29.00
HYDROGRAPH AT					
	HIGH1	1.29	1	FLOW	327.
				TIME	17.00
ROUTED TO					
+	PHIGH	1.29	1	FLOW	39.
				TIME	25.25

```
                                        ** PEAK STAGES IN FEET **
                                        1   STAGE       784.36
                                            TIME         25.25

 2 COMBINED AT
                    HIGH      24.37     1   FLOW         2403.
                                            TIME         29.00

ROUTED TO
                   RMD10B     24.37     1   FLOW         2403.
                                            TIME         30.00

HYDROGRAPH AT
+                  MUD10       1.82     1   FLOW          438.
                                            TIME         17.00

 2 COMBINED AT
+                  MD106      26.19     1   FLOW         2403.
                                            TIME         30.00

HYDROGRAPH AT
                   SAND1        .98     1   FLOW          223.
                                            TIME         17.75

ROUTED TO
                  RSAND2        .98     1   FLOW          223.
                                            TIME         18.75

    )GRAPH AT
                   SAND2       1.55     1   FLOW          376.
                                            TIME         17.00

 2 COMBINED AT
+                  156TH       2.53     1   FLOW          578.
                                            TIME         17.25

DIVERSION TO
+                   D156       2.53     1   FLOW          478.
                                            TIME         17.25

HYDROGRAPH AT
                    156       2.53     1   FLOW          100.
                                            TIME         17.25

HYDROGRAPH AT
                  SNDPN1        .00     1   FLOW          478.
                                            TIME         17.25

ROUTED TO
                   P1561        .00     1   FLOW            3.
                                            TIME         25.75

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE         2.98
                                            TIME         26.00

ROUTED TO
+                  P1562        .00     1   FLOW          100.
                                            TIME           .25
```

```
                                        ** PEAK STAGES IN FEET **
                                        1   STAGE        3.00
                                            TIME          .00

    ED TO
                  P1563       .00       1   FLOW          99.
                                            TIME          .75

                                        ** PEAK STAGES IN FEET **
                                        1   STAGE        2.53
                                            TIME          .75

 ROUTED TO
+                 RP156       .00       1   FLOW          99.
                                            TIME        28.25

  2 COMBINED AT
+                  ADD1      2.53       1   FLOW         123.
                                            TIME        28.25

 ROUTED TO
                 RSAND3      2.53       1   FLOW         123.
                                            TIME        29.25

 HYDROGRAPH AT
                  SAND3      1.92       1   FLOW         516.
                                            TIME        16.75

    OMBINED AT
                 SR238S      4.45       1   FLOW         616.
                                            TIME        16.75

 HYDROGRAPH AT
+                 SAND4      1.04       1   FLOW         270.
                                            TIME        17.00

  2 COMBINED AT
+                 238DS      5.49       1   FLOW         886.
                                            TIME        17.00

 ROUTED TO
+                RSAND5      5.49       1   FLOW         886.
                                            TIME        20.25

 HYDROGRAPH AT
                  SAND5      2.04       1   FLOW         553.
                                            TIME        17.00

  2 COMBINED AT
                  MARIL      7.54       1   FLOW        1332.
                                            TIME        17.75

 DIVERSION TO
+                 DLEHR      7.54       1   FLOW        1032.
                                            TIME        17.75

 HYDROGRAPH AT
+                LEHRPN      7.54       1   FLOW         300.
                                            TIME        17.50
```

```
HYDROGRAPH AT
                SNDPN2       .00     1   FLOW        1032.
                                         TIME       17.75

ROUTED TO
                PLEHR1       .00     1   FLOW           3.
                                         TIME       27.50

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE        2.99
                                         TIME       28.00

ROUTED TO
+               PLEHR2       .00     1   FLOW         300.
                                         TIME         .25

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE        3.00
                                         TIME         .00

ROUTED TO
                PLEHR3       .00     1   FLOW         309.
                                         TIME         .50

                                     ** PEAK STAGES IN FEET **
                                     1   STAGE        2.82
                                         TIME         .50

ED TO
                RPLEHR       .00     1   FLOW         309.
                                         TIME       33.00

 2 COMBINED AT
+                 ADD2      7.54     1   FLOW         423.
                                         TIME       33.00

ROUTED TO
+               RSAND6      7.54     1   FLOW         423.
                                         TIME       35.00

HYDROGRAPH AT
+                 SAND6     2.16     1   FLOW         575.
                                         TIME       16.75

 2 COMBINED AT
                I69SAN      9.70     1   FLOW         875.
                                         TIME       16.75

ROUTED TO
                RSAND7      9.70     1   FLOW         875.
                                         TIME       18.50

HYDROGRAPH AT
-                 SAND7     1.69     1   FLOW         411.
                                         TIME       16.75

 2 COMBINED AT
+                  SAND    11.38     1   FLOW        1267.
                                         TIME       17.00
```

```
 2 COMBINED AT
                    106TH     37.57     1   FLOW      3257.
                                            TIME      19.25

   .ED TO
                    RMUD11    37.57     1   FLOW      3257.
                                            TIME      21.50

 HYDROGRAPH AT
+                   MUD11      1.46     1   FLOW       358.
                                            TIME      16.75

  2 COMBINED AT
+                    96TH     39.03     1   FLOW      3391.
                                            TIME      21.50

 ROUTED TO
+                   RMUD12    39.03     1   FLOW      3391.
                                            TIME      22.00

 HYDROGRAPH AT
                    MUD12      1.55     1   FLOW       282.
                                            TIME      18.00

  2 COMBINED AT
                    86TH      40.57     1   FLOW      3567.
                                            TIME      21.75

   ED TO
                   RMUD13     40.57     1   FLOW      3567.
                                            TIME      22.75

 HYDROGRAPH AT
+                   MUD13      1.84     1   FLOW       414.
                                            TIME      17.00

  2 COMBINED AT
+                    GAGE     42.41     1   FLOW      3728.
                                            TIME      21.25


*** NORMAL END OF HEC-1 ***
```

APPENDIX 10

Future-Condition Hydrologic Model Input/Output - Alternative 4

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
            SEPTEMBER 1990             *
             VERSION 4.0               *
*                                      *
*  RUN DATE  02/10/1997  TIME  16:41:46 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
  2           ID   CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT4.HC1
              *DIAGRAM
  3           IT      15 01JAN00    0000     300
  4           IN      72
  5           IO       5
  6           JR    PREC    1.00
              *
              *  ***************************************************************
              *  *                                                             *
              *  * HUFF 3RD QUARTILE DISTRIBUTION                              *
              *  * ---------------------------------------------------------   *
              *  *   RATIO 1:  100-YEAR STORM FREQUENCY                        *
              *  ***************************************************************
              *

  7           KK   HNRY1
  8           KM   SUBAREA HNRY1 (HENRY DITCH)
  9           PB    5.75
 10           PC     0.0     2.6     5.3     8.4    11.6    14.3    17.1    20.7    24.2    31.0
 11           PC    37.8    48.1    58.3    68.2    78.0    83.4    88.7    92.0    95.3    97.7
 12           PC   100.0
```

```
13          BA  1.5211
14          LS       0      78
15          UD    3.79
            *

16          KK    MUD1
17          KM   SUBAREA MUD1 (MUD CREEK)
18          BA  3.3292
19          LS       0      78
20          UD    3.02
            *

21          KK  RMUD2A
22          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2A (MUD CREEK)
23          RT                      4
            *

24          KK    ADD1
25          KM        COMBINE RMUD2A AND HENRY1
26          HC       2
            *

27          KK  RMUD2B
28          KM        ROUTE FLOWS FROM MUD1 THROUGH REACH RMUD2B (MUD CREEK)
29          RT                      2
            *

30          KK    MUD2
31          KM   SUBAREA MUD2 (MUD CREEK)
32          BA  1.3655
33          LS       0      80
34          UD    2.39
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

35          KK  SR13US
36          KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
37          HC       2
            *

38          KK  KYNET1
39          KM   SUBAREA KYNET1 (KYNETT DITCH)
40          BA  1.1386
41          LS       0      79
42          UD    2.65
            *

43          KK   RKYN2
44          KM        ROUTE FLOWS FROM KYNET1 THROUGH SUBAREA KYNET2 (KYNETT DITCH)
45          RT                      4
            *

46          KK  KYNET2
47          KM   SUBAREA KNET2 (KYNETT DITCH)
48          BA  1.1498
49          LS       0      79
50          UD    1.86
```

```
          *

51        KK  KYNETT
52        KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
53        HC       2
          *

54        KK  SR13DS
55        KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
56        HC       2
          *

57        KK   RMUD3
58        KM        ROUTE FLOWS FROM SR13DS THROUGH SUBAREA MUD3 (MUD CREEK)
59        RT                      2
          *

60        KK    MUD3
61        KM   SUBAREA MUD3 (MUD CREEK)
62        BA  1.7324
63        LS       0      79
64        UD    4.28
          *

65        KK    SR38
66        KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
67        HC       2
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

68        KK   RMUD4
69        KM        ROUTE FLOWS FROM SR38 THROUGH SUBAREA MUD4 (MUD CREEK)
70        RT                      3
          *

71        KK    MUD4
72        KM   SUBAREA MUD4 (MUD CREEK)
73        BA  1.8948
74        LS       0      80
75        UD    2.56
          *

76        KK   HAMCO
77        KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
78        HC       2
          *

79        KK  RMUD5A
80        KM        ROUTE FLOWS FROM HAMCO THROUGH REACH RMUD5A (MUD CREEK)
81        RT                      4
          *

82        KK   TRIB1
83        KM   SUBAREA TRIB1 (UNNAMED TRIB)
84        BA  1.7235
85        LS       0      80
86        UD    3.34
```

```
          *

 87       KK  RTRIB2
 88       KM        ROUTE FLOWS FROM TRIB1 THROUGH SUBAREA TRIB2 (UNNAMED TRIB)
 89       RT                      4
          *

 90       KK   TRIB2
 91       KM   SUBAREA TRIB2 (UNNAMED TRIB)
 92       BA  1.0964
 93       LS       0      81
 94       UD    1.36
          *

 95       KK   PTRB2
 96       KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
 97       RS       1    ELEV     0.0
 98       SQ     0.0    66.5    94.1   115.3   133.1   148.8   163.0
 99       SV     0.0    13.0    26.0    39.0    52.0    65.0    78.0
100       SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
          *
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

101       KK    TRIB
102       KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
103       HC       2
          *

104       KK    ADD2
105       KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
106       HC       2
          *

107       KK  RMUD5B
108       KM        ROUTE FLOWS FROM ADD2 THROUGH REACH RMUD5B (MUD CREEK)
109       RT                      4
          *

110       KK    MUD5
111       KM   SUBAREA  MUD5 (MUD CREEK)
112       BA  2.0442
113       LS       0      82
114       UD    1.16
          *

115       KK   PMUD5
116       KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
117       RS       1    ELEV     0.0
118       SQ     0.0   115.9   164.0   200.8   231.9   259.2   284.0
119       SV     0.0    27.2    54.4    81.7   108.9   136.1   163.3
120       SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
          *

121       KK  I69MUD
122       KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
123       HC       2
          *
```

```
124        KK  RMUD6A
125        KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6A (MUD CREEK)
126        RT                      1
           *

127        KK    MUD7
128        KM   SUBAREA  MUD7 (MUD CREEK)
129        BA  0.8429
130        LS       0      80
131        UD    1.15
           *

132        KK   PMUD7
133        KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
134        RS       1    ELEV     0.0
135        SQ     0.0    52.7    74.5    91.2   105.3   117.8   129.0
136        SV     0.0     8.8    17.6    26.4    35.2    44.0    52.8
137        SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
           *
```



```
LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

138        KK  SR238M
139        KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
140        HC       2
           *

141        KK  RMUD6B
142        KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD6B (MUD CREEK)
143        RT                      3
           *

144        KK    MUD6
145        KM   SUBAREA  MUD6 (MUD CREEK)
146        BA  1.3121
147        LS       0      79
148        UD    1.04
           *

149        KK   PMUD6
150        KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
151        RS       1    ELEV     0.0
152        SQ     0.0    71.0   100.5   123.0   142.1   158.9   174.0
153        SV     0.0    15.9    31.7    47.6    63.5    79.3    95.2
154        SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
           *

155        KK   126TH
156        KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
157        HC       2
           *

158        KK   RMUD8
159        KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD8 (MUD CREEK)
160        RT                      4
           *
```

```
161          KK    MUD8
162          KM   SUBAREA  MUD8 (MUD CREEK)
163          BA  2.2573
164          LS       0      79
165          UD    0.79
             *

166          KK   PMUD8
167          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
168          RS       1    ELEV     0.0
169          SQ     0.0   142.9   202.1   247.5   285.8   319.5   350.0
170          SV     0.0    22.3    44.7    67.0    89.3   111.7   134.0
171          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *
1                                          HEC-1 INPUT                                                    PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


172          KK   BROOK
173          KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
174          HC       2
             *

175          KK   RMUD9
176          KM        ROUTE FLOWS FROM I69MUD THROUGH REACH RMUD9 (MUD CREEK)
177          RT                      5
             *

178          KK    MUD9
179          KM   SUBAREA  MUD9 (MUD CREEK)
180          BA  1.6690
181          LS       0      81
182          UD    0.98
             *

183          KK   PMUD9
184          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
185          RS       1    ELEV     0.0
186          SQ     0.0   103.3   146.1   178.9   206.6   231.0   253.0
187          SV     0.0    19.0    38.1    57.1    76.1    95.2   114.2
188          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *

189          KK  KLEPFR
190          KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
191          HC       2
             *

192          KK  RMD10A
193          KM        ROUTE FLOWS FROM KLEPFR THROUGH REACH RMD10A (MUD CREEK)
194          RT                      5
             *

195          KK   HIGH1
196          KM   SUBAREA HIGH1 (HIGH DITCH)
197          BA  1.2943
198          LS       0      81
199          UD    1.09
             *
```

```
*

KK   PHIGH
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
RS       1    ELEV   780.8
SQ     0.0     20.     40.     70.    100.    130.    160.    200.
SV     0.0    163.    227.    309.    355.    367.    375.    383.
SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
*
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


KK    HIGH
KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
HC       2
*

KK  RMD10B
KM        ROUTE FLOWS FROM HIGH THROUGH REACH RMD10B (MUD CREEK)
RT                     4
*

KK   MUD10
KM   SUBAREA MUD10 (MUD CREEK)
BA  1.8169
LS       0      79
UD    1.32
*

KK   PMD10
KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
RS       1    ELEV     0.0
SQ     0.0    94.3   133.4   163.3   188.6   210.9   231.0
SV     0.0    22.7    45.4    68.0    90.7   113.4   136.1
SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
*

KK   MD106
KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
HC       2
*

KK   SAND1
KM   SUBAREA SAND1 (SAND CREEK)
BA  0.9822
LS       0      79
UD    2.22
*

KK  RSAND2
KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND2 (SAND CREEK)
RT                     4
*

KK   SAND2
KM   SUBAREA SAND2 (SAND CREEK)
BA  1.5520
LS       0      79
```

```
238          UD    1.21
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

239          KK   PSND2
240          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
241          RS       1    ELEV     0.0
242          SQ     0.0    93.1   131.6   161.2   186.2   208.1   228.0
243          SV     0.0    15.7    31.5    47.2    62.9    78.7    94.4
244          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *

245          KK   156TH
246          KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
247          HC       2
             *

248          KK  RSAND3
249          KM        ROUTE FLOWS FROM SAND1 THROUGH REACH RSAND3 (SAND CREEK)
250          RT                     4
             *

251          KK   SAND3
252          KM   SUBAREA SAND3 (SAND CREEK)
253          BA  1.9192
254          LS       0      85
255          UD    1.21
             *

256          KK   PSND3
257          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
258          RS       1    ELEV     0.0
259          SQ     0.0   115.1   162.8   199.4   230.3   257.4   282.0
260          SV     0.0    27.6    55.1    82.7   110.2   137.8   165.3
261          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *

262          KK  SR238S
263          KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
264          HC       2
             *

265          KK   SAND4
266          KM   SUBAREA SAND4 (SAND CREEK)
267          BA  1.0401
268          LS       0      83
269          UD    1.24
             *

270          KK   PSND4
271          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
272          RS       1    ELEV     0.0
273          SQ     0.0    62.1    87.8   107.5   124.1   138.7   152.0
274          SV     0.0    13.6    27.2    40.8    54.4    68.0    81.6
275          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

276           KK   238DS
277           KM        COMBINE SR238S AND SAND4 (SAND CREEK)
278           HC       2
              *

279           KK  RSAND5
280           KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND5 (SAND CREEK)
281           RT                      13
              *

282           KK   SAND5
283           KM   SUBAREA SAND5 (SAND CREEK)
284           BA  2.0438
285           LS       0       86
286           UD    1.49
              *

287           KK   PSND5
288           KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
289           RS       1    ELEV     0.0
290           SQ     0.0   118.0   166.8   204.3   236.0   263.8   289.0
291           SV     0.0    31.6    63.1    94.7   126.2   157.8   189.3
292           SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
              *

293           KK   MARIL
294           KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
295           HC       2
              *

296           KK  RSAND6
297           KM        ROUTE FLOWS FROM 238DS THROUGH REACH RSAND6 (SAND CREEK)
298           RT                       8
              *

299           KK   SAND6
300           KM   SUBAREA SAND6 (SAND CREEK)
301           BA  2.1594
302           LS       0       84
303           UD    1.00
              *

304           KK   PSND6
305           KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
306           RS       1    ELEV     0.0
307           SQ     0.0   133.1   188.2   230.5   266.2   297.6   326.0
308           SV     0.0    29.0    58.0    86.9   115.9   144.9   173.9
309           SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
              *
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

310           KK  I69SAN
311           KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
```

```
312          HC       2
             *

313          KK  RSAND7
314          KM        ROUTE FLOWS FROM I69SAN THROUGH REACH RSAND7 (SAND CREEK)
315          RT                      7
             *

316          KK   SAND7
317          KM   SUBAREA SAND7 (SAND CREEK)
318          BA  1.6857
319          LS       0      79
320          UD    0.98
             *

321          KK   PSND7
322          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
323          RS       1    ELEV     0.0
324          SQ     0.0    95.1   134.5   164.8   190.2   212.7   233.0
325          SV     0.0    19.5    38.9    58.4    77.9    97.3   116.8
326          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *

327          KK    SAND
328          KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
329          HC       2
             *

330          KK   106TH
331          KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
332          HC       2
             *

333          KK  RMUD11
334          KM        ROUTE FLOWS FROM 106TH THROUGH REACH RMUD11 (MUD CREEK)
335          RT                      9
             *

336          KK   MUD11
337          KM   SUBAREA MUD11 (MUD CREEK)
338          BA  1.4567
339          LS       0      79
340          UD    0.82
             *

341          KK   PMD11
342          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH PROPOSED DETENTION
343          RS       1    ELEV     0.0
344          SQ     0.0    78.8   111.4   136.5   157.6   176.2   193.0
345          SV     0.0    17.9    35.7    53.6    71.5    89.3   107.2
346          SE     0.0     1.0     2.0     3.0     4.0     5.0     6.0
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

347          KK    96TH
348          KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
349          HC       2
```

```
                *

350             KK  RMUD12
351             KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD12 (MUD CREEK)
352             RT                      2
                *

353             KK   MUD12
354             KM   SUBAREA MUD12 (MUD CREEK)
355             BA  1.5478
356             LS       0      71
357             UD    2.47
                *

358             KK    86TH
359             KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
360             HC       2
                *

361             KK  RMUD13
362             KM        ROUTE FLOWS FROM 96TH THROUGH REACH RMUD13 (MUD CREEK)
363             RT                      4
                *

364             KK   MUD13
365             KM   SUBAREA MUD13 (MUD CREEK)
366             BA  1.8392
367             LS       0      76
368             UD    1.38
                *

369             KK    GAGE
370             KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
371             HC       2
                *
                *
372             ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7        HNRY1
                .
                .
  16            .        MUD1
                .           V
                .           V
  21            .      RMUD2A
                .           .
                .           .
  24         ADD1............
                V
                V
  27       RMUD2B
                .
                .
  30            .        MUD2
```

```
          .           .
          .           .
35     SR13US............
          .
          .
38        .      KYNET1
          .           V
          .           V
43        .       RKYN2
          .           .
          .           .
46        .           .      KYNET2
          .           .           .
          .           .           .
51        .      KYNETT............
          .           .
          .           .
54     SR13DS............
          V
          V
57      RMUD3
          .
          .
60        .        MUD3
          .           .
          .           .
65       SR38............
          V
          V
 3      RMUD4
          .
          .
71        .        MUD4
          .           .
          .           .
76      HAMCO............
          V
          V
79     RMUD5A
          .
          .
82        .       TRIB1
          .           V
          .           V
87        .      RTRIB2
          .           .
          .           .
90        .           .       TRIB2
          .           .           V
          .           .           V
95        .           .       PTRB2
          .           .           .
          .           .           .
101       .        TRIB............
          .           .
          .           .
104      ADD2............
          V
          V
107    RMUD5B
```

```
            .
            .
110         .        MUD5
            .           V
            .           V
115         .       PMUD5
            .           .
            .           .
121     I69MUD............
            V
            V
124     RMUD6A
            .
            .
127         .        MUD7
            .           V
            .           V
132         .       PMUD7
            .           .
            .           .
138     SR238M............
            V
            V
141     RMUD6B
            .
            .
144         .        MUD6
            .           V
            .           V
 ?          .       PMUD6
            .           .
            .           .
155      126TH............
            V
            V
158      RMUD8
            .
            .
161         .        MUD8
            .           V
            .           V
166         .       PMUD8
            .           .
            .           .
172      BROOK............
            V
            V
175      RMUD9
            .
            .
178         .        MUD9
            .           V
            .           V
183         .       PMUD9
            .           .
            .           .
189     KLEPFR............
            V
            V
192     RMD10A
```

```
            .
            .
195         .       HIGH1
            .          V
            .          V
200         .       PHIGH
            .          .
            .          .
206      HIGH............
            V
            V
209    RMD10B
            .
            .
212         .       MUD10
            .          V
            .          V
217         .       PMD10
            .          .
            .          .
223     MD106...........
            .
            .
226         .       SAND1
            .          V
            .          V
231         .      RSAND2
            .          .
            .          .
            .          .       SAND2
            .          .          V
            .          .          V
239         .          .       PSND2
            .          .          .
            .          .          .
245         .      156TH...........
            .          V
            .          V
248         .      RSAND3
            .          .
            .          .
251         .          .       SAND3
            .          .          V
            .          .          V
256         .          .       PSND3
            .          .          .
            .          .          .
262         .      SR238S..........
            .          .
            .          .
265         .          .       SAND4
            .          .          V
            .          .          V
270         .          .       PSND4
            .          .          .
            .          .          .
276         .      238DS...........
            .          V
            .          V
279         .      RSAND5
```

```
          .           .
          .           .
282       .           .       SAND5
          .           .           V
          .           .           V
287       .           .       PSND5
          .           .           .
          .           .           .
293       .       MARIL............
          .           V
          .           V
296       .      RSAND6
          .           .
          .           .
299       .           .       SAND6
          .           .           V
          .           .           V
304       .           .       PSND6
          .           .           .
          .           .           .
310       .      I69SAN............
          .           V
          .           V
313       .      RSAND7
          .           .
          .           .
316       .           .       SAND7
          .           .           V
          .           .           V
  1       .           .       PSND7
          .           .           .
          .           .           .
327       .        SAND............
          .           .
          .           .
330     106TH............
          V
          V
333     RMUD11
          .
          .
336       .       MUD11
          .           V
          .           V
341       .       PMD11
          .           .
          .           .
347      96TH............
          V
          V
350     RMUD12
          .
          .
353       .       MUD12
          .           .
          .           .
358      86TH............
          V
          V
361     RMUD13
```

```
                .
                .
  364           .       MUD13
                .          .
                .          .
  369        GAGE............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  02/10/1997  TIME  16:41:46 *
*                                       *
*****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                    MUD CREEK WATERSHED HYDROLOGIC MODEL - 24 HOUR EVENT
                    CBBEL: 96-297 DLM 27JAN97  ** PROPOSED COND. **  FILE: ALT4.HC1

  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1JAN 0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     4JAN 0  ENDING DATE
                     NDTIME       0245  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .25 HOURS
                      TOTAL TIME BASE   74.75 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT

    JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                   1.00
1

              PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
```

FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00
HYDROGRAPH AT					
	HNRY1	1.52	1	FLOW	297.
				TIME	19.25
HYDROGRAPH AT					
	MUD1	3.33	1	FLOW	693.
				TIME	18.50
ROUTED TO					
+	RMUD2A	3.33	1	FLOW	693.
				TIME	19.50
2 COMBINED AT					
+	ADD1	4.85	1	FLOW	990.
				TIME	19.25
ROUTED TO					
	RMUD2B	4.85	1	FLOW	990.
				TIME	19.75
HYDROGRAPH AT					
	MUD2	1.37	1	FLOW	313.
				TIME	17.75
2 COMBINED AT					
	SR13US	6.22	1	FLOW	1254.
				TIME	19.25
HYDROGRAPH AT					
+	KYNET1	1.14	1	FLOW	250.
				TIME	18.00
ROUTED TO					
+	RKYN2	1.14	1	FLOW	250.
				TIME	19.00
HYDROGRAPH AT					
	KYNET2	1.15	1	FLOW	268.
				TIME	17.25
2 COMBINED AT					
	KYNETT	2.29	1	FLOW	499.
				TIME	18.00
2 COMBINED AT					
	SR13DS	8.50	1	FLOW	1720.
				TIME	19.00
ROUTED TO					
+	RMUD3	8.50	1	FLOW	1720.
				TIME	19.50

```
HYDROGRAPH AT
+                    MUD3      1.73     1   FLOW        333.
                                            TIME       19.75

     MBINED AT
                     SR38     10.24     1   FLOW       2053.
                                            TIME       19.50

ROUTED TO
                    RMUD4     10.24     1   FLOW       2053.
                                            TIME       20.25

HYDROGRAPH AT
                     MUD4      1.89     1   FLOW        429.
                                            TIME       18.00

 2 COMBINED AT
+                   HAMCO     12.13     1   FLOW       2407.
                                            TIME       19.75

ROUTED TO
+                  RMUD5A     12.13     1   FLOW       2407.
                                            TIME       20.75

HYDROGRAPH AT
                    TRIB1      1.72     1   FLOW        366.
                                            TIME       18.50

ROUTED TO
                   RTRIB2      1.72     1   FLOW        366.
                                            TIME       19.50

HYDROGRAPH AT
                    TRIB2      1.10     1   FLOW        274.
                                            TIME       17.00

ROUTED TO
+                   PTRB2      1.10     1   FLOW        160.
                                            TIME       20.00

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE          5.75
                                            TIME       20.00

 2 COMBINED AT
                     TRIB      2.82     1   FLOW        525.
                                            TIME       19.75

 2 COMBINED AT
                     ADD2     14.95     1   FLOW       2916.
                                            TIME       20.50

ROUTED TO
                   RMUD5B     14.95     1   FLOW       2916.
                                            TIME       21.50

HYDROGRAPH AT
+                    MUD5      2.04     1   FLOW        524.
                                            TIME       17.00
```

```
ROUTED TO
+                PMUD5      2.04     1   FLOW        281.
                                         TIME       20.25

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE        5.88
                                         TIME       20.25

 2 COMBINED AT
                 I69MUD     17.00     1   FLOW       3193.
                                         TIME       21.50

ROUTED TO
                RMUD6A      17.00     1   FLOW       3193.
                                         TIME       21.75

HYDROGRAPH AT
+                 MUD7       .84     1   FLOW        208.
                                         TIME       17.00

ROUTED TO
+                 PMUD7       .84     1   FLOW        128.
                                         TIME       19.50

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE        5.88
                                         TIME       19.50

 2 COMBINED AT
                 SR238M      17.84     1   FLOW       3315.
                                         TIME       21.75

ROUTED TO
                RMUD6B      17.84     1   FLOW       3315.
                                         TIME       22.50

HYDROGRAPH AT
+                 MUD6       1.31     1   FLOW        320.
                                         TIME       17.00

ROUTED TO
+                 PMUD6       1.31     1   FLOW        172.
                                         TIME       20.00

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE        5.88
                                         TIME       20.00

 2 COMBINED AT
                  126TH      19.15     1   FLOW       3480.
                                         TIME       22.50

ROUTED TO
                 RMUD8       19.15     1   FLOW       3480.
                                         TIME       23.50

HYDROGRAPH AT
+                 MUD8       2.26     1   FLOW        555.
                                         TIME       16.75
```

```
ROUTED TO
+                    PMUD8      2.26     1   FLOW        345.
                                             TIME       18.50

                                         ** PEAK STAGES IN FEET **
                                         1   STAGE        5.85
                                             TIME       18.50

 2 COMBINED AT
                     BROOK     21.41     1   FLOW       3772.
                                             TIME       23.50

ROUTED TO
                     RMUD9     21.41     1   FLOW       3772.
                                             TIME       24.75

HYDROGRAPH AT
+                     MUD9      1.67     1   FLOW        423.
                                             TIME       16.75

ROUTED TO
+                    PMUD9      1.67     1   FLOW        250.
                                             TIME       19.50

                                         ** PEAK STAGES IN FEET **
                                         1   STAGE        5.86
                                             TIME       19.50

 2 COMBINED AT
                    KLEPFR     23.08     1   FLOW       3980.
                                             TIME       24.75

ROUTED TO
                    RMD10A     23.08     1   FLOW       3980.
                                             TIME       26.00

HYDROGRAPH AT
+                    HIGH1      1.29     1   FLOW        327.
                                             TIME       17.00

ROUTED TO
+                    PHIGH      1.29     1   FLOW         39.
                                             TIME       25.25

                                         ** PEAK STAGES IN FEET **
                                         1   STAGE      784.36
                                             TIME       25.25

 2 COMBINED AT
                     HIGH     24.37     1   FLOW       4019.
                                             TIME       26.00

ROUTED TO
                    RMD10B     24.37     1   FLOW       4019.
                                             TIME       27.00

HYDROGRAPH AT
+                   MUD10      1.82     1   FLOW        438.
                                             TIME       17.00
```

```
ROUTED TO
+                PMD10      1.82     1   FLOW        229.
                                         TIME       20.50

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.90
                                         TIME       20.50

 2 COMBINED AT
                 MD106     26.19     1   FLOW       4205.
                                         TIME       26.75

HYDROGRAPH AT
.                SAND1       .98     1   FLOW        223.
                                         TIME       17.75

ROUTED TO
+               RSAND2       .98     1   FLOW        223.
                                         TIME       18.75

HYDROGRAPH AT
+                SAND2      1.55     1   FLOW        376.
                                         TIME       17.00

ROUTED TO
                 PSND2      1.55     1   FLOW        227.
                                         TIME       19.75

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.97
                                         TIME       19.75

 2 COMBINED AT
                 156TH      2.53     1   FLOW        449.
                                         TIME       18.75

ROUTED TO
+               RSAND3      2.53     1   FLOW        449.
                                         TIME       19.75

HYDROGRAPH AT
+                SAND3      1.92     1   FLOW        516.
                                         TIME       16.75

ROUTED TO
                 PSND3      1.92     1   FLOW        279.
                                         TIME       20.00

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.88
                                         TIME       20.00

 2 COMBINED AT
                 SR238S     4.45     1   FLOW        728.
                                         TIME       19.75

HYDROGRAPH AT
+                SAND4      1.04     1   FLOW        270.
                                         TIME       17.00
```

```
ROUTED TO
+                PSND4      1.04     1   FLOW        150.
                                         TIME       20.00

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.89
                                         TIME       20.00

 2 COMBINED AT
                 238DS      5.49     1   FLOW        878.
                                         TIME       19.75

ROUTED TO
                RSAND5      5.49     1   FLOW        878.
                                         TIME       23.00

HYDROGRAPH AT
+                SAND5      2.04     1   FLOW        553.
                                         TIME       17.00

ROUTED TO
+                PSND5      2.04     1   FLOW        286.
                                         TIME       20.75

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.90
                                         TIME       20.75

 2 COMBINED AT
                 MARIL      7.54     1   FLOW       1156.
                                         TIME       23.00

ROUTED TO
                RSAND6      7.54     1   FLOW       1156.
                                         TIME       25.00

HYDROGRAPH AT
+                SAND6      2.16     1   FLOW        575.
                                         TIME       16.75

ROUTED TO
+                PSND6      2.16     1   FLOW        322.
                                         TIME       19.75

                                   ** PEAK STAGES IN FEET **
                                   1   STAGE        5.86
                                         TIME       19.75

 2 COMBINED AT
                I69SAN      9.70     1   FLOW       1434.
                                         TIME       24.50

ROUTED TO
                RSAND7      9.70     1   FLOW       1434.
                                         TIME       26.25

HYDROGRAPH AT
+                SAND7      1.69     1   FLOW        411.
                                         TIME       16.75
```

```
ROUTED TO
+                PSND7      1.69     1   FLOW        230.
                                         TIME       19.75

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE        5.86
                                         TIME       19.75

 2 COMBINED AT
                 SAND      11.38     1   FLOW       1611.
                                         TIME       26.00

 2 COMBINED AT
                106TH      37.57     1   FLOW       5802.
                                         TIME       26.75

ROUTED TO
+               RMUD11     37.57     1   FLOW       5802.
                                         TIME       29.00

HYDROGRAPH AT
+                MUD11      1.46     1   FLOW        358.
                                         TIME       16.75

ROUTED TO
                 PMD11      1.46     1   FLOW        191.
                                         TIME       19.75

                                    ** PEAK STAGES IN FEET **
                                    1   STAGE        5.86
                                         TIME       19.75

 2 COMBINED AT
                 96TH      39.03     1   FLOW       5913.
                                         TIME       28.75

ROUTED TO
+               RMUD12     39.03     1   FLOW       5913.
                                         TIME       29.25

HYDROGRAPH AT
+                MUD12      1.55     1   FLOW        282.
                                         TIME       18.00

 2 COMBINED AT
                 86TH      40.57     1   FLOW       5924.
                                         TIME       29.25

ROUTED TO
               RMUD13      40.57     1   FLOW       5924.
                                         TIME       30.25

HYDROGRAPH AT
                 MUD13      1.84     1   FLOW        414.
                                         TIME       17.00

 2 COMBINED AT
+                 GAGE      42.41     1   FLOW       5924.
                                         TIME       30.25
```

*** NORMAL END OF HEC-1 ***

Hamilton County Drainage Board
Kenton C. Ward, Surveyor

MUD CREEK WATERSHED
HAMILTON COUNTY, INDIANA

EXISTING-CONDITION HYDROLOGIC ANALYSIS REFINEMENT

May 1998

Prepared by

Christopher B. Burke Engineering, Ltd.
115 W. Washington St., Suite 1368-South
Indianapolis, Indiana 46204

CBBEL Project Number 96-297A

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2 Subbasin Delineations and Stream Reaches

3 Curve Number Calculations

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6 Digital Copy of Existing-Condition Hydrologic Model Input/Output

1.0 PROJECT OVERVIEW

1.1 PROJECT BACKGROUND AND THE NEED FOR THIS STUDY

The Mud Creek watershed, which is a tributary to Fall Creek, drains approximately 44 square miles of area at its mouth. The watershed contains two major streams, identified as Mud Creek and Sand Creek, as well as several ditches including High Ditch, Kynett Ditch, Henry Ditch, and several unnamed tributaries. Portions of the watershed are located within Marion, Hamilton, and Madison Counties, as shown on **Exhibit 1**. Focus of this report is on the portion of the watershed that lies within Hamilton County.

In 1996, Mud Creek watershed was subject of a detailed study by Christopher B. Burke Engineering, Ltd. (CBBEL) which was originally directed towards examining various regional detention schemes within Mud Creek Watershed. The study found that a plan consisting of two major multi-purpose regional ponds, one on Mud Creek and the other on Sand Creek, would have a good chance of achieving some of the County's long-term stormwater goals for the watershed. However, the study also revealed a major discrepancy between the current Mud Creek and Sand Creek regulatory discharges and the detailed CBBEL modeling results. While the results generally indicated that the effective regulatory discharges and flood stages have been severely underestimated, the lack of detailed topographic information would not allow a more definitive conclusion regarding the extent of the underestimation or what the new regulatory values are recommended to be.

As a result of this unexpectedly large discrepancy, CBBEL recommended that the previously developed existing-condition hydrologic model be refined further and then be used as the basis for revising current flood hazard area maps for Mud Creek and Sand Creek within Hamilton County. In addition to incorporating better topographic data, such a refinement had to also closely follow the Federal Emergency Management Agency (FEMA) guidelines so that the resultant discharges can be readily adopted as regulatory values.

As indicated earlier, the noted recommended refinement of the existing-condition hydrologic model and the restudy of the floodplain mapping of the area would have required the use of detailed topographic mapping of the watershed, not available at the time of the original study's completion. However, the noted detailed topographic mapping became available in late 1997 and finally accepted and distributed by the County in early 1998. Consequently, after extensive discussions between the Hamilton County Surveyors Office, Indiana Department of Natural Resources (IDNR), and FEMA, CBBEL was directed in April 1998 to further refine the Mud Creek watershed existing-condition hydrologic model. The work was to be closely coordinated with the IDNR-

Division of Water staff so that the IDNR submittal to FEMA of updated hydraulic study and flood hazard area mapping for both Mud Creek and Sand Creek can proceed according to an accelerated schedule.

This report documents the results of the CBBEL efforts with regards to the refinement of the Mud Creek Watershed hydrologic study. In order to avoid any future confusions and to serve as a support documentation for the IDNR's FEMA submittal, the report is formatted as an independent document describing the collected data, the computer model used, existing-condition basin parameters, assumptions, and the results.

2.0 DATA COLLECTION

2.1 INTRODUCTION

Several sources were used to collect the best available data for the hydrologic modeling performed in conjunction with this study. The following sections briefly describe the sources of information used in the preparation of this report.

2.2 SOILS INFORMATION

Permeability can be described as a measure of the ability of a given soil to pass (infiltrate) water from its superficial layers to underlying soil layers. The permeability of soil can have a dominant effect on the amount of surface runoff produced and the duration of soil saturation for extreme rainfall events. Soil distribution information was derived from the soil maps for the watershed prepared by the Natural Resource Conservation Service (NRCS) in 1967 and 1978.

Soil groups identified from the NRCS soil maps were classified into four (4) groups according to the tabular information presented in the Highway Extension and Research Project for Indiana Counties and Cities (HERPICC) manual. These categories are identified as A, B, C and D in order of decreasing permeability. Some groups of soils exhibit different permeability characteristics, depending on whether or not there is a subsurface conveyance system in place to drain infiltrated water. These soils are given a multiple group classification, such as A/D or B/D. For the purposes of this study, it was assumed that soils with a multiple classification have a tile drain in place, except for areas adjacent to overland flow paths identified on the soils maps.

The majority of soils within the watershed are type B and C, with some type D soils. The watershed is virtually devoid of Type A soils. Information regarding the distribution of the different soil classifications across the watershed can be found in **Appendix 1**.

2.3 EXISTING-CONDITION LAND USE INFORMATION

The aerial photography of the watershed indicates a predominantly agricultural land use for the portions of the watershed in Madison County. The extent of the watershed examined in Marion County indicates a fully developed residential land use. In Hamilton County, the land use is predominantly residential in the areas west of Klepfer School Road and south of Interstate 69, with agricultural land uses predominating the remaining areas. There are also significant areas of existing woods and open space scattered

throughout Hamilton and Madison Counties. Detailed, existing-condition land use conditions across the watershed are also contained in **Appendix 1**.

2.4 TOPOGRAPHIC DATA

The topographic features of an area define the path of surface runoff through that area and ultimately define the contributing drainage area for a watershed. The outer boundary of the Mud Creek watershed was delineated based upon the most recent quadrangle topography mapping prepared by the United States Geological Survey (USGS). This was verified against a delineation performed by the IDNR, with no major discrepancies found between the two delineations. The downstream extent of the watershed delineation corresponds to a currently abandoned gaging station which was formerly operated by the USGS.

The watershed was further subdivided into twenty-six (26) subbasins, as is shown in **Exhibit 2**, based on the same quadrangle mapping. The number and location of subbasins were based on land use, as well as major locations of interest, such as roadway crossings and tributary confluences.

The subbasin delineation allows for a detailed hydrologic analysis of the watershed at various locations, rather than at a single location such as at the Hamilton County-Marion County border alone. By measuring the areas of the individual subbasins, the tributary area can be determined at points of interest. The tributary areas at several locations are summarized in **Table 1**. As can be seen in Table 1, there are 39 square miles of tributary area at the Marion-Hamilton County Border. It should be noted that of this total drainage area, significant portions are contributed by a major tributary, Sand Creek, and by upstream areas under the control of Madison County authorities.

In addition to the above-noted topographic mapping base, detailed 2-foot contour topographic mapping of the entire county became available in early 1998. This latter source was utilized for defining full valley cross sections for use in the subbasin channel routing calculations, as discussed later.

TABLE 1
Tributary Area Summary at Several Locations

Location Description/Waterway	Upstream Drainage Area (Square Miles)
Mud Creek at Madison-Hamilton Co. Border	12.1
Mud Creek at Interstate-69 Bridge	17.0
Mud Creek at Sand Creek Confluence	26.2
Sand Creek at its Mouth	11.4
Mud Creek at 106th Street Bridge	37.6
Mud Creek at 96th Street Bridge	39.0
Mud Creek at Former USGS Gage Station	42.4

3.0 EXISTING-CONDITION HYDROLOGIC ANALYSIS

3.1 INTRODUCTION

A detailed hydrologic analysis of the Mud Creek watershed is required to quantify existing flood discharges and to provide information required for revising FEMA maps showing the extent of flood hazard areas along Mud Creek and Sand Creek. This analysis was performed using computer modeling to simulate the rainfall-runoff process for synthetic design storm events. This chapter includes a discussion of the computer model selected for the hydrologic simulation, input parameters estimated for the hydrologic simulation, and a summary of model calibration efforts.

3.2 HEC-1 COMPUTER MODEL

The hydrologic analysis was performed using the U.S. Army Corps of Engineers HEC-1 computer model. HEC-1 is a single storm event model that estimates runoff from hydrologic parameters input by the user. Typical input parameters include rainfall duration-depth patterns, rainfall-runoff response parameters for each subbasin, and routing parameters of the subbasin hydrographs (discharges as a function of time) at specified nodes. Nodes may represent the confluence of a subbasin with another subbasin, a detention facility, a channel reach, or a diversion location. The model will produce hydrographs and will identify peak flows and volumes at specified locations. The following is a discussion regarding input data used in the existing-condition model.

3.3 DESIGN STORM PARAMETERS

HEC-1 requires observed or synthesized rainfall depth-distribution relationships to produce a runoff response to a given storm. This study utilizes design (synthetic) storm data.

Twenty-four (24) hour rainfall depths were based on Technical Paper 40, and were used in conjunction with the NRCS Type II, 24-hour rainfall distribution. Design storms were analyzed for the 2-, 5-, 10-, 25-, 50- and 100-year design events. **Table 2** shows the design rainfall depths used for various recurrence intervals.

TABLE 2
24-Hour TP-40 Rainfall Depths for Various Return Periods

Return Period (Years)	2	5	10	25	50	100
Design Rainfall Depth (Inches)	2.91	3.70	4.17	4.76	5.32	5.75

3.4 SUBBASIN PARAMETERS

As previously stated, the Mud Creek Watershed was subdivided, based on topographic data, into twenty-six (26) subbasins in order to more clearly define the locations of interest. Of these twenty-six subbasins, twelve (12) are associated with the Mud Creek mainstem, seven (7) are associated with Sand Creek, two (2) are associated with Kynett Ditch, three (3) are associated with unnamed tributaries, and two (2) are associated with High and Henry ditches. The areas of the individual subbasins range from 0.84 to 3.3 square miles with an average size of approximately 1.6 square miles. Detailed delineations and assumed subbasin flow paths for all subbasins are shown on a topographic map as **Appendix 2**.

The NRCS dimensionless unit hydrograph method was selected as the basis of the rainfall-runoff generation for individual subareas. This method requires three inputs for a given subbasin: basin area, NRCS curve number, and the NRCS lag time.

Basin areas were digitized and verified using an electronic planimeter. Curve numbers were calculated based on the soil data and land use information described in Chapter 2. Background curve number calculations for various subbasins are contained in **Appendix 3**. NRCS lag time is Typically estimated as a ratio (usually 0.6) of subbasin's time-of-concentration (Tc). Tc is defined as the time required for the entire subbasin to contribute runoff at the subbasin outfall. Initial Time-of-concentration calculations were performed by utilizing the TR-55 methodology and then adjusting the calculation results for Indiana-specific conditions. The NRCS TR-55 methodology considers the ground cover and slopes found in the individual subbasins to calculate travel times for various reaches of a subbasin. Background Tc calculations, based on application of TR-55 methodology, for various subbasins in the watershed is provided in **Appendix 4**. Consistent with the IDNR common procedures, these calculated values were multiplied by a factor of 1.67 to account for Indiana-specific conditions. An initial estimate of the NRCS Lag Time parameter was then developed by multiplying the adjusted value of Tc

by 0.6, as recommended by the HEC-1 computer program procedures. A summary of the calculated subbasin hydrologic input parameters for existing conditions is shown in **Table 3**.

TABLE 3
Calculated Hydrologic Parameters Summary

Subarea ID	AREA (ACRES)	AREA (Sq. mi.)	Initial Estimate of NRCS Lag Time (HOURS)	NRCS Curve Number (CN)
MUD1	2131	3.33	5.04	78
MUD2	874	1.37	3.99	80
MUD3	1109	1.73	7.13	79
MUD4	1213	1.89	4.26	80
MUD5	1308	2.04	3.23	77
MUD6	840	1.31	2.89	75
MUD7	539	0.84	3.19	80
MUD8	1445	2.26	2.19	79
MUD9	1068	1.67	2.72	79
MUD10	1163	1.82	3.66	75
MUD11	932	1.46	2.28	74
MUD12	991	1.55	4.11	71
MUD13	1177	1.84	2.30	76
SAND1	629	0.98	3.70	79
SAND2	993	1.55	3.36	79
SAND3	1228	1.92	3.36	79
SAND4	666	1.04	3.43	79
SAND5	1308	2.04	4.15	79
SAND6	1382	2.16	2.78	79
SAND7	1079	1.69	2.71	76
TRIB1	1103	1.72	5.56	80
TRIB2	702	1.10	3.76	80
HENRY1	974	1.52	6.31	78
KYNET1	729	1.14	4.42	79
KYNET2	736	1.15	3.1	79
HIGH1	828	1.29	3.03	81

3.5 SUBBASIN CHANNEL ROUTING

In order to account for existing channel storage and to properly lag the hydrographs between subbasins, the Muskingum-Cunge method, which incorporates both hydrograph translation and attenuation of peak flows, was selected to route hydrographs through various channel reaches. The Muskingum-Cunge method requires an eight-point cross-section to best represent the attenuation and storage within a given reach. The formulation of these representative cross-sections were based on valley cross-sections obtained from the recent Hamilton County 2-foot contour interval mapping. Other data used to estimate the required parameters for each subbasin included USGS quadrangle maps, IDNR official mileage maps, IDNR-supplied approximate Manning's N values, and IDNR-recorded high water marks along Mud Creek and Sand Creek for the flood of May 1989.

3.6 FLOW DIVERSIONS

Diversion occurs when flood elevations along a stream or conveyance path reach an elevation above the outer boundary of the watershed at a location other than the most downstream location within the watershed. Once this elevation is reached, runoff can exit the subject watershed at this location, thus causing a loss of runoff volume at the ultimate outfall.

Two potential diversion locations were preliminarily identified based on the topographic mapping. The first location is approximately 2,500 feet east of Brooks School Road along the southern watershed boundary. The second is near the Sand Creek crossing of 136th Street. The first location would divert Mud Creek runoff into Geist Reservoir, located approximately 5,000 feet downstream of the diversion crest. The second location would divert Sand Creek runoff to William Lehr Ditch. The historic profile for Mud Creek would indicate that the first location did divert runoff in past extreme events, including the 1989 event for which high water marks exist. No documentation was found as to whether the potential diversion at Sand Creek has been observed to divert runoff.

Although the Geist Reservoir diversion has occurred in the past, based on the most recent detailed topographic mapping of the area this diversion location is no longer effective, as this area has since been developed into residential neighborhoods.

Since no historic profile was found for Sand Creek, the current regulatory hydraulic model for Sand Creek was examined near 136th Street to estimate the flood profile at this location. The model indicates an elevation of 812 feet at the upstream face of the 136th Street crossing. Using detailed topography compiled in 1970 (Williams, 1970), the

minimum roadway elevation for 136th Street near the potential diversion path was 813.5 feet. It is therefore assumed that diversion to Lehr Ditch would only have occurred for events more extreme than the 100-year event. This is not to say that diversion of flows did not occur in the past, since the current regulatory model may or may not be hydraulically representative of site conditions or consistent with historic events due to physical changes that may have occurred along Sand Creek and Sand Creek bridge crossings. However, the available information dictates that this potential diversion path be ignored for the purposes of this study.

Therefore, although both locations may have diverted runoff in past storm events, no diversion is accounted for in the existing-condition hydrologic modeling at these locations.

3.7 USGS GAGE DATA

During the period of years from 1958 to 1976, the United States Geological Survey maintained a continuous record gage on Mud Creek adjacent to Lantern Road, north of 75th Street, on the north side of Marion County. This gage was then reduced to read only crest stage and low-flow partial records until 1984 when gage measurements were discontinued altogether. The former location of this gage is identified on the most recent quadrangle mapping for the area. It can be noted that the reported drainage area at this gage is 42.4 square miles, coinciding with the delineation performed for this study and with the delineation performed by the IDNR.

Both the IDNR and the USGS were contacted to obtain available information on the gage records. The fate of the original continuous gage data, which would have provided hydrographs for historic events, is unknown at this point. However, peak discharge data was provided by the Indiana Department of Natural Resources. This information indicates a peak flowrate of 2,010 cfs for the April 1964 storm event, the highest flow recorded at the gage.

No historic profiles were available for the 1964 flood event. However, a historic profile of the 1961 flood event was available and was utilized to examine the representativeness of the gage records. An examination into the 1961 historic flood profile for Mud Creek near the diversion point yielded a maximum flood profile elevation of approximately 795.5 feet for the Mud Creek mainstem, which was influenced by the Geist Reservoir diversion during the 1961 storm event. Based on Fall Creek (Geist) Reservoir mapping compiled in 1971, Brooks School Road would have been overtopped at an elevation of 794.8 feet along the diversion path. An analysis of the Brooks School roadway profile, obtained from the 1971 mapping, yielded a roadway overtopping capacity of 200 cfs at an

elevation of 795.5. Increasing the overtopping profile to an elevation of 796.0 feet would increase the diversion capacity to 600 cfs, with a diversion capacity in excess of 1,000 cfs at a roadway overtopping elevation of 796.5 feet.

The 1961 historic profile obtained from the IDNR corresponded to a peak flowrate measured at the USGS gaging station of 1,090 cfs. Based on a listing of observed peak flow rates during the gage station operation period, it appears that four (4) out of twenty-one (21) peak annual discharges measured at the USGS gage station were equal or greater than the discharge of 1,090 cfs, for which diversion of flow have occurred. Since the noted diversion is no longer effective due to new development in the area and blockage of the former overflow path, it is concluded that the historically recorded data at this location are not representative of the existing condition of the watershed. Subsequently, peak discharge estimates resulting from statistical analyses of the Mud Creek gage data should not be used for design analyses or for determining the extent of potential flood hazard areas in the basin.

3.8 COORDINATED DISCHARGE DATA

The coordinated discharge for Mud Creek was based, at least partially, on a statistical analysis of twenty-one (21) annual peak discharges measured at the former gaging station. The current 100-year coordinated discharge at the Mud Creek gage station is approximately 2,430 cfs, with the Sand Creek discharge coordination based on the Mud Creek coordination. The 100-year coordinated discharge for Sand Creek at its mouth is approximately 975 cfs.

As discussed in Section 3.7, the USGS gage data, which included only twenty-one (21) annual peak discharges, likely experienced unaccounted diversion flow for at least four of the annual peak discharge measurements. Therefore, extrapolation of this gage data to predict extreme flood discharges, such as a 100-year event discharge, would not appear to produce an accurate estimate for the existing conditions of the watershed. As will be discussed later, it appears that the coordinated discharges for Mud Creek and Sand Creek significantly underestimate the expected 100-year discharge, as calculated through detailed hydrologic analyses and regional peak discharge determinations. A comparison of Mud Creek coordinated discharges relationships with relationships of other similar streams in the area reveals a significant discrepancy in the magnitude of expected discharges for a given size of watershed area.

3.9 MODEL CALIBRATION

Ideally, all hydrologic models would be calibrated against a reliable gage on the waterway in question. Unfortunately, no detailed or reliable data are available from the former Mud Creek Gage. Therefore, after discussions with the IDNR, USGS, and FEMA staff, it was decided to calibrate the model against a regionally determined estimate of the 100-year flood peak at the former gage location.

3.9.1 Regional Determination of 100-Year Peak Discharge

The first regional determination made for the site was based on the USGS regression equation (USGS,1984 and HERPICC,1995). The USGS regression equation, correlating various selected parameters, was developed by USGS for seven (7) areas within the State of Indiana. Mud Creek Watershed falls within Area 3 where pertinent parameters for 60 stream gaging stations were used to develop a regional relationship between peak flood discharge of various return intervals and drainage area, slope, and rainfall intensity. The regression equation for the 100-year peak discharge is as follows:

$$Q_{100} = 181\ DA^{0.779}\ SL^{0.466}\ (I_{24,2}-2.5)^{0.831}$$

Where,

- Q_{100} is the regional estimate of the 100-year peak discharge (cfs),
- DA is the contributing drainage area (mi^2),
- SL is the slope (feet per mile), and
- $I_{24,2}$ is the rainfall intensity for the 2-year, 24-hour storm (inches).

Mud Creek has a drainage area of 42.4 mi^2 at the former stream gage location, a slope of 6.7 feet per mile, and an $I_{24,2}$ of 2.9 inches. Using these parameters, the regional estimate of the 100-year flood peak discharge was calculated to be about 3,800 cfs.

Because the USGS regression equation may have been affected by the non-representative peak discharge estimates from the former Mud Creek gage, it was decided to develop other regional estimates of the 100-year peak flood discharge for the site which were not affected by the gage data. To accomplish this, pertinent information for 28 gaging stations in the region with adequate length of record were obtained from a USGS publication (USGS, 1994) and from the IDNR-Division of Water files. General locations of these stream gages are shown in **Exhibit 3**. **Table 4** summarizes the pertinent data for these stations. The 100-year peak discharge estimates for these stations were obtained from the most recent, printed IDNR flood frequency analyses results, developed using the Bulletin 17B program. The number of years of record used for the analysis of each station is also provided in the table.

TABLE 4
Pertinent Data on Selected Stream Gaging Stations in the Region

No.	Stream and Station Name	USGS Station ID	DA (mi^2)	Slope (ft/mi)	Yrs. of Record	Q_{100} Estimate from B-17B (cfs)
1	Pleasant Run at Arlington	3353120	7.58	15.5	36	3,660
2	Eagle Creek at Zionsville	3353200	103	15.2	36	19,300
3	Lick Creek at Indianapolis	3353620	15.6	11.5	24	3,950
4	West Fork White Lick Creek at Danville	3353700	28.8	10.6	38	5,640
5	White Lick Creek at Mooresville	3353800	212	9	38	23,700
6	Plum Creek Near Bainbridge	3357350	3	24.2	25	1,130
7	Big Blue River at Carthage	3361000	184	5.8	45	12,200
8	Sugar Creek at New Palestine	3361650	93.9	5.5	27	4,910
9	Buck Creek at Acton	3361850	78.8	14.8	27	7,050
10	Youngs Creek Near Edinburgh	3362000	107	4.3	51	14,500
11	Clifty Creek at Hartsville	3364500	91.4	10.3	47	12,300
12	Brush Creek Near Nebraska	3368000	11.4	28.1	39	5,840
13	Back Creek at Leesville	3371520	24.1	25.5	24	17,200
14	Hall Creek Near St. Anthony	3375800	21.8	18.2	24	11,100
15	West Fork Blue River at Salem	3302680	19	36.8	24	12,000
16	Big Lick Creek Near Hartford City	3326070	29.2	4.2	24	2,530
17	Wildcat Creek Near Jerome	3333450	146	3.3	32	8,660
18	Kokomo Creek Near Kokomo	3333600	24.7	4.5	35	1,110
19	Big Raccoon Creek Near Fincastle	3340800	139	7.2	37	30,600
20	Busseron Creek Near Hymera	3342100	16.7	13.2	28	2,420
21	Pipe Creek at Frankton	3348350	113	4.5	26	7,440
22	Stony Creek Near Noblesville	3350700	50.8	6.8	27	2,340
23	Killbuck Creek Near Gaston	3348020	25.5	3.6	23	1,940
24	Buck Creek Near Muncie	3347500	35.5	10.2	40	2,160
25	Fall Creek Near Fortville	3351500	169	7.2	53	10,000
26	Little Cicero Creek Near Arcadia	3349700	40.4	6.2	26	4,440
27	Hinkle Creek Near Cicero	3350100	18.5	18.7	26	6,560
28	Cicero Creek Near Arcadia	3349500	131	4	26	6,460

Originally, several subsets of these 28 stations were analyzed to investigate a correlation between the estimated 100-year peak discharge and the contributing drainage area. These subsets included (a) all 28 stations, (b) stations with relatively similar slopes (between 0.5 to 2.0 times the slope of Mud Creek at the gage), (c) stations with relatively similar drainage area size (between 0.5 and 2.0 times the drainage area of Mud Creek at Gage), and (d) selected stations in close proximity of the Mud Creek gage. Based on previous experience, it was assumed that the drainage area vs. discharge relationship will be linear when analyzed on a log-log basis. Further analyses of the basin parameters and gage locations revealed that, due to wide range of slopes and geographical variations, subsets (a) and (c) would not adequately represent the specific Mud Creek watershed conditions. Therefore, subsets (a) and (c) were eventually eliminated from further analyses.

Stations included in the "relatively similar slope" subset, subset (b), included Station numbers 3 through 5, 7, 8, 10, 16 through 26, and 28. Using the log-log relationship, the least square fit between the peak 100-year discharge and contributing drainage area for the group of stations in the noted subset was established. **Exhibit 4** shows the best-fit relationship for this subset. Based on the noted correlation analysis of the "relatively similar slope" subset, the 100-year peak discharge for the Mud Creek former gage location was estimated to be approximately 4,040 cfs.

Stations included in the "selected geographically close" subset, subset (d), included Station numbers 21 and 22 through 27. Using the log-log relationship, the least square fit between the peak 100-year discharge and contributing drainage area for the group of stations in the noted subset was established. **Exhibit 5** shows the best-fit relationship for this subset. Based on the noted correlation analysis of the "selected geographically close" subset, the 100-year peak discharge for the Mud Creek former gage location was estimated to be approximately 4,070 cfs.

Based on the application of the USGS regression equation and the above peak discharge - drainage area correlation analyses, it is concluded that the 100-year peak discharge at the former Mud Creek stream gage location is expected to be in a range between 3,800 cfs and 4,070 cfs. However, as indicated earlier, it is possible that the USGS regression equation for this area may have been unduly influenced by the non-representative Mud Creek gage peak discharge estimate. Therefore, to be conservative, a value of approximately **4,000 cfs** is selected as the regional estimate of the 100-year peak discharge at the Mud Creek former gage location. This estimated value is about 65% higher than the current regulatory peak 100-year discharge at this location (2,430).

3.9.2 Mud Creek Watershed HEC-1 Model Calibration

For the NRCS dimensionless unit hydrograph method, normally two subbasin parameters can be adjusted to calibrate a hydrologic model: the curve number and/or the time of concentration. However, approximation for the time of concentration is often more subjective than the curve number calculation. Based on past experience with hydrologic modeling of watersheds in Indiana, more realistic estimates of the time of concentration for Indiana watersheds have traditionally resulted from increasing the values calculated through the use of NRCS TR-55 methodologies.

To determine whether the previously determined times of concentration needed adjustment, the initial uncalibrated existing-condition model, using the parameters indicated in Table 3, was executed for the 100-year event. As expected, the resultant 100-year peak discharge at the former gage location was higher than the regional estimate.

For the Mud Creek Watershed, the slopes of the subbasin reaches were estimated from the USGS quadrangle maps with 10-foot contour intervals. This level of contour data precludes accurate estimates of the slope of a flat subbasin reach, such as many of Mud Creek watershed subbasins. In addition, many of the Mud Creek watershed subbasins include depressional storage which could further decrease the velocity of the water and lengthen the time of concentration. For these site-specific reasons, the times of concentration of watershed subbasins were adjusted upward to achieve calibration of the 100-year peak discharge to the regional estimate.

The calibration was achieved by increasing the NRCS lag times for each subbasin by a uniform coefficient until the 100-year discharge converged to a value reasonably close to the regionalized estimate of about 4,000 cfs at the former gage site. This resulted in a coefficient of 1.75 being applied to the initial NRCS lag time estimates (an increase of 75%). The calibrated parameters for various subbasins has been provided in **Table 5**

TABLE 5
Calibrated Hydrologic Parameters Summary

Subarea ID	AREA (ACRES)	AREA (Sq. mi.)	Calibrated NRCS Lag Time (HOURS)	NRCS Curve Number (CN)
MUD1	2131	3.33	8.82	78
MUD2	874	1.37	6.98	80
MUD3	1109	1.73	12.48	79
MUD4	1213	1.89	7.46	80
MUD5	1308	2.04	5.65	77
MUD6	840	1.31	5.06	75
MUD7	539	0.84	5.58	80
MUD8	1445	2.26	3.83	79
MUD9	1068	1.67	4.76	79
MUD10	1163	1.82	6.41	75
MUD11	932	1.46	3.99	74
MUD12	991	1.55	7.19	71
MUD13	1177	1.84	4.03	76
SAND1	629	0.98	6.48	79
SAND2	993	1.55	5.88	79
SAND3	1228	1.92	5.88	79
SAND4	666	1.04	6.00	79
SAND5	1308	2.04	7.26	79
SAND6	1382	2.16	4.87	79
SAND7	1079	1.69	4.74	76
TRIB1	1103	1.72	9.73	80
TRIB2	702	1.10	6.58	80
HENRY1	974	1.52	11.04	78
KYNET1	729	1.14	7.74	79
KYNET2	736	1.15	5.43	79
HIGH1	828	1.29	5.30	81

4.0 FINAL RESULTS

4.1 INTRODUCTION

This chapter presents the results of detailed, calibrated hydrologic modeling for the existing conditions of the Mud Creek watershed and provides a comparison between the modeling results and current regulatory discharges.

4.2 EXISTING-CONDITION HYDROLOGIC ANALYSIS RESULTS

The calibrated existing-condition model was executed using the design storm events described in Section 3.3 and the calibrated basin parameters described in Section 3.9. The results are summarized for Mud Creek in **Table 6**. **Table 7** shows the summary of results for Sand Creek. **Exhibit 6** shows the final 100-year hydrographs for Sand Creek at its confluence with Mud Creek, Mud Creek just upstream of Sand Creek Confluence, and Mud Creek at the former USGS gaging station location. A detailed input/output of the model is provided in **Appendix 5** and a digital copy of the model is included as **Appendix 6**.

This analysis assumed negligible peak discharge attenuation due to potentially restrictive structures such as inadequate bridge or culvert crossings, on the assumption that any such structures were not necessarily designed to be restrictive and would eventually be replaced.

From a detailed analysis of the existing-condition hydrographs, it can be observed that the composite Sand Creek hydrograph reaches peak before the corresponding Mud Creek mainstem hydrograph peak at that same location (22.75 verses 28.50 hours after start of the 24-hour 100-year rainfall event). Potential future-condition detention facilities should be cognizant of this timing difference between the two watersheds. Such facilities should be designed to benefit from the difference in timing of the Sand Creek and Mud Creek hydrographs, rather than exacerbating the downstream flooding problem.

TABLE 6
Existing-Condition Peak Discharges at Select Locations Along Mud Creek

Location Description	Contributing Drainage Area (Sq. Miles)	Peak Discharges for Various Design Storm Recurrence Intervals (cfs)					
		2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
Mud Creek at Hamilton-Madison County Border	12.1	557	847	1,057	1,304	1,558	1,738
Mud Creek at I-69	17.0	736	1,122	1,405	1,736	2,079	2,323
Mud Creek at SR238	17.8	761	1,162	1,457	1,801	2,157	2,412
Mud Creek u/s of Sand Creek Confluence	26.2	798	1,230	1,557	1,948	2,364	2,666
Mud Creek d/s of Sand Creek (106th Street Bridge)	37.6	1,112	1,698	2,145	2,753	3,435	3,932
Mud Creek at the 96th Street Bridge (Marion County Line)	39.0	1,140	1,738	2,173	2,760	3,428	3,919
Mud Creek at the Former USGS Gage (u/s of 75th St)	42.4	1,211	1,843	2,284	2,846	3,516	4,017

TABLE 7
Existing-Condition Peak Discharges at Select Locations Along Sand Creek

Location Description	Contributing Drainage Area (Sq. Miles)	Peak Discharges for Various Design Storm Recurrence Intervals (cfs)					
		2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
Sand Creek at 156th Street	2.5	161	247	310	383	458	511
Sand Creek d/s of SR238	5.5	343	525	658	811	968	1,080
Sand Creek at 136th Street	7.5	458	700	878	1,081	1,288	1,434
Sand Creek at I-69	9.7	553	843	1,040	1,274	1,516	1,686
Sand Creek at Mouth	11.4	607	919	1,134	1,380	1,640	1,826

4.2 COMPARISON OF DETAILED STUDY RESULTS AND REGULATORY VALUES

The results of the refined existing-condition analysis confirmed large differences between peak discharges estimated in this study and those previously estimated by regulatory agencies through less detailed analysis. **Table 8** provides a summary comparison of flowrates estimated by various sources at several key locations within the watershed.

TABLE 8
Comparison of 100-Year Peak Discharges Estimated by Various Sources

Location Description	100-Year Peak Discharges			
	Drainage Area (Sq. mi.)	Coordinated Discharge (cfs)	Flood Insurance Study Discharge (cfs)	Existing-Condition Model Discharge (cfs)
Mud Creek at Hamilton-Madison County Border	12.1	1,050 *	NA**	1,738
Mud Creek at I-69	17.0	1,320 *	NA**	2,323
Mud Creek at SR238	17.8	1,380 *	NA**	2,412
Mud Creek u/s of Sand Creek Confluence	26.2	1,740	1,740	2,666
Mud Creek d/s of Sand Creek Confluence (106th St. Bridge)	37.6	2,280	2,280	3,932
Mud Creek at 96th Street Bridge	39.0	2,300	2,500	3,919
Mud Creek at Former Gage	42.4	2,430	2,500	4,017
Sand Creek at 156th Street	2.5	360 *	NA**	511
Sand Creek d/s of SR238	5.5	610	490	1,080
Sand Creek at 136th Street	7.5	750	700	1,434
Sand Creek at I-69	9.7	880	860	1,686
Sand Creek at its mouth	11.4	980	990	1,826

* The specified location is beyond the limits shown on the Coordinated Discharge curve. However, for comparison purposes an extrapolated value is being provided.

** The specified location is beyond the limits of the detailed Flood Insurance Study hydraulic model.

From Table 8 it can be seen that the 100-year flowrates used in the regulatory hydraulic model and those determined from the effective Coordinated Discharge relationships are approximately 55% to 60% of that predicted by the existing-condition hydrologic model for the Mud Creek mainstem, and approximately 50% to 55% for the Sand Creek. *There are serious implications to this, as the flood protection grade for existing residential structures built adjacent to the regulatory floodplain is expected to have been based on this lower flowrate.* The extreme differences in existing-condition and Coordinated Discharges, as shown in Table 8, imply a significant need for agency re-evaluation of discharge-drainage area relationships (also known as" re-coordination") of Mud Creek and Sand Creek, based on the results of this detailed HEC-1 study. This re-coordination would more effectively guide future development in the basin since flood elevations would be based on more refined estimates of Mud Creek and Sand Creek discharges.

R96297A.598

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- McCordsville - Created 1962, Revised 1981, Photoinspected 1984.
- Riverwood - Created 1969, Photorevised 1988, Minor Revisions 1994.

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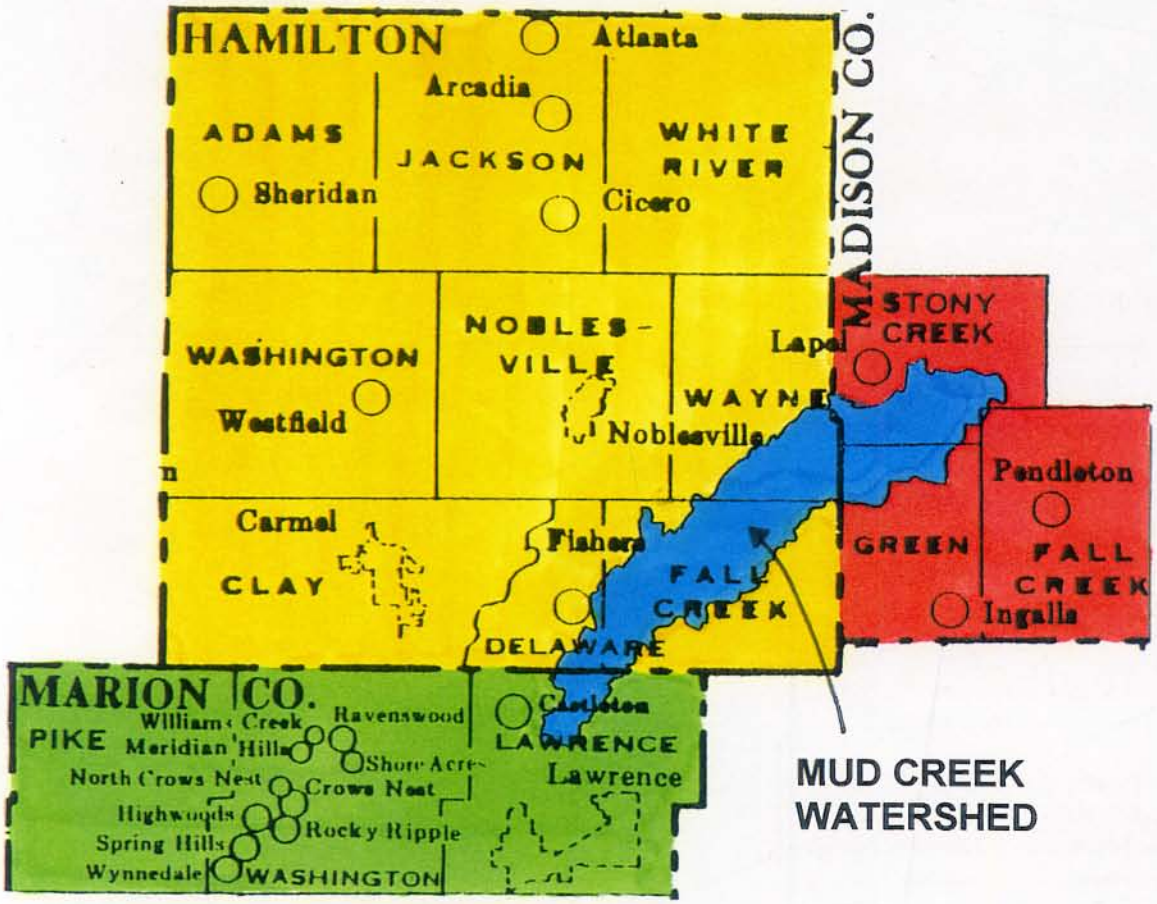

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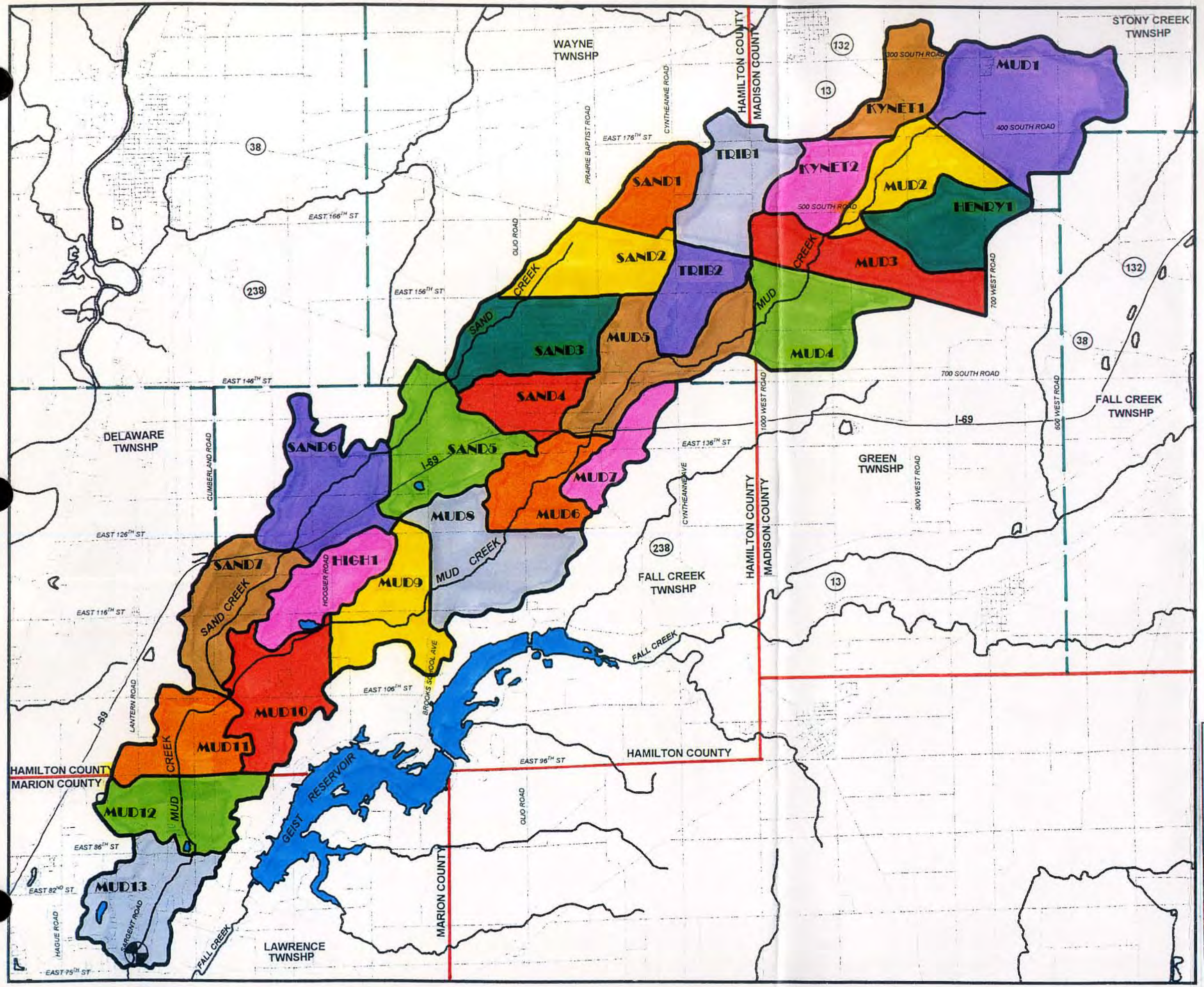

LEGEND

- County Boundary
- Township Boundary
- Sub-Basin Boundary
- MUD7 — Sub-Basin Name
- Abandoned USGS Gaging Station

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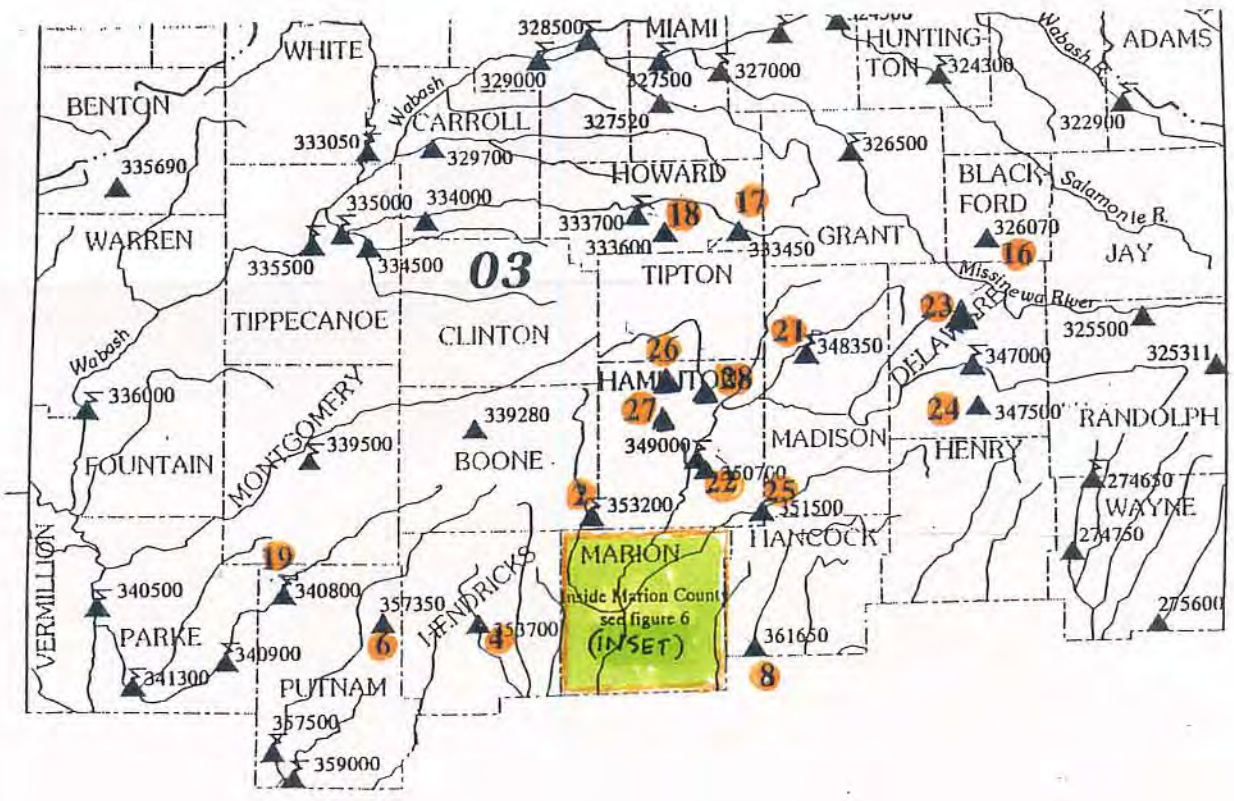
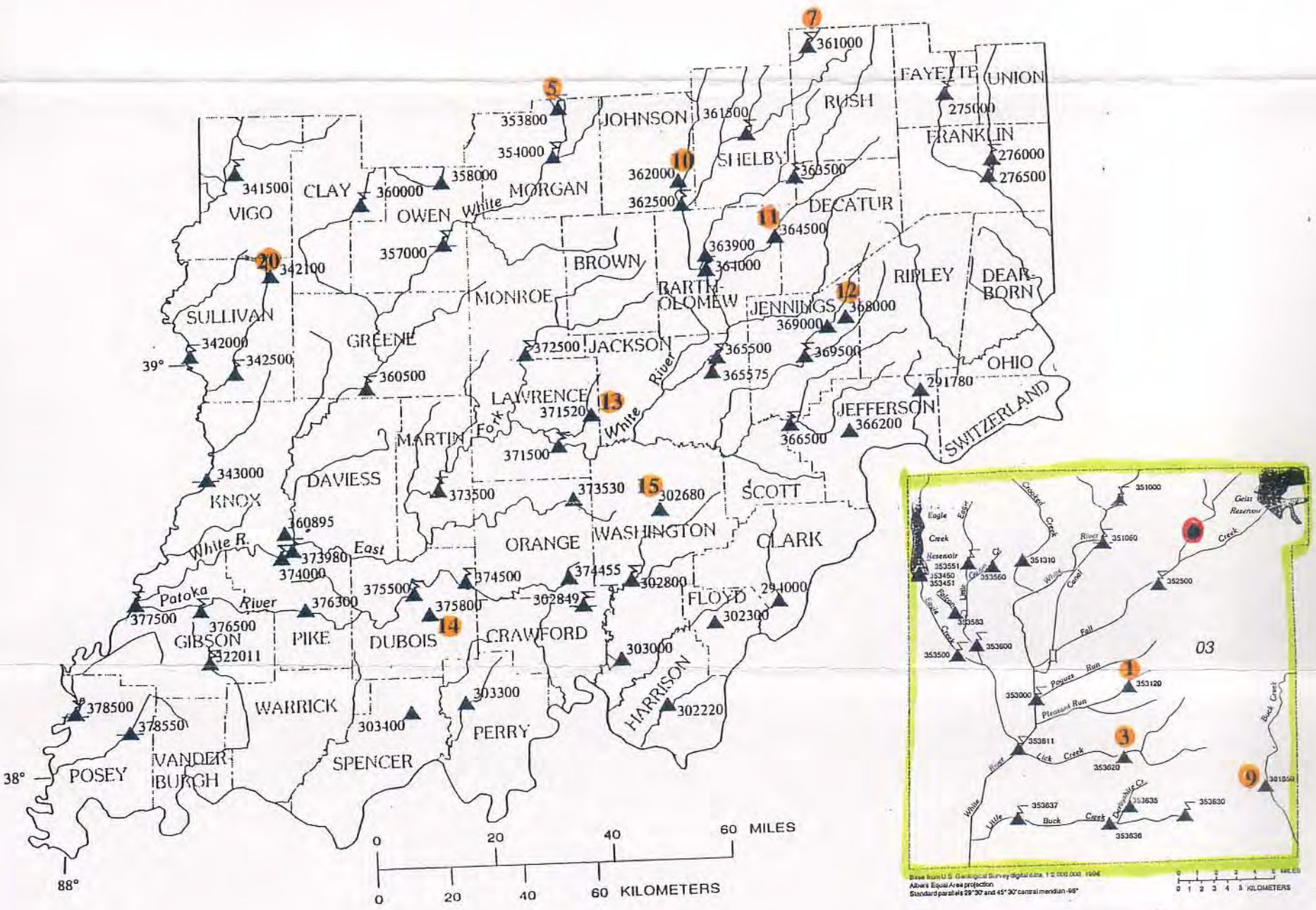
TITLE: SUBBASIN IDENTIFICATION MAP		DATE: 05/98
		EXHIBIT 2





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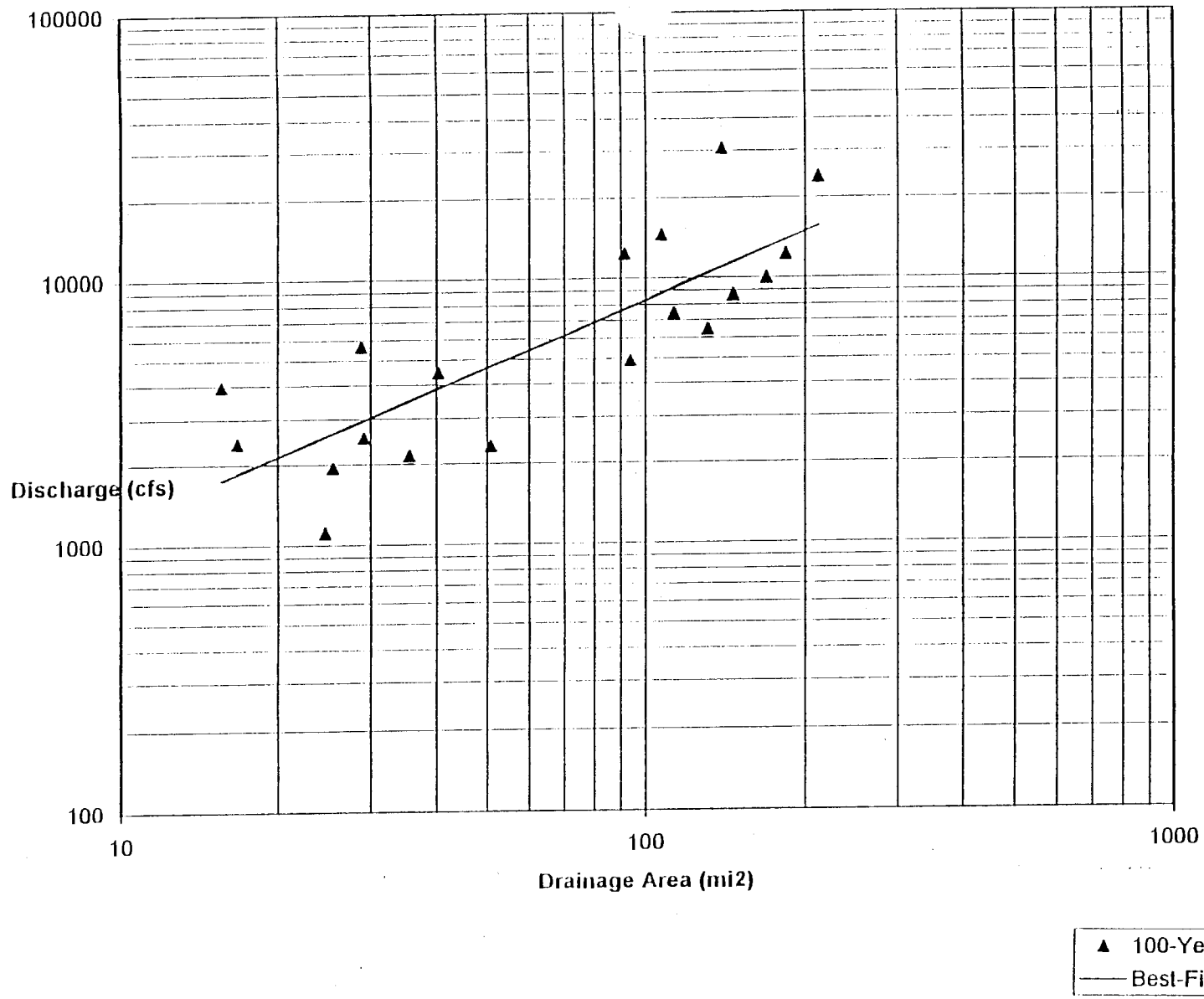

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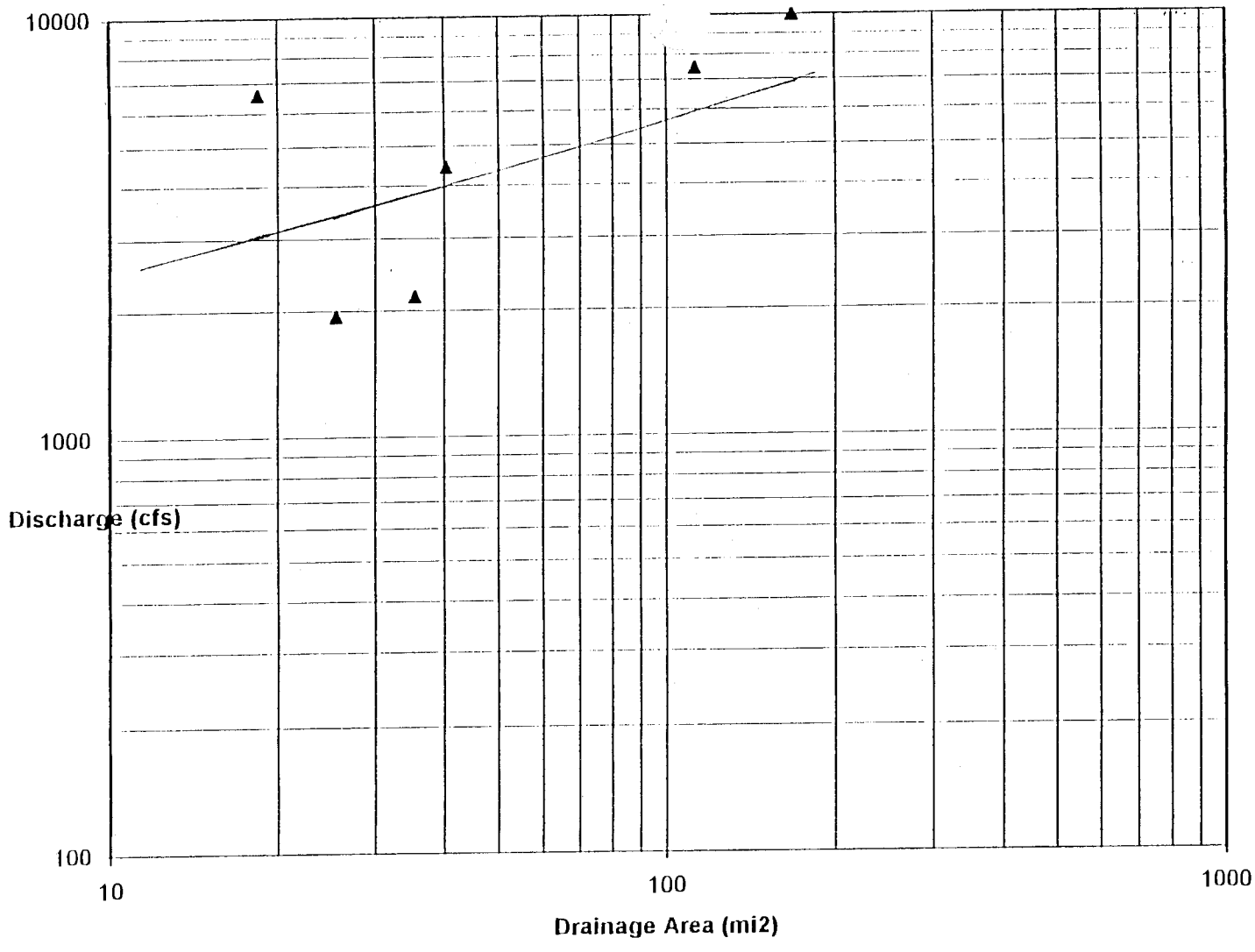
		EXHIBIT 4



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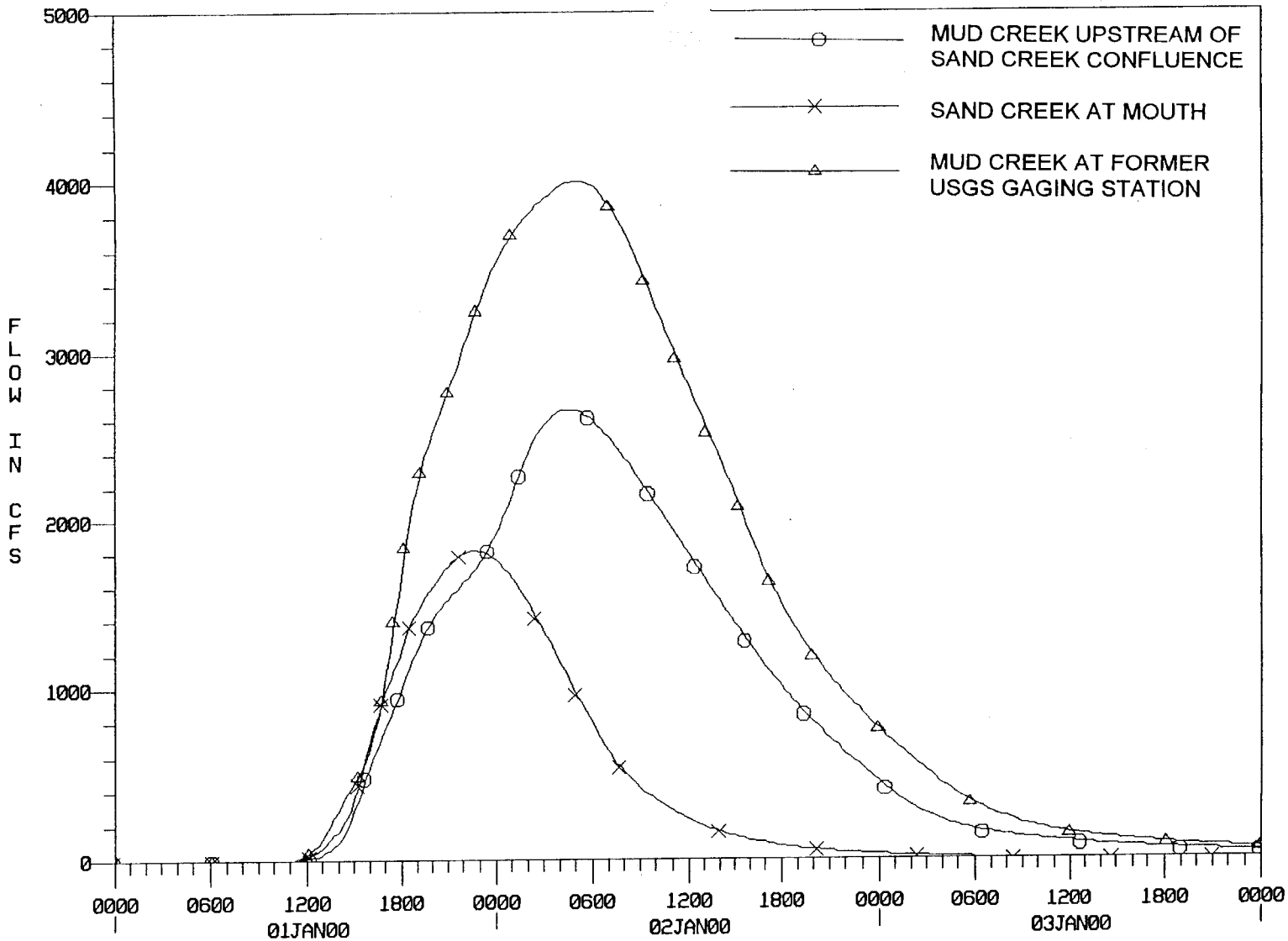
TITLE: 100-YEAR PEAK DISCHARGE RELATIONSHIP WITH DRAINAGE AREA FOR SELECTED STATIONS IN CLOSE PROXIMITY TO THE MUD CREEK WATERSHED		DATE: 05/98
		EXHIBIT 5



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PROJECT:	PROJECT NO.:	APPROX. SCALE:
MUD CREEK WATERSHED HYDROLOGIC ANALYSIS REFINEMENT	96-297a	N / A
TITLE: EXISTING CONDITION 100-YEAR FLOOD HYDROGRAPHS AT SELECT LOCATIONS		DATE: 05/98
		EXHIBIT 6

APPENDIX 1

Existing-Condition Land Use/Soil Classification Data

Mud Creek Watershed Study
CBBEL Project No. i96-297

CALCULATED BY DLM DATE 12/27/96
CHECKED BY MMR DATE 12/30/96

HYDROLOGIC SOIL GROUP DISTRIBUTIONS FOR EACH SUBAREA*

Subarea ID	A	B	C	D
MUD1	0.0%	50.0%	30.0%	20.0%
MUD2	0.0%	35.0%	40.0%	25.0%
MUD3	0.0%	50.0%	45.0%	5.0%
MUD4	0.0%	35.0%	50.0%	15.0%
MUD5	0.0%	50.0%	45.0%	5.0%
MUD6	2.0%	64.0%	30.0%	4.0%
MUD7	0.0%	35.0%	60.0%	5.0%
MUD8	0.0%	35.0%	60.0%	5.0%
MUD9	0.0%	35.0%	40.0%	25.0%
MUD10	0.0%	40.0%	45.0%	15.0%
MUD11	0.0%	65.0%	30.0%	5.0%
MUD12	0.0%	70.0%	25.0%	5.0%
MUD13	0.0%	50.0%	40.0%	10.0%
SAND1	0.0%	35.0%	65.0%	0.0%
SAND2	0.0%	40.0%	50.0%	10.0%
SAND3	0.0%	50.0%	35.0%	15.0%
SAND4	0.0%	52.0%	40.0%	8.0%
SAND5	1.0%	42.0%	42.0%	15.0%
SAND6	0.0%	40.0%	50.0%	10.0%
SAND7	0.0%	55.0%	40.0%	5.0%
TRIB1	0.0%	35.0%	45.0%	20.0%
TRIB2	0.0%	35.0%	45.0%	20.0%
HENRY1	0.0%	60.0%	30.0%	10.0%
KYNET1	0.0%	50.0%	35.0%	15.0%
KYNET2	0.0%	45.0%	40.0%	15.0%
HIGH1	0.0%	30.0%	40.0%	30.0%

* - Distribution estimated based on visual inspection of soil distribution in each subarea

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JOB Mud Creek Watershed Study 96-297
SHEET NO. CN (summary + assumptions) OF
CALCULATED BY MR DATE 12/31/96
CHECKED BY DLM DATE 1/3/97
SCALE

Assumptions for CNs (present condition)

① aerials flown in 1985 → assume land use has not changed significantly*

② Unless soil maps showed convincingly otherwise, wooded areas and farmsteads were associated with soil groups proportionate to the percentage over the entire sub-watershed. If total was 2% or less of subarea, C soils were used.

③ All farmland was assumed to be Row Crops, Straight Row + Residue Cover, + in good condition

④ All wooded areas were assumed to be in fair condition

⑤ Areas inundated by water were subtracted from the total percentage of C soils within the sub-watershed.

⑥ For Town of Fishers:
- ⓐ Residential (Subdivisions) are assumed ½ acre lots
- ⓑ Golf Courses are in good condition
- ⓒ heavily wooded residential lots are assumed woods, fair condition

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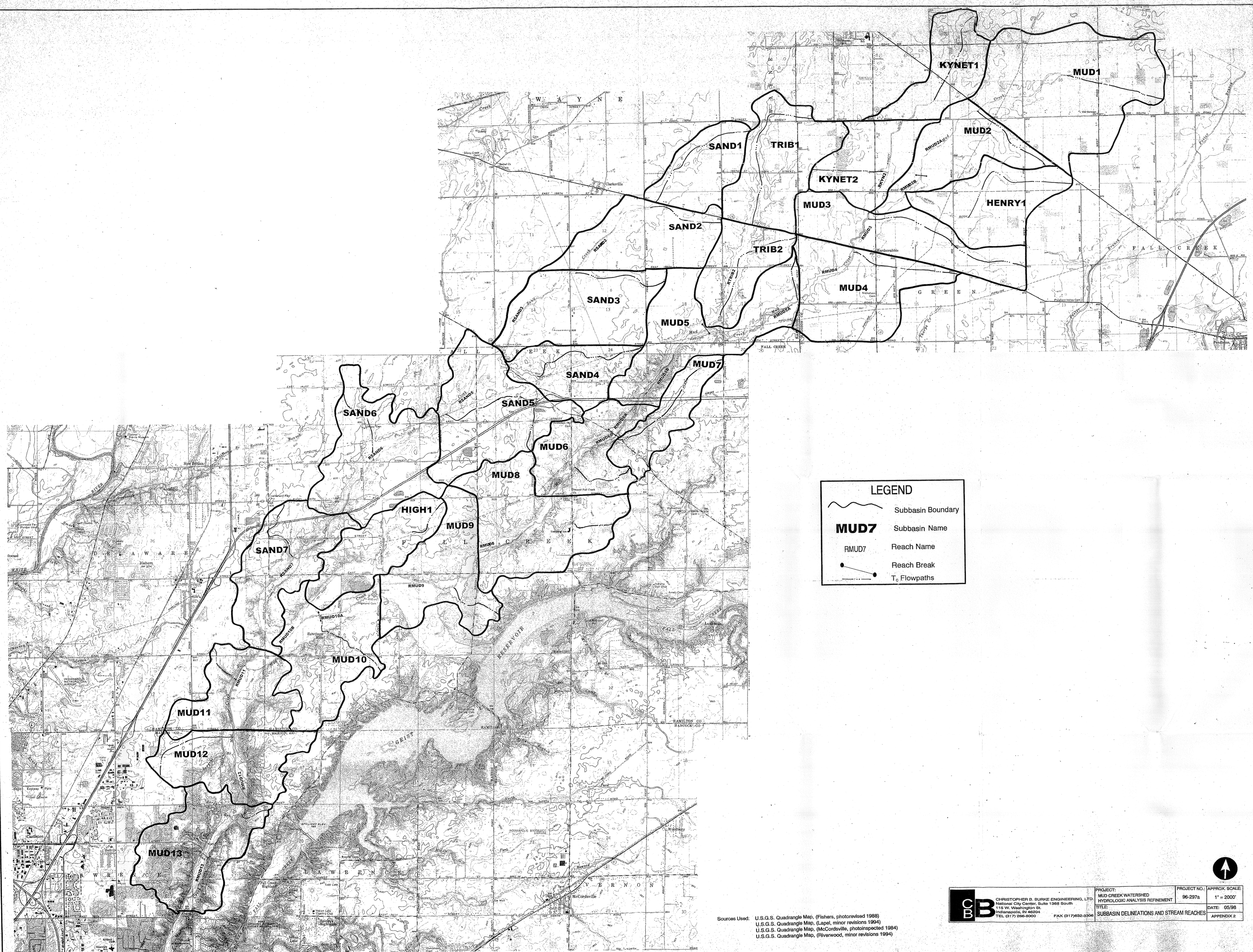
APPENDIX 2

Subbasin Delineations and Stream Reaches



Sources Used: U.S.G.S. Quadrangle Map, (Fishers, photorevised 1988)
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TITLE: SUBBASIN DELINEATIONS AND STREAM REACHES	DATE: 05/98	
	APPENDIX 2	

APPENDIX 3

Curve Number Calculations

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			1	0.73
B	Row Crops, SR+CR, Good	75			48	36.0
C	"	82			27	22.14
D	"	85			20	17.0
C	Farmsteads	82			2	1.64
				Totals =	100	77.66

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ——— = _____; Use CN = 78

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By DMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed MUD 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Farmstead	82			1.0	0.82
B	Row Crops, SR+CR, Good	75			35.0	26.25
C	"	82			39.0	31.98
D	"	85			25.	21.25
				Totals =	100	80.3

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed MUD 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	Farmsteads	74			2	1.48
C	Farmsteads	82			2	1.64
C	Woods, Fair	73			1	0.73
B	Row Crops, STR, Good	75			48	36.0
C	"	82			42	34.44
D	"	85			5	4.25
				Totals =	100	78.54

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DCM Date 1/3/97

Circle one: (Present) Developed MUD 4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
C	Woods, Fair	73			2.0	1.46
B	Row Crop, SR+CR, Good	75			35.0	26.25
C	"	82			47.0	38.54
D	"	85			15.0	12.75
C	Farmsteads	82			1.0	0.82
				Totals =	100	79.82

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			11	8.03
-	Water	98			1	0.98
C	Residential, 1 acre lots	79			1	0.79
C	Farmsteads	82			1	0.82
B	Row Crops SR+CR, Good	75			48	36
C	"	82			31	25.42
D	"	85			5	4.25
				Totals =	100	77.49

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 77

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/9/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
-	Water	98			1	0.98
A	Woods, Fair	36			2	0.72
B	Woods, Fair	60			3	1.8
C	Woods, Fair	73			12	8.76
D	Woods, Fair	79			1	0.79
C	Farmsteads	82			2	1.64
B	Row Crops, SR+CR, Good	75			61	45.75
C	"	82			15	12.3
D	"	85			3	2.55
				Totals =	100	75.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 75

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
noff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/9

Circle one: (Present) Developed MUD 7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Woods Fair	73			2	1.46
C	Farmsteads	82			2	1.64
B	Row Crops, SR+CR, Good	75			35	26.25
C	"	82			56	45.92
D	"	85			5	4.25
				Totals =	100	79.52

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
noff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 8

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
B	Farmstead	74			2	1.48
C	Farmstead	82			5	4.1
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			5	3.65
D	Woods, Fair	79			1	0.79
B	Row Crop, SR+CR, Good	75			31	23.25
C	"	82			50	41
D	"	85			4	3.4
				Totals =	100	78.87

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

Storm #1	Storm #2	Storm #3

Frequency ..... yr

Rainfall, P (24-hour) ..... in

Runoff, Q ..... in
(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 9

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	Woods, Fair	60			2.0	1.2
C	Woods, Fair	73			4.5	3.29
D	Woods, Fair	79			1.0	0.79
B	Farmsteads	74			3.5	2.59
C	Farmsteads	82			3.5	2.87
B	Row Crop, SR+CR, Good	75			26.5	19.87
C	"	82			29	23.78
D	"	85			24	20.4
B	Residential, 1/2 acre lots	70			3	2.1
C	Residential 1/2 acre lots	80			3	2.4
				Totals =	100	79.29

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/31/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed MUD 10

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
B	Residential, ½ acre lots	70			24	16.8
C	"	80			26	20.8
D	"	85			2	1.7
B	Open Space (Golf Course) Good	61			3	1.83
C	"	74			8	5.92
D	"	80			1	0.8
B	Woods, Fair	60			6	3.6
C	"	73			6	4.38
D	"	79			2	1.58
B	Row Crops SR+CR, Good	75			6	4.5
C	"	82			6	4.92
D	"	85			10	8.5
				Totals =		75.33

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 75

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/31/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/96

Circle one: (Present) Developed MUD 11

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
C	Open Space, (Park), Good	74			4	2.96
D	"	80			3	2.40
B	Residential, ½ acre lots	70			20	14
C	"	80			12	9.6
D	"	85			1	0.85
B	Woods, Fair	60			9	5.4
C	"	73			4	2.92
D	"	79			1	0.79
B	Row Crops, SR+CR, Good	75			36	27
C		82			10	8.2

1/ Use only one CN source per line. Totals = 100 74.12

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 74

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 1/2/97

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed MUD 12

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Residential, 1/4 acre	75			14	10.5
C	Residential 1/4 acre	83			16	13.28
B	Woods, Fair	60			33	19.8
C	Woods Fair	73			3	2.19
D	Woods Fair	79			4	3.16
B	Residential 1/2-acre	70			23	16.1
C	"	80			6	4.8
D	"	85			1	0.85
				Totals =		70.68

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 71

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By ML Date 1/2/97

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed Mud 13

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Residential, 1-acre lots	68			30	20.4
C	"	79			24	18.96
D	"	84			9	7.56
B	Residential, 1/4 acre lots	75			20	15
C	"	83			16	13.28
D	"	87			1	.87
				Totals =		76.07

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 76

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
noff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Woods, Fair	73			2.5	1.825
B	Woods, Fair	60			1.0	.60
C	Farmsteads	82			2.0	1.64
B	Row Crops, SR + CR, Good	75			34.0	25.5
C	"	82			60.5	49.61
				Totals =	100	79.18

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: NMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed SAND 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
B	Woods, Fair	60			3.0	1.8
D	Woods, Fair	79			1.0	.79
C	Farmsteads	82			1.0	.82
B	Row Crops, SR+CR, Good	75			37	27.75
C	"	82			49	40.18
D	"	85			9	7.65
				Totals =	100	78.99

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLH Date 1/3/97

Circle one: (Present) Developed SAND 3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Farmstead	74			2.0	1.48
C	Farmstead	82			1.0	0.82
B	Row Crops, SR+CR, Good	75			48	36
C	"	82			34	27.88
D	"	85			15	12.75
				Totals =	100	78.93

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
noff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MWR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
-	Paved	98			3.5	3.43
B	Woods, Fair	60			1.5	0.90
C	Woods, Fair	73			1.0	0.73
C	Farmsteads	82			1.0	0.82
B	Row Crops, SR+CR, Good	75			50.5	37.88
C	"	82			34.5	28.29
D	"	85			8.0	6.8
				Totals =	100	78.85

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed SAND 5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
-	Paved	98			4.5	4.41
B	Woods, Fair	60			2.5	1.50
C	Woods, Fair	73			2.5	1.83
D	Woods, Fair	79			1.0	0.79
-	Water	98			0.5	0.49
B	Farmstead	74			0.8	0.59
C	Farmstead	82			0.8	0.65
A	Row Crops, Strcr, Good	64			1.0	0.64
B	"	75			38.7	29.03
C	"	82			33.7	27.63
D	"	85			14	11.9
				Totals =	100	79.46

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By NMR Date 12/31/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/96

Circle one: (Present) Developed SAND 6

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
—	Water	98			0.5	0.49
—	Paved	98			3	2.94
B	Woods, Fair	60			2	1.2
C	Woods, Fair	73			3	2.19
D	Woods Fair	79			1	0.79
B	Farmstead	74			3.5	2.59
C	Farmstead	82			4.5	3.69
B	Row Crops, SR+CR, Good	75			34.5	25.87
C	"	82			39.0	31.98
D	"	85			9	7.65
				Totals =	100	79.39

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
noff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/13/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed SAND 7

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☐ %	Product of CN x area
B	Residential, 1/2 acre lots	70			3	2.1
C	"	80			6	4.8
D	"	85			2	1.7
B	Woods, Fair	60			12	7.2
C	Woods, Fair	73			6	4.38
C	Farmstead	82			2	1.64
B	Row Crop, SR + CR, Good	75			40	30
C	"	82			26	21.32
D	"	85			3	2.55
				Totals =	100	75.69

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 76

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed TRIB 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			2.0	1.2
C	Woods, Fair	73			1.0	0.73
C	Farmstead	82			2.0	1.64
B	Row Crop, SR+CR, Good	75			33	24.75
C	"	82			42	34.44
D	"	85			20	17
				Totals =	100	79.76

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MWR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DCM Date 1/3/97

Circle one: (Present) Developed TRIB 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
—	Water	98			0.75	0.74
B	Farmsteads	74			2.0	1.48
C	Farmsteads	82			2.25	1.85
B	Row Crops SR+CR Good	75			33	24.75
C	"	82			42	34.44
D	"	85			20	17
				Totals =	100	80.26

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
noff, Q (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed HENRY 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Row Crops, SR+CR, Good	75			59	44.25
C	"	82			28	22.96
D	"	85			10	8.5
C	Farmsteads	82			2	1.64
B	Woods, Fair	60			1	.60
				Totals =	100	77.95

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{77.84}{100} = 77.84$; Use CN = 78

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project Mud Creek Watershed Study By MMR Date 12/30/96

Location Marion, Hamilton + Madison Counties Checked DLM Date 1/3/97

Circle one: (Present) Developed KYNET I

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
C	Woods Fair	73			1.0	0.73
C	Farmsteads	82			1.0	0.82
B	Row Crops, STR, Good	75			50	37.5
C	"	82			33	27.06
D	"	85			15.0	12.75
				Totals =	100	78.86

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
noff, Q ..... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/30/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed KYNET 2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☑ %	Product of CN x area
B	Woods, Fair	60			4.0	2.4
C	Woods, Fair	73			1.0	.73
B	Farmsteads	74			2.0	1.48
C	Farmsteads	82			1.0	.82
B	Row Crops, SR+CR, Good	75			39	29.25
C	"	82			38	31.16
D	"	85			15	12.75
				Totals =	100	78.59

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = 79

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
noff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 2: Runoff curve number and runoff

Project: Mud Creek Watershed Study By: MMR Date: 12/31/96

Location: Marion, Hamilton + Madison Counties Checked: DLM Date: 1/3/97

Circle one: (Present) Developed HIGH 1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☐ acres ☐ mi² ☒ %	Product of CN x area
-	Water Wetland area	100			6.5	6.5
B	Woods, Fair	60			4	2.4
C	Woods, Fair	73			7	5.11
D	Woods, Fair	79			2	1.58
D	Residential, 1 acre lots	84			4	3.36
B	Row Crop, SR+CR, Good	75			22.5	16.88
C	"	82			22.0	18.04
D	"	85			24.0	20.4
B	Farmstead	74			3.5	2.59
C	Farmstead	82			4.5	3.69
				Totals =	100	80.55

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN = 81

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

APPENDIX 4

Time-of-Concentration Calculations

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked WMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0015		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.28	+	= 1.28

$\frac{880-870}{6500} = 0.0015$

Shallow concentrated flow

		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		6500		
9. Watercourse slope, s	ft/ft		0.0015		
10. Average velocity, V (figure 3-1)	ft/s		0.64		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		2.82	+	= 2.82

Channel flow

		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0007		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		6800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.94	+	= 0.94

$\frac{870-865}{6800} = 7.4\times10^{-4}$

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr **5.04**

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0037		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.90	÷	= 0.90

$\frac{881-870}{3000} = 0.0037$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	5900		
9. Watercourse slope, s	ft/ft	0.0037		
10. Average velocity, V (figure 3-1)	ft/s	0.98		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.67	÷	= 1.67

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0014		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	10200		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.42	÷	= 1.42

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 3.99

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A	
1. Surface description (table 3-1)			CULT SOIL RES >20%	
2. Manning's roughness coeff., n (table 3-1)			0.17	
3. Flow length, L (total L ≤ 300 ft)	ft		300	
4. Two-yr 24-hr rainfall, P_2	in		2.91	
5. Land slope, s	ft/ft		0.0016	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr		1.25 ÷	= 1.25

$\frac{873-870}{1900} = 0.0016$

Shallow concentrated flow

		Segment ID	B	
7. Surface description (paved or unpaved)			UNPAVED	
8. Flow length, L	ft		11700	
9. Watercourse slope, s	ft/ft		0.0013	
10. Average velocity, V (figure 3-1)	ft/s		0.58	
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		5.60 ÷	= 5.60

$\frac{870-860}{8000} = 0.0013$

Channel flow

		Segment ID	C	
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft		0.0011	
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*	
18. Flow length, L	ft		2000	
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		0.28 ÷	= 0.28

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 7.13

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD4

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.002		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.14	+	= 1.14

$\frac{870-860}{4900} = 0.0020$

Shallow concentrated flow

		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	
8. Flow length, L	ft		4600	2200	
9. Watercourse slope, s	ft/ft		0.0020	0.0045	
10. Average velocity, V (figure 3-1)	ft/s		0.72	1.08	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.77	+ 0.57	= 2.34

$\frac{860-850}{2200} = 0.0045$

Channel flow

		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0010		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		5600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.78	+	= 0.78

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.26

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD5

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
1. Surface description (table 3-1)		CULT SOIL, RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0077		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.67	÷	= 0.67

$\frac{870-860}{1300} = 0.0077$

Shallow concentrated flow

		Segment ID		
7. Surface description (paved or unpaved)		B UNPAVED		
8. Flow length, L	ft	2500		
9. Watercourse slope, s	ft/ft	0.008		
10. Average velocity, V (figure 3-1)	ft/s	1.44		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.48	÷	= 0.48

Channel flow

		Segment ID		
		C		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0017		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	15000		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	2.08	÷	= 2.08
20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19)	hr			3.23

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD6

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
1. Surface description (table 3-1)		A		
		WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1)		0.40		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0042		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.69	+	= 1.69

$\frac{850-845}{1200} = 0.0042$

Shallow concentrated flow

		Segment ID		
7. Surface description (paved or unpaved)		B	C	
		UNPAVED	UNPAVED	
8. Flow length, L	ft	2500	1400	
9. Watercourse slope, s	ft/ft	0.0042	0.021	
10. Average velocity, V (figure 3-1)	ft/s	1.04	2.34	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.67	+ 0.17	= 0.84

$\frac{840-810}{1400} = 0.021$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0017		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	2600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.36	+	= 0.36

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 2.89

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MNR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD7

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES ≥ 20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.79	+	= 0.79

$\frac{860-855}{1000} = 0.005$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	8800		
9. Watercourse slope, s	ft/ft	0.004		
10. Average velocity, V (figure 3-1)	ft/s	1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	2.40	+	= 2.40

$\frac{855-825}{7500} = 0.004$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.19

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD8

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0056		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.76	÷	= 0.76

$\frac{845-840}{900} = 0.0056$

Shallow concentrated flow

		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		2200		
9. Watercourse slope, s	ft/ft		0.0082		
10. Average velocity, V (figure 3-1)	ft/s		1.46		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.42	÷	= 0.42

$\frac{843-825}{2200} = 0.0082$

Channel flow

		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		7300		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.01	÷	= 1.01

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr **2.19**

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked NMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD9

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1)		0.40		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.01		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.19	+	= 1.19

Shallow concentrated flow	Segment ID	B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	
8. Flow length, L	ft	2800	1100	
9. Watercourse slope, s	ft/ft	0.009	0.0045	
10. Average velocity, V (figure 3-1)	ft/s	1.53	1.08	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.51	+ 0.28	= 0.79

$\frac{825-800}{2800} = 0.009$

$\frac{800-795}{1100} = 0.0045$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	1.91*		
18. Flow length, L	ft	5100		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.74	+	= 0.74

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 2.72

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_c through subarea SUBAREA MUD10

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		GRASS, DENSE		
2. Manning's roughness coeff., n (table 3-1)		0.24		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.003		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.28	÷	= 1.28

$\frac{830-825}{1600} = 0.003$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	2000		
9. Watercourse slope, s	ft/ft	0.004		
10. Average velocity, V (figure 3-1)	ft/s	1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.54	÷	= 0.54

$\frac{828-820}{2000} = 0.004$

Channel flow	Segment ID	C	D
12. Cross sectional flow area, a	ft^2		
13. Wetted perimeter, p_w	ft		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft		
15. Channel slope, s	ft/ft		
16. Manning's roughness coeff., n			
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	1.18*	
18. Flow length, L	ft	7800	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.84	÷ = 1.84

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 3.66

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD11

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
1. Surface description (table 3-1)		A		
		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0045		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.83	+	= 0.83

$\frac{815-810}{1100} = 0.0045$

Shallow concentrated flow

		Segment ID		
		B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	
8. Flow length, L	ft	800	1500	
9. Watercourse slope, s	ft/ft	0.0045	0.027	
10. Average velocity, V (figure 3-1)	ft/s	1.08	2.63	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.21	+ 0.16	= 0.37

$\frac{815-775}{1500} = 0.027$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	0.98*		
18. Flow length, L	ft	3800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.08	+	= 1.08

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.28

* BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA MUD12

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
1. Surface description (table 3-1)		A		
		WOODS, LIGHT		
2. Manning's roughness coeff., n (table 3-1)		0.40		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.003		$0.003 = \frac{830-825}{1500}$
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.93 ÷	= 1.93	

Shallow concentrated flow

		Segment ID		
7. Surface description (paved or unpaved)		B	C	$\frac{828-820}{4200} = 0.002$
		UNPAVED	UNPAVED	$\frac{820-775}{1900} = 0.024$
8. Flow length, L	ft	4200	1900	
9. Watercourse slope, s	ft/ft	0.002	0.024	
10. Average velocity, V (figure 3-1)	ft/s	0.72	2.50	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.62 ÷	0.21 = 1.83	

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	3.85*		
18. Flow length, L	ft	4800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.35 ÷	= 0.35	

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.11

* BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA MUD13

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID				
		A			
1. Surface description (table 3-1)		DENSE GRASS			
2. Manning's roughness coeff., n (table 3-1) ..		0.24			
3. Flow length, L (total L ≤ 300 ft)	ft	300			
4. Two-yr 24-hr rainfall, P_2	in	2.91			
5. Land slope, s	ft/ft	0.0033			
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.23	÷		= 1.23

$\frac{840-835}{1500} = 0.0033$

Shallow concentrated flow	Segment ID				
		B	C		
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED		
8. Flow length, L	ft	1000	800		
9. Watercourse slope, s	ft/ft	0.0033	0.081		
10. Average velocity, V (figure 3-1)	ft/s	0.93	4.59		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.30	+ 0.05	= 0.35	

$\frac{835-770}{800} = 0.081$

Channel flow	Segment ID				
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.93*			
18. Flow length, L	ft	7600			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.72	+		= 0.72

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 2.30

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_c through subarea SUBAREA SAND1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID A	
1. Surface description (table 3-1)		CULT SOIL RES>20%	
2. Manning's roughness coeff., n (table 3-1)		0.17	
3. Flow length, L (total L ≤ 300 ft)	ft	300	
4. Two-yr 24-hr rainfall, P_2	in	2.91	
5. Land slope, s	ft/ft	0.0042	
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.85 +	= 0.85

$\frac{860-850}{2400} = 0.0042$

Shallow concentrated flow

		Segment ID B	C
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED
8. Flow length, L	ft	2100	5600
9. Watercourse slope, s	ft/ft	0.0042	0.0018
10. Average velocity, V (figure 3-1)	ft/s	1.04	0.68
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.56 +	2.29 = 2.85

$\frac{850-840}{5600} = 0.0018$

Channel flow

		Segment ID	
12. Cross sectional flow area, a	ft^2		
13. Wetted perimeter, P_w	ft		
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft		
15. Channel slope, s	ft/ft		
16. Manning's roughness coeff., n			
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		
18. Flow length, L	ft		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 3.70

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA SAND2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		$\frac{862-860}{600} = 0.003$
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.003		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.97	+	= 0.97

Shallow concentrated flow

		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	$\frac{860-850}{3200} = 0.003$
8. Flow length, L	ft		3500	1500	$\frac{850-840}{1000} = 0.01$
9. Watercourse slope, s	ft/ft		0.003	0.01	
10. Average velocity, V (figure 3-1)	ft/s		0.88	1.61	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.10	+ 0.26	= 1.36

Channel flow

		Segment ID	D	
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft		0.0019	
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*	
18. Flow length, L	ft		7400	
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.03	+ = 1.03

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.36

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA SAND3

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		$\frac{860-850}{1300} = 0.0077$
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0077		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.67	+	= 0.67

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		$\frac{850-830}{5000} = 0.004$
8. Flow length, L	ft		5900		
9. Watercourse slope, s	ft/ft		0.004		
10. Average velocity, V (figure 3-1)	ft/s		1.02		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.61	+	= 1.61

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0013		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		7800		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		1.08	+	= 1.08

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.36

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND4

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.0029		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.99	÷	= 0.99

$\frac{854-850}{1400} = 0.0029$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		7300		
9. Watercourse slope, s	ft/ft		0.0034		
10. Average velocity, V (figure 3-1)	ft/s		0.94		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		2.16	÷	= 2.16

$\frac{850-825}{7300} = 0.0034$

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.003		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		2000		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.28	÷	= 0.28

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.43

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked UMK Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_c through subarea SUBAREA SAND5

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
1. Surface description (table 3-1)		A		
		CULT SOIL RES > 20%		$\frac{840-835}{250} = 0.02$
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.02		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.46	+	= 0.46

Shallow concentrated flow

		Segment ID		
		B	C	
7. Surface description (paved or unpaved)		UNPAVED	UNPAVED	$\frac{835-825}{4300} = 0.0023$
8. Flow length, L	ft	4300	5400	$\frac{825-815}{5400} = 0.0019$
9. Watercourse slope, s	ft/ft	0.0023	0.0019	
10. Average velocity, V (figure 3-1)	ft/s	0.77	0.70	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.55	+ 2.14	= 3.69

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.15

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SAND6

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID	A		
1. Surface description (table 3-1)		CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.006		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.74	÷	= 0.74

$\frac{833-830}{500} = 0.006$

Shallow concentrated flow	Segment ID	B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	5000		
9. Watercourse slope, s	ft/ft	0.005		
10. Average velocity, V (figure 3-1)	ft/s	1.14		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.22	÷	= 1.22

$\frac{830-805}{5000} = 0.005$

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.001		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	1.45*		
18. Flow length, L	ft	4300		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.82	÷	= 0.82

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 2.78

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA SWD7

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		$\frac{830-825}{800} = 0.0062$
1. Surface description (table 3-1)		CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0062		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.73	÷	= 0.73

Shallow concentrated flow

		Segment ID		
		B		$\frac{828-795}{4800} = 0.0069$
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	4800		
9. Watercourse slope, s	ft/ft	0.0069		
10. Average velocity, V (figure 3-1)	ft/s	1.34		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.00	÷	= 1.00

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.24*		
18. Flow length, L	ft	7900		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.98	÷	= 0.98

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr **2.71**

*BASED ON FIS HEC-2 MODEL

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_c through subarea SUBAREA TRIB1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.79	+	= 0.79

$\frac{870-860}{2000} = 0.005$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	10300		
9. Watercourse slope, s	ft/ft	0.0014		
10. Average velocity, V (figure 3-1)	ft/s	0.60		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	4.77	+	= 4.77

$\frac{850-840}{7200} = 0.0014$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		+	=

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 5.56

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked ____ Date ____

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA TRIB2

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.004		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.87	+	= 0.87

$\frac{870-860}{2300} = 0.004$

Shallow concentrated flow

		Segment ID	B	C	
7. Surface description (paved or unpaved)			UNPAVED	UNPAVED	
8. Flow length, L	ft		3100	4700	
9. Watercourse slope, s	ft/ft		0.0086	0.0014	
10. Average velocity, V (figure 3-1)	ft/s		1.50	0.60	
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.57	+ 2.17	= 2.74

$0.0086 = \frac{870-840}{3500}$

$0.0014 = \frac{839-828}{7800}$

Channel flow

		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0014		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		1100		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.15	+	= 0.15

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.76

*ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project: MUD CREEK WATERSHED STUDY By: DLM Date: 1/2/97

Location: MARION, HAMILTON & MADISON COS. Checked: MMR Date: 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA HENRY1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL RES>20%		
2. Manning's roughness coeff., n (table 3-1)			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		0.0013		
5. Land slope, s	ft/ft		0.0013		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		1.36	÷	= 1.36

$\frac{875-870}{3900} = 0.0013$

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		9000		
9. Watercourse slope, s	ft/ft		0.0013		
10. Average velocity, V (figure 3-1)	ft/s		0.58		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		4.31	÷	= 4.31

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0022		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		4600		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.64	÷	= 0.64

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) hr 6.31

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA KYNETI

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A		
1. Surface description (table 3-1)			CULT SOIL, RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..			0.17		
3. Flow length, L (total L ≤ 300 ft)	ft		300		
4. Two-yr 24-hr rainfall, P_2	in		2.91		
5. Land slope, s	ft/ft		0.01		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr		0.60	+	= 0.60

Shallow concentrated flow		Segment ID	B		
7. Surface description (paved or unpaved)			UNPAVED		
8. Flow length, L	ft		7300		$\frac{870-860}{8000} = 0.0013$
9. Watercourse slope, s	ft/ft		0.0013		
10. Average velocity, V (figure 3-1)	ft/s		0.58		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		3.50	+	= 3.50

Channel flow		Segment ID			
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, P_w	ft				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft				
15. Channel slope, s	ft/ft		0.0013		
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s		2.0*		
18. Flow length, L	ft		2300		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr		0.32	+	= 0.32

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 4.42

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/4/97

Circle one: Present Developed

Circle one: T_c T_t through subarea SUBAREA KYNETZ

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1) ..		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.0024		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	1.06	+	= 1.06

$\frac{870-860}{4200} = 0.0024$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	4800		
9. Watercourse slope, s	ft/ft	0.0024		
10. Average velocity, V (figure 3-1)	ft/s	0.79		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.69	+	= 1.69

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0013		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	2500		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.35	+	= 0.35

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr **3.10**

* ASSUMED CHANNEL VELOCITY

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MUD CREEK WATERSHED STUDY By DLM Date 1/2/97

Location MARION, HAMILTON & MADISON COS. Checked MMR Date 1/3/97

Circle one: (Present) Developed

Circle one: T_c (T_c through subarea) SUBAREA H16H1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

		Segment ID		
		A		
1. Surface description (table 3-1)		CULT SOIL RES >20%		
2. Manning's roughness coeff., n (table 3-1)		0.17		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	2.91		
5. Land slope, s	ft/ft	0.005		
6. $T_c = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_c	hr	0.79	÷	= 0.79

$\frac{833-830}{600} = 0.005$

Shallow concentrated flow

		Segment ID		
		B		
7. Surface description (paved or unpaved)		UNPAVED		
8. Flow length, L	ft	2900		
9. Watercourse slope, s	ft/ft	0.0041		
10. Average velocity, V (figure 3-1)	ft/s	1.03		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	0.78	÷	= 0.78

$\frac{832-820}{2900} = 0.0041$

Channel flow

		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft	0.0037		
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	2.0*		
18. Flow length, L	ft	10500		
19. $T_c = \frac{L}{3600\,V}$ Compute T_c	hr	1.46	÷	= 1.46

20. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... hr 3.03

APPENDIX 5

Hard Copy of Existing-Condition Hydrologic Model Input/Output

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  05/26/1998  TIME  13:20:47 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                    PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   MUD CREEK WATERSHED HYDROLOGIC MODEL
  2           ID   CBBEL: 96-297A DLM 22MAY98  ** EXISTING COND. **  FILE: EXISTLT.HC1
              *DIAGRAM
  3           IT      15 01JAN00       0     300
  4           IN      72 01JAN00       0
  5           IO       5       0       0
  6           JR    PREC    0.51    0.64    0.73    0.83    0.93    1.00
              *
              *  ***************************************************************
              *  *                                                             *
              *  * 24-OUR SCS II DISTRIBUTION                                 *
              *  * -------------------------------------------------------    *
              *  *   RATIO 1:    2-YEAR STORM FREQUENCY                        *
              *  *   RATIO 2:    5-YEAR STORM FREQUENCY                        *
              *  *   RATIO 3:   10-YEAR STORM FREQUENCY                        *
              *  *   RATIO 4:   25-YEAR STORM FREQUENCY                        *
              *  *   RATIO 5:   50-YEAR STORM FREQUENCY                        *
              *  *   RATIO 6:  100-YEAR STORM FREQUENCY                        *
              *  ***************************************************************
              *
              *  ***************************************************************
              *  *                                                             *
```

```
*  * NOTE:                                                    *
*  * ---------------------------------------------------      *
*  * CALCULATED LAG TIMES INCREASED BY 75% FOR PEAK DISCHARGE  *
*  * CALIBRATION                                              *
*  ************************************************************
*

KK   HNRY1
KM   SUBAREA HNRY1 (HENRY DITCH)
PB    5.75
PC     0.0     1.3     2.5     4.0     6.0     8.0    10.0    13.0    16.5    22.0
PC    64.0    78.0    83.5    87.0    89.5    92.0    94.0    96.0    98.0    99.0
PC   100.0
BA  1.5211
LS       0      78
UD   11.04
*

KK    MUD1
KM   SUBAREA MUD1 (MUD CREEK)
BA  3.3292
LS       0      78
UD    8.82
*

KK  RMD2A
KM     ROUTE FLOWS THROUGH SUBBASIN MUD2 (UPPER)
*    EG BASED ON CHANNEL SLOPE FROM QUADRANGLE MAPPING
*    MANNING'S N VALUES ASSUMED
*    REACH LENGTH BASED ON IDNR MILEAGE MAP
*    CROSS-SECTION DATA FROM QUADRANGLE MAPPING
RD
RC    0.07    0.04    0.07     780  0.0015
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

RX       0     500    1450    1490    1510    1550    2500    3000
RY   870.0   864.0   864.0   862.0   862.0   864.0   864.0   866.0
*

KK    ADD1
KM        COMBINE RMUD2A AND HENRY1
HC       2
*

KK  RMD2B
KM     ROUTE FLOWS THROUGH SUBBASIN MUD2 (LOWER)
*    EG BASED ON CHANNEL SLOPE FROM QUADRANGLE MAPPING
*    MANNING'S N VALUES ASSUMED
*    REACH LENGTH BASED ON IDNR MILEAGE MAP
*    CROSS-SECTION DATA FROM QUADRANGLE MAPPING
RD
RC    0.07    0.04    0.07     400  0.0015
RX       0     500    1450    1490    1510    1550    2500    3000
RY   870.0   864.0   864.0   862.0   862.0   864.0   864.0   866.0
*

KK    MUD2
KM   SUBAREA MUD2 (MUD CREEK)
```

```
38          BA  1.3655
39          LS       0      80
40          UD    6.98
            *

41          KK  SR13US
42          KM        COMBINE FLOWS UPSTREAM OF S.R. 13 (MUD CREEK)
43          HC       2
            *

44          KK  KYNET1
45          KM   SUBAREA KYNET1 (KYNETT DITCH)
46          BA  1.1386
47          LS       0      79
48          UD    7.74
            *

49          KK   RKYN2
50          KM     ROUTE FLOWS THROUGH SUBBASIN KYNET2
            *    EG BASED ON CHANNEL SLOPE FROM QUADRANGLE MAPPING
            *    MANNING'S N VALUES ASSUMED
            *    REACH LENGTH BASED ON QUADRANGLE MAP
            *    CROSS-SECTION DATA FROM QUADRANGLE MAPPING
51          RD
52          RC    0.07    0.04    0.07    6500  0.0015
53          RX       0     750    1500    1510    1530    1550    2500    3300
54          RY   865.0   864.0   862.0   860.0   860.0   862.0   864.0   865.0
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

55          KK  KYNET2
56          KM   SUBAREA KNET2 (KYNETT DITCH)
57          BA  1.1498
58          LS       0      79
59          UD    5.43
            *

60          KK  KYNETT
61          KM        COMBINE FLOWS ALONG KYNETT DITCH (KYNETT DITCH)
62          HC       2
            *

63          KK  SR13DS
64          KM        COMBINE FLOWS FROM KYNETT DITCH WITH MUD CREEK MAINSTEM FLOWS (MUD CREEK
65          HC       2
            *

66          KK  RMUD3
67          KM     ROUTE FLOWS THROUGH SUBBASIN MUD3
            *    EG BASED ON CHANNEL SLOPE FROM QUADRANGLE MAPPING
            *    MANNING'S N VALUES ASSUMED
            *    REACH LENGTH BASED ON IDNR MILEAGE MAP
            *    CROSS-SECTION DATA FROM QUADRANGLE MAPPING
68          RD
69          RC    0.07    0.04    0.07    3400  0.0011
70          RX       0     450     920     940     950     970    1500    2000
71          RY   860.0   855.0   850.0   848.0   848.0   850.0   855.0   860.0
```

```
            *

 72         KK    MUD3
 73         KM   SUBAREA MUD3 (MUD CREEK)
 74         BA  1.7324
 75         LS       0      79
 76         UD   12.48
            *

 77         KK    SR38
 78         KM        COMBINE FLOWS UPSTREAM OF S.R. 38 (MUD CREEK)
 79         HC       2
            *

 80         KK  RMUD4
 81         KM     ROUTE FLOWS THROUGH SUBBASIN MUD4
            *    EG BASED ON CHANNEL SLOPE FROM QUADRANGLE MAPPING
            *    MANNING'S N VALUES ASSUMED
            *    REACH LENGTH BASED ON IDNR MILEAGE MAP
            *    CROSS-SECTION DATA FROM QUADRANGLE MAPPING
 82         RD
 83         RC    0.07    0.04    0.07    6100  0.0011
 84         RX       0     900    1800    2000    2300    2500    2900    3300
 85         RY   860.0   855.0   850.0   847.0   847.0   850.0   855.0   860.0
            *
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 86         KK    MUD4
 87         KM   SUBAREA MUD4 (MUD CREEK)
 88         BA  1.8948
 89         LS       0      80
 90         UD    7.46
            *

 91         KK   HAMCO
 92         KM        COMBINE FLOWS UPSTREAM OF HAMILTON CO. LINE (MUD CREEK)
 93         HC       2
            *

 94         KK  RMD5A
 95         KM     ROUTE FLOWS THROUGH SUBBASIN MUD6 (UPPER)
            *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
            *    MANNING'S N VALUES ASSUMED
            *    REACH LENGTH BASED ON IDNR MILEAGE MAP
            *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
 96         RD
 97         RC    0.07    0.04    0.07    8200  0.0012
 98         RX       0     150     200     230     250     260     600     960
 99         RY   856.0   854.0   850.0   838.0   838.0   840.0   842.0   856.0
            *

100         KK   TRIB1
101         KM   SUBAREA TRIB1 (UNNAMED TRIB)
102         BA  1.7235
103         LS       0      80
104         UD    9.73
            *
```

```
105          KK  RTRIB2
106          KM     ROUTE FLOWS THROUGH SUBBASIN TRIB2
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON 2-FOOT TOPOGRAPHY
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
107          RD
108          RC    0.07    0.04    0.07    7600  0.0018
109          RX       0     180     260     370     680     840    1050    1150
110          RY   860.0   850.0   840.0   833.0   833.0   840.0   846.0   860.0
             *

111          KK   TRIB2
112          KM   SUBAREA TRIB2 (UNNAMED TRIB)
113          BA  1.0964
114          LS       0      80
115          UD    6.58
             *
1                                    HEC-1 INPUT                                          PAGE  5

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


116          KK    TRIB
117          KM        COMBINE FLOWS FROM UNNAMED TRIB (UNNAMED TRIB)
118          HC       2
             *

119          KK    ADD2
120          KM        COMBINE FLOWS FROM UNNAMED TRIB WITH MUD CREEK MAINSTEM (MUD CREEK)
121          HC       2
             *

122          KK  RMD5B
123          KM     ROUTE FLOWS THROUGH SUBBASIN MUD6 (LOWER)
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
124          RD
125          RC    0.07    0.04    0.07    7700  0.0013
126          RX       0     160     420     450     480     500     670     820
127          RY   840.0   830.0   824.0   822.0   822.0   825.0   830.0   840.0
             *

128          KK    MUD5
129          KM   SUBAREA  MUD5 (MUD CREEK)
130          BA  2.0442
131          LS       0      77
132          UD    5.65
             *

133          KK  I69MUD
134          KM        COMBINE FLOWS UPSTREAM OF I-69 (MUD CREEK)
135          HC       2
             *

136          KK  RMD6A
137          KM     ROUTE FLOWS THROUGH SUBBASIN MUD6 (UPPER)
```

```
          *    EG BASED ON 1989 EVENT HWL RECORDS
          *    MANNING'S N VALUES ASSUMED
          *    REACH LENGTH BASED ON IDNR MILEAGE MAP
          *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
138       RD
139       RC    0.07    0.04    0.07    3200  0.0016
140       RX       0     100     250     340     370     700     760     900
141       RY   845.0   840.0   830.0   820.0   820.0   826.0   836.0   842.0
          *

142       KK    MUD7
143       KM   SUBAREA  MUD7 (MUD CREEK)
144       BA  0.8429
145       LS       0      80
146       UD    5.58
          *
1                                   HEC-1 INPUT                                                    PAGE  6

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


147       KK  SR238M
148       KM        COMBINE FLOWS UPSTREAM OF S.R 238 (MUD CREEK)
149       HC       2
          *

150       KK  RMD6B
151       KM     ROUTE FLOWS THROUGH SUBBASIN MUD6 (LOWER)
          *    EG BASED ON 1989 EVENT HWL RECORDS
          *    MANNING'S N VALUES ASSUMED
          *    REACH LENGTH BASED ON IDNR MILEAGE MAP
          *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
152       RD
153       RC    0.07    0.04    0.07    7100  0.0016
154       RX       0     100     350     360     380     390     660     800
155       RY   830.0   820.0   816.0   814.0   814.0   816.0   820.0   830.0
          *

156       KK    MUD6
157       KM   SUBAREA  MUD6 (MUD CREEK)
158       BA  1.3121
159       LS       0      75
160       UD    5.06
          *

161       KK   126TH
162       KM        COMBINE FLOWS UPSTREAM OF 126TH STREET (MUD CREEK)
163       HC       2
          *

164       KK  RMD8
165       KM     ROUTE FLOWS THROUGH SUBBASIN MUD8
          *    EG BASED ON 1989 EVENT HWL RECORDS
          *    MANNING'S N VALUES BASED ON INFORMATION PROVIDED BY IDNR
          *    REACH LENGTH BASED ON IDNR MILEAGE MAP
          *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
166       RD
167       RC    0.08   0.045    0.08    7400   0.001
168       RX       0     150     500     510     550     560     650     780
169       RY   820.0   810.0   804.0   802.0   802.0   804.0   808.0   820.0
```

```
*

KK    MUD8
KM   SUBAREA  MUD8 (MUD CREEK)
BA  2.2573
LS       0      79
UD    3.83
*

KK   BROOK
KM        COMBINE FLOWS UPSTREAM OF BROOKS SCHOOL ROAD (MUD CREEK)
HC       2
*
```



```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  RMD9
KM     ROUTE FLOWS THROUGH SUBBASIN MUD9
*    EG BASED ON 1989 EVENT HWL RECORDS
*    MANNING'S N VALUES BASED ON INFORMATION PROVIDED BY IDNR
*    REACH LENGTH BASED ON IDNR MILEAGE MAP
*    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
RD
RC    0.07    0.04    0.07    8700   0.001
RX       0     220    1580    1600    1640    1650    1700    1770
RY   800.0   793.0   792.0   790.0   790.0   792.0   800.0   806.0
*

KK    MUD9
KM   SUBAREA  MUD9 (MUD CREEK)
BA  1.6690
LS       0      79
UD    4.76
*

KK  KLEPFR
KM        COMBINE FLOWS UPSTREAM OF KLEPFER SCHOOL ROAD (MUD CREEK)
HC       2
*

KK  RMD10A
KM     ROUTE FLOWS THROUGH SUBBASIN MUD10 (UPPER)
*    EG BASED ON 1989 EVENT HWL RECORDS
*    MANNING'S N VALUES BASED ON INFORMATION PROVIDED BY IDNR
*    REACH LENGTH BASED ON IDNR MILEAGE MAP
*    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
RD
RC    0.07    0.04    0.07    5800   0.001
RX       0     200     450     460     480     520     710     860
RY   800.0   790.0   786.0   782.0   782.0   788.0   790.0   796.0
*

KK   HIGH1
KM   SUBAREA HIGH1 (HIGH DITCH)
BA  1.2943
LS       0      81
UD    5.30
*
```

```
203          KK   PHIGH
204          KM        ROUTE FLOWS FROM UPSTREAM WATERSHED THROUGH HIGH DITCH POND
205          RS       1    ELEV   780.8
206          SQ     0.0     20.     40.     70.    100.    130.    160.    200.
207          SV     0.0    163.    227.    309.    355.    367.    375.    383.
208          SE   780.8   783.4   784.4   785.7   786.4   786.6   786.8   786.9
             *
1                                          HEC-1 INPUT                                                    PAGE  8

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


209          KK    HIGH
210          KM        COMBINE FLOWS FROM HIGH DITCH WITH MUD CREEK MAINSTEM (MUD CREEK)
211          HC       2
             *

212          KK  RMD10B
213          KM     ROUTE FLOWS THROUGH SUBBASIN MUD10 (LOWER)
             *    EG BASED ON 1989 EVENT HWL RECORDS
             *    MANNING'S N VALUES BASED ON INFORMATION PROVIDED BY IDNR
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
214          RD
215          RC    0.07    0.04    0.07    3700  0.0002
216          RX       0     340     550     560     580     590     820     900
217          RY   790.0   784.0   784.0   780.0   780.0   782.0   782.0   790.0
             *

218          KK   MUD10
219          KM   SUBAREA MUD10 (MUD CREEK)
220          BA  1.8169
221          LS       0      75
222          UD    6.41
             *

223          KK   MD106
224          KM        COMBINE FLOWS FROM MUD CREEK U/S OF 106TH STREET (MUD CREEK)
225          HC       2
             *

226          KK   SAND1
227          KM   SUBAREA SAND1 (SAND CREEK)
228          BA  0.9822
229          LS       0      79
230          UD    6.48
             *

231          KK  RSND2
232          KM     ROUTE FLOWS THROUGH SUBBASIN SAND2
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
233          RD
234          RC    0.07    0.04    0.07    7700  0.0018
235          RX       0     310     450     470     480     500     850    1200
236          RY   840.0   834.0   832.0   829.0   829.0   832.0   832.0   840.0
             *
```

```
237          KK   SAND2
238          KM   SUBAREA SAND2 (SAND CREEK)
239          BA  1.5520
240          LS       0      79
241          UD    5.88
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

242          KK   156TH
243          KM        COMBINE FLOWS UPSTREAM OF 156TH STREET (SAND CREEK)
244          HC       2
             *

245          KK  RSND3
246          KM     ROUTE FLOWS THROUGH SUBBASIN SAND3
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
247          RD
248          RC    0.07    0.04    0.07    8700  0.0014
249          RX       0     510     640     650     660     680     800    1150
250          RY   829.0   822.0   822.0   819.0   819.0   820.0   822.0   829.0
             *

251          KK   SAND3
252          KM   SUBAREA SAND3 (SAND CREEK)
253          BA  1.9192
254          LS       0      79
255          UD    5.88
             *

256          KK  SR238S
257          KM        COMBINE FLOWS UPSTREAM OF S.R. 238 (SAND CREEK)
258          HC       2
             *

259          KK   SAND4
260          KM   SUBAREA SAND4 (SAND CREEK)
261          BA  1.0401
262          LS       0      79
263          UD    6.00
             *

264          KK   238DS
265          KM        COMBINE SR238S AND SAND4 (SAND CREEK)
266          HC       2
             *

267          KK  RSND5
268          KM     ROUTE FLOWS THROUGH SUBBASIN SAND5
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
269          RD
```

```
270          RC    0.07    0.04    0.07    6600  0.0008
271          RX       0     320     700     740     760     780    1050    1230
272          RY   820.0   816.0   814.0   806.0   806.0   812.0   814.0   820.0
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

273          KK   SAND5
274          KM   SUBAREA SAND5 (SAND CREEK)
275          BA  2.0438
276          LS       0      79
277          UD    7.26
             *

278          KK   MARIL
279          KM        COMBINE FLOWS UPSTREAM OF MARILYN ROAD (SAND CREEK)
280          HC       2
             *

281          KK  RSND6A
282          KM     ROUTE FLOWS THROUGH SUBBASIN SAND6 (UPPER)
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
283          RD
284          RC    0.07    0.04    0.07    5500  0.0008
285          RX       0     240     740     800     830     870    1080    1350
286          RY   820.0   810.0   810.0   806.0   806.0   810.0   812.0   820.0
             *

287          KK  RSND6B
288          KM     ROUTE FLOWS THROUGH SUBBASIN SAND6 (LOWER)
             *    EG BASED ON CHANNEL SLOPE FROM 2-FOOT TOPOGRAPHY DATA
             *    MANNING'S N VALUES ASSUMED
             *    REACH LENGTH BASED ON IDNR MILEAGE MAP
             *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
289          RD
290          RC    0.07    0.04    0.07    5000  0.0012
291          RX       0     300     450     470     490     560     810    1000
292          RY   820.0   810.0   804.0   802.0   802.0   806.0   810.0   820.0
             *

293          KK   SAND6
294          KM   SUBAREA SAND6 (SAND CREEK)
295          BA  2.1594
296          LS       0      79
297          UD    4.87
             *

298          KK  I69SAN
299          KM        COMBINE FLOWS UPSTREAM OF I-69 (SAND CREEK)
300          HC       2
             *

301          KK  RSND7A
302          KM     ROUTE FLOWS THROUGH SUBBASIN SAND7 (UPPER)
             *    EG BASED ON 1989 EVENT HWL RECORDS
```

```
              *    MANNING'S N VALUES ASSUMED
              *    REACH LENGTH BASED ON IDNR MILEAGE MAP
              *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  303         RD
  304         RC    0.07    0.04    0.07    6100  0.0010
  305         RX       0     160     210     240     260     300     500     850
  306         RY   824.0   820.0   810.0   792.0   792.0   796.0   800.0   820.0
              *

  307         KK  RSND7B
  308         KM     ROUTE FLOWS THROUGH SUBBASIN SAND7 (LOWER)
              *    EG BASED ON 1989 EVENT HWL RECORDS
              *    MANNING'S N VALUES ASSUMED
              *    REACH LENGTH BASED ON IDNR MILEAGE MAP
              *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
  309         RD
  310         RC    0.07    0.04    0.07    7400  0.0010
  311         RX       0     200     480     500     520     540     660     740
  312         RY   800.0   786.0   784.0   780.0   780.0   784.0   790.0   800.0
              *

  313         KK   SAND7
  314         KM   SUBAREA SAND7 (SAND CREEK)
  315         BA  1.6857
  316         LS       0      76
  317         UD    4.74
              *

  318         KK    SAND
  319         KM        COMBINE FLOWS FROM SAND CREEK (SAND CREEK)
  320         HC       2
              *

  321         KK   106TH
  322         KM        COMBINE FLOWS FROM SAND CREEK WITH MUD CREEK MAINSTEM (MUD CREEK)
  323         HC       2
              *

  324         KK  RMUD11
  325         KM     ROUTE FLOWS THROUGH SUBBASIN MUD11
              *    EG BASED ON 1989 EVENT HWL RECORDS
              *    MANNING'S N VALUES BASED ON INFORMATION PROVIDED BY IDNR
              *    REACH LENGTH BASED ON IDNR MILEAGE MAP
              *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
  326         RD
  327         RC    0.08    0.04    0.08    7900  0.0006
  328         RX       0     750    1400    1430    1460    1600    1750    1860
  329         RY   785.0   780.0   780.0   774.0   774.0   780.0   784.0   790.0
              *

  330         KK   MUD11
  331         KM   SUBAREA MUD11 (MUD CREEK)
  332         BA  1.4567
  333         LS       0      74
  334         UD    3.99
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 335          KK    96TH
 336          KM        COMBINE FLOWS UPSTREAM OF 96TH STREET (MUD CREEK AT MARION CO. LINE)
 337          HC       2
              *

 338          KK  RMUD12
 339          KM     ROUTE FLOWS THROUGH SUBBASIN MUD13
              *    EG BASED ON 1989 EVENT HWL RECORDS
              *    MANNING'S N VALUES ASSUMED
              *    REACH LENGTH BASED ON IDNR MILEAGE MAP
              *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
 340          RD
 341          RC    0.08    0.04    0.08    5800  0.0008
 342          RX       0     330     700     730     760     790    1330    1650
 343          RY   820.0   780.0   774.0   771.0   771.0   774.0   780.0   820.0
              *

 344          KK   MUD12
 345          KM   SUBAREA MUD12 (MUD CREEK)
 346          BA  1.5478
 347          LS       0      71
 348          UD    7.19
              *

 349          KK    86TH
 350          KM        COMBINE FLOWS UPSTREAM OF 86TH STREET (MUD CREEK)
 351          HC       2
              *

 352          KK  RMUD13
 353          KM     ROUTE FLOWS THROUGH SUBBASIN MUD13
              *    EG BASED ON 1989 EVENT HWL RECORDS
              *    MANNING'S N VALUES ASSUMED
              *    REACH LENGTH BASED ON IDNR MILEAGE MAP
              *    CROSS-SECTION DATA FROM 2-FOOT TOPOGRAPHY
 354          RD
 355          RC    0.08    0.04    0.08    9300  0.0015
 356          RX       0     120     200     220     250     350     830     950
 357          RY   800.0   770.0   764.0   762.0   762.0   766.0   773.0   800.0
              *

 358          KK   MUD13
 359          KM   SUBAREA MUD13 (MUD CREEK)
 360          BA  1.8392
 361          LS       0      76
 362          UD    4.03
              *

 363          KK    GAGE
 364          KM        COMBINE FLOWS UPSTREAM OF USGS GAGE AT LANTERN ROAD (MUD CREEK)
 365          HC       2
              *
 366          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

           (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7        HNRY1
                .
                .
  16            .        MUD1
                .           V
                .           V
  21            .      RMD2A
                .           .
                .           .
  27        ADD1............
                V
                V
  30      RMD2B
                .
                .
  36            .        MUD2
                .           .
                .           .
  41      SR13US............
                .
                .
  44            .      KYNET1
                .           V
                .           V
                .       RKYN2
                .           .
                .           .
  55            .           .      KYNET2
                .           .           .
                .           .           .
  60            .      KYNETT............
                .           .
                .           .
  63      SR13DS............
                V
                V
  66      RMUD3
                .
                .
  72            .        MUD3
                .           .
                .           .
  77        SR38............
                V
                V
  80      RMUD4
                .
                .
  86            .        MUD4
                .           .
                .           .
  91        HAMCO............
                V
                V
  94      RMD5A
```

```
            .
            .
100         .       TRIB1
            .          V
            .          V
105         .      RTRIB2
            .          .
            .          .
111         .          .       TRIB2
            .          .          .
            .          .          .
116         .        TRIB............
            .          .
            .          .
119       ADD2............
             V
             V
122     RMD5B
            .
            .
128         .        MUD5
            .          .
            .          .
133     I69MUD............
             V
             V
136     RMD6A
            .
            .
            .        MUD7
            .          .
            .          .
147     SR238M............
             V
             V
150     RMD6B
            .
            .
156         .        MUD6
            .          .
            .          .
161      126TH............
             V
             V
164     RMD8
            .
            .
170         .        MUD8
            .          .
            .          .
175      BROOK............
             V
             V
178     RMD9
            .
            .
184         .        MUD9
            .          .
            .          .
189     KLEPFR............
```

```
            V
            V
192     RMD10A
            .
            .
198         .       HIGH1
            .           V
            .           V
203         .       PHIGH
            .           .
            .           .
209       HIGH............
            V
            V
212     RMD10B
            .
            .
218         .       MUD10
            .           .
            .           .
223      MD106............
            .
            .
226         .       SAND1
            .           V
            .           V
231         .      RSND2
            .           .
            .           .
            .           .       SAND2
            .           .           .
            .           .           .
242         .       156TH............
            .           V
            .           V
245         .      RSND3
            .           .
            .           .
251         .           .       SAND3
            .           .           .
            .           .           .
256         .      SR238S............
            .           .
            .           .
259         .           .       SAND4
            .           .           .
            .           .           .
264         .       238DS............
            .           V
            .           V
267         .      RSND5
            .           .
            .           .
273         .           .       SAND5
            .           .           .
            .           .           .
278         .       MARIL............
            .           V
            .           V
281         .      RSND6A
```

```
                .          V
                .          V
 287            .      RSND6B
                .          .
                .          .
 293            .          .       SAND6
                .          .          .
                .          .          .
 298            .      I69SAN............
                .          V
                .          V
 301            .      RSND7A
                .          V
                .          V
 307            .      RSND7B
                .          .
                .          .
 313            .          .       SAND7
                .          .          .
                .          .          .
 318            .        SAND............
                .          .
                .          .
 321        106TH............
                V
                V
 324       RMUD11
                .
                .
                .       MUD11
                .          .
                .          .
 335         96TH............
                V
                V
 338       RMUD12
                .
                .
 344            .       MUD12
                .          .
                .          .
 349         86TH............
                V
                V
 352       RMUD13
                .
                .
 358            .       MUD13
                .          .
                .          .
 363         GAGE............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
*  RUN DATE  05/26/1998  TIME  13:20:47 *
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104              *
```

```
*                                        *                                                    *                                        *
*****************************************                                                    *****************************************
```

MUD CREEK WATERSHED HYDROLOGIC MODEL
CBBEL: 96-297 DLM 22MAY98 ** EXISTING COND. ** FILE: EXISTLT.HC1

```
5 IO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

  IT          HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JAN 0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     4JAN 0  ENDING DATE
                   NDTIME       0245  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL     .25 HOURS
                   TOTAL TIME BASE   74.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

  JP          MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

  JR          MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
                .51      .64      .73      .83      .93     1.00
1
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION					
OPERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
					.51	.64	.73	.83	.93	1.00
HYDROGRAPH AT										
+	HNRY1	1.52	1	FLOW	61.	92.	116.	143.	172.	192.
				TIME	24.75	24.50	24.50	24.25	24.25	24.00
HYDROGRAPH AT										
+	MUD1	3.33	1	FLOW	157.	240.	301.	373.	447.	500.
				TIME	22.25	22.00	21.75	21.75	21.75	21.50

ROUTED TO										
+	RMD2A	3.33	1	FLOW	157.	239.	301.	372.	446.	499.
				TIME	22.50	22.25	22.25	22.25	22.00	22.00
2 COMBINED AT										
+	ADD1	4.85	1	FLOW	214.	327.	412.	509.	610.	682.
				TIME	23.00	22.75	22.75	22.75	22.50	22.50
ROUTED TO										
+	RMD2B	4.85	1	FLOW	214.	327.	412.	509.	610.	681.
				TIME	23.25	23.00	23.00	23.00	22.75	22.75
HYDROGRAPH AT										
+	MUD2	1.37	1	FLOW	85.	128.	160.	197.	234.	261.
				TIME	20.00	19.75	19.50	19.50	19.50	19.50
2 COMBINED AT										
+	SR13US	6.22	1	FLOW	289.	438.	548.	677.	810.	905.
				TIME	22.00	21.75	22.00	21.75	21.75	21.75
HYDROGRAPH AT										
+	KYNET1	1.14	1	FLOW	62.	95.	118.	146.	174.	195.
				TIME	20.75	20.50	20.50	20.50	20.25	20.25
ROUTED TO										
+	RKYN2	1.14	1	FLOW	62.	94.	118.	146.	174.	194.
				TIME	21.75	21.50	21.25	21.50	21.75	22.00
[illegible]RAPH AT										
+	KYNET2	1.15	1	FLOW	82.	125.	156.	193.	231.	258.
				TIME	18.00	18.00	18.00	17.75	17.75	17.75
2 COMBINED AT										
+	KYNETT	2.29	1	FLOW	131.	200.	252.	310.	368.	407.
				TIME	19.50	19.25	19.25	19.00	19.00	18.75
2 COMBINED AT										
+	SR13DS	8.50	1	FLOW	408.	618.	771.	951.	1136.	1267.
				TIME	21.25	21.00	21.00	21.00	21.00	21.00
ROUTED TO										
+	RMUD3	8.50	1	FLOW	407.	616.	769.	949.	1133.	1264.
				TIME	22.00	21.75	21.75	21.75	21.75	21.75
HYDROGRAPH AT										
+	MUD3	1.73	1	FLOW	66.	100.	125.	154.	183.	204.
				TIME	26.25	26.00	26.00	25.75	25.75	25.75
2 COMBINED AT										
+	SR38	10.24	1	FLOW	462.	700.	874.	1078.	1288.	1437.
				TIME	22.50	22.25	22.25	22.25	22.00	22.00
ROUTED TO										
+	RMUD4	10.24	1	FLOW	461.	698.	873.	1076.	1286.	1435.
				TIME	23.75	23.25	23.25	23.00	23.00	23.00
HYDROGRAPH AT										
+	MUD4	1.89	1	FLOW	113.	169.	211.	259.	309.	344.
				TIME	20.50	20.25	20.25	20.00	20.00	20.00

2 COMBINED AT										
+	HAMCO	12.13	1	FLOW	557.	847.	1057.	1304.	1558.	1738.
				TIME	23.00	22.75	22.50	22.50	22.25	22.25
ROUTED TO										
+	RMD5A	12.13	1	FLOW	553.	841.	1052.	1298.	1551.	1731.
				TIME	25.00	24.25	24.00	23.75	23.50	23.50
HYDROGRAPH AT										
+	TRIB1	1.72	1	FLOW	84.	126.	157.	192.	228.	254.
				TIME	23.25	23.00	22.75	22.75	22.50	22.50
ROUTED TO										
+	RTRIB2	1.72	1	FLOW	84.	126.	156.	192.	228.	254.
				TIME	25.50	25.25	25.00	24.75	24.50	24.50
HYDROGRAPH AT										
+	TRIB2	1.10	1	FLOW	72.	108.	134.	165.	197.	219.
				TIME	19.50	19.25	19.25	19.00	19.00	19.00
2 COMBINED AT										
+	TRIB	2.82	1	FLOW	130.	196.	244.	301.	360.	402.
				TIME	22.75	22.50	22.25	22.00	21.75	21.75
2 COMBINED AT										
+	ADD2	14.95	1	FLOW	679.	1032.	1290.	1592.	1903.	2124.
				TIME	24.75	24.25	23.75	23.50	23.25	23.25
[illegible] TO										
+	RMD5B	14.95	1	FLOW	678.	1030.	1287.	1588.	1898.	2119.
				TIME	25.75	25.00	24.75	24.50	24.25	24.00
HYDROGRAPH AT										
+	MUD5	2.04	1	FLOW	125.	196.	248.	309.	373.	418.
				TIME	18.50	18.25	18.25	18.00	18.00	18.00
2 COMBINED AT										
+	I69MUD	17.00	1	FLOW	736.	1122.	1405.	1736.	2079.	2323.
				TIME	25.25	24.75	24.25	24.00	23.75	23.50
ROUTED TO										
+	RMD6A	17.00	1	FLOW	735.	1122.	1404.	1736.	2078.	2322.
				TIME	25.75	25.00	24.50	24.25	24.00	24.00
HYDROGRAPH AT										
+	MUD7	.84	1	FLOW	62.	94.	117.	144.	171.	191.
				TIME	18.25	18.00	18.00	18.00	18.00	18.00
2 COMBINED AT										
+	SR238M	17.84	1	FLOW	761.	1162.	1457.	1801.	2157.	2412.
				TIME	25.50	24.75	24.50	24.25	23.75	23.75
ROUTED TO										
+	RMD6B	17.84	1	FLOW	759.	1159.	1453.	1796.	2152.	2406.
				TIME	26.75	26.00	25.50	25.25	24.75	24.75
HYDROGRAPH AT										
+	MUD6	1.31	1	FLOW	77.	123.	158.	199.	242.	273.
				TIME	18.00	17.75	17.50	17.50	17.50	17.50

2 COMBINED AT										
+	126TH	19.15	1	FLOW	785.	1202.	1510.	1868.	2241.	2508.
				TIME	26.50	25.75	25.25	25.00	24.75	24.50
ROUTED TO										
+	RMD8	19.15	1	FLOW	780.	1194.	1500.	1856.	2227.	2492.
				TIME	27.75	27.00	26.50	26.00	25.75	25.50
HYDROGRAPH AT										
+	MUD8	2.26	1	FLOW	206.	315.	396.	490.	586.	654.
				TIME	16.25	16.25	16.00	16.00	16.00	16.00
2 COMBINED AT										
+	BROOK	21.41	1	FLOW	807.	1241.	1564.	1941.	2332.	2613.
				TIME	27.50	26.75	26.25	25.75	25.50	25.25
ROUTED TO										
+	RMD9	21.41	1	FLOW	798.	1221.	1541.	1916.	2308.	2589.
				TIME	30.50	29.75	29.00	28.25	27.50	27.25
HYDROGRAPH AT										
+	MUD9	1.67	1	FLOW	130.	199.	250.	309.	370.	413.
				TIME	17.25	17.25	17.00	17.00	17.00	17.00
2 COMBINED AT										
+	KLEPFR	23.08	1	FLOW	811.	1244.	1575.	1967.	2376.	2671.
				TIME	30.25	29.50	28.75	28.00	27.50	27.00
[illegible] TO										
+	RMD10A	23.08	1	FLOW	809.	1240.	1568.	1956.	2364.	2657.
				TIME	31.00	30.25	29.50	29.00	28.25	27.75
HYDROGRAPH AT										
+	HIGH1	1.29	1	FLOW	105.	157.	194.	238.	282.	314.
				TIME	17.75	17.75	17.75	17.50	17.50	17.50
ROUTED TO										
+	PHIGH	1.29	1	FLOW	9.	14.	17.	21.	30.	36.
				TIME	31.50	31.50	31.50	31.25	30.50	30.25
			** PEAK STAGES IN FEET **							
			1	STAGE	782.00	782.57	782.98	783.45	783.89	784.19
				TIME	31.75	31.50	31.50	31.25	30.50	30.25
2 COMBINED AT										
+	HIGH	24.37	1	FLOW	818.	1253.	1585.	1977.	2393.	2692.
				TIME	31.00	30.25	29.50	29.00	28.25	27.75
ROUTED TO										
+	RMD10B	24.37	1	FLOW	782.	1201.	1515.	1889.	2284.	2570.
				TIME	32.25	31.25	30.50	29.75	29.25	28.75
HYDROGRAPH AT										
+	MUD10	1.82	1	FLOW	90.	143.	184.	231.	281.	317.
				TIME	19.50	19.25	19.25	19.00	19.00	19.00
2 COMBINED AT										
+	MD106	26.19	1	FLOW	798.	1230.	1557.	1948.	2364.	2666.
				TIME	32.00	31.00	30.25	29.50	29.00	28.50

HYDROGRAPH AT										
+	SAND1	.98	1	FLOW	61.	93.	117.	144.	173.	193.
				TIME	19.25	19.25	19.00	19.00	19.00	19.00
ROUTED TO										
+	RSND2	.98	1	FLOW	61.	93.	117.	144.	172.	192.
				TIME	20.50	20.00	20.00	19.75	19.75	19.75
HYDROGRAPH AT										
+	SAND2	1.55	1	FLOW	104.	159.	199.	246.	294.	328.
				TIME	18.75	18.50	18.50	18.25	18.25	18.25
2 COMBINED AT										
+	156TH	2.53	1	FLOW	161.	247.	310.	383.	458.	511.
				TIME	19.50	19.25	19.00	19.00	18.75	18.75
ROUTED TO										
+	RSND3	2.53	1	FLOW	161.	245.	308.	380.	454.	507.
				TIME	21.00	20.75	20.75	20.75	20.50	20.50
HYDROGRAPH AT										
+	SAND3	1.92	1	FLOW	129.	196.	246.	304.	363.	405.
				TIME	18.75	18.50	18.50	18.25	18.25	18.25
2 COMBINED AT										
+	SR238S	4.45	1	FLOW	277.	424.	532.	655.	782.	873.
				TIME	20.00	19.75	19.75	19.75	19.75	19.75
[illegible]RAPH AT										
+	SAND4	1.04	1	FLOW	69.	105.	131.	162.	194.	216.
				TIME	18.75	18.50	18.50	18.50	18.50	18.50
2 COMBINED AT										
+	238DS	5.49	1	FLOW	343.	525.	658.	811.	968.	1080.
				TIME	20.00	19.75	19.50	19.50	19.50	19.50
ROUTED TO										
+	RSND5	5.49	1	FLOW	341.	522.	654.	806.	961.	1069.
				TIME	20.50	20.25	20.00	20.25	20.25	20.25
HYDROGRAPH AT										
+	SAND5	2.04	1	FLOW	117.	178.	223.	275.	329.	367.
				TIME	20.25	20.00	20.00	20.00	19.75	19.75
2 COMBINED AT										
+	MARIL	7.54	1	FLOW	458.	700.	878.	1081.	1288.	1434.
				TIME	20.50	20.25	20.00	20.00	20.25	20.25
ROUTED TO										
+	RSND6A	7.54	1	FLOW	455.	696.	867.	1066.	1270.	1414.
				TIME	21.25	21.00	21.50	21.50	21.50	21.50
ROUTED TO										
+	RSND6B	7.54	1	FLOW	454.	694.	865.	1063.	1267.	1411.
				TIME	21.75	21.75	22.00	22.00	22.00	22.00
HYDROGRAPH AT										
+	SAND6	2.16	1	FLOW	166.	254.	319.	394.	471.	525.
				TIME	17.50	17.25	17.25	17.25	17.25	17.00

2 COMBINED AT										
+	I69SAN	9.70	1	FLOW	553.	843.	1040.	1274.	1516.	1686.
				TIME	21.25	21.00	21.25	21.25	21.25	21.25
ROUTED TO										
+	RSND7A	9.70	1	FLOW	551.	840.	1038.	1270.	1510.	1679.
				TIME	22.00	21.75	21.75	22.00	22.00	22.00
ROUTED TO										
+	RSND7B	9.70	1	FLOW	550.	835.	1032.	1259.	1497.	1667.
				TIME	22.75	22.75	23.00	23.25	23.00	23.00
HYDROGRAPH AT										
+	SAND7	1.69	1	FLOW	110.	175.	223.	280.	338.	381.
				TIME	17.50	17.25	17.25	17.00	17.00	17.00
2 COMBINED AT										
+	SAND	11.38	1	FLOW	607.	919.	1134.	1380.	1640.	1826.
				TIME	22.50	22.50	22.50	22.75	22.75	22.75
2 COMBINED AT										
+	106TH	37.57	1	FLOW	1112.	1698.	2145.	2753.	3435.	3932.
				TIME	23.25	23.75	24.25	26.75	26.75	26.50
ROUTED TO										
+	RMUD11	37.57	1	FLOW	1107.	1694.	2132.	2732.	3394.	3879.
				TIME	24.25	24.75	26.50	28.25	28.25	28.00
HYDROGRAPH AT										
+	MUD11	1.46	1	FLOW	94.	154.	199.	253.	308.	349.
				TIME	16.75	16.50	16.50	16.25	16.25	16.25
2 COMBINED AT										
+	96TH	39.03	1	FLOW	1140.	1738.	2173.	2760.	3428.	3919.
				TIME	24.00	24.50	25.75	28.00	28.00	27.75
ROUTED TO										
+	RMUD12	39.03	1	FLOW	1136.	1733.	2169.	2754.	3412.	3898.
				TIME	25.25	25.50	26.75	29.00	29.00	28.75
HYDROGRAPH AT										
+	MUD12	1.55	1	FLOW	55.	91.	120.	153.	189.	215.
				TIME	20.75	20.50	20.25	20.25	20.00	20.00
2 COMBINED AT										
+	86TH	40.57	1	FLOW	1177.	1796.	2238.	2818.	3489.	3987.
				TIME	25.00	25.25	26.50	28.50	28.75	28.50
ROUTED TO										
+	RMUD13	40.57	1	FLOW	1176.	1795.	2237.	2817.	3486.	3983.
				TIME	25.75	26.00	27.25	29.25	29.25	29.25
HYDROGRAPH AT										
+	MUD13	1.84	1	FLOW	135.	214.	273.	343.	416.	467.
				TIME	16.50	16.50	16.50	16.25	16.25	16.25
2 COMBINED AT										
+	GAGE	42.41	1	FLOW	1211.	1843.	2284.	2846.	3516.	4017.
				TIME	25.50	25.75	26.50	28.50	29.25	29.00

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	8.19	156.62	1343.89	1.08	15.00	156.57	1350.00	1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1919E+03 EXCESS= .0000E+00 OUTFLOW= .1920E+03 BASIN STORAGE= .2909E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	7.26	239.53	1329.35	1.64	15.00	239.49	1335.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2904E+03 EXCESS= .0000E+00 OUTFLOW= .2904E+03 BASIN STORAGE= .2915E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	7.75	301.06	1332.53	2.05	15.00	301.05	1335.00	2.05

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3632E+03 EXCESS= .0000E+00 OUTFLOW= .3632E+03 BASIN STORAGE= .2641E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	9.94	372.47	1331.43	2.52	15.00	372.38	1335.00	2.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4474E+03 EXCESS= .0000E+00 OUTFLOW= .4473E+03 BASIN STORAGE= .2650E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	14.02	446.35	1318.32	3.01	15.00	446.33	1320.00	3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5343E+03 EXCESS= .0000E+00 OUTFLOW= .5342E+03 BASIN STORAGE= .3242E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2A	MANE	15.00	499.20	1320.00	3.36	15.00	499.20	1320.00	3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5964E+03 EXCESS= .0000E+00 OUTFLOW= .5963E+03 BASIN STORAGE= .2957E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RMD2B	MANE	3.86	214.07	1385.70	1.08	15.00	214.03	1395.00	1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2796E+03 EXCESS= .0000E+00 OUTFLOW= .2797E+03 BASIN STORAGE= .2222E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00

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          RMD2B   MANE        4.32    327.02   1381.34      1.64     15.00    327.02   1380.00        1.64

     NUITY SUMMARY (AC-FT) - INFLOW= .4231E+03 EXCESS= .0000E+00 OUTFLOW= .4231E+03 BASIN STORAGE= .3168E-03 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD2B   MANE        6.03    411.84   1380.17      2.05     15.00    411.84   1380.00        2.05

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5291E+03 EXCESS= .0000E+00 OUTFLOW= .5291E+03 BASIN STORAGE= .3769E-03 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD2B   MANE       11.05    509.07   1370.15      2.52     15.00    509.00   1380.00        2.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6517E+03 EXCESS= .0000E+00 OUTFLOW= .6517E+03 BASIN STORAGE= .4729E-03 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD2B   MANE       12.28    609.58   1362.76      3.01     15.00    609.55   1365.00        3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7783E+03 EXCESS= .0000E+00 OUTFLOW= .7782E+03 BASIN STORAGE= .5330E-03 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD2B   MANE       12.03    681.55   1359.87      3.36     15.00    681.43   1365.00        3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8688E+03 EXCESS= .0000E+00 OUTFLOW= .8687E+03 BASIN STORAGE= .5949E-03 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
           RKYN2  MANE       15.00     62.25   1305.00      1.14     15.00     62.25   1305.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6919E+02 EXCESS= .0000E+00 OUTFLOW= .6922E+02 BASIN STORAGE= .2855E-02 PERCENT ERROR=   -.1

         FOR PLAN = 1  RATIO=  .00
           RKYN2  MANE       15.00     94.49   1290.00      1.71     15.00     94.49   1290.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1037E+03 EXCESS= .0000E+00 OUTFLOW= .1037E+03 BASIN STORAGE= .3473E-02 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
           RKYN2  MANE       15.00    118.34   1275.00      2.13     15.00    118.34   1275.00        2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1290E+03 EXCESS= .0000E+00 OUTFLOW= .1291E+03 BASIN STORAGE= .3438E-02 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
           RKYN2  MANE       15.00    145.90   1290.00      2.61     15.00    145.90   1290.00        2.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1583E+03 EXCESS= .0000E+00 OUTFLOW= .1584E+03 BASIN STORAGE= .3125E-02 PERCENT ERROR=    .0
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FOR PLAN = 1  RATIO=  .00
  RKYN2  MANE        15.00    174.16   1305.00      3.10     15.00    174.16   1305.00        3.10

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1884E+03 EXCESS= .0000E+00 OUTFLOW= .1885E+03 BASIN STORAGE= .2770E-02 PERCENT ERROR=    .0

FOR PLAN =1  RATIO=  .00
  RKYN2  MANE        15.00    193.98   1320.00      3.46     15.00    193.98   1320.00        3.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2099E+03 EXCESS= .0000E+00 OUTFLOW= .2099E+03 BASIN STORAGE= .3207E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00    406.84   1320.00      1.12     15.00    406.84   1320.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5061E+03 EXCESS= .0000E+00 OUTFLOW= .5059E+03 BASIN STORAGE= .2322E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00    615.79   1305.00      1.68     15.00    615.79   1305.00        1.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7611E+03 EXCESS= .0000E+00 OUTFLOW= .7606E+03 BASIN STORAGE= .3326E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00    768.60   1305.00      2.09     15.00    768.60   1305.00        2.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9491E+03 EXCESS= .0000E+00 OUTFLOW= .9485E+03 BASIN STORAGE= .4044E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00    948.73   1305.00      2.57     15.00    948.73   1305.00        2.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1166E+04 EXCESS= .0000E+00 OUTFLOW= .1165E+04 BASIN STORAGE= .4775E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00   1133.33   1305.00      3.06     15.00   1133.33   1305.00        3.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1390E+04 EXCESS= .0000E+00 OUTFLOW= .1389E+04 BASIN STORAGE= .5524E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMUD3  MANE        15.00   1263.50   1305.00      3.41     15.00   1263.50   1305.00        3.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1550E+04 EXCESS= .0000E+00 OUTFLOW= .1549E+04 BASIN STORAGE= .6047E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMUD4  MANE        15.00    461.11   1425.00      1.12     15.00    461.11   1425.00        1.12
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .6111E+03 EXCESS= .0000E+00 OUTFLOW= .6105E+03 BASIN STORAGE= .4228E-01 PERCENT ERROR=    .1

          FOR PLAN = 1  RATIO=  .00
            RMUD4   MANE        15.00    698.49   1395.00      1.68     15.00    698.49   1395.00        1.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9183E+03 EXCESS= .0000E+00 OUTFLOW= .9182E+03 BASIN STORAGE= .5570E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMUD4   MANE        15.00    872.61   1395.00      2.10     15.00    872.61   1395.00        2.10

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1145E+04 EXCESS= .0000E+00 OUTFLOW= .1145E+04 BASIN STORAGE= .6720E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMUD4   MANE        15.00   1076.29   1380.00      2.58     15.00   1076.29   1380.00        2.58

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1406E+04 EXCESS= .0000E+00 OUTFLOW= .1406E+04 BASIN STORAGE= .7661E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMUD4   MANE        15.00   1286.11   1380.00      3.07     15.00   1286.11   1380.00        3.07

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1676E+04 EXCESS= .0000E+00 OUTFLOW= .1676E+04 BASIN STORAGE= .8888E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMUD4   MANE        15.00   1434.65   1380.00      3.42     15.00   1434.65   1380.00        3.42

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1868E+04 EXCESS= .0000E+00 OUTFLOW= .1869E+04 BASIN STORAGE= .9303E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5A   MANE        15.00    553.16   1500.00      1.13     15.00    553.16   1500.00        1.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7317E+03 EXCESS= .0000E+00 OUTFLOW= .7305E+03 BASIN STORAGE= .8151E-01 PERCENT ERROR=    .2

          FOR PLAN = 1  RATIO=  .00
            RMD5A   MANE        15.00    841.19   1455.00      1.69     15.00    841.19   1455.00        1.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1098E+04 EXCESS= .0000E+00 OUTFLOW= .1096E+04 BASIN STORAGE= .1076E+00 PERCENT ERROR=    .2

          FOR PLAN = 1  RATIO=  .00
            RMD5A   MANE        15.00   1051.51   1440.00      2.11     15.00   1051.51   1440.00        2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1368E+04 EXCESS= .0000E+00 OUTFLOW= .1366E+04 BASIN STORAGE= .1315E+00 PERCENT ERROR=    .1
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FOR PLAN = 1  RATIO=  .00
  RMD5A   MANE        15.00   1297.79   1425.00      2.59     15.00   1297.79   1425.00        2.59

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1679E+04 EXCESS= .0000E+00 OUTFLOW= .1677E+04 BASIN STORAGE= .1454E+00 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMD5A   MANE        15.00   1551.47   1410.00      3.09     15.00   1551.47   1410.00        3.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1999E+04 EXCESS= .0000E+00 OUTFLOW= .1997E+04 BASIN STORAGE= .1704E+00 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RMD5A   MANE        15.00   1730.95   1410.00      3.44     15.00   1730.95   1410.00        3.44

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2228E+04 EXCESS= .0000E+00 OUTFLOW= .2226E+04 BASIN STORAGE= .1709E+00 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00     84.09   1530.00      1.20     15.00     84.09   1530.00        1.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1103E+03 EXCESS= .0000E+00 OUTFLOW= .1102E+03 BASIN STORAGE= .9506E-03 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00    125.74   1515.00      1.78     15.00    125.74   1515.00        1.78

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1636E+03 EXCESS= .0000E+00 OUTFLOW= .1635E+03 BASIN STORAGE= .9366E-03 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00    156.38   1500.00      2.20     15.00    156.38   1500.00        2.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2028E+03 EXCESS= .0000E+00 OUTFLOW= .2026E+03 BASIN STORAGE= .9224E-03 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00    191.62   1485.00      2.69     15.00    191.62   1485.00        2.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2478E+03 EXCESS= .0000E+00 OUTFLOW= .2475E+03 BASIN STORAGE= .9869E-03 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00    227.79   1470.00      3.19     15.00    227.79   1470.00        3.19

C     'ITY SUMMARY (AC-FT) - INFLOW= .2940E+03 EXCESS= .0000E+00 OUTFLOW= .2937E+03 BASIN STORAGE= .9366E-03 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RTRIB2  MANE        15.00    253.66   1470.00      3.55     15.00    253.66   1470.00        3.55
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .3269E+03 EXCESS= .0000E+00 OUTFLOW= .3265E+03 BASIN STORAGE= .9880E-03 PERCENT ERROR=    .1

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00    678.35   1545.00      1.14     15.00    678.35   1545.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9108E+03 EXCESS= .0000E+00 OUTFLOW= .9109E+03 BASIN STORAGE= .1180E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00   1030.23   1500.00      1.71     15.00   1030.23   1500.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1364E+04 EXCESS= .0000E+00 OUTFLOW= .1364E+04 BASIN STORAGE= .1588E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00   1287.47   1485.00      2.13     15.00   1287.47   1485.00        2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1697E+04 EXCESS= .0000E+00 OUTFLOW= .1697E+04 BASIN STORAGE= .1904E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00   1588.04   1470.00      2.61     15.00   1588.04   1470.00        2.61

UITY SUMMARY (AC-FT) - INFLOW= .2082E+04 EXCESS= .0000E+00 OUTFLOW= .2081E+04 BASIN STORAGE= .2078E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00   1898.27   1455.00      3.11     15.00   1898.27   1455.00        3.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2478E+04 EXCESS= .0000E+00 OUTFLOW= .2477E+04 BASIN STORAGE= .2456E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD5B   MANE        15.00   2118.79   1440.00      3.46     15.00   2118.79   1440.00        3.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2761E+04 EXCESS= .0000E+00 OUTFLOW= .2759E+04 BASIN STORAGE= .2430E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD6A   MANE        15.00    735.36   1545.00      1.13     15.00    735.36   1545.00        1.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1023E+04 EXCESS= .0000E+00 OUTFLOW= .1023E+04 BASIN STORAGE= .5304E-01 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD6A   MANE        15.00   1121.64   1500.00      1.69     15.00   1121.64   1500.00        1.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1534E+04 EXCESS= .0000E+00 OUTFLOW= .1534E+04 BASIN STORAGE= .7064E-01 PERCENT ERROR=    .0
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FOR PLAN = 1  RATIO=  .00
  RMD6A   MANE        15.00   1404.40   1470.00      2.11     15.00   1404.40   1470.00        2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1911E+04 EXCESS= .0000E+00 OUTFLOW= .1911E+04 BASIN STORAGE= .8301E-01 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6A   MANE        15.00   1735.56   1455.00      2.59     15.00   1735.56   1455.00        2.59

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2347E+04 EXCESS= .0000E+00 OUTFLOW= .2347E+04 BASIN STORAGE= .9069E-01 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6A   MANE        15.00   2078.15   1440.00      3.08     15.00   2078.15   1440.00        3.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2795E+04 EXCESS= .0000E+00 OUTFLOW= .2795E+04 BASIN STORAGE= .1079E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6A   MANE        15.00   2321.90   1440.00      3.44     15.00   2321.90   1440.00        3.44

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3115E+04 EXCESS= .0000E+00 OUTFLOW= .3115E+04 BASIN STORAGE= .1066E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6B   MANE        15.00    759.25   1605.00      1.13     15.00    759.25   1605.00        1.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1076E+04 EXCESS= .0000E+00 OUTFLOW= .1076E+04 BASIN STORAGE= .1695E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6B   MANE        15.00   1159.26   1560.00      1.70     15.00   1159.26   1560.00        1.70

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1614E+04 EXCESS= .0000E+00 OUTFLOW= .1614E+04 BASIN STORAGE= .2261E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6B   MANE        15.00   1453.22   1530.00      2.11     15.00   1453.22   1530.00        2.11

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2010E+04 EXCESS= .0000E+00 OUTFLOW= .2009E+04 BASIN STORAGE= .2684E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6B   MANE        15.00   1796.19   1515.00      2.59     15.00   1796.19   1515.00        2.59

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2468E+04 EXCESS= .0000E+00 OUTFLOW= .2467E+04 BASIN STORAGE= .2963E+00 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD6B   MANE        15.00   2151.84   1485.00      3.09     15.00   2151.84   1485.00        3.09
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .2938E+04 EXCESS= .0000E+00 OUTFLOW= .2937E+04 BASIN STORAGE= .3440E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD6B   MANE        15.00   2405.85   1485.00      3.44     15.00   2405.85   1485.00        3.44

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3275E+04 EXCESS= .0000E+00 OUTFLOW= .3274E+04 BASIN STORAGE= .3411E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00    780.41   1665.00      1.12     15.00    780.41   1665.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1140E+04 EXCESS= .0000E+00 OUTFLOW= .1140E+04 BASIN STORAGE= .3156E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00   1193.98   1620.00      1.68     15.00   1193.98   1620.00        1.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1714E+04 EXCESS= .0000E+00 OUTFLOW= .1713E+04 BASIN STORAGE= .4313E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00   1499.63   1590.00      2.09     15.00   1499.63   1590.00        2.09

r     'UITY SUMMARY (AC-FT) - INFLOW= .2137E+04 EXCESS= .0000E+00 OUTFLOW= .2135E+04 BASIN STORAGE= .5181E+00 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00   1855.99   1560.00      2.57     15.00   1855.99   1560.00        2.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2625E+04 EXCESS= .0000E+00 OUTFLOW= .2623E+04 BASIN STORAGE= .5818E+00 PERCENT ERROR=    .1

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00   2227.06   1545.00      3.06     15.00   2227.06   1545.00        3.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3128E+04 EXCESS= .0000E+00 OUTFLOW= .3126E+04 BASIN STORAGE= .6656E+00 PERCENT ERROR=    .1

          FOR PLAN = 1  RATIO=  .00
            RMD8    MANE        15.00   2492.25   1530.00      3.41     15.00   2492.25   1530.00        3.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3488E+04 EXCESS= .0000E+00 OUTFLOW= .3485E+04 BASIN STORAGE= .6689E+00 PERCENT ERROR=    .1

          FOR PLAN = 1  RATIO=  .00
            RMD9    MANE        15.00    797.75   1830.00      1.12     15.00    797.75   1830.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1277E+04 EXCESS= .0000E+00 OUTFLOW= .1274E+04 BASIN STORAGE= .7067E+00 PERCENT ERROR=    .2

          FOR PLAN = 1  RATIO=  .00
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          RMD9    MANE        15.00   1220.93   1785.00      1.68     15.00   1220.93   1785.00        1.68

     IUITY SUMMARY (AC-FT) - INFLOW= .1918E+04 EXCESS= .0000E+00 OUTFLOW= .1914E+04 BASIN STORAGE= .9610E+00 PERCENT ERROR=    .2

         FOR PLAN = 1  RATIO=  .00
          RMD9    MANE        15.00   1540.69   1740.00      2.09     15.00   1540.69   1740.00        2.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2391E+04 EXCESS= .0000E+00 OUTFLOW= .2385E+04 BASIN STORAGE= .1148E+01 PERCENT ERROR=    .2

         FOR PLAN = 1  RATIO=  .00
          RMD9    MANE        15.00   1916.35   1695.00      2.57     15.00   1916.35   1695.00        2.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2937E+04 EXCESS= .0000E+00 OUTFLOW= .2931E+04 BASIN STORAGE= .1286E+01 PERCENT ERROR=    .2

         FOR PLAN = 1  RATIO=  .00
          RMD9    MANE        15.00   2307.67   1650.00      3.06     15.00   2307.67   1650.00        3.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3499E+04 EXCESS= .0000E+00 OUTFLOW= .3493E+04 BASIN STORAGE= .1454E+01 PERCENT ERROR=    .1

         FOR PLAN = 1  RATIO=  .00
          RMD9    MANE        15.00   2588.91   1635.00      3.41     15.00   2588.91   1635.00        3.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3902E+04 EXCESS= .0000E+00 OUTFLOW= .3895E+04 BASIN STORAGE= .1457E+01 PERCENT ERROR=    .1

         FOR PLAN = 1  RATIO=  .00
          RMD10A  MANE        15.00    808.72   1860.00      1.12     15.00    808.72   1860.00        1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1375E+04 EXCESS= .0000E+00 OUTFLOW= .1375E+04 BASIN STORAGE= .8196E+00 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD10A  MANE        15.00   1239.78   1815.00      1.68     15.00   1239.78   1815.00        1.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2066E+04 EXCESS= .0000E+00 OUTFLOW= .2065E+04 BASIN STORAGE= .1052E+01 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD10A  MANE        15.00   1568.38   1770.00      2.09     15.00   1568.38   1770.00        2.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2575E+04 EXCESS= .0000E+00 OUTFLOW= .2573E+04 BASIN STORAGE= .1201E+01 PERCENT ERROR=    .0

         FOR PLAN = 1  RATIO=  .00
          RMD10A  MANE        15.00   1956.47   1740.00      2.57     15.00   1956.47   1740.00        2.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3163E+04 EXCESS= .0000E+00 OUTFLOW= .3161E+04 BASIN STORAGE= .1334E+01 PERCENT ERROR=    .0
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FOR PLAN = 1  RATIO=  .00
  RMD10A  MANE        15.00   2363.87   1695.00      3.06     15.00   2363.87   1695.00        3.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3769E+04 EXCESS= .0000E+00 OUTFLOW= .3767E+04 BASIN STORAGE= .1465E+01 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD10A  MANE        15.00   2656.82   1665.00      3.41     15.00   2656.82   1665.00        3.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4203E+04 EXCESS= .0000E+00 OUTFLOW= .4200E+04 BASIN STORAGE= .1483E+01 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00    782.15   1935.00      1.08     15.00    782.15   1935.00        1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1411E+04 EXCESS= .0000E+00 OUTFLOW= .1401E+04 BASIN STORAGE= .2347E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00   1201.32   1875.00      1.62     15.00   1201.32   1875.00        1.62

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2119E+04 EXCESS= .0000E+00 OUTFLOW= .2105E+04 BASIN STORAGE= .2847E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00   1515.47   1830.00      2.02     15.00   1515.47   1830.00        2.02

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2640E+04 EXCESS= .0000E+00 OUTFLOW= .2624E+04 BASIN STORAGE= .3192E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00   1888.89   1785.00      2.48     15.00   1888.89   1785.00        2.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3243E+04 EXCESS= .0000E+00 OUTFLOW= .3224E+04 BASIN STORAGE= .3647E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00   2283.57   1755.00      2.96     15.00   2283.57   1755.00        2.96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3868E+04 EXCESS= .0000E+00 OUTFLOW= .3846E+04 BASIN STORAGE= .4233E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RMD10B  MANE        15.00   2569.91   1725.00      3.30     15.00   2569.91   1725.00        3.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4318E+04 EXCESS= .0000E+00 OUTFLOW= .4293E+04 BASIN STORAGE= .4516E+01 PERCENT ERROR=    .5

FOR PLAN = 1  RATIO=  .00
  RSND2   MANE        15.00     61.17   1230.00      1.14     15.00     61.17   1230.00        1.14
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .5968E+02 EXCESS= .0000E+00 OUTFLOW= .5971E+02 BASIN STORAGE= .2186E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND2   MANE        15.00     93.13   1200.00      1.71     15.00     93.13   1200.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8942E+02 EXCESS= .0000E+00 OUTFLOW= .8946E+02 BASIN STORAGE= .2052E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND2   MANE        15.00    116.80   1200.00      2.13     15.00    116.80   1200.00        2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1113E+03 EXCESS= .0000E+00 OUTFLOW= .1114E+03 BASIN STORAGE= .1953E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND2   MANE        15.00    144.11   1185.00      2.61     15.00    144.11   1185.00        2.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1366E+03 EXCESS= .0000E+00 OUTFLOW= .1366E+03 BASIN STORAGE= .2389E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND2   MANE        15.00    172.28   1185.00      3.10     15.00    172.28   1185.00        3.10

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1626E+03 EXCESS= .0000E+00 OUTFLOW= .1626E+03 BASIN STORAGE= .2189E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND2   MANE        15.00    192.33   1185.00      3.46     15.00    192.33   1185.00        3.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1811E+03 EXCESS= .0000E+00 OUTFLOW= .1812E+03 BASIN STORAGE= .2427E-02 PERCENT ERROR=    .0

          FOR PLAN =1  RATIO=  .00
            RSND3   MANE        15.00    160.50   1260.00      1.14     15.00    160.50   1260.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1540E+03 EXCESS= .0000E+00 OUTFLOW= .1540E+03 BASIN STORAGE= .3448E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND3   MANE        15.00    245.00   1245.00      1.71     15.00    245.00   1245.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2308E+03 EXCESS= .0000E+00 OUTFLOW= .2307E+03 BASIN STORAGE= .3305E-02 PERCENT ERROR=    .0

          FOR PLAN = 1  RATIO=  .00
            RSND3   MANE        15.00    307.70   1245.00      2.12     15.00    307.70   1245.00        2.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2872E+03 EXCESS= .0000E+00 OUTFLOW= .2872E+03 BASIN STORAGE= .3166E-02 PERCENT ERROR=    .0
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FOR PLAN = 1  RATIO=  .00
  RSND3   MANE        15.00    379.94   1245.00      2.61     15.00    379.94   1245.00        2.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3524E+03 EXCESS= .0000E+00 OUTFLOW= .3523E+03 BASIN STORAGE= .2859E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND3   MANE        15.00    454.08   1230.00      3.10     15.00    454.08   1230.00        3.10

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4195E+03 EXCESS= .0000E+00 OUTFLOW= .4193E+03 BASIN STORAGE= .3643E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND3   MANE        15.00    506.95   1230.00      3.46     15.00    506.95   1230.00        3.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4673E+03 EXCESS= .0000E+00 OUTFLOW= .4670E+03 BASIN STORAGE= .2909E-02 PERCENT ERROR=    .1

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00    340.93   1230.00      1.14     15.00    340.93   1230.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3338E+03 EXCESS= .0000E+00 OUTFLOW= .3338E+03 BASIN STORAGE= .1986E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00    522.15   1215.00      1.71     15.00    522.15   1215.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5001E+03 EXCESS= .0000E+00 OUTFLOW= .4999E+03 BASIN STORAGE= .2644E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00    654.48   1200.00      2.12     15.00    654.48   1200.00        2.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6226E+03 EXCESS= .0000E+00 OUTFLOW= .6224E+03 BASIN STORAGE= .2524E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00    806.31   1215.00      2.61     15.00    806.31   1215.00        2.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7638E+03 EXCESS= .0000E+00 OUTFLOW= .7637E+03 BASIN STORAGE= .2392E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00    960.57   1215.00      3.10     15.00    960.57   1215.00        3.10

JITY SUMMARY (AC-FT) - INFLOW= .9091E+03 EXCESS= .0000E+00 OUTFLOW= .9088E+03 BASIN STORAGE= .2636E-02 PERCENT ERROR=    .0

FOR PLAN = 1  RATIO=  .00
  RSND5   MANE        15.00   1068.69   1215.00      3.45     15.00   1068.69   1215.00        3.45
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CONTINUITY SUMMARY (AC-FT) - INFLOW= .1013E+04 EXCESS= .0000E+00 OUTFLOW= .1012E+04 BASIN STORAGE= .2071E-02 PERCENT ERROR=    .1

:OR
 ANUT      FOR PLAN = 1  RATIO=  .00
            RSND6A  MANE        15.00    455.47   1275.00      1.14     15.00    455.47   1275.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4580E+03 EXCESS= .0000E+00 OUTFLOW= .4580E+03 BASIN STORAGE= .2241E-02 PERCENT ERROR=    .0

           FOR PLAN = 1  RATIO=  .00
            RSND6A  MANE        15.00    696.07   1260.00      1.71     15.00    696.07   1260.00        1.71

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6860E+03 EXCESS= .0000E+00 OUTFLOW= .6864E+03 BASIN STORAGE= .2117E-02 PERCENT ERROR=   -.1

           FOR PLAN = 1  RATIO=  .00
            RSND6A  MANE        15.00    866.72   1290.00      2.12     15.00    866.72   1290.00        2.12

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8540E+03 EXCESS= .0000E+00 OUTFLOW= .8535E+03 BASIN STORAGE= .1908E-02 PERCENT ERROR=    .1

           FOR PLAN = 1  RATIO=  .00
            RSND6A  MANE        15.00   1065.76   1290.00      2.60     15.00   1065.76   1290.00        2.60

 SU
     .UITY SUMMARY (AC-FT) - INFLOW= .1048E+04 EXCESS= .0000E+00 OUTFLOW= .1046E+04 BASIN STORAGE= .1960E-02 PERCENT ERROR=    .2

           FOR PLAN = 1  RATIO=  .00
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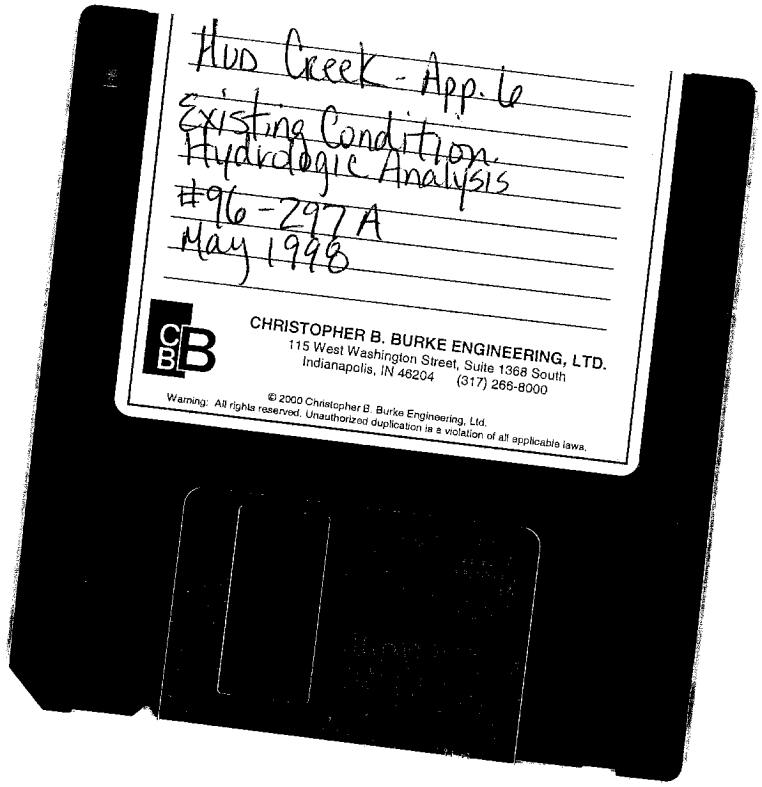
*** NORMAL END OF HEC-1 ***

APPENDIX 6

Digital Copy of Existing-Condition Hydrologic Model Input/Output


Hud Creek - App. 6
Existing Condition
Hydrologic Analysis
#96-297A
May 1998
CHRISTOPHER B. BURKE ENGINEERING, LTD.
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Indianapolis, IN 46204 (317) 266-8000
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Mud Creek Watershed Flood Protection Alternatives Analysis

Prepared for

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October 2002

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CBBEL Project No. 01-410

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EXECUTIVE SUMMARY

The Mud Creek Watershed Flood Protection Alternatives Analysis was completed to assist the Hamilton County Drainage Board and Surveyor's Office in making decisions regarding flood control options for the watershed. This study was initiated because of the significant increase in Base Flood Elevations being proposed with the revised FEMA Flood Insurance Study (FIS) for Hamilton County. This is a concern because many existing developments in the watershed were approved and built using the information presented in the existing FIS. Consequently, many areas previously shown outside the floodplain and floodway limits may be within the limits of the revised flood mapping. In addition to the potential danger to people and property in the event of a flood, property owners with structures that are located in the floodplain may be required to buy flood insurance.

Several sources were used to collect the best available data for the analysis presented in this report. This included copies of the revised Flood Insurance Rate Maps (FIRMs) from the Indiana Department of Natural Resources (IDNR), the latest county mapping from Hamilton County, information on proposed development from both Hamilton County and IDNR staff, and field reconnaissance by CBBEL staff to field-verify the problem areas that were identified based on the mapping, and also to identify any other problem areas.

In analyzing the nature and extent of the problems along both creeks, it became obvious that the existing problems fall into three major categories: 1) mapping problems; 2) isolated residential flooding; and 3) bridge and/or roadway overtopping. A majority of the identified problems are due either to the proposed flood mapping not accurately reflecting the existing ground elevations, or to the floodplain boundary being drawn incorrectly. There are a few existing residences correctly shown as being in the floodplain or floodway that will likely be subject to flood damages as a result of a 100-year flood. In addition, several bridges and culverts and/or their approach roads would be overtopped during flood events.

The proposed revised floodplain and floodway limits for Mud Creek and Sand Creek, along with all identified impacted areas along Mud Creek and Sand Creek are shown on **Exhibits 2 – 8** in the report.

CBBEL identified several potential alternatives to consider for solving the identified problems. Based on the results of a preliminary screening process, a short list of promising solutions for further consideration was compiled. The short-listed, promising solutions were subjected to a more detailed evaluation of their technical effectiveness, economic feasibility, social and institutional impacts, and environmental feasibility. They were then given a final screening to identify their relative advantages and disadvantages to determine whether they should be recommended for further action.

The overall conclusions of this study are that several road crossings would be overtopped by flood flows, and that most of the other problems resulting from the revised hydraulic analysis are apparently due to inaccuracies in the proposed mapping of the revised floodplain boundaries.

The study resulted in 10 specific conclusions and associated recommendations and estimated costs, which are presented in detail in Section 7.0 of the report, and briefly summarized below.

1. Approximately 114 of the 121 lots and homes that are shown within the floodplain limits appear to be at elevations that are higher than the proposed BFEs and should therefore not be in the floodplain. It is recommended that property owners are notified and offered advice and guidance on pursuing the appropriate letter from FEMA. No significant cost to the county is expected.

2. Three properties along Mud Creek and four properties along Sand Creek are correctly shown in the floodplain. It is recommended that consideration be given to the future implementation of a countywide "Flood Hazard Mitigation Plan." The estimated cost of preparing this plan is $100,000, of which the County would pay 25% with 75% federal funding.

3. Six road crossings each over Mud Creek and Sand Creek would be overtopped by flood flows and should be improved. It is recommended that a capital improvement plan be implemented to improve the crossings to prevent inundation during flood events. The estimated cost of improving all 12 crossings is $3.6 million. This work would normally be completed by the Hamilton County Highway Department, the Town of Fishers, or the City of Noblesville, depending on the location of the crossing.

4. Several homes with basements have been built very close to Mud Creek and Sand Creek and those basements are subject to flooding. It is recommended that the county stormwater ordinance based on guidelines provided in FEMA Technical Bulletin 10-10 continue to be enforced. Also, strongly recommend to developers that basements not be built in areas that have been removed from the regulatory floodplain based on fill, or in areas located close to the floodplain. No significant cost to the county is expected.

5. No maintenance assessments are currently being collected from residents in the watershed for the Mud Creek and Sand Creek county regulated drains, and no maintenance is being done by the County Surveyor's Office. It is recommended that both streams be added to the county assessment roles for stream maintenance. No significant cost to the county is expected as the costs for stream maintenance and inspections would be covered by the assessments.

6. The county's proactive stormwater detention policy and strict enforcement of floodplain

storage protective measures ensure flow rates will not increase significantly with development. The only way to ensure maintenance of the natural floodplain storage is to allow no filling within the floodplain limits. It is recommended that a policy be implemented in the county and in the City of Noblesville and the Town of Fishers of no filling in the floodplain and that the county's proactive stormwater detention and floodplain development policies continue to be strictly enforced throughout the county. No significant cost to the county is expected.

7. Several detention ponds have been built within the limits of the floodplain, and in some cases, within the limits of the floodway of Mud Creek and Sand Creek. It is recommended that detailed analyses be completed to determine whether retrofitting the ponds, or some other action, is desirable. The estimated cost of implementing this recommendation is up to several thousand dollars for each detention basin.

8. The Mud Creek watershed may be suffering from stormwater quality problems. It is recommended that a detailed evaluation of stormwater quality within the Mud Creek watershed be completed. The estimated cost of completing this evaluation would be on the order of $50,000.

9. The IDNR and FEMA used the modeling developed for the Mud Creek watershed to develop a new Flood Insurance Study and associated mapping. It is recommended that any future proposed stormwater facility design is completed using the same methodology as used in the approved analyses. No significant cost to the county is expected.

10. Currently, there is no local control or influence over the national flood insurance mapping program run by FEMA for Hamilton County. It is recommended that Hamilton County become a FEMA partner with the Cooperating Technical Partner (CTP) program administered through the surveyor's office so that FEMA maps may be revised directly by the county and the revisions may be published by FEMA in a timely manner. There would be no cost initially, but once the agreement is approved and established, approximately $50,000 to $100,000 should be budgeted annually to undertake limited, locally funded floodplain mapping projects and to provide the required match for available funding from FEMA.

Full implementation of each of the recommendations presented in the report would effectively eliminate the flooding problems identified as part of this study.

1.0 PROJECT OVERVIEW

1.1 BACKGROUND

Christopher B. Burke Engineering, Ltd. (CBBEL) completed a detailed study of the Mud Creek watershed and presented the results in the report Mud Creek Watershed Hydrologic Analysis, dated February 1997. That report was originally directed toward examining regional detention options within the watershed. However, the detailed hydrologic analysis showed the regulatory discharges for Mud Creek and Sand Creek were significantly less than the results of the CBBEL modeling. Based on that conclusion, the report included the following recommendations:

1. The Coordinated Discharge curves for Mud Creek and Sand Creek should be revised.
2. A comprehensive hydraulic analysis using the revised Coordinated Discharges should be completed for Mud Creek and Sand Creek.
3. Based on the results of the revised hydraulic analysis, a comprehensive feasibility-level study evaluating various flood control options, beyond regional detention basins should be completed.
4. Using additional, more detailed information, conduct additional evaluation of regional detention basin functions.

The first recommendation was implemented when CBBEL completed a detailed analysis of the hydrology of the watershed including revised Coordinated Discharge curves for Mud Creek and Sand Creek. The results of that analysis were presented in the report Existing – Condition Hydrologic Analysis Refinement, dated May 1998. The Coordinated Discharge curves were subsequently adopted in accordance with the multi-agency agreement between the Indiana Department of Natural Resources (IDNR), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS) and the United States Army Corps of Engineers (USACE) wherein each agency agreed to coordinate discharge-frequency values for use in water resources investigations and planning activities in the state of Indiana.

The second recommendation was implemented when staff from the IDNR completed a comprehensive hydraulic analysis using the flow rates from the revised Coordinated Discharge curves. The results of this comprehensive analysis were used to develop new floodplain and floodway mapping along Mud Creek and Sand Creek. This mapping has been submitted to the Federal Emergency Management Agency (FEMA) to be included in the revised Hamilton County Flood Insurance Study (FIS). FEMA has completed its review of the hydraulic analyses and the proposed FIS maps were distributed for public comment. It is anticipated the revised FIS maps for Mud Creek and Sand Creek will be formally published within the next year.

In response to the third recommendation, the Hamilton County Surveyor's office contracted with CBBEL to complete a comprehensive feasibility-level study to evaluate a wide array of flood protection measures. The results of that study are contained in this report. The fourth recommendation would only be necessary and acted upon if regional detention is chosen as the recommended alternative.

1.2 INTRODUCTION

This report presents the results of the Mud Creek watershed flood protection alternatives analysis completed by CBBEL for Hamilton County. The study was initiated because of the significant increase in Base Flood Elevations being proposed with the revised FEMA Flood Insurance Study for Hamilton County. The Mud Creek watershed includes approximately 44 square miles of area upstream of the creek's confluence with Fall Creek in Marion County. The Mud Creek watershed includes two major streams, Mud Creek and Sand Creek, and several smaller ditches including High Ditch, Hynett Ditch, Henry Ditch, as well as several unnamed tributary streams. Roughly 11 miles of Mud Creek and all of Sand Creek traverse the southeast part of Hamilton County. Portions of the Mud Creek watershed are located in Marion, Hamilton, and Madison Counties, as shown on **Exhibit 1**.

The existing land use along Mud Creek and Sand Creek ranges from rural areas in the upper reaches with little development to extensive suburban and urban development along the middle and lower reaches. A concern is that many of the existing developments were approved and built using the information presented in the existing FIS. Consequently, many areas previously shown outside the floodplain and floodway limits may be within the limits of the revised flood mapping. This is a concern due to the potential danger to people and property in the event of a flood, and also the fact that property owners with structures located in the floodplain may be required to buy flood insurance. For any residential structures located within the limits of the revised floodway, there would be additional concerns due to regulations of the IDNR.

1.3 PURPOSE AND SCOPE

The purpose of this report is to document the results of a CBBEL study identifying the location and severity of overbank flooding problems within the Mud Creek Watershed; identifying alternative solutions to these problems; evaluating the alternative solutions for their technical effectiveness, economic feasibility, institutional/social acceptance, and environmental impacts; and recommending a plan of action based on these evaluations.

The scope of the study is reconnaissance in nature, offering project features with a planning level of accuracy. The opinions of probable cost estimates provided in the report are for comparing alternatives. They are not design-level cost estimates that would be appropriate for initiating the funding of specific projects.

The scope of services included field reconnaissance and collection of data, identification of problem areas, development of flood protection measures that would solve the identified problems, evaluation of the proposed solutions to determine the best alternatives, and preparation of a summary report.

1.4 ORGANIZATION OF THIS DOCUMENT

This report is organized into several chapters, sections, and appendices. A brief summary of the contents of each of the chapters is provided below:

- Chapter 1, **Project Overview**, presents the purpose and scope of the project as well as descriptions of the project location.

- Chapter 2, **Data Collection**, summarizes the steps taken in gathering the pertinent information on flooding sources and development plans within the Mud Creek and Sand Creek floodplain corridors.

- Chapter 3, **Problem Identification**, summarizes the location and severity of problems based on the extent of existing and proposed development within the latest revised floodplain/floodway limits.

- Chapter 4, **Preliminary Screening of Potential Solutions**, provides a listing of alternative solutions for addressing the known flooding problems and provides a summary of preliminary screening results, identifying those alternatives that would be included on the short list of promising alternatives.

- Chapter 5, **Detailed Evaluation of Promising Solutions**, provides a brief description of each short-listed alternative and summarizes the results of the detailed evaluation of each.

- Chapter 6, **Final Screening of Promising Solutions**, provides a tabulated summary of each promising solution's advantages and disadvantages, and whether the alternative is recommended for further action.

- Chapter 7, **Conclusions and Recommendations**, provides a summary of conclusions of the study and the associated recommendations and estimated costs, as applicable.

- Chapter 8, **References**, lists a summary of reference material used in this study.

1.5 EVALUATION CRITERIA

The following is a summary of technical, environmental, institutional, and economic criteria by which the various alternatives will be screened and evaluated.

Technical Criteria

- The recommended alternative should contribute to the reduction or elimination of existing and future flooding concerns within the study reaches. For the purposes of this study, flooding concerns being addressed include primarily overbank flooding, particularly those areas shown added to the floodplain due to the recent upward revisions of the base flood elevations.

- The recommended alternative should not result in increased flood levels in other portions of the watershed or other affected basins.

Environmental Criteria

- The recommended alternative must not have any significant and/or permanent negative impacts on the environment, recreational opportunities, and/or fish and wildlife resources.

Institutional Criteria

- The recommended alternative must be permittable under existing federal, state, and local permit programs.

- The recommended alternative must be socially acceptable to residents and, to the extent practicable, to other interest groups.

Economic Criteria

- The recommended alternative should be fundable and should also significantly reduce the economic hardships and social costs resulting from the 1% annual chance flood event.

- The recommended alternative, while not necessarily required to meet federal funding guidelines with regard to benefit/cost ratio, should be among the alternatives providing the most cost effective solutions to the identified flooding problems.

- The recommended alternative would produce the most economic advantage to the Hamilton County communities and their residents.

2.0 DATA COLLECTION

2.1 INTRODUCTION

Several sources were used to collect the best available data for the analysis presented in this report. The following sections briefly describe the sources of information used in the preparation of this report.

2.2 REVISED FLOOD INSURANCE RATE MAPS

IDNR staff provided CBBEL with copies of the proposed revised Flood Insurance Rate Maps (FIRMs) that will be published by FEMA. Staff from the IDNR also provided digital copies of the hydraulic modeling they had developed to define the revised floodway and floodway fringe boundaries.

2.3 EXISTING DEVELOPMENT

Mapping obtained from the Hamilton County GIS was used to plot all lot lines and buildings as available. Additional information regarding existing development along the stream corridors was obtained from the Hamilton County Surveyor's office.

2.4 PROPOSED DEVELOPMENT

Staff from the Hamilton County Surveyor's office provided information regarding proposed development along the stream corridors. Additionally, the IDNR provided copies of all permit applications that have been filed for properties along the stream, showing both work that has already been completed, and work that is proposed but not yet done.

2.5 FIELD RECONNAISSANCE

Staff from CBBEL conducted field visits along both streams in February and May 2002. The reconnaissance was done after all potential problem areas had been delineated on mapping of the areas along the stream. The purpose of the field reconnaissance was to field-verify the likelihood of the problems identified based on the mapping, and to identify any other areas that may not have been obvious on the maps.

3.0 PROBLEM IDENTIFICATION AND ASSESSMENT

3.1 INTRODUCTION

Before solutions can be identified and evaluated, it is necessary to identify and clearly define the nature and extent of the problems. This chapter presents the nature and extent of the flooding problems along Mud Creek and Sand Creek.

3.2 EXISTING PROBLEMS

This analysis was undertaken to pinpoint what areas along the corridors of Mud Creek and Sand Creek are at risk and develop a recommended solution to address each area of concern. In analyzing the nature and extent of the problems along both creeks, it became obvious that the existing problems fall into the following three major categories:

1. Mapping Problems – A majority of the existing problems are due to the proposed flood mapping not accurately reflecting the existing ground elevations. In many cases, Letters of Map Revision based on Fill (LOMR-Fs) have been approved by FEMA. In other cases, residences are shown in the floodplain based on a boundary that appears to be drawn incorrectly, sometimes crossing several contour lines.

2. Isolated Residential Flooding – Based on this analysis, a few existing residences appear to be correctly shown within the proposed floodplain and/or floodway limits; therefore, these structures are subject to flooding from the base flood.

3. Bridge/Roadway Overtopping – Hydraulic modeling shows several bridges and culverts would be overtopped during flood events.

Existing problems were identified by reviewing the hydraulic models of the creeks developed by the IDNR (as revised by CBBEL to include approved work in the floodway) and by overlaying the proposed floodplain and floodway limits for each creek onto the Hamilton County mapping and highlighting the developed areas impacted by the revised floodplain and floodway limits. The Hamilton County mapping included layers from the county GIS showing all streets, streams, contours, lot lines, and many buildings. The mapping only includes the buildings that existed when the mapping was developed in 1998. Consequently, any buildings constructed since 1998 are not shown. Due to the rapid growth rate within the watershed, this includes a large number of structures.

Several areas along each stream were identified as being impacted by the revised flooding limits. Areas were identified as impacted if any part of a structure on the property was shown touching the proposed floodplain. The type of impacted structure was verified during the field reconnaissance. On the residential parcels, only that area where a home is impacted by the revised flood mapping is included as an area of concern. Non-residential

lots are identified as impacted if the revised flood delineations touch any structure on the lot. The proposed revised floodplain and floodway limits, along with all identified impacted areas along Mud Creek and Sand Creek are shown on **Exhibits 2 – 8**. An index for Exhibits 2 – 8 is provided as **Exhibit 1a**. A summary of each of the flooding concerns along Mud Creek, including the problem category as discussed above, with the corresponding label from the exhibit map, is provided in **Table 1**. **Table 2** provides the same information for the problem areas along Sand Creek. Photographs from areas along Mud Creek and Sand Creek are provided as **Exhibits 9 – 13**. An index for the photographs included on Exhibits 9 – 13 is provided as **Exhibit 1b**.

Table 1
Summary of Flooding Concerns Along Mud Creek

General Location	Notes and Problem Category
Bradford Knoll –Sec.1B Area “B” on Exhibit 2	Inundation of detention pond. Top of bank is below BFE per plans and pond is shown in the floodplain. Home locations are not shown on the plans so cannot verify if any homes are now in the floodway fringe, although there is a LOMR-F for this area, Case No. 97-0504372A, dated 9/5/97 that is on the preliminary revalidation list. There is another LOMR-F, No. 01-05-0149A dated 12/21/00 that is <u>not on the preliminary revalidation list.</u> **Category:** Mapping Problem
Bradford Ridge – Sec. 2 Area “B1” on Exhibit 2	The floodplain is shown touching the corner of the home on Lot 21. Based on County mapping, the floodplain boundary may be drawn wrong in this area. Although the pond is shown outside the floodplain limits, the construction plans show the top of bank elevation is lower than BFE meaning the pond may be inundated during the 100-year event. **Category:** Mapping Problem

General Location	Notes and Problem Category
Cumberland Road Bridge Area “B2” on Exhibit 2	Based on the hydraulic modeling, the roadway north of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
106th Street Bridge Area “B3” on Exhibit 2	Based on the hydraulic modeling, the roadway west of the bridge would be overtopped during the 50-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Quaker Ridge – Sec. 1 Area “D” on Exhibit 2	The floodplain is shown touching one corner of the home on lot 15 in area “D”. However the floodplain line crosses three contours, meaning a six-foot elevation change. Based on the county mapping, the floodplain boundary appears to be drawn incorrectly, and the home should be outside of the floodplain limits. **Category:** Mapping Problem
Spyglass Hills – Sec. 4 Areas “F” & “H” on Exhibit 2	The pad elevations are higher than the BFE per plans. However, the floodplain is shown touching the home on lot 240 in area “F”. The floodplain is shown very close to the home on lot 160 in area “H”. However, based on county mapping, the floodplain boundary appears to be drawn incorrectly in both areas and the homes should be outside the floodplain limits. There is a LOMR-F for lot 240, No. 94-05-1214A dated 10/7/94, but it is <u>not on the preliminary revalidation list.</u> **Category:** Mapping Problem

General Location	Notes and Problem Category
Spyglass Hills – Sec. 5 Area “J1” on Exhibit 2	The majority of lots 257, 258, 262, & 263 are shown in the floodplain. However, the subdivision plans show the pad elevations are higher than the BFE. **Category:** Mapping Problem
Spyglass Hills – Sec. 6 Area “J2” on Exhibit 2	The majority of lots 286, 287, & 288 are shown in the floodplain. However, the subdivision plans show the pad elevations are higher than the BFE. There is a LOMR-F for this area, No. 97-05-2020A dated 4/7/97 that is on the preliminary revalidation list. **Category:** Mapping Problem
Spyglass Hills – Sec. 7 Area “J3” on Exhibit 2	The entire area (Lots 316 – 325) is shown within the floodplain. The subdivision plans show the lowest level elevations are higher than the BFE. **Category:** Mapping Problem
Lake Stonebridge – Sec. 2 Area “J4” on Exhibit 2	Lots 49 - 51, 61 – 69, 73, & 77 are shown in the floodplain. The subdivision plans show the lowest level elevations may be at or below the BFE on some of the lots. There is a LOMR-F for this area, excluding lots 61 – 69 and 73, No. 99-05-5706A dated 1/12/00 that is on the preliminary revalidation list. **Category:** Mapping Problem

General Location	Notes and Problem Category
Golf course clubhouse east of Hoosier Road, about ¼ mile south of 116th Street, and The Horizon – Sec.1 Area "J8" on Exhibit 3	The golf course clubhouse is shown in the floodplain; two other buildings are shown within the floodway. Nearly all of the Horizon development is shown in the floodplain. The subdivision plans show the ponds for this development would be inundated during the 100-year storm. IDNR staff stated a LOMR-F for this area is being reviewed by FEMA. **Category:** Mapping Problem
Talon Bluff Area "K" on Exhibit 3	Lots 1, 2, 3, & 30 are shown in the floodplain. The subdivision plans show the pad elevations are higher than the BFE. The contours shown on the construction plans do not match the County mapping. **Category:** Mapping Problem
Audubon Trace Area "L" on Exhibit 3	The detention pond is located entirely within the floodway. The development plans show the top of bank elevations are below the BFE, meaning the pond would be inundated during the 100-year event. Lots 1 – 6 are shown in the floodplain. Plans show the pad elevations are higher than the BFE. Contours on plans do not match the County mapping. A LOMR-F, Case No. 01-05-2606A, dated June 29, 2001, removes lots 1 – 7 from the floodplain limits of the existing FIRM for the area, but is <u>not on the preliminary revalidation list.</u> **Category:** Mapping Problem
Arbor Glen – Sec. 1 Area "M" on Exhibit 3	The detention pond is located in the floodway. The development plans show top of bank elevations below the BFE. The floodplain goes across the pad locations on several lots as shown on the plans; however, the plans show the pad elevations are higher than BFE. **Category:** Mapping Problem

General Location	Notes and Problem Category
116th Street Bridge Area “M1” on Exhibit 3	Based on the hydraulic modeling, the roadway west of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Brooks School Road Bridge Area “M2” on Exhibit 3	Based on the hydraulic modeling, the roadway south of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Cottonwood Creek @ Gray Eagle – Sec. 1 Area “N” on Exhibit 3	It appears the detention pond may become inundated during flood events. It also appears the home on lot 54 may be in the floodplain. The development plans show all pad elevations are higher than the BFE. **Category:** Mapping Problem
The Bluffs @ Gray Eagle Sec.1 Area “O” on Exhibit 3	It appears the detention pond may become inundated during flood events. The homes on lots 24 – 29 appear to be shown in the floodplain. The development plans show all finished floor elevations would be higher than the BFE. **Category:** Mapping Problem

General Location	Notes and Problem Category
126th Street Bridge Area “O2” on Exhibit 4	Based on the hydraulic modeling, the bridge and roadway would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Private residence located about 1/8 mile north of 126th Street on the west side of Olio Road. Area “P” on Exhibit 4	The floodplain, as drawn, touches part of the home. However, the contours show the home is approximately 7’ higher than BFE; the floodplain boundary appears to be drawn incorrectly. **Category:** Mapping Problem
Private residence located on the north side of SR 238 just west of Mud Creek. Area “R” on Exhibit 4	A portion of the home is shown in the floodplain. This area was previously mapped as Zone A. **Category:** Isolated Residential Flooding
136th Street Bridge Area “R2” on Exhibit 4	Based on the hydraulic modeling, the bridge and roadway would be overtopped during the 50-year and more serious flood events. The bridge and roadway would not be overtopped during the 10-year and less serious events. **Category:** Bridge/Roadway Overtopping
146th Street Bridge Area “R3” on Exhibit 5	Based on the hydraulic modeling, the bridge and roadway would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping

General Location	Notes and Problem Category
Cyntheanne Road Area “R4” on Exhibit 5	Based on the county contour mapping, and observations, a major section of the road located about 2,000 feet north of the bridge at the Frank Jackson Drain crossing would be overtopped during relatively frequent events. **Category:** Bridge/Roadway Overtopping
Lake Stonebridge – Sec. 1 Area “J5” on Exhibit 6	It appears that a portion of the home on lot 22 may be in the floodplain. The subdivision plans show the finished floor elevation may be below the BFE. There is a LOMR-F for this area, No. 98-05-4388A dated 8/12/98 that is on the preliminary revalidation list. **Category:** Mapping Problem
Lake Stonebridge – Sec. 3 Area “J6” on Exhibit 6	A corner of the home on lot 105 may be touching the floodplain, based on subdivision plans for that area. **Category:** Mapping Problem
Rolling Knoll Sec. 1, Rolling Meadow Sec. 2 @ Hoosier Woods Area “J7” on Exhibit 6	Several lots in Rolling Knoll and lots 40 – 42 and 54 – 56 of Rolling Meadow are shown in the floodplain. The subdivision plans show pad elevations at or just above the BFE for Rolling Knoll and Rolling Meadow. It appears that some homes in Rolling Knoll may have basements. These areas were previously mapped as Zone C. There are two LOMR-Fs for Rolling Meadow Section 2, No. 01-05-0002A dated 3/7/01 for lots 55 and 56, and No. 01-05-2022A dated 5/23/01 for lots 40 – 42 and 54. <u>Neither LOMR-F is on the preliminary revalidation list</u>. **Category:** Mapping Problem

General Location	Notes and Problem Category
Hoosier Road Bridge Area "J9" on Exhibit 6	Based on the hydraulic modeling, the roadway north and south of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Two lots just west of the Rolling Knoll subdivision north of 116th Street Area "J10" on Exhibit 6	Both lots, including the structures which include homes, are shown in the floodplain; they were previously mapped as Zone C. **Category:** Isolated residential flooding

Table 2
Summary of Flooding Concerns Along Sand Creek

General Location	Notes and Problem Category
Valley Farms Estates Lot 14 Area "G" on Exhibit 2	Floodplain touches edge of the home, but appears to be drawn incorrectly, crossing several contour lines. Based on the county mapping, the home should be outside the floodplain limits. **Category:** Mapping Problem
Walnut Creek Section 6 Area "G1" on Exhibit 2	Major portions of lots and homes are shown in the floodplain and floodway. Lots 2, 3, & 4 are shown almost entirely in floodplain, with lot 5 totally in the floodway. No plans were found for this development, but the pads appear to be elevated. **Category:** Mapping Problem

General Location	Notes and Problem Category
Cumberland Road Bridge (South) Area “G2” on Exhibit 2	Based on the hydraulic modeling, the road north of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Lot 18 in Walnut Hills Subdivision Area “G3” on Exhibit 2	The structure appears to be outside the floodplain limits; however, the resident says the basement occasionally floods and sump pump runs constantly. A site visit by county surveyor staff showed a 36” storm drain flows into a 12” storm drain at this lot, causing flooding. **Category:** Isolated Residential Flooding
Valley Springs Boulevard Bridge Area “G4” on Exhibit 2	Based on the hydraulic modeling, the road east of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Walnut Hills Area “I” on Exhibit 2	New floodway and floodplain appears to impact homes on lots 9 – 15 and 59 –72. Pad elevations are higher than the BFE per development plans. Several homes appear to have basements. Homes on lot 63 – 69 are shown in the floodway. There is a LOMR-F for this area, No. 98-05-1188A dated 7/10/98, that is on the preliminary revalidation list. **Category:** Mapping Problem
Cumberland Road Bridge (North) Area “I1” on Exhibit 2	Based on the hydraulic modeling, the road north of the bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping

General Location	Notes and Problem Category
Cumberland Woods Sec. 1 Area “I2” on Exhibit 6	The floodplain passes through lots 1 and 54. The pad elevations are higher than the BFE per the development plans. **Category:** Mapping Problem
Promise Road Bridge Area “I3” on Exhibit 6	Based on the hydraulic modeling, the road and bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
131st Street Bridge Area “I4” on Exhibit 6	Based on the hydraulic modeling, the road and bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping
Private residences on Promise Road, north of 131st. Area “U” on Exhibit 6	The home on parcel 014 is entirely in the floodplain. The floodplain boundary touches the end of the home on parcel 012, but may be drawn incorrectly, crossing contour lines. The home on parcel 014 is shown in Zone A on the current FIRM, but parcel 012 is currently shown outside the floodplain limits. **Category:** Isolated Residential Flooding
Brooks School Road Bridge Area “U2” on Exhibit 7	Based on the hydraulic modeling, the road and bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping

General Location	Notes and Problem Category
Private residence at northeast corner of 146th Street and Boden Road. (Verizon music Center) Area "W" on Exhibit 7	Home and structures are located in the floodplain. This area was previously mapped as Zone A. **Category:** Isolated Residential Flooding
Private residence at northwest corner of 156th Street and Olio Road. Area "X" on Exhibit 8	Floodplain may be just touching one corner of the home. There is also a shed structure located entirely within the floodway limits. **Category:** Isolated Residential Flooding/Mapping Problem
156th Street Bridge Area "X2" on Exhibit 8	Based on the hydraulic modeling, the road and bridge would be overtopped during the 10-year and more serious flood events. **Category:** Bridge/Roadway Overtopping

LOMR-Fs are referenced several times in the above tables. LOMR-Fs are letters issued by FEMA to remove either a structure or undeveloped parcel from the 100-year floodplain based on fill. This determination involves existing or as-built conditions and the elevation of structures or parcels to or above the base flood elevation (BFE) through the placement and compaction of fill in accordance with FEMA's compaction criteria. No change is made to a published map when a LOMR-F is issued, i.e., the property is still shown in the floodplain on the FEMA map. However, the property owner can use the letter from FEMA to prove the property or structure has been removed from the floodplain.

The development area called "The Horizon", located on the south side of 116th Street between Hoosier Road and Brooks School Road, is the only proposed development found for the areas along Mud Creek and Sand Creek. This area is adjacent to Mud Creek and is labeled "J8" on Exhibit 3. As noted in Table 1, most of the area is shown as being in the floodplain; however, staff from the IDNR stated that FEMA is currently reviewing an application for a LOMR-F for this area that would remove all of the proposed home sites from the floodplain.

3.3 PROBLEM AREAS BASED ON FUTURE DEVELOPMENT

A study completed by CBBEL dated February 1997 and titled Mud Creek Watershed Hydrologic Analysis analyzed the impact of future development on the peak flow rates of Mud Creek and Sand Creek. That study found that if the watershed in Hamilton County was fully developed in accordance with the future land use map, and each development area was built in accordance with the Hamilton County Drainage Ordinance, the peak flow rates along Mud Creek would increase due to changes in the timing of peak flow rates along Sand Creek and Mud Creek, and the tributary streams. The current ordinance requires that individual sites provide detention to reduce the 100-year future-condition peak discharge to the 10-year existing-condition peak discharge, and the 10-year future-condition peak discharge to the 2-year existing-condition peak discharge. The analysis showed that this requirement would affect the timing of the Sand Creek and Mud Creek hydrographs causing the combined peak flows in Mud Creek downstream of about State Road 238 to increase.

The 1997 study was subsequently refined by CBBEL based on regional analyses. The results of that study, which were somewhat different from the 1997 study, were presented in a report titled Existing-Condition Hydrologic Analysis Refinement dated May 1998. The IDNR accepted the results from the 1998 study and published a revised Coordinated Discharge Graph dated June 1998, as explained in Section 1.0 of this report.

In order to calculate the impact of the increased flow rates that would be caused by ultimate development of the watershed, the hydraulic model developed by the IDNR for the FIS analysis in June 1998 was modified by CBBEL to include the higher ultimate development peak flow rates. For the purposes of this study, the ultimate development peak flow rates were calculated based on the relative increases calculated by CBBEL in the 1997 study. The ratios of ultimate-development peak flow to existing-condition peak flow from the 1997 study were applied to the flow rates used in the IDNR FIS model. **Table 3** presents the proposed FIS flow rates and the higher ultimate development flow rates along Mud Creek.

Table 3
Proposed FIS and Ultimate Development Peak Flow Rates Along Mud Creek

Location	FIS 100-Year Peak (cfs)	Ultimate Development 100-Year Peak (cfs)
At 96th Street	3,825	4,020
At 106th Street	3,750	3,950
Upstream of Sand Creek	3,000	3,270
Upstream of High Ditch	2,850	3,110
At Hoosier Road	2,775	3,000
At Brooks School Road	2,650	2,825
At 126th Street	2,460	2,600
At State Road 238	2,350	2,360
At Interstate 69	2,280	2,280
At Cyntheanne Road	2,110	2,110
At Atlantic Road	1,720	1,720

The 1997 CBBEL study also found that the peak flow rates along Sand Creek would be reduced slightly after ultimate development of the watershed. Based on this slight reduction, the Sand Creek Base Flood Elevations and corresponding floodway and floodplain limits would be unaffected.

The Mud Creek hydraulic model developed for the proposed FIS, with the Ultimate Development 100-Year peak flow rates listed in Table 3, showed a maximum increase in Base Flood Elevations of less than two inches. Based on the results of this analysis, the increased peak flow rates expected after ultimate development of the watershed in Hamilton County under current ordinance requirements would have an insignificant impact on the Base Flood Elevations and corresponding floodway and floodplain limits along Mud Creek and Sand Creek. Therefore, no additional flood protection measures for the expected increased flow rates would be warranted assuming Hamilton County's current policies are enforced. In addition, this assumes the existing conveyance and flood storage conditions along the stream are maintained, which would require that no filling is allowed within the limits of the floodplains of the streams in the watershed.

3.4 REQUIRED LEVELS OF PROTECTION

All residential structures and commercial buildings should be protected from the 100-year flood event. Additionally, in order to be in compliance with the requirements of the Hamilton County Drainage Ordinance, all road crossings of streams (bridges and culverts) should be capable of passing the 100-year peak flow rate without overtopping.

4.0 PRELIMINARY SCREENING OF POTENTIAL SOLUTIONS

In completing the evaluation of the Mud Creek watershed to identify and evaluate flooding problems along Sand Creek and Mud Creek, it became obvious that most of the "problems" that were identified are caused by the way the floodplain and floodway boundaries are drawn rather than being caused by the increased flood elevations. This is particularly true for the newer subdivisions in which it appears the existing ground elevations that have been raised by filling are higher than the proposed BFEs. No structural flood control improvements designed to lower flood elevations are needed to solve these specific problems since the existing ground elevations are already higher than the flood elevations. If the previously issued LOMR-Fs are revalidated, many of the problems identified in Tables 1 and 2 will be resolved. "Revalidation" is a FEMA process through which all previously issued letters of map amendment or map revisions are reevaluated when new maps are going to be published.

The areas included under the category of "Mapping Problem" can be subcategorized as follows:

1. Areas for which a LOMR-F was previously issued and the area is on the preliminary revalidation list.

2. Areas for which a LOMR-F was previously issued and the area is not on the preliminary revalidation list.

3. Areas that have been raised by fill to elevations higher than the BFEs but no LOMR-F was ever issued

4. Homes or areas with natural ground elevations that are higher than the BFE, but the area is inadvertently shown within the floodplain limits.

The revalidation list that was reviewed as part of this study is preliminary, dated February 17, 2000. IDNR staff indicated they anticipate receiving an updated preliminary list at any time. Areas not currently on the list could be added before the final maps are published. Conversely, areas that are on the current list could be removed.

Structural flood control improvements that would lower flood elevations could help the areas identified as "Isolated Residential Flooding" that would be inundated during floods, as well as the existing road crossings that would be overtopped during a flood event. With these facts in mind, the evaluation of potential solutions focused on alternatives, structural and non-structural, to best solve the actual problems.

CBBEL has identified several potential alternatives to consider. **Table 4** provides a summary listing of these alternatives and the preliminary screening results. Based on the

results of the preliminary screening process, a short list of promising solutions for further consideration was compiled and is presented in **Table 5**.

TABLE 4
Initial Screening of Potential Alternatives

No.	Description	Remarks
A	Revise mapping to reflect existing ground elevations	Since the deadline for commenting on the proposed re-mapping has passed and IDNR and FEMA will not consider any additional proposed revisions prior to publishing, a Physical Map Revision (PMR) after formal publication of the new maps by FEMA would be required. This would be a very costly and time-consuming option due to the very detailed FEMA requirements. Additionally, an application for a PMR may not be successful due to the presence of fill in many of the areas. Due to the cost and time requirements, this option does not merit further consideration.
B	After formal publication of revised FIRMs, pursue letters from FEMA to remove from the floodplain existing areas with ground elevations that are higher than the BFEs	Although letters from FEMA would not change the published maps, they are a viable option for removing specific parcels from the regulated floodplain. The type of letter required would depend on the specific circumstance. Different actions would be required for each of the four subcategories of "Mapping Problem" identified in the paragraphs above. **This alternative will be carried to the short list of promising solutions for further analysis.**
C	Field check elevations and enlarge existing stream crossings as required	This alternative would improve the existing stream crossings that are overtopped during flood events or that cause a significant backwater. It has the potential of reducing upstream flood elevations and would bring the crossings into compliance with county ordinance requirements for stream crossings to convey the 100-year flow rate. **It will be carried to the short list of promising solutions for further analysis.**

No.	Description	Remarks
D	Construct single regional detention basin	This alternative was evaluated in the 1997 CBBEL report. As presented in that report, a single regional detention basin would require approximately 1,750 acre-feet of active storage and would cost more than $26 million. This alternative does not meet the evaluation criteria requirements and will not be considered further.
E	Construct multiple regional detention basins	The 1997 CBBEL report included an analysis of an option of three detention basins, two along Sand Creek and one on Mud Creek. This alternative had an estimated cost of $33.5 million. Because of this high cost, this alternative does not meet the evaluation criteria requirements and will not be considered further.
F	Field check all elevations and elevate (raise-in-place) residential structures located within the floodplain	This alternative has the potential to eliminate existing flooding problems in an economical manner with minimal negative impacts based on the evaluation criteria. It would need to be evaluated in more detail as part of a flood hazard mitigation plan that would include elevation of structures, floodproofing, and potential voluntary buyout of residential structures. **This alternative will be carried to the short list of promising alternatives for further evaluation.**
G	Floodproofing residential structures located within the floodplain	See the remarks for Potential Alternative F. **This alternative will be carried to the short list of promising alternatives for further evaluation.**
H	Acquisition of residential structures located within the floodplain	See the remarks for Potential Alternative F. **This alternative will be carried to the short list of promising alternatives for further evaluation.**

No.	Description	Remarks
I	Reconstruct the previous diversion to Geist Reservoir	The Geist Reservoir diversion location is now almost fully developed with residential subdivisions. Restoring this diversion would not be feasible, even if it could be justified economically. This alternative would not meet the evaluation criteria requirements and will not be evaluated further.
J	Dredge and widen Mud Creek and Sand Creek to increase conveyance capacity	This alternative would involve widening Sand Creek and Mud Creek sufficiently to increase the conveyance capacity of the streams to reduce the calculated peak flood elevations. Although this alternative may have technical merit, in that sufficient widening would reduce flood elevations, it would not meet the environmental criteria. Both Sand Creek and Mud Creek are valuable environmental resources. Extensive construction within the channel would cause significant negative impacts to the environment and fish and wildlife resources. This alternative does not meet the evaluation criteria requirements and will not be evaluated further.
K	Do nothing	"Do Nothing" is always an alternative for the county. This alternative would allow future development according to the current ordinance requirements for the Mud Creek watershed. It would exclude pursuing any letters from FEMA for existing properties located within the revised floodplain limits, or construction of any flood control improvements, or pursuing buyout or floodproofing scenarios for affected properties. This alternative would allow property owners to pursue solutions to their flooding problems, but would not provide any funding for potential solutions. **This alternative will be carried to the short list of potential solutions that will be evaluated further.**

Based on the results of the initial screening presented in Table 4, a short list of promising solutions for further consideration and possible inclusion in the recommended plan was compiled. In order to compare the effectiveness of various alternatives and to act as a base-condition, the "Do Nothing" alternative is included in the short list. **Table 5** is a summary listing of the four alternatives selected for additional analysis. An in-depth discussion of each alternative is provided in the next section of the report.

TABLE 5
Short List of Promising Solutions

Alternative #	Description	Affected Areas
1	Do nothing (Base Condition: allow future development according to traditional stormwater and floodplain ordinance methods)	All areas
2	Apply for appropriate letters from FEMA for each impacted property that has existing ground elevations that are higher than the revised flood elevation.	Mapping Problem Areas
3	Enlarge existing stream crossings to convey the full 100-year flow with no overtopping.	Bridge/Road Overtopping Areas
4	Implementation of a flood hazard mitigation plan consisting of structure elevation, floodproofing, or voluntary buyout	Isolated Residential Flooding Areas

5.0 DETAILED EVALUATION OF PROMISING SOLUTIONS

The short-listed, promising solutions identified in the previous section were subjected to a more detailed evaluation of their technical effectiveness, economic feasibility, social and institutional impacts, and environmental feasibility. A detailed discussion of each short-listed promising solution is provided under each sub-heading.

5.1 Alternative 1: Do Nothing

This alternative is being considered as a base-condition scenario for evaluating other alternatives, as well as a legitimate alternative itself. Detailed hydrologic evaluations of this alternative were completed as part of the 1997 CBBEL study referenced earlier in this report. According to that study, future development in accordance with county standards regarding on-site detention would not impact peak flow rates along either stream sufficiently to significantly increase flood elevations. Since the majority of the problems along each stream are due to the flood mapping not accurately reflecting existing ground elevations, allowing affected property owners to submit applications for appropriate letters from FEMA, as in this alternative, may be appropriate.

5.2 Alternative 2: Apply for FEMA Letters for Affected Properties

As opposed to Alternative 1, the county could implement a project to get appropriate FEMA letters for each affected property. This would involve doing all the work required for submitting the applications including confirming ground elevations around residential structures, completing the application forms, and coordinating with FEMA throughout the review process. The appropriate action to take would depend on the specific situation. Section 4.0 of this report included four sub-categories for the areas identified as having a Mapping Problem. Those categories are listed below with the appropriate action to take for each:

1. Areas for which a LOMR-F was previously issued and the area is on the preliminary revalidation list.

   In these cases, there are no issues and the only action required would be to follow up with FEMA to ensure the lots remain on the revalidation list.

2. Areas for which a LOMR-F was previously issued and the area is not on the preliminary revalidation list.

   In these cases, FEMA should be contacted to determine why the lots are not going to be revalidated. It may simply be an oversight on FEMA's part. However, it could be that FEMA will not revalidate fill areas that have buildings with lowest floor elevations (including basements) that are lower than the BFE. Although unlikely, if

this happens, procedures from FEMA Technical Bulletin 10-01 could be used to show that the basements are safe from flooding. This would not preclude the need for flood insurance for these structures, but they would be categorized as "in compliance" with significantly reduced insurance rates compared with homes that are not in compliance.

3. Areas that have been raised by fill to elevations higher than the BFEs but no LOMR-F was ever issued.

   Pursue a LOMR-F for each applicable lot. This option would be difficult for homes with basements that are at elevations lower than the BFE.

4. Homes or areas with natural ground elevations that are higher than the BFE, but the area is inadvertently shown within the floodplain limits.

   Pursue a Letter of Map Amendment (LOMA). FEMA issues LOMAs for properties or structures that are inadvertent inclusions in the 100-year floodplain on the effective FIRM for a community. The request for a LOMA cannot be based on fill, revised flood elevations, or revised floodway boundaries.

Since each affected property would require a separate letter, and each letter would only apply to a single property, it is recommended that this alternative be modified. County staff could assist property owners with the process, offering copies of required forms and guidance in completing the forms and coordinating with FEMA, but the responsibility for completing the application and final coordination would be left with the individual property owners.

Another issue regarding flooding problems that FEMA letters will not solve is the proximity of several homes to the streams. In several areas, it appears that homes with basements have been built close to the streams. Although many of these homes are located outside the floodplain limits, their basements will likely be flooded during extreme, and not-so-extreme events. Although the surveyor's office received no specific complaints, according to newspaper reports, at least two homes along Mud Creek had flooded basements during the rainstorms experienced in May 2002. Additionally, the owners of the home on lot 18 in the Walnut Hills subdivision, which is located adjacent to Sand Creek, have stated their basement is routinely flooded and their basement sump pump runs constantly. This home is shown outside the floodplain limits of Sand Creek. Based on conversations with IDNR staff who visited the property owners, and examination of the county contour mapping of the area, the basement flooding is likely caused by saturated ground around the basement. The runoff from several lots located west of Lot 18 drains across the property to Sand Creek. Additionally, according to staff from the county surveyor's office, there is also a 36" storm drain that flows into a 12" storm drain meaning runoff exceeding the capacity of the 12" pipe will flow overland across the property. This runoff likely helps saturate the ground,

which would be compounded by Sand Creek flows, particularly during the rainy times of the year.

5.3 Alternative 3: Enlarge Stream Crossings and Raise Road Elevations

This alternative would include raising the roadway elevations and enlarging each stream crossing that the hydraulic modeling shows would be overtopped by the 100-year event. The purpose of this is to bring the crossings into compliance with the County requirements. Preliminary modeling shows that in order to bring the crossings into compliance, the road elevations would have to be raised to elevations higher than the BFE. Raising the road elevations without increasing the size of the bridge or culvert would cause higher upstream flood elevations due to reduced flow conveyance. Therefore, in order to meet IDNR requirements regarding surcharge, the culvert or bridge would have to be enlarged to provide the required additional flow area. This could be done by adding an adjacent culvert, or by replacing the existing structure(s) with something larger.

Based on CBBEL modifications to the IDNR FIS model that added permitted work in the floodway, including new pedestrian and golf cart bridges and bridge replacement for Olio Road on Mud Creek, and bridge replacements at 116th Street and 136th Street on Sand Creek, the following bridges or roadways would be overtopped during a 100-year flood event:

Mud Creek: 136th Street, 126th Street, Brooks School Road, 116th Street, Hoosier Road, 106th Street, and Cumberland Road. A permit has been approved for replacement of the 116th Street bridge with a larger structure and modeling for that proposed structure shows no roadway overtopping. The Hamilton County Highway Department shows this bridge is scheduled to be completed in 2002. In addition, the 136th Street crossing is scheduled for replacement with a significantly larger structure in 2003. Hydraulic modeling shows all of the above crossings except 106th Street would be overtopped during the 10-year and more serious events. 106th Street would not be overtopped during the 10-year event, but would be overtopped during the 50-year and more serious events.

Sand Creek: 156th Street, Brooks School Road, 131st Street, Promise Road, Cumberland Road (North crossing), Valley Springs Boulevard, and Cumberland Road (South crossing). A permit has been approved for replacement of the Promise Road culvert with a bridge structure and modeling for the proposed structure shows no roadway overtopping. The Hamilton County Highway Department shows this bridge is scheduled to be completed in 2002. Hydraulic modeling shows each of the above crossings would be overtopped during the 10-year and more serious events.

In addition to bridge and adjacent roadway overtopping, the revised mapping shows a portion of Cyntheanne Road located about 2,000 feet north of the Mud Creek crossing would be inundated by floodwaters from Mud Creek and the Frank Kaiser Drain. This area

was flooded during the May 2002 rainstorms. This portion of the road should be elevated above the BFE to be in compliance with the county drainage ordinance.

The IDNR FIS model was used to calculate the approximate required bridge/culvert openings that would meet the IDNR maximum surcharge requirements. The required road elevations were established assuming two feet of freeboard above the 100-year flood elevation. The required bridge opening or culvert size was calculated based on the IDNR's requirement that surcharge from construction in the floodway not exceed 0.14 feet. Alternatives for the bridge or culvert opening included the option of adding an adjacent culvert (or culverts) where applicable, and replacing the existing bridge or culvert(s) with a new structure. The results of that modeling are summarized in **Table 6** below.

TABLE 6
Summary of Required Stream Crossing/Roadway Modifications

Stream	Road	Existing Bridge/Culvert Area (Sq. Ft.)	Required Bridge/Culvert Area (Sq. Ft.)	Existing Road Elevation	Required Road Elevation	Approach Road or Bridge Overtopping
Mud Creek	126th St.	355	625	812.2	817.0	Bridge
Mud Creek	Brooks School Rd.	810	1280	800.8	804.8	Approach Road
Mud Creek	Hoosier Rd.	600	840	791.0	796.1	Approach Road
Mud Creek	106th St.	1440	1620	784.0	786.8	Approach Road
Mud Creek	Cumberland Rd.	420	1160	782.4	786.0	Approach Road
Mud Creek	Cyntheanne Rd.	Isolated road flooding at the Frank Kaiser Drain crossing		832.0	838.4	Road
Sand Creek	156th St.	70	235	830.0	833.2	Bridge
Sand Creek	Brooks School Rd.	95	630	816.0	819.2	Bridge
Sand Creek	131st St.	170	470	810.0	812.6	Bridge
Sand Creek	Cumberland Road (North)	250	530	790.0	794.0	Approach Road
Sand Creek	Valley Springs Blvd	625	625	788.3	791.7	Approach Road
Sand Creek	Cumberland Rd. (South)	305	480	786.0	790.3	Bridge

5.4 Alternative 4: Elevation, Floodproofing, or Voluntary Buyout

As presented in this report, major flood control projects designed to reduce peak flow rates or otherwise lower BFEs are not considered appropriate to address the isolated residential flooding problems for the three residences along Mud Creek and four residences along Sand Creek. Consequently, a "floodplain management" solution consisting of elevation, floodproofing, or voluntary buyout of these residential structures, may be a viable alternative.

This alternative would require the preparation of a regional or countywide "Flood Hazard Mitigation Plan" to determine the best course of action regarding these and other structures located within the floodplains throughout the county, and to secure FEMA funding. As part of the noted Mitigation Plan, an inventory of at-risk structures would be prepared and options to address the potential flood damages to the structures would be compared according to FEMA guidelines. The Plan would result in an action plan including estimates of the associated costs. If the FEMA application procedures are followed properly, the costs associated with preparation of the plan and implementing its recommendations should be eligible for a 75% federal/25% local cost-share.

This alternative could be an effective, economical, and fundable solution to the problem of existing homes located within the proposed floodplain limits if the county decided to implement a countywide study.

6.0 FINAL SCREENING OF PROMISING SOLUTIONS

This chapter presents the final screening of the four short-listed alternatives discussed in the previous chapter. **Table 7** provides a summary of the advantages and disadvantages associated with the short-listed alternatives and whether they are recommended for further action.

Table 7
Comparison of the Short-listed Alternatives

ID	DESCRIPTION	ADVANTAGES	DISADVANTAGES	RECOM MEND?
1	Do Nothing	• No additional costs to Drainage Board or Surveyor's office. • Since most of the problems identified along the creeks are mapping issues, it may be more appropriate for the individuals to resolve them.	• Would not resolve any of the problems identified in the study.	No
2	Provide Assistance in Securing Appropriate FEMA Letters	• Would resolve a majority of the problems identified in this study. • Would help property owners incorrectly shown in floodplain • Would provide a central location for affected property owners to get questions answered. • Would require minimal county resources to provide help to local constituents.	• Would require county resources to provide assistance to property owners seeking new letters. • Would not resolve all of the problems identified in the study.	Yes
3	Enlarge Existing Undersized Stream Crossings	• Would eliminate road overflow at the undersized stream crossings. • Could lower flood elevations immediately upstream of the crossings. • This could be done as bridges are replaced in the future.	• Very expensive, ranging from $200,000 to more than $1 million for each crossing, depending on the location and amount of work required. Due to the magnitude of road overflow typical, most of the crossings would require total replacement with a larger bridge. • Although flood elevations would be slightly lower with larger crossings, the extent of lowering would be limited and the benefit would not be commensurate with the cost.	No*

ID	DESCRIPTION	ADVANTAGES	DISADVANTAGES	RECOM MEND?
4	Implement a Flood Hazard Mitigation Plan	• Would solve problem of existing structures located within the floodplain. • Major portion of funding would be from FEMA. • Could be coordinated and managed by the County Surveyor's office.	• Difficult to justify for only the seven structures along Sand Creek and Mud Creek. Plan needs to be countywide. • Residents may be unwilling to be "bought out." • Would increase local government bureaucracy with another program. • Would require extensive initial effort and time.	Yes**

***** This alternative is not recommended for the County Drainage Board and Surveyor's office to undertake. However, assistance could and should be provided to the County Highway Department in setting priorities for bridge replacements. A list of the bridges and portions of road that would be inundated during a flood event should be provided to the highway department.

****** This alternative is recommended because it would solve the flooding problems for the residents currently in the floodplain. However, it is not recommended for only the Mud Creek watershed because of the limited number of residences that would be affected. The plan would have to be countywide. If the county would pursue such a plan in the future, the structures in the Mud Creek watershed should be included.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

A detailed review of the flooding concerns along Sand Creek and Mud Creek was completed by CBBEL. Several alternative solutions were evaluated to determine the most appropriate actions that the Hamilton County Drainage Board and Surveyor's Office should take to mitigate the flooding concerns. This chapter summarizes the study's conclusions and recommendations, provides estimated costs for each recommendation, and discusses funding considerations.

7.2 CONCLUSIONS AND RECOMMENDATIONS

The overall conclusion of this study is that most of the problems resulting from the revised hydraulic analysis of Mud Creek and Sand Creek are apparently due to inaccuracies in the proposed mapping of the revised floodplain boundaries. These inaccuracies are the natural consequence of land alterations performed after the 1998 Hamilton County detailed mapping was developed. Most of the lots/buildings shown within the limits of the proposed floodplain appear to be on land with ground elevations that are higher than the proposed flood elevations. These lots could be formally removed from the floodplain limits using the appropriate FEMA letter process, i.e., LOMR-F or LOMA. Additionally, several road crossings along each stream have insufficient capacity to convey the full 100-year peak flow without overtopping either the structure or the adjacent road surface. Raising the roads to elevations higher than the BFEs and either replacing the existing structures with larger structures or possibly adding new culverts adjacent to the existing structures would improve the stream crossings.

The major conclusions, recommendations, and statements of estimated cost for each recommendation of this study are presented below:

- **Conclusion #1:** Based on the available county mapping, and the proposed floodway and floodplain mapping, approximately 121 lots and homes are shown within the floodplain limits. It appears that approximately 114 of these properties may be at elevations that are higher than the proposed BFEs.

  Recommendation#1: Notify residents, or developers, as applicable, via a public meeting, that their property is shown as being within the floodplain limits and, if there is no existing letter from FEMA for their property, they can pursue a letter from FEMA to formally remove their property. Offer advice and guidance on pursuing the appropriate FEMA letter.

  Estimated Cost of Recommendation #1: The cost associated with this alternative would be the county manpower costs associated with conducting public meetings and

assisting applicants. All costs associated with submitting the application would be borne by each individual applicant.

- **Conclusion #2:** Based on the available mapping, at least three properties along Mud Creek and four properties along Sand Creek are shown in the floodplain on land with apparent elevations that are lower than the proposed BFEs. The FEMA letter process would not apply to these properties.

  Recommendation #2: Consider future implementation of a "floodplain management" solution to these problems, and other flooding problems throughout the county by means of a countywide "Flood Hazard Mitigation Plan", presented as Alternative 4 in Section 5.3 of this report.

  Estimated Cost of Recommendation #2: The estimated cost of implementing such a plan is based on CBBEL experience implementing similar programs in other parts of the state. Based on this prior experience, the estimated cost of conducting the analysis and preparing the plan would be about $100,000, of which the County would pay 25%, assuming the program would meet FEMA requirements to qualify for the 75% federal funding of the program. The estimated cost of implementing the program, including floodproofing, or other options, would depend on the results of the study that would encompass the entire county.

- **Conclusion #3:** Based on currently available mapping, and the proposed FIS hydraulic model developed by the IDNR, as revised by CBBEL to include the new crossings that have been built or have been permitted and will be built within the next two years, 6 road crossings over Mud Creek and 6 road crossings over Sand Creek, and/or the adjacent roadways, would be overtopped during a 100-year flood event. This violates the Hamilton County ordinance requirement that all stream crossings and adjacent roadways be constructed at elevations higher than the BFE.

  Recommendation #3: Implement a capital improvement plan to replace inadequate stream crossings and/or raise adjacent roadways that would be inundated by the 100-year flood event. This work would normally be programmed and completed by the Hamilton County Highway Department, the Town of Fishers, or the City of Noblesville, depending on the location of the crossing.

  Estimated Cost of Recommendation #3: It is estimated that the cost of replacing the structures would vary from approximately $200,000 to more than $1 million per structure, depending on the crossing. Assuming an average cost of $300,000, the total estimated cost for replacing all 12 structures would be $3.6 million.

- **Conclusion #4:** Over the recent past, several homes have been built very close to Mud Creek and Sand Creek (even though they may have been outside the regulatory floodplain). Many of these homes appear to have basements. As noted during the May 2002 rainstorms, basements in these homes will be subject to flooding, particularly during extended wet periods.

  Recommendation #4: Enforce county stormwater ordinance based on guidelines provided in FEMA Technical Bulletin 10-01. Strongly recommend that basements not be constructed in areas that have been removed from the regulatory floodplain based on fill, or areas located close to the floodplain, reminding the builder(s) that FEMA could rescind their LOMR-F if the lowest finished floor is lower than the BFE. Recommend local and county review staff notify applicants about the likelihood of flooded basements, particularly in homes built adjacent to the creeks.

  Estimated Cost of Recommendation #4: Implementation of this recommendation would result in no additional.

- **Conclusion #5:** Although Mud Creek and Sand Creek are county regulated drains, no funds are currently being collected from residents in the watershed and no maintenance is being done by the County Surveyor's Office. Without inspection and maintenance, over time the streams will degrade causing flooding problems due to decreased conveyance capacity.

  Recommendation #5: Add both streams to the county assessment roles for stream maintenance. The assessments should be sufficient to cover the costs of regular stream maintenance. This would ensure the streams have ongoing capacity which will prevent future overbank flooding problems.

  Estimated Cost of Recommendation #5: The costs associated with this recommendation would be for any required inspections of the two streams and administrative costs associated with adding the streams to the assessment roles. The costs for stream maintenance would be covered by the assessments collected from within the watersheds.

- **Conclusion #6:** Several homes along each stream that were built outside the limits of the floodway but within the previously designated floodplain limits have been impacted with flooded basements due to saturated ground. Additionally, development (filling) in the floodplain, although permittable under IDNR and FEMA criteria, removes the natural overbank flood storage, potentially increasing downstream flow rates. The only way to ensure maintenance of the natural floodplain storage is to allow no filling within the floodplain limits. This would prevent future flooding problems with structures built in or adjacent to the floodplain, and when coupled with the county's stormwater ordinance detention requirements, would help ensure no negative impacts due to future

development within the watershed. Based on detailed hydrologic analyses performed by CBBEL, flow rates are not expected to significantly increase if these measures are continued to be enforced by the county and are also adopted by Noblesville and Fishers.

Recommendation #6: Continue strict enforcement of current county policies regarding stormwater detention and floodplain development and encourage the City of Noblesville and Town of Fishers to do the same. This policy should include the requirement that required detention storage ponds be built outside the limits of the floodplain. This is required to ensure the peak flow rates in each stream (and in all county streams) are not increased beyond the calculated results as the watershed develops.

Estimated Cost of Recommendation #6: There would be no additional monetary cost to the county. But, developers will undoubtedly express opposition to a policy that would allow no development in the floodway fringe areas, which is currently allowed per current local, state, and federal guidelines.

- **Conclusion #7:** Several detention ponds have been built within the limits of the floodplain, and in some cases, within the limits of the floodway. It also appears that the top of bank elevations of the ponds are lower than the revised BFEs meaning the ponds would be inundated by stream flows during 100-year flood events and no local development flood storage would be available. Further analysis of each specific basin is required to determine whether retrofitting, or some other action, would be desirable.

  Recommendation #7: Complete detailed analysis of each detention pond located within the limits of the floodplain/floodway to verify top of bank elevations and to determine whether retrofitting, or some other action, is desirable. This would be required on each basin, separately. Also, see Recommendation #6 regarding placement of stormwater detention facilities within the floodplain.

  Estimated Cost of Recommendation #7: The cost of this analysis would be up to several thousand dollars for each detention basin. A decision would have to be made regarding who would fund these analyses since the projects were apparently approved as designed and built.

- **Conclusion #8:** It is suspected that the Mud Creek Watershed may be suffering from stormwater quality problems although no comprehensive studies have been conducted to clearly identify, define, and assess these problems. In addition, IDEM's proposed Rule 13 (designed to meet the requirements of the EPA's NPDES Phase II program) requires, among other things, an inventory of stormwater quality concerns within the watershed and the development of specific plans to address these concerns.

Recommendation #8: Complete a detailed evaluation of stormwater quality within the Mud Creek Watershed. In order to complete this evaluation, several sites will need to be sampled in order to establish baseline data. Biological data, in the form of habitat evaluation and macroinvertebrate sampling, should be conducted once in October and once in May. Physical observations concerning the dimensions, geometry, stability, siltation, and riparian zone should be conducted once in May. Chemical data should be collected twice in late Spring (May or June). One sampling should follow a rainfall event; the other should sample base flow. Chemical data collection should include the following parameters: pH, temperature, dissolved oxygen, turbidity, conductivity, nitrate/nitrite, organic nitrogen, ammonia nitrogen, total and dissolved phosphorous, and E. coli. Sampling site locations should be determined following a preliminary evaluation of land use within the watershed. In general, sampling sites should either be located within subwatersheds that are selected as representative of the larger watershed, downstream of suspected problem areas, and/or at the confluence of major tributaries. Data collection should be consistent with the Qualitative Habitat Evaluation Index and EPA's Rapid Bioassessment Protocol II. Quality control/quality assurance procedures should be a part of the sampling and stormwater quality analysis. It is also recommended that an evaluation of the U.S. EPA NPDES Phase II stormwater regulation issues as they pertain to the Mud Creek Watershed be completed. This should include an evaluation of the general nature and extent of efforts needed in this watershed towards meeting the six minimum control measures of the NPDES Phase 2 regulation requirements.

Estimated Cost of Recommendation #8: The estimated cost of implementing this recommendation would be on the order of $50,000 depending on the extent of the efforts. These funds would come from the county and local municipalities.

- **Conclusion #9:** Detailed hydrologic analyses and modeling have been completed for the Mud Creek watershed. This modeling was used by the IDNR and FEMA to develop a new Flood Insurance Study and associated mapping. The use and refinement of the modeling to evaluate/incorporate the effects of new development would ensure consistency with the overall goals for the watershed.

  Recommendation #9: Any proposed stormwater facility design (detention ponds, storm drains, etc.) should be completed using the same model methodology as used in the hydrologic analyses completed for this watershed and adopted by the IDNR and FEMA. It is recommended and intended that the data and study results should be used as the basis for any future work in the watershed and should not be circumvented by other, separate work that may contradict this approved modeling. Any future changes to the modeling due to better data, construction, or other City/County acknowledged activity should be incorporated into the base condition modeling and related analyses developed as a part of this study to fully understand and evaluate the impacts of those changes.

Estimated Cost of Recommendation #9: Implementation of this recommendation should result in no additional cost.

- **Conclusion #10:** Currently, there is no local control or influence over the national flood insurance mapping program run by FEMA. Additionally, much of the flood mapping in the county is not based on the latest county contour mapping. This means the data used for local permitting and planning is different from the mapping used by FEMA. The best way of resolving this issue would be to become a Cooperating Technical Partner (CTP) with FEMA so that FEMA maps may be routinely and efficiently updated based on an ongoing agreement and partnership between FEMA and Hamilton County.

  Recommendation #10: Hamilton County should become a FEMA partner with the CTP program administered through the surveyor's office so that FEMA maps may be revised directly by the county and the revisions may be published by FEMA in a timely manner. In addition to streamlining the process, a CTP arrangement would include supplemental funding from FEMA with priority.

  Estimated Cost of Recommendation #10: There would be no cost initially. Once the agreement is approved and established, approximately $50,000 to $100,000 should be budgeted annually to undertake limited, locally funded floodplain mapping projects and to provide the required match for available funding from FEMA for mapping activities. These funds would likely come from the county and local municipalities.

7.3 FUNDING CONSIDERATIONS

Other than potential federal cost-sharing for CTP activities, and the federal match of 75% of total costs for the Flood Hazard Mitigation Plan, there are no known federal or state funds available to solve the flooding problems identified in this study. Funding for Recommendation #1 would likely come from the general funds of the County Drainage Board and Surveyor's office. The federal government would provide 75% of the funds for Recommendation #2, with 25% of the funds coming from the county. Funding for Recommendation #3 would likely come from the County Highway Department "cumulative bridge funds" or other general funds. The priority for replacing each crossing would likely be set by the County Commissioners based on input from the County Engineer and County Surveyor. The decision on priority should be based on the amount of traffic over each crossing, as well as the availability of alternate emergency access routes. As noted, Recommendation #4 would result in no additional cost to the county. The potential sources of funds for Recommendations #5 through #10 are provided in the Estimated Cost paragraph with each recommendation.

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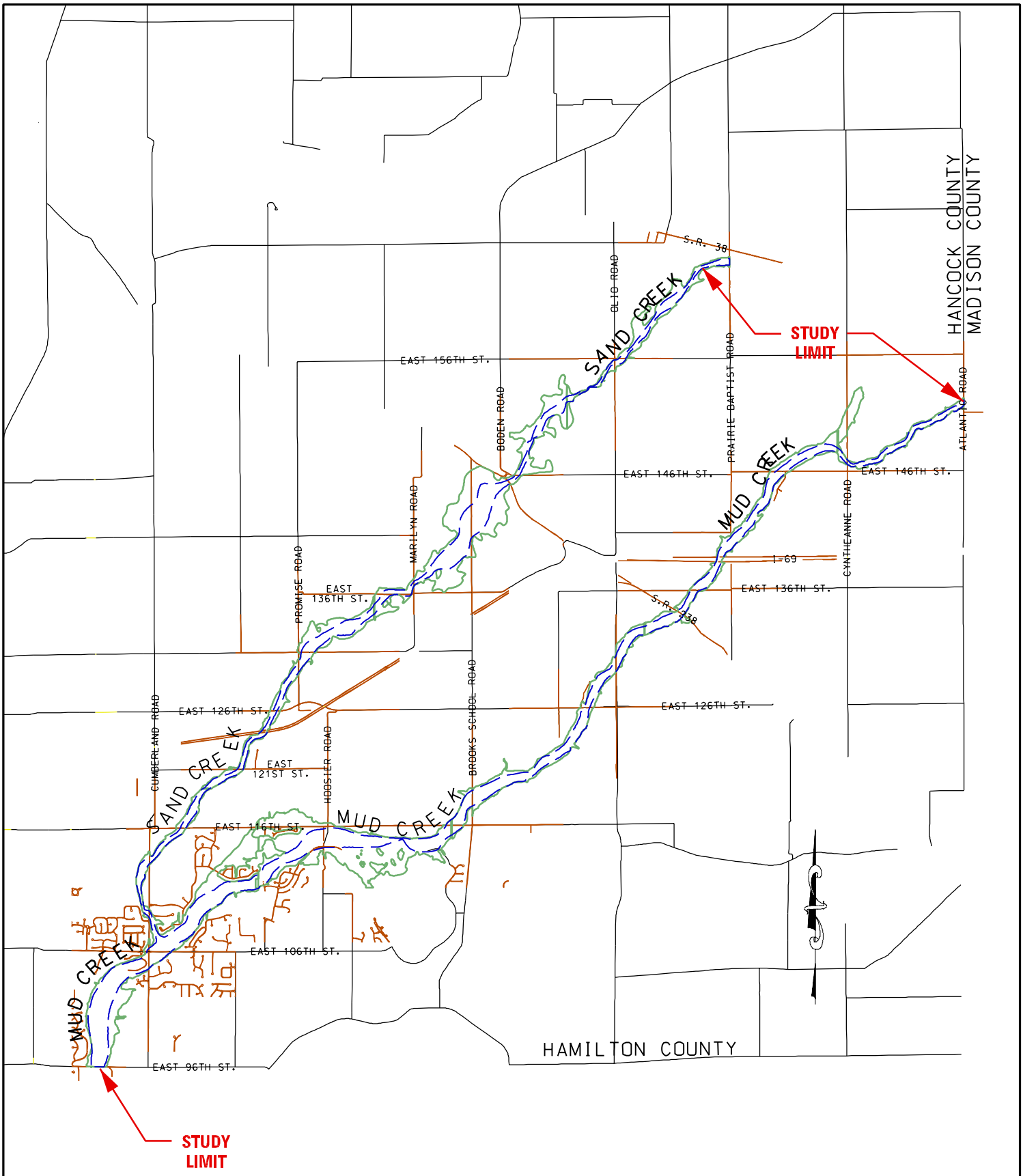

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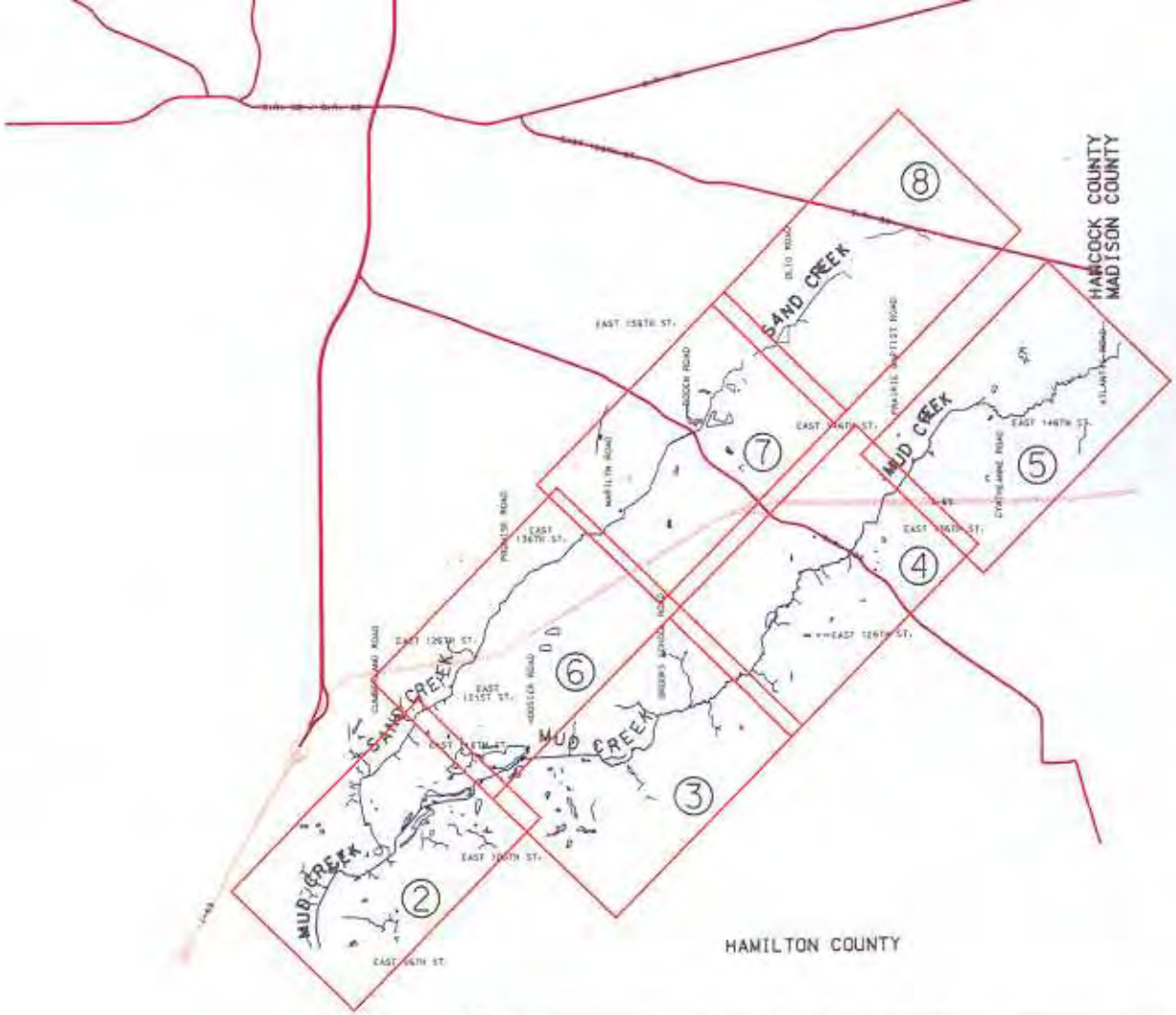
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED FLOOD PROTECTION ALTERNATIVES	01-410	1"=6000'
TITLE: MUD CREEK AND SAND CREEK LOCATION MAP	DATE: 5/02	EXHIBIT: 1



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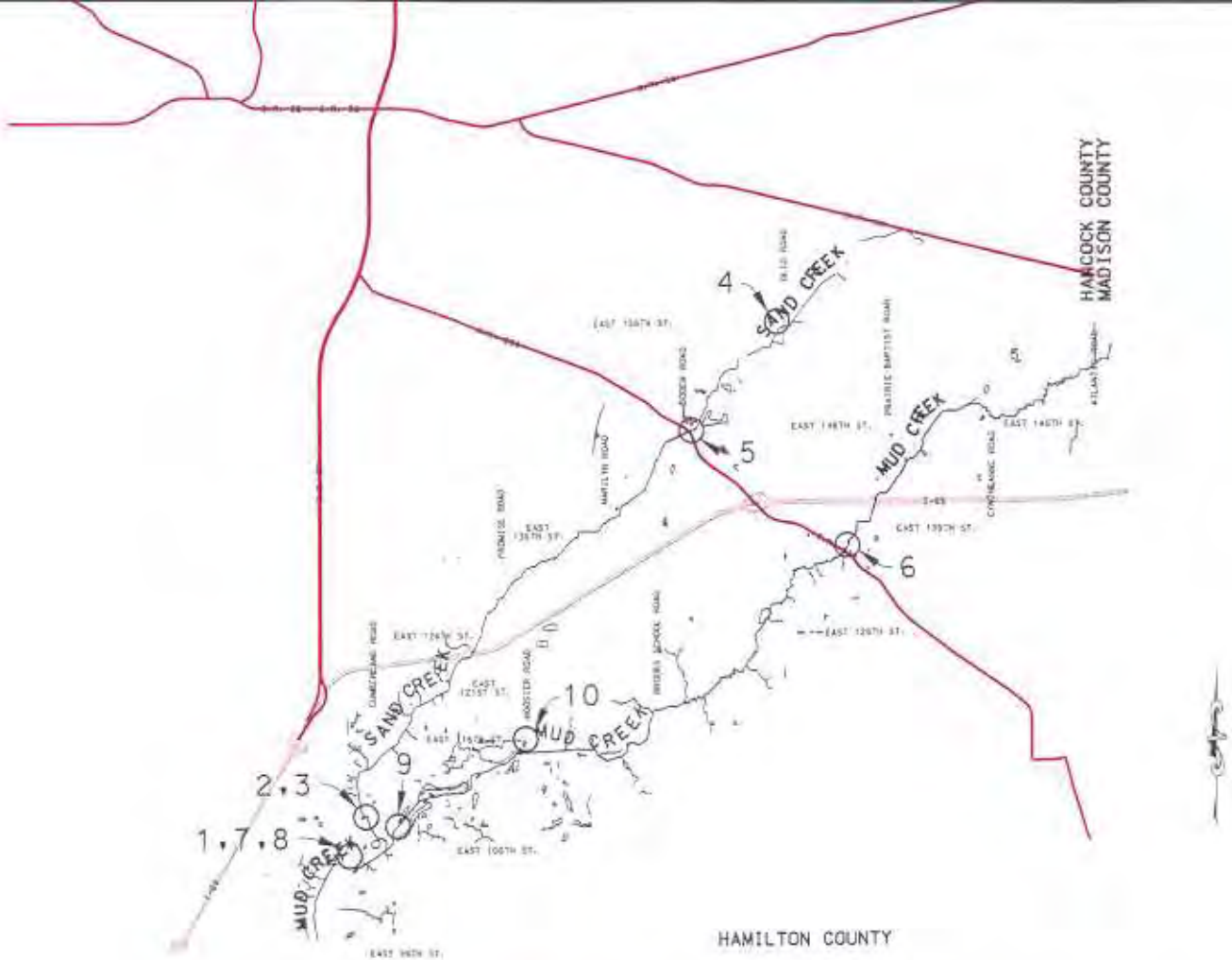
	TITLE: INDEX OF EXHIBITS 2 - 8	DATE: 5/02	EXHIBIT: 1a



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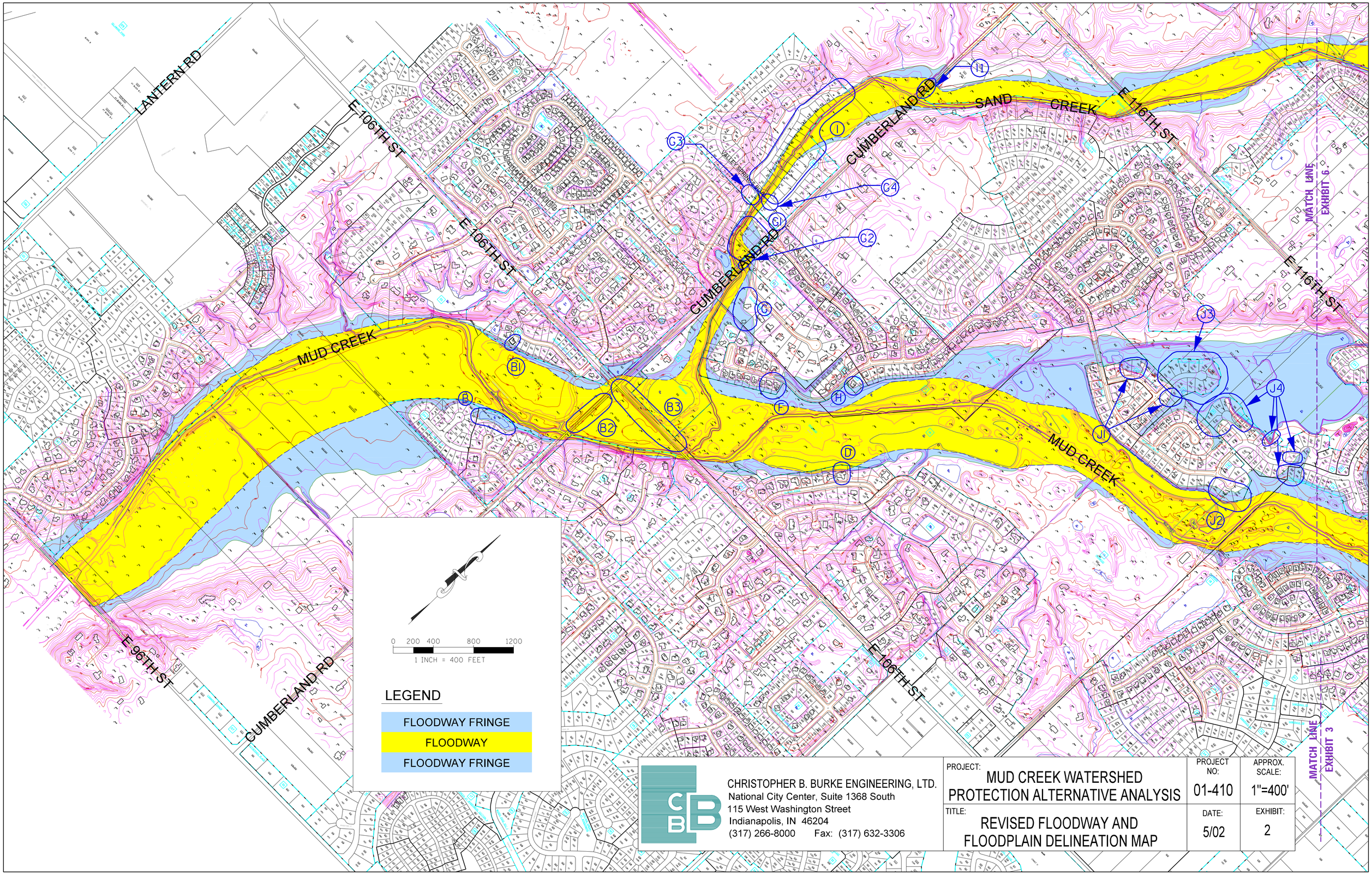
	TITLE: PHOTO INDEX FOR EXHIBITS 9 - 13	DATE: 5/02	EXHIBIT: 1b



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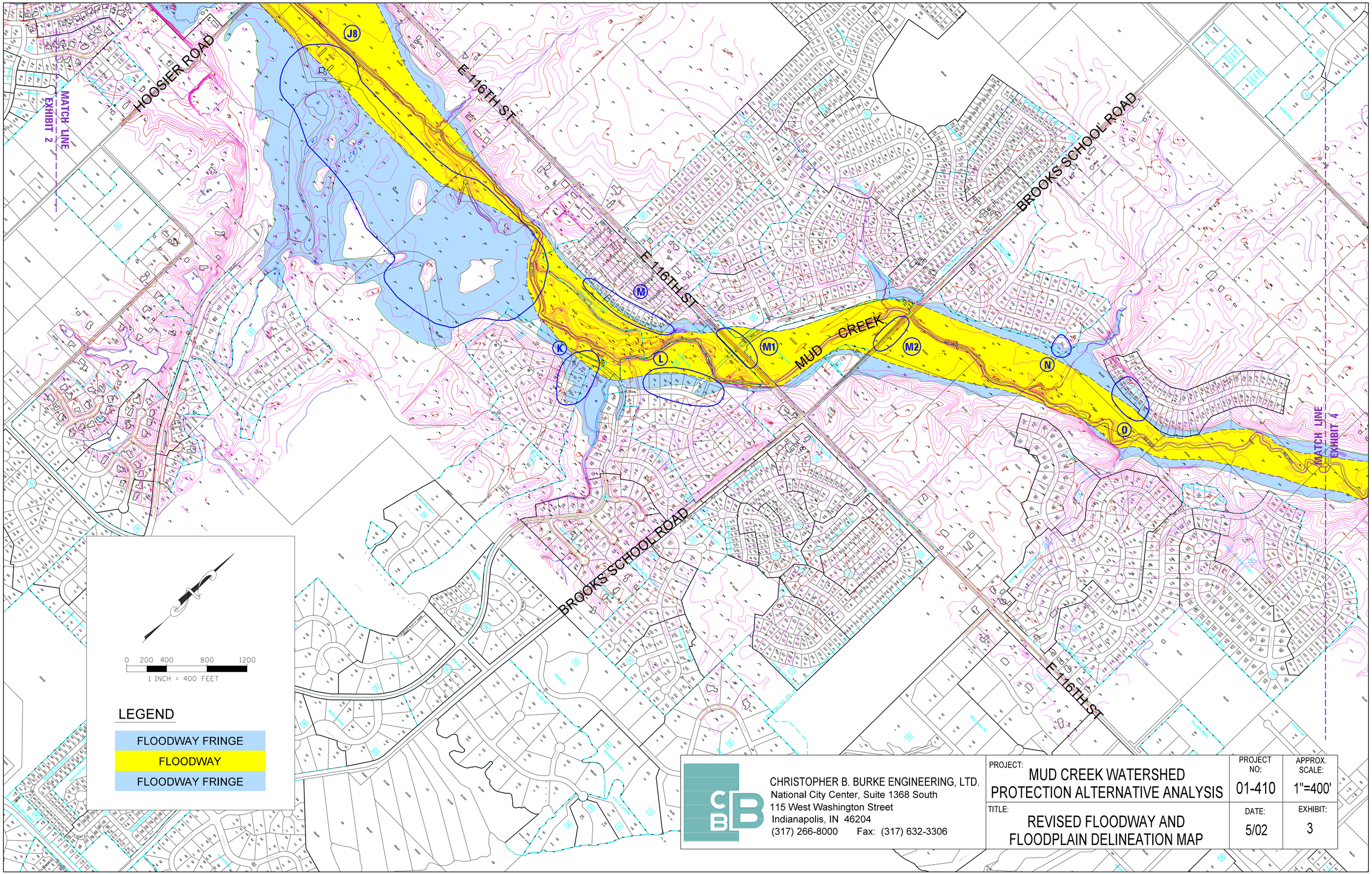
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 2



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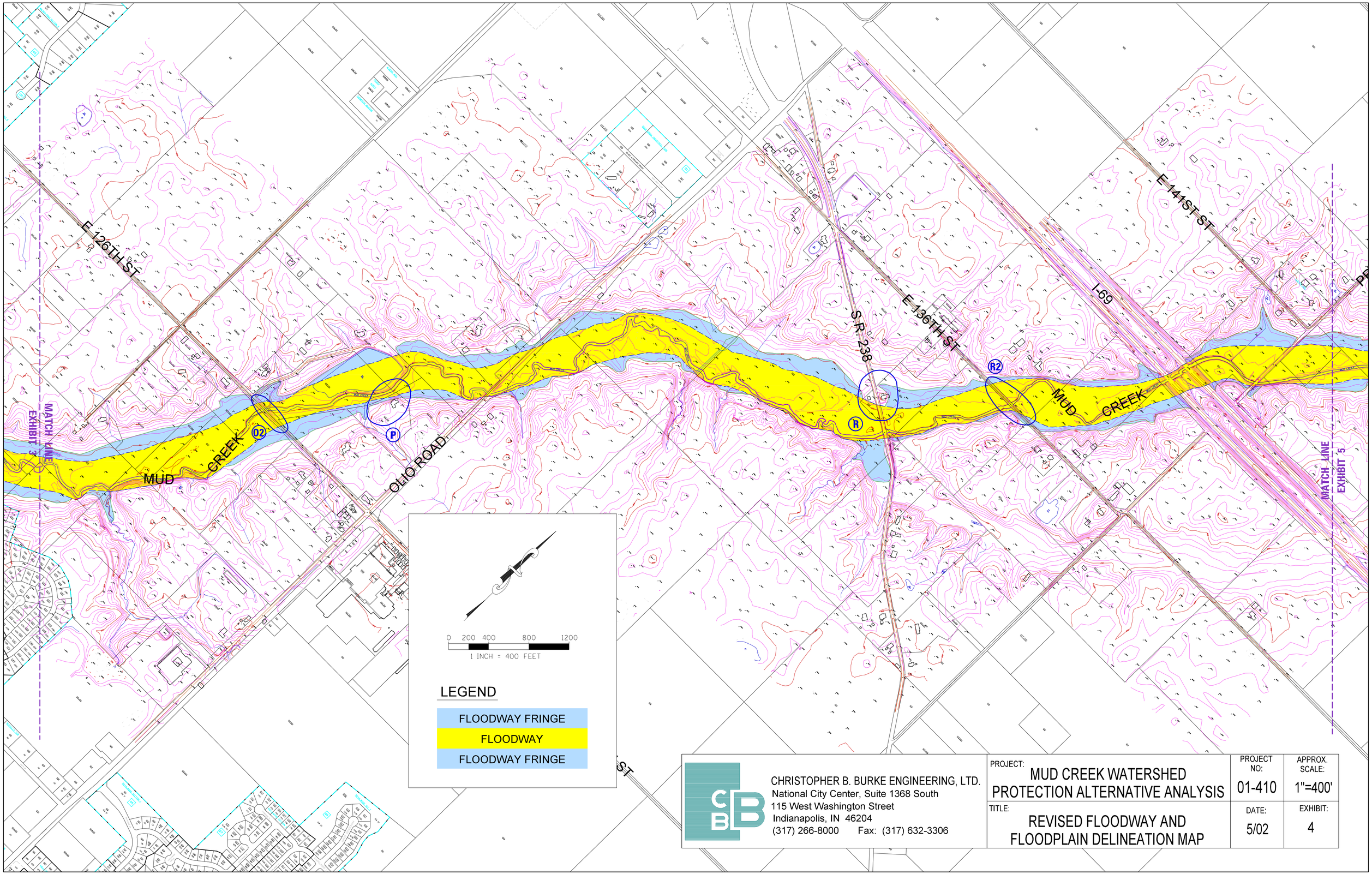
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 3



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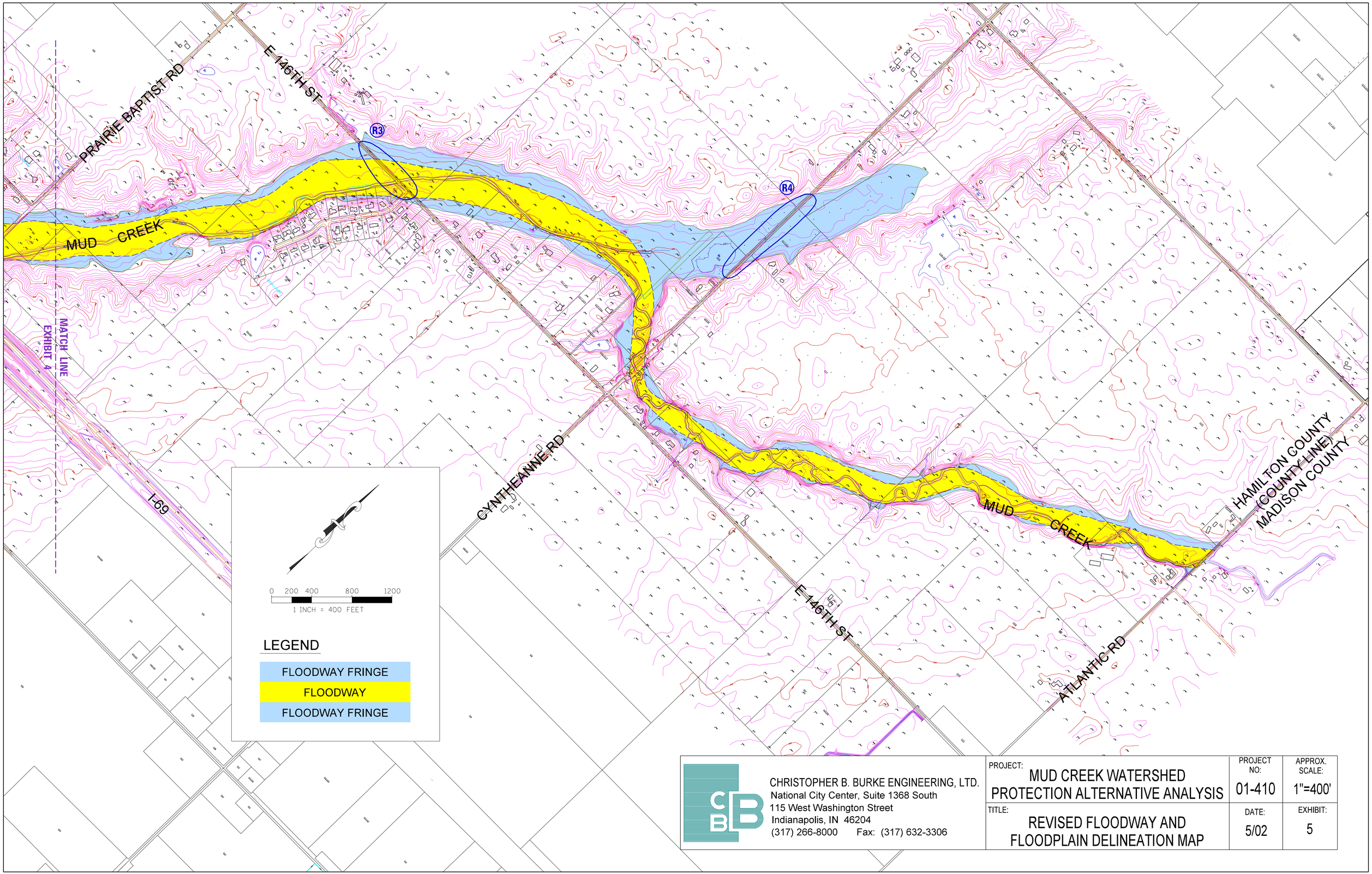
PROJECT: MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	PROJECT NO: 01-410	APPROX. SCALE: 1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 4



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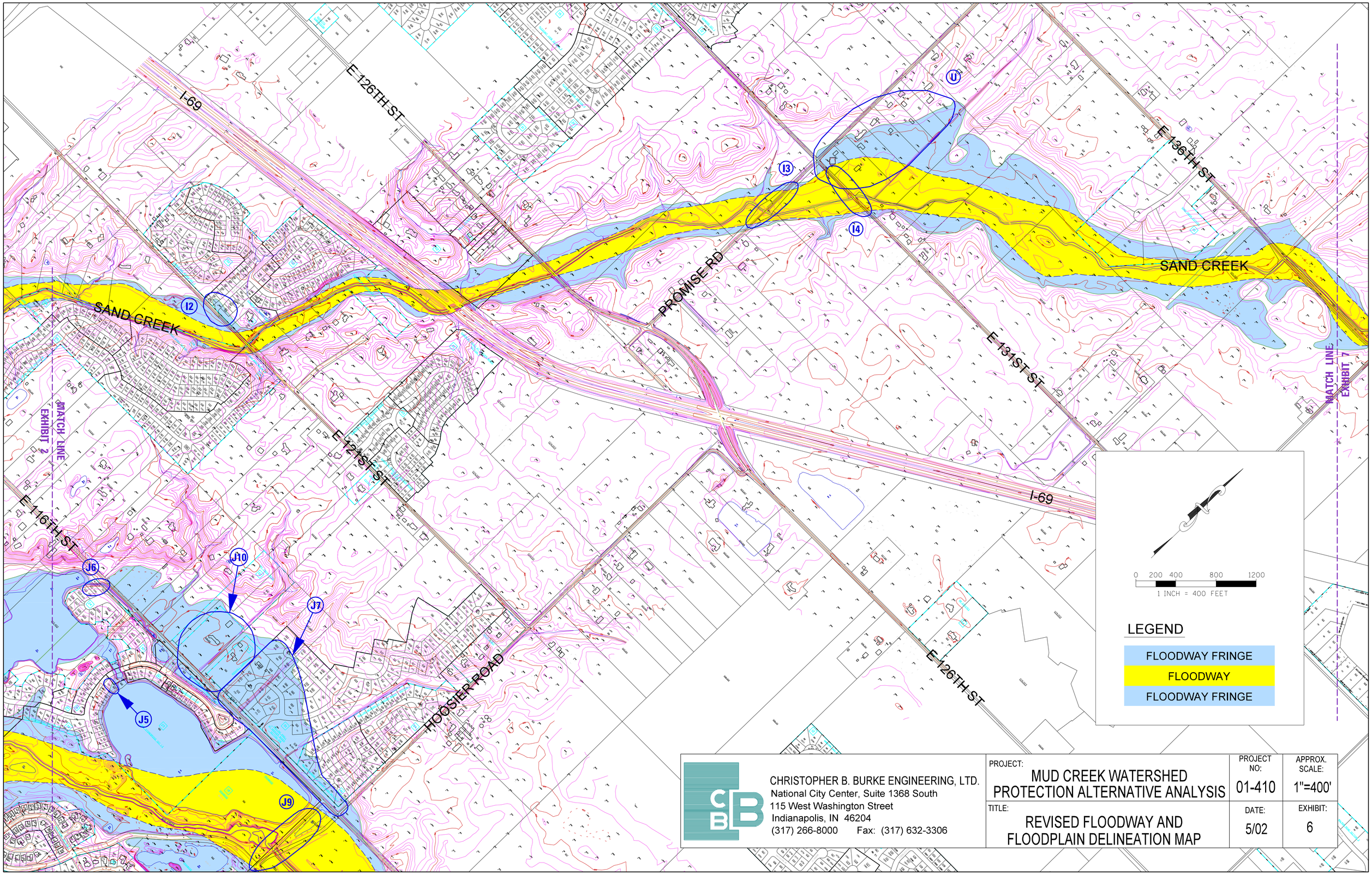
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 5



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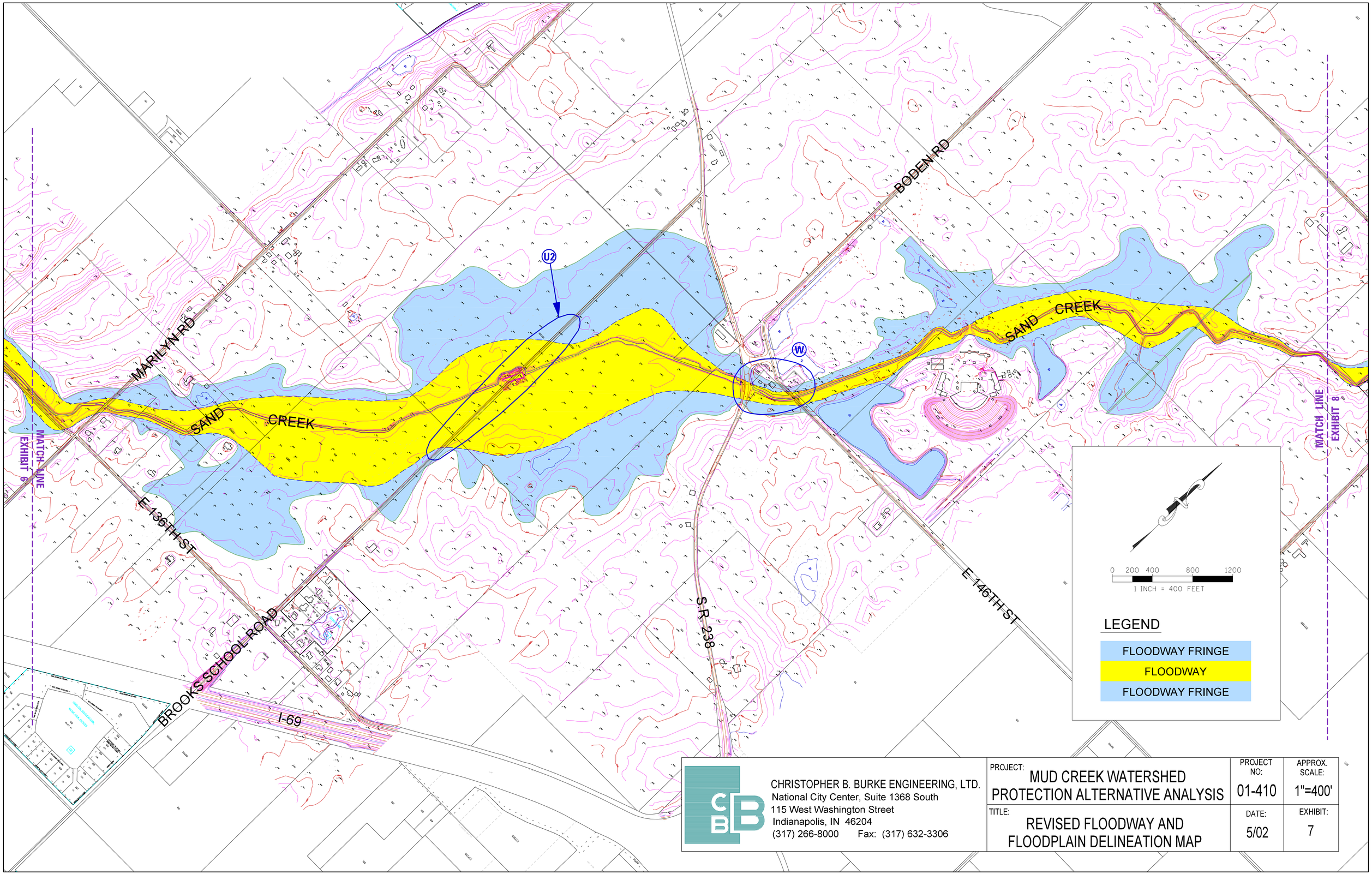
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 6



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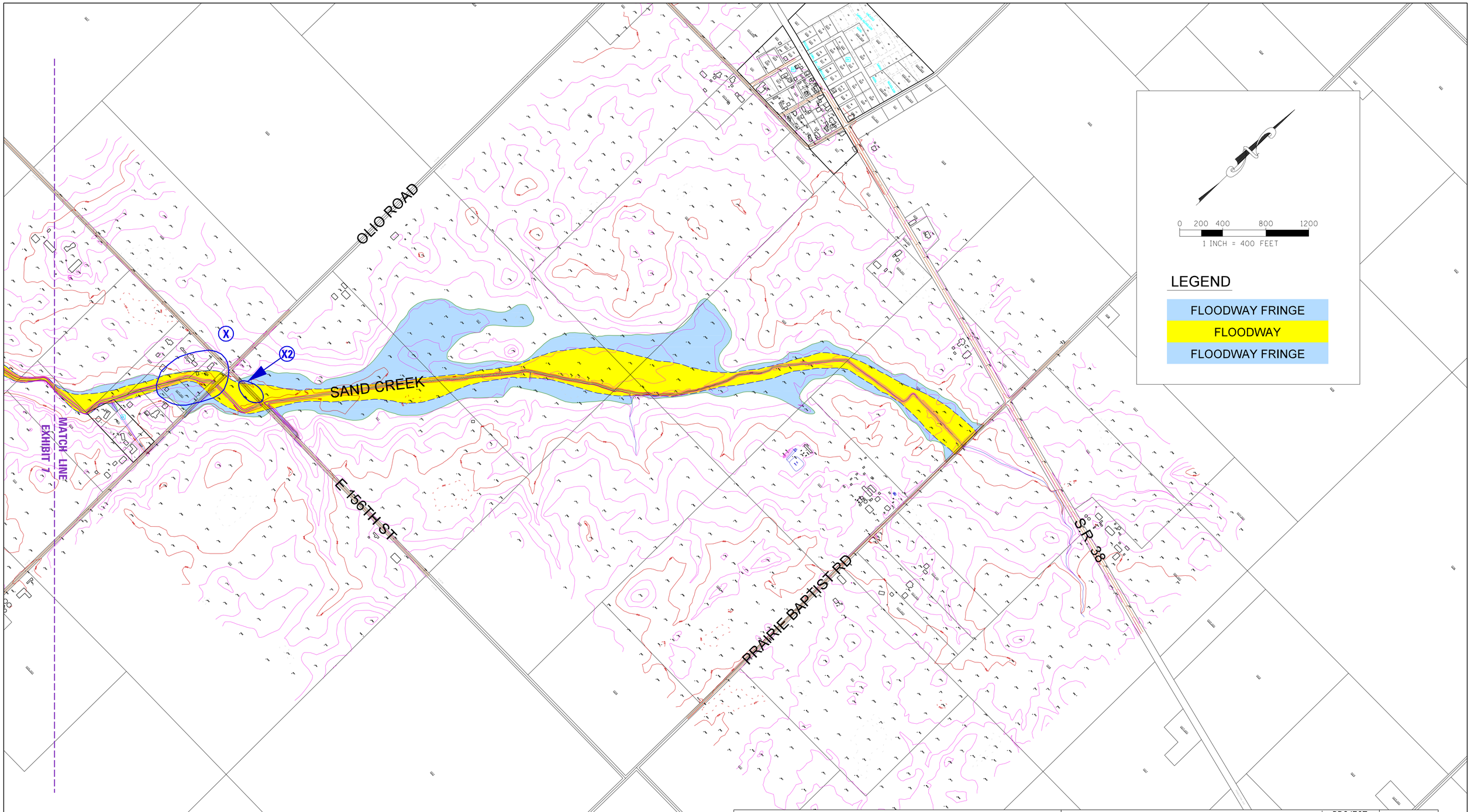
PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 7



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PROJECT:	PROJECT NO:	APPROX. SCALE:
MUD CREEK WATERSHED PROTECTION ALTERNATIVE ANALYSIS	01-410	1"=400'
TITLE: REVISED FLOODWAY AND FLOODPLAIN DELINEATION MAP	DATE: 5/02	EXHIBIT: 8

Bradford Ridge – Sec. 2., 106th & Cumberland Rd. Standing in Mud Creek floodplain looking east along the south side of the development behind lots 20 & 21. Floodplain is used for soccer fields. Date of Photo: 2/25/02. Index Location # 1.

Walnut Creek – Sec. 6., ¼ mile north of 106th & Cumberland Rd. Looking west from east side of Cumberland Rd. Home on fill. New maps show entire lot and home in the floodway of Sand Creek. Date of Photo: 2/25/02. Index Location # 2.

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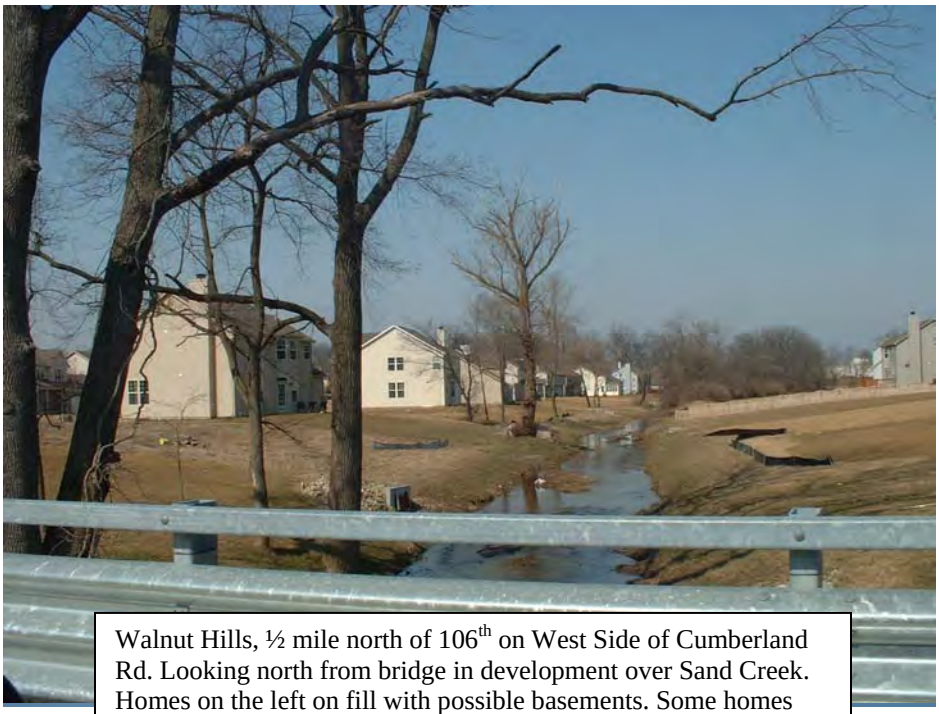
PROJECT: Mud Creek Watershed Flood Protection Alternatives	**PROJECT NO:** 01-410	**APPROX. SCALE:** Not To Scale
TITLE: Selected Photographs in Watershed		**DATE:** 2/25/02
		EXHIBIT 9



Walnut Hills, ½ mile north of 106th on West Side of Cumberland Rd. Looking north from bridge in development over Sand Creek. Homes on the left on fill with possible basements. Some homes appear to encroach into proposed floodway and floodplain of Sand Creek. Date of Photo: 2/25/02. Index Location # 3.

Single family residence at SW corner of 156th St. and Olio Rd. New maps show home just outside floodway and floodplain of Sand Creek. Date of Photo: 2/25/02. Index Location # 4.

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PROJECT:	PROJECT NO:	APPROX. SCALE:
Mud Creek Watershed Flood Protection Alternatives	01-410	Not To Scale
TITLE: Selected Photographs in Watershed		DATE: 2/25/02
		EXHIBIT 10

Single family residence at SE corner of 146th St. and Boden Rd. New maps show home in floodplain of Sand Creek. Bridge on 146th Street was replaced in May 2002 with twin 11'x 7' pipe arches. Date of Photo: 2/25/02. Index Location # 5.

Single family residence on the north side of SR 238; just west of the Mud Creek crossing. New maps show portion of home in floodplain. Land is very flat from creek to lower level garage. Date of Photo: 2/25/02. Index Location # 6.

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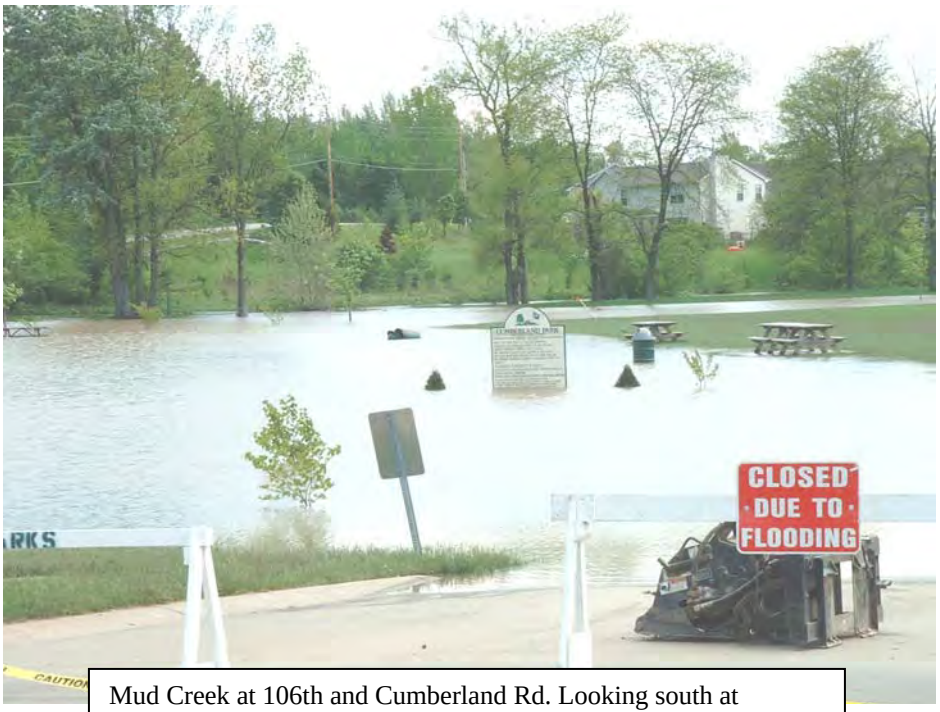
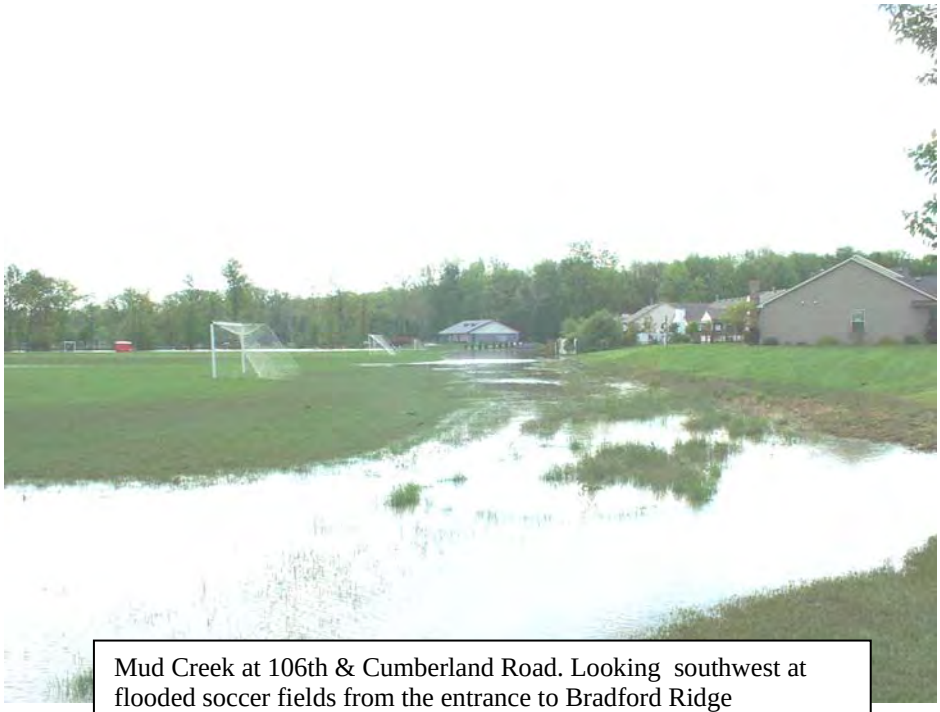
PROJECT: Mud Creek Watershed Flood Protection Alternatives	**PROJECT NO:** 01-410	**APPROX. SCALE:** Not To Scale
TITLE: Selected Photographs in Watershed		**DATE:** 2/25/02
		EXHIBIT 11



Mud Creek at 106th and Cumberland Rd. Looking south at flooded soccer fields from the entrance to Bradford Ridge Subdivision. Date of Photo: 5/14/02. Index Location # 7.



Mud Creek at 106th & Cumberland Road. Looking southwest at flooded soccer fields from the entrance to Bradford Ridge Subdivision. Date of Photo: 5/14/02. Index Location # 8.

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TITLE: Selected Photographs in Watershed		**DATE:** 5/14/02
		EXHIBIT 12

Mud Creek along Spyglass Hills Section 4 looking north along Knightsbridge Lane Date of Photo: 5/14/02.
Index Location # 9.

Mud Creek. Looking northeast from Hoosier Road at entrance to Ironwood Golf Course. Overbank flooding along south overbank. Date of Photo: 5/14/02. Index Location # 10.

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TITLE: Selected Photographs in Watershed		**DATE:** 5/14/02
		EXHIBIT 13