

TOPAZ USER MANUAL

Version 3.1.2

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1. INTRODUCTION

This User Manual provides information on the operation and application of TOPAZ Version 3.1. The use of this manual assumes that the user is familiar with the TOPAZ capabilities, organization, programs and hardware requirements which are described in the document entitled "TOPAZ Overview". It is further assumed that TOPAZ has been properly installed and verified as described in document "TOPAZ Installation Guide".

This introduction provides a brief overview of TOPAZ and its operation. In subsequent sections the input files, input parameters, user options, output files and interactive procedures are described for each program. The last sections contain the tables, figures and appendices that go along with this user manual.

1.1 Overview of TOPAZ Programs

TOPAZ Version 3.1 consists of 6 programs: DEDNM, RASPRO, RASFOR, RASBIN, NSSTAT and PARAM. These programs are described in document "TOPAZ Overview". The main function of each program is summarized in the following:

Program DEDNM (Digital Elevation Drainage Network Model) pre-processes the elevation data, performs the hydrographic watershed segmentation and defines the drainage network.

Program RASPRO (RASter PROperties) derives additional spatial topographic information and parameters from the basic rasters produced by program DEDNM.

Program RASFOR (RASter FORmating) is a raster reformatting utility.

Program RASBIN (RASter to BINary network) transforms a raster based drainage network definition into a binary (only 2 inflows per junction) drainage network definition.

Program NSSTAT (Network and Subcatchment STATistics) computes the basic statistics of the channel link and subcatchment properties.

Program PARAM (Subcatchment PARAMeterization) computes subcatchment properties such as, area, length and slope.

1.2 General Program Interdependence and Operation

The TOPAZ programs are interdependent and must be applied in a specific order. The interdependence of TOPAZ programs and the order in which they can be applied are described in this section and are illustrated in Section 9, Fig. 1.1 "Program interdependence and application order".

Program DEDNM performs the initial and basic processing of the Digital Elevation Model (DEM) and must be applied first. It produces raster and tabular data that are used, directly or indirectly, by other TOPAZ programs. The raster data produced by program DEDNM are in TOPAZ internal raster format and units. For this data to be useful to the user, it must first be reformatted into a user selected format by program RASFOR. After program DEDNM has been applied, the user can choose to proceed with either program RASPRO, RASFOR or RASBIN, in any order.

Program RASPRO should be applied if the user requires further spatial topographic data than that produced by program DEDNM. Program RASPRO must be applied if the user will need program PARAM, because program RASPRO produces input files for program PARAM. All results from program RASPRO are in TOPAZ internal raster format and units. Again, for the data to be useful to the user, it must first be reformatted into a user selected format by program RASFOR. After program RASPRO has been applied the user can choose to proceed with either program PARAM or RASFOR, in any order.

Program RASFOR reformats TOPAZ internal raster files into a user selected format and must be applied if the unformatted raster files produced by programs DEDNM and RASPRO need to be accessed by the user. Program RASFOR has been designed as a stand alone program to allow the user to repeatedly apply program RASFOR, specifying different formats and different raster files without having to re-process the entire DEM by program DEDNM. Program RASFOR does not require prior evaluation of program RASPRO. If program RASPRO has not been evaluated, then program RASFOR only reformats the rasters produced by program DEDNM.

Program RASBIN generates tables of channel and subcatchment properties for the binary network. Program RASBIN is required if the statistics of the channel and subcatchment properties are to be computed by program NSSTAT. Program RASBIN does not require programs RASPRO or RASFOR to have been applied.

Program NSSTAT produces network and subcatchment statistics and can only be used after programs DEDNM and RASBIN have been previously applied, because the program requires the tabular channel and subcatchment data for both the raster and the binary drainage networks which are computed by programs DEDNM and RASBIN, respectively.

Program PARAM computes subcatchment properties and can only be applied if program DEDNM and RASPRO have been previously applied, because the program requires tabular and raster network and subcatchment data created by Program DEDNM and subcatchment raster files created by program RASPRO.

1.3 File Types

1.3.1 Report files

Report files are sequential, formatted, ASCII files. Their primary purpose is to convey program execution information to the user.

1.3.2 Tabular Files

Tabular files are sequential, formatted, ASCII files. Their primary purpose is for user review of computed channel, network and subcatchment values. The headings and units of the tabulated data are given in the files. The channel link and subcatchment counters (first column in tables) refer to the position of the element in the table. The channel link, subcatchment and node index refers to the identifying index of the channel link or subcatchment. Node, channel link and subcatchment index 1 is assigned to the watershed outlet and numerical indexing of the remainder of the watershed properties proceeds from there. An in-depth discussion on the network indexing can be found in the published literature on TOPAZ (given in "TOPAZ Overview document").

1.3.3 Unformatted Parameter Files

Unformatted parameter files are sequential, unformatted files that are not intended for user access. The primary purpose of these files is the transfer of non-raster data between TOPAZ programs. The data in some of the unformatted parameter files are also reproduced as tabular output data (see Section 1.3.2 "Tabular Files").

1.3.4 Evaluation Files

Evaluation files are sequential, formatted, ASCII files. These files are for user review of computed network, channel and subcatchment properties and statistics. The headings and units of the tabulated data are given in the files.

1.3.5 Unformatted Raster Files

Unformatted raster files are sequential, unformatted files that are not intended for direct user access. Some files contain data in TOPAZ internal units. The primary purpose of these files is the transfer of raster data between TOPAZ programs. To make these files user accessible they must first be reformatted into a user selected format and adjusted for proper unit conversions by applying program RASFOR.

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2. PROGRAM DEDNM

Program DEDNM (Digital Elevation Drainage Network Model) reads and performs quality control on the initial input Digital Elevation Model (DEM) data; pre-processes the elevation data to rectify depressions and flat surfaces to allow an unambiguous definition of downslope drainage; performs the hydrographic watershed segmentation that defines the watershed boundary, the raster drainage network and the corresponding channel links and subcatchments; assigns the channel link and subcatchment identification indices; and, tabulates the channel link and subcatchment properties and parameters. The user should note that the raster drainage network may contain junction nodes with more than two inflows. The drainage network definition, the channel and subcatchment indices and the tabular files account explicitly for this type of junction nodes. Additional information on junction nodes with more than two inflows can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

This section describes the input files, input parameters, user options, output files, operation and interactive procedures for program DEDNM.

2.1 Input Files

Program DEDNM requires three input files, DNMCNT.INP, DEDNM.INP and NTGCOD.INP. The first file is a parameter file and the last two are raster files. If the option for spatially variable Critical Source Area (CSA) and Minimum Source Channel Length (MSCL) in file DNMCNT.INP is not selected only input files DNMCNT.INP and DEDNM.INP are required. All input files must reside in the same directory as the executable TOPAZ programs. The content of the three input files for program DEDNM is described in this section. The input files are listed in Section 8, Table 2.1 "List of input files for program DEDNM", and the general organization of the I/O is shown in Section 9, Fig. 2.1 "General input/output organization of program DEDNM". Specifications of all input files are given in Section 10.1, Appendix I "Input/Output File Specifications".

2.1.1 File DNMCNT.INP

File DNMCNT.INP is the parameter file which contains values describing the DEM raster characteristics, the DEM processing options and corresponding processing parameters, and the user output options. The definition of each variable in this file, with recommended and/or acceptable range of values, is given in Section 8, Table 2.2 "Definition of variables in file DNMCNT.INP". The variables in this table are in the same order in which they appear in the input file and the names are those used in program DEDNM. The names have little relevance for the user, but are given here for lack of a better designation or nomenclature. An example of file DNMCNT.INP is given in Section 10.2.1 "Input file DNMCNT.INP". The lengthy output of the program capabilities, specifications and limitations can be turned off by user option in file DNMCNT.INP.

2.1.2 File DEDNM.INP

File DEDNM.INP is the raster file which contains the elevation data of the DEM. The unit of elevation is meters, and the precision with which the values are read is 1/10th of a meter or one decimeter. Any additional precision of the elevation input is rounded to the nearest decimeter. The minimum and maximum elevation values accepted by TOPAZ are 1.0 and 9999.0 meters, respectively. Sometimes not all elevation values in a DEM are relevant or known. In these cases a characteristic elevation value that designates indeterminate elevation must be provided. This value can be any value outside the range of recognized elevation values as defined by parameters ELMIN and ELMAX in input file DNMCNT.INP, including negative values. A recommended value for indeterminate elevation is 0 (zero) or a user selected negative number.

The format of the elevation data is one value per record, ordered column first, row second. Column first, row second means that the raster values are ordered in increasing column number for row 1, followed by those of row 2, etc. An example of the data sequence in input file DEDNM.INP is shown in Section 9, Fig. 2.2 "Example of the data sequence in input file DEDNM.INP", and an example of file DEDNM.INP is given Section 10.2.2 "Input file DEDNM.INP".

2.1.3 File NTGCOD.INP

File NTGCOD.INP is the ASCII raster file which contains the codes for the Critical Source Area (CSA) and Minimum Source Channel Length (MSCL) parameter values for each cell in the raster. The spatial distribution of the codes reflect the spatial variability of geophysical landscape properties that are relevant to the CSA and MSCL parameters and for the generation of the drainage network and watershed segmentation to exhibit spatially variable characteristics. Accepted code values are 1 through 5. Each code value corresponds to a user defined CSA and MSCL value as given in input file DNMCNT.INP. The spatial arrangement of the code values in the raster determines which CSA and MSCL parameter is to be used at any particular raster cell (or watershed location) for the generation of the network and segmentation of the watershed. The format in which the code data must be provided is one value per record, ordered column first, row second, in exactly the same way as for input file DEDNM.INP (see previous section). An example of file NTGCOD.INP is given in Section 10.2.3 "Input file NTGCOD.INP".

The input file NTGCOD.INP is not needed if the user elected to use only one CSA and MSCL value for the entire DEM, and if the parameter IOPT5 in file DNMCNT.INP is set to 0 (zero) (see definition of IOPT5 in Section 8, Table 2.2 "Definition of variables in file DNMCNT.INP").

2.2 Program Execution

After the input files DNMCNT.INP, DEDNM.INP and NTGCOD.INP are prepared, program DEDNM can be applied. All input files must be resident in the same directory as the executable TOPAZ programs, and all output files are written to this directory. Program DEDNM can be applied for one of four processing options: DEM pre-processing only; DEM pre-processing and full network generation; full run; or calibration run. During processing, run-time messages will appear on the screen to inform the user on the progress of the DEM processing.

If the user has selected the "DEM pre-processing only" or the "DEM pre-processing and full network generation" option, the program terminates without further user input.

If a full run is being performed, the upstream drainage areas of channel cells (raster cells that identify channel location) are displayed on the monitor during the processing. This display shows the upstream drainage area values in the vicinity of the user specified watershed outlet. Large values indicate channels with large upstream drainage areas; values of 0 define overland areas. This information guides the user in the final selection of the watershed outlet location. A channel cell must be selected as the watershed outlet. If the selected outlet is not on a channel cell, program DEDNM cannot proceed, because there is no drainage network to evaluate.

If the desired watershed outlet is not included on the display, the user can display a different location by interactively entering new row/column coordinates for the outlet. This can be done repeatedly until a suitable outlet is found. An initial outlet can be found by first executing program DEDNM for a preprocessing run (option 2). After completion of this run, the file NETFUL.DAT can be viewed to determine the desired outlet coordinates. Upon entry of a correct outlet the program completes the DEM processing. However, entry of an erroneous outlet can, under special circumstances, result in the termination of the program execution. Under these conditions the user must re-apply program DEDNM from the beginning.

If a calibration run is being performed, the DEM pre-processing is not repeated. Instead the required DEM pre-processed data from the previous run of program DEDNM is read. Calibration runs are much faster than full runs of program DEDNM, but the user can only change one of the following three parameters at a time: the watershed outlet, the CSA and MSCL parameter values, or the code values in file NTGCOD.INP.

After program DEDNM is applied, the report file and tabular files are available to the user. Note that for the "DEM pre-processing only" or the "DEM pre-processing and full network generation" option there are no tabular files. All generated raster files are unformatted and require the application of program RASFOR to reformat the raster files into a user specified format. The separation of programs DEDNM and RASFOR allows the user to apply program RASFOR repeatedly, specifying different formats and different raster files without having to re-process the entire DEM by program DEDNM.

2.3 Output Files

Program DEDNM has five types of output files: report files, tabular files, unformatted raster files, unformatted program files and unformatted parameter files. Report files contain program execution information and input parameter values. Tabular files contain tables of computed network and subcatchment properties. Report and tabular files are coded files that are written for the user to review the program execution steps and the computed values, respectively. Unformatted raster, program and parameter files contain unformatted data for interface to other TOPAZ programs or internal program usage. The user does not need to access unformatted files. All output files are written to the directory in which the executable TOPAZ programs reside. The content of the output files is described in this section. The output files are listed in Section 8, Table 2.3 "List of output files from program DEDNM", and the general organization of the I/O is shown in Section 9, Fig. 2.1 "General input/output organization of program DEDNM". Specifications of all output files are given in Section 10.1, Appendix I "Input/Output File Specifications".

2.3.1 Report Files

2.3.1.1 File DEDNM.RPT

File DEDNM.RPT contains program header and disclaimer, program capabilities and limitations, title of current application, input parameter values, program execution trace, raster error checking summary, and program error messages. An example of this file is given in Section 10.2.4 "Output file DEDNM.RPT".

2.3.2 Tabular Files

2.3.2.1 File NETW.TAB

File NETW.TAB contains channel link information such as channel link index; coordinates, upstream drainage area and elevation of upstream and downstream end of channel link; channel link length; and, topology of channel link. An example of this file is given in Section 10.2.5 "Output file NETW.TAB". The user should note that the raster drainage network may contain junction nodes with more than two inflows. The channel data in this file contains explicit information regarding this type of junction nodes. Additional information on junction nodes with more than two inflows can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

2.3.2.2 File SBCT.TAB

File SBCT.TAB contains subcatchment indices and drainage areas. Subcatchments include right and left subcatchments draining into a channel link, and, for source channel links, they also include the upstream catchment draining into the channel link source. An example of this file is given in Section 10.2.6 "Output file SBCT.TAB". The user should note that the raster drainage network may contain junction nodes with more than two inflows. The subcatchment data in this file contains explicit information regarding this type of junction nodes. Additional information on junction nodes with more than two inflows can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

2.3.2.3 File CATWIN.TAB

File CATWIN.TAB contains the window identification of subcatchment areas defined in file SBCT.TAB (Section 2.3.2.2 "File SBCT.TAB"). Window identification of a subcatchment area is provided by the minimum and maximum row/column coordinates required to completely contain a subcatchment in a raster area.

2.3.3 Unformatted Raster Files

2.3.3.1 File INELEV.OUT

File INELEV.OUT contains the elevation values of the input DEM. The values are either the original, aggregated or resampled input DEM elevation values, depending on the user selected processing option. The elevation values are rounded to the nearest decimeter and are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the elevation values are returned in meters with a precision of 1/10th of a meter.

2.3.3.2 File SMOOTH.OUT

File SMOOTH.OUT contains the smoothed DEM elevation values after the input DEM has been optionally aggregated or resampled. The smoothed elevation values are rounded to the nearest decimeter and are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the elevation values are returned in meters with a precision of 1/10th of a meter. This file is only produced if the user selected the "DEM smoothing" option.

2.3.3.3 File FILDEP.OUT

File FILDEP.OUT contains the DEM elevation values after the input DEM has been optionally aggregated or resampled, optionally smoothed, and the depressions have been breached and/or filled, depending on the user selected processing option. The elevation values are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the elevation values are returned in meters with a precision of 1/10th of a meter.

2.3.3.4 File RELIEF.OUT

File RELIEF.OUT contains the relief corrected DEM elevation values after the input DEM has been optionally aggregated or resampled, optionally smoothed, and depression breached/filled. The elevation values are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the elevation values are returned in meters with a precision of 1/100'000th of a meter to reflect the incremental elevations of the relief correction.

2.3.3.5 File FLOVEC.OUT

File FLOVEC.OUT contains the drainage direction at each raster cell (local flow vectors) in one of eight principal directions of the raster grid (D-8 method). Values of flow vectors are 0 through 4, and 6 through 9. The value of 0 defines cells with indeterminate flow direction. The remainder of the values are defined as direction from the center cell to one of its eight adjacent cells as follows:

value of 1 points to the upper left;

value of 2 points straight up;

value of 3 points to the upper right;

value of 4 points left;

value of 6 points right;

value of 7 point to the lower left;

value of 8 point down; and,

value of 9 point to the lower right.

2.3.3.6 File UPAREA.OUT

File UPAREA.OUT contains the accumulated upstream area draining into each cell. The accumulated upstream area is given in number of upstream cells, excluding the current cell. Therefore, cells at the drainage divide which have no upstream drainage area, are given a value of 0. Cells with indeterminate elevation value are assigned a "-1". All other values of accumulated upstream area can range from 0 through (NROW * NCOL), where NROW and NCOL are the number of rows and columns of the raster, respectively.

2.3.3.7 File NTGCOD.OUT

File NTGCOD.OUT contains the codes that define the CSA and MSCL parameters used in the generation of the drainage network and watershed segmentation. Code values and their spatial distribution within the raster are user-defined (input file NTGCOD.INP). If the user elected to aggregate or resample the input DEM, then file NTGCOD.OUT is produced and contains the aggregated or resample code values of input file NTGCOD.INP. If the user elected not to aggregate or resample the input DEM, then file NTGCOD.OUT is the same as input file NTGCOD.INP. If the user elected not to use a spatially distributed Critical Source Area (CSA) and Minimum Source Channel Length (MSCL) and file NTGCOD.INP does not exist then program DEDNM will create file NTGCOD.OUT with a single default code value (1).

Code values range from 0 to 5, inclusive. A code value of 0 signifies that the CSA and MSCL value is indeterminate. Code values between 1 and 5 define different combinations of CSA and MSCL parameter values as given in input file DNMCNT.INP. For further information on the codes in file NTGCOD.OUT the reader is referred to Section 2.1.3 "File NTGCOD.INP".

2.3.3.8 File NETFUL.OUT

File NETFUL.OUT contains the computed drainage network for the full DEM coverage. Cells with a value of zero are background cells (overland or non-channel areas), and cells with a value of 1 represent channel cells.

2.3.3.9 File BOUND.OUT

File BOUND.OUT contains the watershed definition above the user specified watershed outlet point. Cells with a value of 0 are outside the watershed boundaries, and cells with a value of 1 define the area within the watershed boundaries.

2.3.3.10 File FLOPAT.OUT

File FLOPAT.OUT defines the beginning and end of flow paths. Raster cells are assigned the following values:

- 0: for a cell with indeterminate flow direction or indeterminate elevation;
- 1: for a cell that is the end of a flow path;
- 2: for a cell that is the beginning of a flow path;
- 3: for a cell that is simultaneously the beginning and ending of a flow path;
- 4: for a cell that has an upstream inflow and flow vector pointing to a downstream cell which itself has a defined flow vector.

2.3.3.11 File NETW.OUT

File NETW.OUT defines the drainage network within the watershed boundaries above the user selected watershed outlet. Cells with a value of 0 are background cells (overland or non-channel areas), and cells with a positive value represent channel cells. The value of a channel cell represents the Strahler channel order of the channel in that cell. If a cell is shared by several channels (such as at junctions) the highest Strahler order of the channels in that cell prevails. The user should note that the raster drainage network may contain junction nodes with more than two inflows. Additional information on junction nodes with more than two inflows can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

2.3.3.12 File SUBWTA.OUT

File SUBWTA.OUT contains the subcatchment indices. Each subcatchment has a unique index which is the same as the node or channel link index to which it corresponds. Clusters of cells with the same index identify a subcatchment. The values of the indices are 0 for cells outside of the watershed boundaries, and range from 10 to $(MXNMND * 10 + 4)$ for cells inside the watershed boundaries, where MXNMND is the highest index assigned to the nodes or channel links of the generated drainage network. The values for indices are as follows:

Source Node Subcatchments = $(NODN * 10) + 1$

Right Bank Subcatchments = $(NODN * 10) + 2$

Left Bank Subcatchments = $(NODN * 10) + 3$

Channel Network Cells = $(NODN * 10) + 4$

where NODN is the index assigned to the nodes or channel links of the generated drainage network. The user should note that the raster drainage network may contain junction nodes with more than two inflows. Additional information on junction nodes with more than two inflows can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

2.3.3.13 File INDTAR.OUT

File INDTAR.OUT contains the drainage network of the full DEM scene with areas adjacent to indeterminate (undefined) areas assigned 1's, defined portions of the watershed area assigned 2's and indeterminate (undefined) areas assigned 0's.

2.3.4 Unformatted Parameter Files

2.3.4.1 File OUTCNT.UNF

File OUTCNT.UNF contains TOPAZ control parameters such as raster characteristics, DEM processing options and user options, as well as TOPAZ internal parameters that control program settings, program execution and output formats, among others. This file is created by program DEDNM, and it is accessed, modified and complemented by all other TOPAZ programs, as needed.

2.3.4.2 File OUTCHA.UNF

File OUTCHA.UNF contains the channel link data that is reproduced in tabular file NETW.TAB (Section 2.3.2.1 "File NETW.TAB"). This file is accessed by other TOPAZ programs.

2.3.4.3 File OUTCAT.UNF

File OUTCAT.UNF contains the subcatchment data that is reproduced in tabular file SBCT.TAB (Section 2.3.2.2 "File SBCT.TAB"). This file is accessed by other TOPAZ programs.

2.3.5 Unformatted Program Files

2.3.5.1 File NTWINT.FIL

Raster file written for TOPAZ internal use. Location of cells having defined/indeterminate elevation value and of cells with defined elevation values that are adjacent to a cell with indeterminate elevation value.

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3. PROGRAM RASPRO

Program RASPRO (RASter PROperties) derives additional spatial topographic information and parameters from the basic rasters produced by program DEDNM. Examples of new raster information include, but are not limited to, location and extent of depressions and flat surfaces in the DEM; elevation reclassification into user specified classes; alternative computations of raster cell slope and aspect; enhancement of the visualization of channel network and drainage divides; flow travel distance to the next channel and to the watershed outlet; elevation drop from each cell to the next channel and to the watershed outlet; and, aggregation of all subcatchments draining directly into one channel link into a single direct contributing area for that channel link.

This section describes the input files, input parameters, user options, output files and operation of program RASPRO.

3.1 Input files

Program RASPRO requires one formatted input file, RASPRO.INP; one unformatted input file, OUTCNT.UNF; and, the unformatted raster files FILDEP.OUT, INELEV.OUT, RELIEF.OUT, FLOVEC.OUT, UPAREA.OUT, NETW.OUT and SUBWTA.OUT, all of which are produced by program DEDNM which is run prior to RASPRO. All input files must reside in the same directory as the executable TOPAZ programs. The content of the input files for program RASPRO is described in this section. The input files are listed in Section 8, Table 3.1 "List of input files for program RASPRO", and the general organization of the I/O is shown in Section 9, Fig. 3.1 "General input/output organization of program RASPRO". Specifications regarding all input files are given in Section 10.1, Appendix I "Input/Output File Specifications".

3.1.1 File RASPRO.INP

File RASPRO.INP is the parameter input file that contains the raster processing and user output options. The options are listed and described in Section 8, Table 3.2 "List of user options for program RASPRO". They are given in the same order in which they appear in file RASPRO.INP and their names are those used in program RASPRO. The names have little relevance for the user, but are given here for lack of a better designation or nomenclature. An example of input file RASPRO.INP is given in Section 10.2.7 "Input file RASPRO.INP".

3.1.2 File OUTCNT.UNF

For general information about file OUTCNT.UNF see Section 2.3.4.1 "File OUTCNT.UNF".

3.1.3 Unformatted Raster Files

Ten unformatted raster files with extension .OUT are needed for input to program RASPRO. They are files INELEV.OUT, FILDEP.OUT, RELIEF.OUT, FLOVEC.OUT, UPAREA.OUT, NETW.OUT, BOUND.OUT, FLOPAT.OUT, INDTAR.OUT and SUBWTA.OUT. These raster files must have been generated by program DEDNM prior to applying program RASPRO. For general information on Unformatted Raster Files see Section 1.3.5 "Unformatted Raster Files". The content of each .OUT file is described in Section 2.3.3 "Unformatted Raster Files".

3.2 Program Execution

Program RASPRO can be used after program DEDNM has been run, the .OUT files from program DEDNM have been produced, and the user options in file RASPRO.INP have been set. All input files must reside in the same directory as the executable TOPAZ programs, and all output files are written to this directory. During processing, run-time messages will appear on the screen to inform the user of the progress of the raster processing. Upon completion of program RASPRO, all generated raster files are in unformatted format and require the use of program RASFOR to reformat the raster files into a user specified format.

3.3 OUTPUT FILES

Program RASPRO produces three types of output files: report files, unformatted raster files and unformatted parameter files. Report files are sequential, formatted, ASCII files that contain program execution information. These files are written for the user to review the program execution steps. Unformatted parameter files are produced for data interface to other TOPAZ programs. Unformatted raster files contain unformatted data for interface to other TOPAZ programs. The user should not access unformatted files. All output files are written to the directory in which the executable TOPAZ programs reside. The content of the output files is described in this section. The output files are listed in Section 8, Table 3.3 "List of output files from program RASPRO", and the general organization of the I/O is given in Section 9, Fig. 3.1 "General input/output organization of program RASPRO". The specifications of all output files are given in Section 10.1, Appendix I "Input/Output File Specifications".

3.3.1 Report Files

3.3.1.1 File RASPRO.RPT

File RASPRO.RPT contains program header, disclaimer, title of current application, input parameter values, summary of user selected input options, program execution trace, and program error messages. An example of this file is given in Section 10.2.8 "Output file RASPRO.RPT".

3.3.2 Unformatted Raster Files

3.3.2.1 File DEPFLT.OUT

File DEPFLT.OUT contains information on the location and extent of depressions and flat areas in the DEM. Values in this file are 0 through 6 as specified in the following:

- 1: Cells that have been raised to fill a depression and that, after being raised, are not adjacent to any neighboring cell that is at a higher elevation.
- 2: Cells that have been raised to fill a depression and that, after being raised, are adjacent to at least one neighboring cell that is at a higher elevation.
- 3: Cells for which all neighboring cells are at the same elevation. These cells have no inflow and/or outflow; they are in the middle of flat areas.

- 4: Cells that have no neighboring cells at a lower or indeterminate elevation, but that have at least one neighboring cell at a higher elevation. These cells have an inflow, but no outflow. They are usually encountered at the edge of flat areas adjacent to rising terrain.
- 5: Cells that have no neighboring cells at a higher elevation, but that have at least one neighboring cells at a lower or indeterminate elevation. These cells have an outflow, but no inflow. They are usually encountered at the edge of flat areas adjacent to falling terrain. However, they also exist by themselves without an adjacent flat area, as for example drainage ridge or drainage divide cells. Ridge cells are defined as a continuous string of cells (at least 2 cells) at same elevation surrounded by cells of lower or indeterminate elevation. Note summit cells (single cell surrounded cells of lower or indeterminate elevation) are not included here, they do not qualify as a flat area which requires at least 2 cells of same elevation.
- 6: Cells that are neither part of a depression or flat area.
- 0: Cells that have an indeterminate elevation.

Note: Depression cells that are identified by code 1 or 2, are not overwritten by flat area code 3, 4, 5 or 6. It is understood that depression cells, after being filled, are also flat area cells.

3.3.2.2 File ELVCLA.OUT

File ELVCLA.OUT contains the reclassified DEM elevations into a user specified number of elevation classes. The file contains the mean elevation value of the class into which the original elevation value was reclassified. All values are rounded to the nearest decimeter and expressed in TOPAZ internal units. Raster cells with indeterminate elevation value are assigned a TOPAZ internal value that is outside the range of accepted elevation values. Upon reformatting by program RASFOR, the elevation values are returned in meters with a precision of 1/10th of a meter, and raster cells with indeterminate elevation value are reassigned the user specified value for indeterminate elevation (see input file DNMCNT.INP Section 2.1.1 "File DNMCNT.INP").

3.3.2.3 File FVASPE.OUT

File FVASPE.OUT contains the aspect of the flow vector at each raster cell. The aspect points in the same direction as the flow vector which is the steepest downslope direction to a neighboring cell. The aspect is given in degrees East of North (0 - 359); values of -1 specify the presence of an indeterminate elevation in the calculation of the aspect.

3.3.2.4 File FVSLOP.OUT

File FVSLOP.OUT contains the slope of the flow vector at each raster cell. Slope values are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the slope values are returned in decimal (no units) with a precision of 1/100'000th; values of -1 specify the presence of an indeterminate elevation in the calculation of the slope.

3.3.2.5 File HSLOPE.OUT

File HSLOPE.OUT contains the hydraulic effective slope at each cell. It is the flow weighted mean slope of all flow vectors entering and leaving the cell. Slope values are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the slope values are returned in decimal (no units) with a precision of 1/100'000th; values of -1 specify the presence of an indeterminate elevation in the calculation of the slope.

3.3.2.6 File TSLOPE.OUT

File TSLOPE.OUT contains the terrain slope at each cell which is computed as the maximum slope that is fitted to the DEM elevations on a mathematical surface interpolation of the current and surface adjacent cells. Slope values are expressed in TOPAZ internal units. Upon reformatting by program RASFOR, the slope values are returned in decimal (no units) with a precision of 1/100'000th; values of -1 specify the presence of an indeterminate elevation in the calculation of the slope.

3.3.2.7 File TASPEC.OUT

File TASPEC.OUT contains the terrain aspect at each cell which is computed as the aspect of the direction of the maximum downward slope away from the DEM cell based on the mathematical surface interpolation of the local DEM elevations. The aspect is given in degrees East of North (0 - 359); values of -1 specify the presence of an indeterminate elevation in the calculation of the aspect.

3.3.2.8 File NETWE.OUT

File NETWE.OUT contains the enhanced (widened) drainage network. Values are 0 for background and 1 for channel cells. Generally the channels in a drainage network are defined by a string of connected raster cells. For large and high resolution rasters, this may produce very thin and sometimes unconnected and hard to identify lines on a monitor display. To improve the visual display the channels, they are redefined into a band 2 to 3 cells wide. This raster NETWE.OUT is for display enhancement only. It should not be used for any evaluations.

3.3.2.9 File SUBBDA.OUT

File SUBBDA.OUT contains the boundaries of the subcatchments. Values are 0 for background and 1 for subcatchment boundaries. This raster is for display only. It should not be used for any evaluations.

3.3.2.10 File SUBWTB.OUT

File SUBWTB.OUT contains the aggregated subcatchments for each channel link in the network. The aggregation includes the right and left subcatchments adjacent to the channel link, the drainage area of the channel link itself, and, for source channels, the upstream subcatchment (see Section 2.3.3.11 "File SUBWTA.OUT"). The aggregated subcatchment are define by the index NNOD of the channel the subcatchment drains into; values are 0 for background.

3.3.2.11 File SUBBDB.OUT

File SUBBDB.OUT contains the boundaries of the aggregated subcatchment. Values are 0 for background and 1 for subcatchment boundaries. This raster is for display only. It should not be used for any evaluations.

3.3.2.12 File DISCHA.OUT

File DISCHA.OUT contains the distance from each cell to the first downstream channel it flows into. For channel cells the distance is 1/4 of the cell distance.

3.3.2.13 File DISOUT.OUT

File DISOUT.OUT contains the distance from each cell to the watershed outlet. This distance includes the distance across the watershed outlet cell.

3.3.2.14 File ELDCHA.OUT

File ELDCHA.OUT contains the elevation drop in meters from each cell to the first downstream channel it flows into. For channel cells the elevation drop is 0.

3.3.2.15 File ELDOUT.OUT

File ELDOUT.OUT contains the elevation drop in meters from each cell to the watershed outlet in meters.

3.3.3 Unformatted Parameter Files

3.3.3.1 File OUTCNT.UNF

Same as Section 3.1.2 "File OUTCNT.UNF".

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4. PROGRAM RASFOR

Program RASFOR (RASter FORmating) is a raster reformatting utility. It reads the unformatted raster files produced by programs DEDNM and RASPRO, and reformats them into either ASCII or GIS specific files. The user can use one of the available formats, or reformat the ASCII raster files into a user desired format by use of a user written code. The formats that are implemented at this time are 2 ASCII formats (1-D and 2-D) and 2 GIS formats (IDRISI, and ARCINFO). This section describes the input files, input parameters, user options, output files and operation of program RASFOR.

4.1 Input Files

Program RASFOR requires one formatted input file, RASFOR.INP; one unformatted input file, OUTCNT.UNF; and, the unformatted files with extension .OUT produced by programs DEDNM and RASPRO. All input files must reside in the same directory as the executable TOPAZ programs. The content of the input files for program RASFOR is described in this section. The input files are listed in Section 8, Table 4.1 "List of input files for program RASFOR", and the general organization of the I/O is shown in Section 9, Fig. 4.1 "General input/output organization of program RASFOR". Specifications regarding all input files are given in Section 10.1, Appendix I "Input/Output File Specifications".

4.1.1 File RASFOR.INP

File RASFOR.INP is a parameter file that contains the raster processing and user output options. The options are listed and described in Section 8, Table 4.2 "List of user options for program RASFOR". They are given in the same order in which they appear in file RASFOR.INP and their names are those used in program RASFOR. The names have little relevance for the user, but are given here for lack of a better designation or nomenclature. An example of input file RASFOR.INP is given in Section 10.2.9 "Input file RASFOR.INP".

4.1.2 File OUTCNT.UNF

For general information about file OUTCNT.UNF see Section 2.3.4.1 "File OUTCNT.UNF".

4.1.3 Unformatted Raster Files

Up to 28 raster files with extension .OUT are needed for input to program RASFOR. These raster files are unformatted raster files that must be generated by programs DEDNM and RASPRO prior to running program RASFOR. Program DEDNM produces 13 of these .OUT files and program RASPRO the other 15 .OUT files. For general information on Unformatted Raster Files see Section 1.3.5 "Unformatted Raster Files". File name, origin and content of the unformatted raster files are given in Section 8, Table 4.1 "List of input files for program RASFOR". A more detailed description of each .OUT file from programs DEDNM and RASPRO is given in Sections 2.3.3 and 3.3.3 "Unformatted Raster Files", respectively.

4.2 Program Execution

Program RASFOR can be used after programs DEDNM and RASPRO (optional) have been applied, the .OUT files from programs DEDNM and RASPRO are produced, and the user options in file RASFOR.INP have been set. All input files must reside in the same directory as the executable TOPAZ programs, and all output files are written to this directory. During processing, run-time messages will appear on the screen to inform the user on the progress of the raster reformatting. Upon completion of program RASFOR, the reformatted raster files are available to the user for interface to other software packages.

Program RASFOR reformats files created by both programs DEDNM and RASPRO. However, if only program DEDNM has been previously applied, then the .OUT files of program RASPRO are not available. Under these conditions program RASFOR reformats the .OUT files of program DEDNM and returns the following message at completion:

- PROGRAM RASPRO HAS NOT BEEN EXECUTED FOR THE CURRENT APPLICATION OF TOPAZ. CORRESPONDING RASTER FILES CANNOT BE REFORMATTED.

4.3 Output Files

Program RASFOR produces three types of output files: report files, formatted raster files and unformatted parameter files. Report files are sequential, formatted, ASCII files that contain program execution information. These files are written for the user to review the program execution steps. Unformatted parameter files are produced for data interface to other TOPAZ programs. Formatted raster files contain the reformatted raster files for direct viewing by the user or for interface to a user selected GIS software package. All output files are written to the directory in which the executable TOPAZ programs reside. The formats of the output files are described in this section. The output files are listed in Section 8, Table 4.3 "List of output files from program RASFOR", and the general organization of the I/O is given in Section 9, Fig. 4.1 "General input/output organization of program RASFOR". The content of the reformatted raster files is given in Sections 2.3.3 and 3.3.3 "Unformatted Raster Files". Finally, the specifications of all output files are found in Section 10.1, Appendix I "Input/Output File Specifications".

4.3.1 Report Files

4.3.1.1 File RASFOR.RPT

File RASFOR.RPT contains program header, disclaimer, title of current application, input parameter values, summary of user selected input options, list of files that have been reformatted, program execution trace, and program error messages. An example of this file is given in Section 10.2.10 "File RASFOR.RPT".

4.3.2 Reformatted Raster Files

The file format, the output file names, and the data format of the reformatted raster files are described in this section. The file format is selected by the user. The four reformatting options are ASCII 1-D, ASCII 2-D, ARCINFO, and IDRISI formats. Each reformatting option is briefly described in the subsections below.

The names of the reformatted raster files are the same as the corresponding unformatted raster input file names, but with different extensions. Output files that have been reformatted with reformatting options ASCII 1-D and ASCII 2-D are given the extension .DAT; output files reformatted with the IDRISI option come in pairs and are given the extension .IMG and .DOC.; output files that have been reformatted with the reformatting option ARCINFO are given the extension .ARC. File names and extensions for the different file formats (reformatting options) are shown in Section 8, Table 4.3 "List of output files from program RASFOR".

The data format in each file varies with the type and magnitude of the data values. Elevation and slope data are reported in type real; all other data are reported in type integer. The number of digits with which the data is reported is variable and depends on the magnitude of the largest value in the respective files. Integer numbers have a maximum of 10 digits and cannot exceed the limit of 1×10^4 which is +2'147'483'647. Real numbers are written with up to a maximum of 11 significant digits. Elevation values in files INELEV.DAT, SMOOTH.DAT, FILDEP.DAT and ELVCLA.DAT (or with extension .IMG or .ARC) are reported in meters and rounded to the nearest decimeter (1/10th of a meter). Elevation values in file RELIEF.DAT (or .IMG or .ARC) are reported to 1/100'000th of a meter. This increased precision for file RELIEF.DAT (or .IMG or .ARC) allows the user to capture the incremental elevation adjustments of the relief imposition algorithm. Slope values in files FVSLOP.DAT, HSLOPE.DAT and TSLOPE.DAT (or with extension .IMG or .ARC) have no units and are reported to 1/100'000th. Data type and format for each reformatted output file are summarized in Section 8, Table 4.3 "List of output files from program RASFOR".

4.3.2.1 ASCII 1-D format

ASCII 1-D files have one value per record. The order of the values are column first, row second, similar to the data of input file DEDNM.INP (see Section 2.1.2 "File DEDNM.INP" and Section 9, Fig. 2.2 "Example of the data sequence in input file DEDNM.INP"). An example of a reformatted raster file in ASCII 1-D format is given in Section 10.2.11 "Files UPAREA.DAT and RELIEF.DAT in ASCII 1-D format from program RASFOR".

4.3.2.2 ASCII 2-D format

ASCII 2-D files have multiple data entries per record. Each record contains the data of an entire row of the raster file. Thus, record 1 contains all the column values in the first row of the raster, record 2 the data of the second row, etc. The values within one record are given in increasing column order, starting with column 1 up to a maximum number of 12'500 columns. The data values in each record are evenly spaced so that columns from one record to the next line-up and the raster data can easily be viewed by the user.

Raster files that contain only single digit integer values are written with no blank spaces between values. This format allows the user to easily view and recognize spatial patterns when viewing the ASCII raster data in an editor. However, if any integer value in the file is negative

(i.e. is preceded by a negative sign), then all values are spaced by 1 blank position to accommodate the negative sign. The presence of a negative value is automatically detected prior to writing the file. Raster files that contain integer numbers with more than 1 digit always have blank spaces between values so that each individual data value can be recognized by the user.

Raster files that contain real numbers are written with spaces between values so that each individual data value can be recognized when read by the user. An example of reformatted raster files in ASCII 2-D format, one with integer and the other with real data types, is given in Section 10.2.12 "Files SUBWTA.DAT and FILDEP.DAT in ASCII 2-D format from program RASFOR".

4.3.2.3 IDRISI format

Files in IDRISI format can be directly imported into the commercial GIS package IDRISI. The files come in pairs: one image file (extension .IMG) and one corresponding documentation file (extension .DOC). The format of the image file (.IMG file) is ASCII with one value per record, similar to the ASCII 1-D format. The documentation file (.DOC file) is written as an IDRISI compatible ASCII text file. The documentation file contains raster parameters such as number of rows/columns in the raster, minimum/maximum raster value, UTM coordinates, and type of the file (integer or real). The image and documentation files are fully compatible with IDRISI Version 4.1 and IDRISI for WINDOWS Version 2.0. An example of a reformatted raster file in IDRISI 1-D format (.IMG and .DOC files) is given in Section 10.2.13 "Files HSLOPE.IMG and HSLOPE.DOC in IDRISI format from program RASFOR".

Note: Files that are reformatted into IDRISI format can be viewed directly in IDRISI Ver. 4.1 using the display function 'color a' and in IDRISI for Windows using DISPLAY. However, automatic reclassification, grouping and color wrapping in IDRISI may affect the visual appearance of the data. The user must perform additional file manipulations within IDRISI to display the data according to user specifications and needs.

Reference: IDRISI Vers. 4.1
IDRISI for Windows Vers. 2.0
ClarkUniversity
J. Ronald Eastman
Graduate School of Geography,
Worcester, Massachusetts 01610, USA

4.3.2.4 ARCINFO format

Files in ARCINFO format can directly be imported into the commercial GIS package ARC/INFO. The ARC/INFO command ASCIIGRID can be used to put the file in ARC/INFO GRID format. The format of the arc file (.ARC file) is ASCII with multiple values per record, similar to the ASCII 2-D format. The header of the file contains raster parameters such as number of rows/columns in the raster, indeterminate raster value and size of each cell. An example of a reformatted raster file in ARC/INFO format (.ARC) is given in Section 10.2.14 "File NETW.ARC in ARC/INFO format from program RASFOR".

Reference: ARC/INFO VERSION 7.0.X ARC/INFO
ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE INC.
380 NEW YORK STREET
REDLANDS CA. 92373
USA.

4.3.3 Unformatted Parameter Files

4.3.3.1 File OUTCNT.UNF

Same as Section 4.1.2 "File OUTCNT.UNF".

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5. PROGRAM RASBIN

Program RASBIN (RASter to BINary network) transforms a raster based drainage network into a binary (2 inflows per junction) drainage network by decomposing complex junction nodes (more than 2 inflows per junction) into a sequence of simple junction nodes (only 2 inflows per junction); assigns channel link and subcatchment indices to the binary network; computes the optimal sequence for cascade-type flow routing through the binary network; and, tabulates the channel link and subcatchment properties and parameters of the binary network. Additional information on junction nodes with more than two inflows and on binary junction nodes can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

This section describes the input files, input parameters, user options, output files and operation of program RASBIN.

5.1 Input Files

Program RASBIN requires three unformatted input files, OUTCNT.UNF, OUTCHA.UNF, and OUTCAT.UNF which are produced by program DEDNM. There are no formatted input files and no user options for program RASBIN. All input files must reside in the same directory as the executable TOPAZ programs. The content of the input files for program RASBIN is described in this section. The input files are listed in Section 8, Table 5.1 "List of input files for program RASBIN", and the general organization of the I/O is shown in Section 9, Fig. 5.1 "General input/output organization of program RASBIN". Specifications regarding all input files are given in Section 10.1, Appendix I "Input/Output File Specifications".

5.1.1 File OUTCNT.UNF

For general information about file OUTCNT.UNF see Section 2.3.4.1 "File OUTCNT.UNF".

5.1.2 File OUTCHA.UNF

File OUTCHA.UNF is the unformatted parameter file which contains channel link properties. This file was produced by program DEDNM and its content is similar to the data described in Section 2.3.2.1 "File NETW.TAB".

5.1.3 File OUTCAT.UNF

File OUTCAT.UNF is the unformatted parameter file which contains subcatchment properties. This file was produced by program DEDNM and its content is similar to the data described in Section 2.3.2.2 "File SBCT.TAB".

5.2 Program Execution

Program RASBIN can be executed after program DEDNM has been applied and the necessary .UNF files produced. No ASCII input files are required for program RASBIN. All unformatted input files must reside in the same directory as the executable TOPAZ programs, and all output files are written to this directory. During processing, run-time messages will appear on the screen to inform the user on the progress of the raster to binary network conversion. Upon completion of program RASBIN, the tabular data files of channel link and subcatchment properties of the binary drainage network are available to the user.

5.3 Output Files

Program RASBIN produces three types of output files: report files, tabular data files and unformatted parameter files. Report files are sequential, formatted, ASCII files that contain program execution information. Tabular data files are sequential formatted, ASCII files that contain the binary network and subcatchment data. Report and tabular files are coded files that are written for the user to review the program execution steps and the computed values, respectively. Unformatted parameter files are produced for data interface to other TOPAZ programs. The user should not access unformatted files. All output files are written to the directory in which the executable TOPAZ programs reside. The content of the output files is described in this section. The output files are listed in Section 8, Table 5.2 "List of Output files from program RASBIN", and the general organization of the I/O is given in Section 9, Fig. 5.1 "General input/output organization of program RASBIN". The specifications of all output files are given in Section 10.1, Appendix I "Input/Output File Specifications".

5.3.1 Report Files

5.3.1.1 File RASBIN.RPT

File RASBIN.RPT contains program header, disclaimer, title of current application, program execution trace, and program error messages. An example of this file is given in Section 10.2.15, "File RASBIN.RPT".

5.3.2 Tabular Files

5.3.2.1 File NETWB.TAB

File NETWB.TAB contains binary channel link information such as channel link index, Strahler order, upstream drainage area, direct drainage area, channel slope, and node indices of the inflow channels; channel link length; and, topology of channel link. An example of this file is given in Section 10.2.16 "Output File NETWB.TAB". Additional information on junction nodes with more than two inflows and on binary junction nodes can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

5.3.2.2 File SBCTB.TAB

File SBCTB.TAB contains binary subcatchment information such as indices and drainage areas. Subcatchments include right, left and total subcatchment area draining into a channel link, and, for source channel links, they also include the upstream catchment draining into the channel link source. An example of this file is given in Section 10.2.17 "Output File SBCTB.TAB". Additional information on junction nodes with more than two inflows and on binary junction nodes can be found in the Overview Manual, Section 3.4 "Topographic Parameterization".

5.3.3 Unformatted Parameter Files

5.3.3.1 File OUTCNT.UNF

Same as Section 5.1.1 "File OUTCNT.UNF".

5.3.3.2 File RBKEY.UNF

File RBKEY.UNF contains the raster to binary transformation key. The file contains the corresponding node indices of the raster and binary network; the location of additional channel nodes, channels and subcatchments; and, the location where channel lengths and subcatchment areas must be subtracted to maintain channel length and subcatchment area conservation.

5.3.3.3 File RBNET.UNF

File RBNET.UNF is the unformatted parameter file containing the channel link properties of the binary drainage network. The data in this file are reproduced in tabular file NETWB.TAB. File RBNET.UNF is accessed by other TOPAZ programs.

5.3.3.4 File RBSBC.UNF

File RBSBC.UNF is the unformatted parameter file containing the subcatchment properties of the binary drainage network. The data in this file are reproduced in tabular file SBCTB.TAB. File RBSBC.UNF is accessed by other TOPAZ programs.

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6. PROGRAM NSSTAT

Program NSSTAT (Network and Subcatchment STATistics) computes the mean and standard deviation of the channel link and subcatchment properties for both the raster and binary channel network. It also computes subcatchment and channel network properties and parameters such as watershed drainage area, number of channel links, drainage density and network composition parameters.

This section describes the input files, input parameters, user options, output files and operation of program RASPRO.

6.1 Input Files

Program NSSTAT requires 5 unformatted input files: OUTCNT.UNF, OUTCHA.UNF, and OUTCAT.UNF which are produced by program DEDNM; and, RBNET.UNF and RBSBC.UNF which are produced by program RASBIN. All input files must reside in the same directory as the executable TOPAZ programs. The content of the input files for program NSSTAT is described in this section. The input files are listed in Section 8, Table 6.1 "List of input files for program NSSTAT", and the general organization of the I/O is shown in Section 9, Fig. 6.1 "General input/output organization of program NSSTAT". Specifications regarding all input files are given in Appendix I, Section 10.1 "Input/Output File Specifications".

6.1.1 File OUTCNT.UNF

For general information about file OUTCNT.UNF see Section 2.3.4.1 "File OUTCNT.UNF".

6.1.2 File OUTCHA.UNF

File OUTCHA.UNF is the unformatted parameter file which contains channel link properties. This file was produced by program DEDNM and its content is similar to the data described in Section 2.3.2.1 "File NETW.TAB".

6.1.3 File OUTCAT.UNF

File OUTCAT.UNF is the unformatted parameter file which contains subcatchment properties. This file was produced by program DEDNM and its content is similar to the data described in Section 2.3.2.2 "File SBCT.TAB".

6.1.4 File RBNET.UNF

File RBNET.UNF is the unformatted parameter file which contains the channel link properties of the binary drainage network. This file was created by program RASBIN and its contents is described in Section 5.3.3.3 "File RBNET.UNF".

6.1.5 File RBSBC.UNF

File RBSBC.UNF is the unformatted parameter file which contains the subcatchment properties of the binary drainage network. This file was created by program RASBIN and its content is described in Section 5.3.3.4 "File RBSBC.UNF".

6.2 Program Execution

Program NSSTAT can be executed after programs DEDNM and RASBIN have been applied, and the .UNF files from programs DEDNM and RASBIN produced. No ASCII input files are required for program NSSTAT. All unformatted input files must reside in the same directory as the executable TOPAZ programs, and all output files are written to this directory. During processing, run-time messages appear on the screen to inform the user on the progress of the network and subcatchment evaluation. Upon completion of program NSSTAT, the evaluation of the network, channel and subcatchment statistics are available to the user.

6.3 Output Files

Program NSSTAT produces three types of output files: report files, evaluation data files and unformatted parameter files. Report files are sequential, formatted, ASCII files that contain program execution information. Evaluation data files are sequential formatted, ASCII files that contain the statistics of the network, channel and subcatchment data. Report and evaluation files are coded files that are written for the user to review the program execution steps and the computed values, respectively. Unformatted parameter files are produced for data interface to other TOPAZ programs. The user should not access unformatted files. All output files are written to the directory in which the executable TOPAZ programs reside. The content of the output files is described in this section. The output files are listed in Section 8, Table 6.2 "List of Output files of program NSSTAT", and the general organization of the I/O is given in Section 9, Fig. 6.1 "General input/output organization of program NSSTAT". The specifications of all output files are given in Appendix I, Section 10.1 "Input/Output File Specifications".

6.3.1 Report Files

6.3.1.1 File NSSTAT.RPT

File NSSTAT.RPT contains program header, disclaimer, title of current application, program execution trace, and program error messages. An example of this file is given in Section 10.2.18 "Output file NSSTAT.RPT".

6.3.2 Evaluation Files

6.3.2.1 File NETWT.EVL

File NETWT.EVL contains the statistics of network and channel link properties of the raster and binary drainage network representations. An example of this file is given in Section 10.2.19 "Output file NETWT.EVL".

6.3.2.2 File SBCTT.EVL

File SBCTT.EVL contains the statistics of subcatchment properties of the raster and binary drainage network representations. An example of this file is given in Section 10.2.20 "Output file SBCTT.EVL".

6.3.3 Unformatted Parameter Files

6.3.3.1 File OUTCNT.UNF

Same as Section 6.1.1 "File OUTCNT.UNF".

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7. PROGRAM PARAM

Program PARAM (subcatchment PARAMeterization) processes subcatchment parameters and rasters produced by programs DEDNM and RASPRO to derive subcatchment properties.

This section describes the input files, input parameters, user options, output files and operation of program PARAM.

7.1 Input Files

Program PARAM requires 3 unformatted input files: OUTCNT.UNF, OUTCHA.UNF, and OUTCAT.UNF and 11 unformatted raster files: SUBWTA.OUT, DISCHA.OUT, FLOPAT.OUT, FVSLOP.OUT, RELIEF.OUT, NTWINT.FIL, HSLOPE.OUT, TSLOPE.OUT, FLOVEC.OUT, NETW.OUT, ELDCHA.OUT, which are produced by programs DEDNM and RASPRO. All input files must reside in the same directory as the executable TOPAZ programs. The content of the input files for program PARAM is described in this section. The input files are listed in Section 8, Table 7.1 "List of input files for program PARAM", and the general organization of the I/O is shown in Section 9, Fig. 7.1 "General input/output organization of program PARAM". Specifications regarding all input files are given in Appendix I, Section 10.1 "Input/Output File Specifications".

7.1.1 File PARAM.INP

File RASFOR.INP is the parameter file that contains the subcatchment parameterization user output options. The options are listed and described in Section 8, Table 7.2 "List of user options for program PARAM". They are given in the same order in which they appear in file PARAM.INP and their names are those used in program PARAM. The names have little relevance for the user, but are given here for lack of a better designation or nomenclature. An example of input file PARAM.INP is given in Section 10.2.21 "Input file PARAM.INP".

7.1.2 File OUTCNT.UNF

For general information about file OUTCNT.UNF see Section 2.3.4.1 "File OUTCNT.UNF".

7.1.3 File OUTCHA.UNF

File OUTCHA.UNF is the unformatted parameter file which contains channel link properties. This file is produced by program DEDNM and its content is similar to the data described in Section 2.3.2.1 "File NETW.TAB".

7.1.4 File OUTCAT.UNF

File OUTCAT.UNF is the unformatted parameter file which contains subcatchment properties. This file is produced by program DEDNM and its content is similar to the data described in Section 2.3.2.2 "File SBCT.TAB".

7.1.5 Unformatted Raster Files

Ten unformatted raster files with extension .OUT and one unformatted program file with extension .FIL are needed for input to program PARAM. They are files SUBWTA.OUT, DISCHA.OUT, FLOPAT.OUT, FVSLOP.OUT, RELIEF.OUT, HSLOPE.OUT, TSLOPE.OUT, FLOVEC.OUT, NETW.OUT, ELDCHA.OUT and NTWINT.FIL. These raster files must have been generated by programs DEDNM and RASPRO prior to applying program PARAM. For general information on Unformatted Raster Files see Section 1.3.5 "Unformatted Raster Files". The content of each .OUT file is described in Section 2.3.3 "Unformatted Raster Files" and in Section 3.3.2 "Unformatted Program Files".

7.2 Program Execution

Program PARAM can be used after programs DEDNM and RASPRO have been applied, and the .UNF , .OUT and .FIL files from programs DEDNM and RASPRO are produced. All input files must reside in the same directory as the executable TOPAZ programs, and all output files are written to this directory. During processing, run-time messages appear on the screen to inform the user on the progress of the subcatchment parameterization. Upon completion of program PARAM, the output files of subcatchment properties are available to the user.

7.3 Output Files

Program PARAM produces three types of output files: report files, tabular data files and unformatted parameter files. Report files are sequential, formatted, ASCII files that contain program execution information. Tabular data files are sequential formatted, ASCII files that contain the parameterized subcatchment data. Report and tabular files are coded files written for the user to review the program execution steps and the computed values, respectively. Unformatted parameter files are produced for data interface to other TOPAZ programs. The user should not access unformatted files. All output files are written to the directory in which the executable TOPAZ programs reside. The content of the output files is described in this section. The output files are listed in Section 8, Table 7.2 "List of Output files of program PARAM", and the general organization of the I/O is given in Section 9, Fig. 7.1 "General input/output organization of program PARAM". The specifications of all output files are given in Appendix I, Section 10.1 "Input/Output File Specifications".

7.3.1 Report Files

7.3.1.1 File PARAM.RPT

File PARAM.RPT contains program header, disclaimer, title of current application, program execution trace, and program error messages. An example of this file is given in Section 10.2.22 "Output file PARAM.RPT".

7.3.2 Tabular data Files

7.3.2.1 File SBCTA.TAB

File SBCTA.TAB contains subcatchment area calculation alternatives. Node Strahler order and node index value corresponding to the subcatchment are included in the file. An example of this file is given in Section 10.2.23 "Output file SBCTA.TAB".

7.3.2.2 File SBCTL.TAB

File SBCTL.TAB contains subcatchment length calculation alternatives. Node Strahler order and node index value corresponding to the subcatchment are included in the file. An example of this file is given in Section 10.2.24 "Output file SBCTL.TAB".

7.3.2.3 File SBCTS.TAB

File SBCTS.TAB contains subcatchment slope calculation alternatives. Node Strahler order and node index value corresponding to the subcatchment are included in the file. An example of this file is given in Section 10.2.25 "Output file SBCTS.TAB".

7.3.3 Unformatted Parameter Files

7.3.3.1 File OUTCNT.UNF

Same as Section 7.1.2 "File OUTCNT.UNF".

7.3.3.2 File OUTCAT.UNF

Same as Section 7.1.4 "File OUTCAT.UNF".

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8. TABLES

Table 2.1 List of input files for program DEDNM.

DNMCNT.INP	File containing parameters describing the DEM raster characteristics, the DEM processing options with corresponding parameters, and the user output options.
DEDNM.INP	File containing the Digital Elevation Model (DEM).
NTGCOD.INP	File containing the codes defining the spatial variability of geophysical landscape properties.

Table 2.2 Definition of variables in file DNMCNT.INP.

*** General information

TITLE1 First title line for current application of TOPAZ.
TITLE2 Second title line for current application of TOPAZ.
TITLE3 Third title line for current application of TOPAZ.

Maximum of 79 characters per title record, starting in column 1.
The titles are printed out at the beginning the each report file.

*** DEM raster characteristics

IUTMZ UTM zone number of the UTM projection containing the upper left corner of the input DEM. Integer value between 1 and 60; value of 0 for unknown.

IUTMX UTM Easting coordinate in meters of the upper left corner of the input DEM. Positive integer value not exceeding 1'000'000 meters; value of 0 for unknown.

IUTMY UTM Northing coordinate in meters of the upper left corner of the input DEM. Positive integer value not exceeding 10'000'000 meters; value of 0 for unknown.

NROWI Number of rows in the input DEM. The value must be an integer greater than 1 and not to exceed the limits of the raster array size given by the parameter variable IRS, unless a DEM size reduction through aggregation or resampling is selected. For this condition, NROWI may exceed the value of the parameter variable IRS by a factor equal to the DEM reduction given by NNOD below.

NCOLI Number of columns in the input DEM. The value must be an integer greater than 1 and not to exceed the limits of the raster array size given by the parameter variable IAS. The value also cannot exceed the parameter value ICS unless a DEM size reduction through aggregation or resampling is selected. For this condition NCOLI may exceed the value of the parameter variable ICS by a factor equal to the DEM reduction given by NNOD below.

ELMIN Minimum recognized elevation value in meters with one decimal value precision. Additional precision in the elevation value is rounded by the program to the nearest decimeter. The smallest value accepted by the program is 1.0 meter; the largest value is 9999.0 meters. Also, the value of ELMIN must be smaller than the value of ELMAX.

ELMAX Maximum recognized elevation value in meters with one decimal value precision. Additional precision in the elevation value is rounded by the program to the nearest decimeter. The smallest value accepted by the program is 1.0 meter; the largest value is 9999.0 meters. Also, the value of ELMAX must be larger than the value of ELMIN.

VUND Value defining indeterminate elevation (unknown elevation). This can be a positive

or negative value, including zero. It must however be outside of the range of recognized elevation value as defined by ELMAX and ELMIN in meters.

TVLPIX Length of the side of a cell in the input DEM in meters. Cells are square and only one length need to be specified. The length is that of the unaggregated or unresampled DEM. The value must be greater than 1.0 meter.

IGOR Orientation of the DEM input raster. The orientation of the raster is given by the vector along the left edge of the DEM raster and pointing toward the upper left corner of the DEM. Orientation values are between 0 and 359 degrees, where 0 is for north, 90 for east, 180 for south, and 270 for west.

IDR Row number defining the approximate location of the outlet of the drainage area (watershed outlet) for which the network and the segmentation is to be generated. The entered row number can subsequently be revised interactively by viewing the generated drainage pattern to coincide with the exact location of the outlet. The value must be greater than 1 and smaller than the previously entered number of rows in the DEM (NROWI).

IDC Column number defining the approximate location of the outlet of the drainage area (watershed outlet) for which the network and the segmentation is to be generated. The entered column number can subsequently be revised interactively by viewing the generated drainage pattern to coincide with the exact location of the outlet. The value must be greater than 1 and smaller than the previously entered number of columns in the DEM (NCOLI).

*** DEM processing options and processing parameters

IOPT1 Input DEM reduction option:
0 = use the input DEM raster as is.
1 = aggregate the input DEM raster.
2 = resample the input DEM raster.

NNOD Number of cells in the horizontal and vertical that are to be aggregated or resampled into one value (reduction factor); alternative definition: size of a square window in number of cells per side that is to be aggregated or resampled. Enter 2 for a 2 by 2 cell aggregation or resampling window; enter 3 for a 3 by 3 cell aggregation or resampling window. The maximum number of cells that can be entered for aggregation or resampling is 20.

IOPT4 Option to smooth the initial, aggregated or resampled DEM data. Smoothing is performed on a moving 3 by 3 cell window with different weights assigned to the cells within the window.
0 = for smoothing not to be performed;
1 = for smoothing to be performed.

NTIM Number of consecutive smoothing passes to be performed if the smoothing option was selected. Assign a value of 1 if the smoothing option was not selected. The smallest value that can be entered is 1 and the largest is 100.

- IW1 Weight assigned to the center cell of the 3 by 3 smoothing window. The value for the weight can be between 0 and 100, however, all three weights IW1, IW2 and IW3 cannot be simultaneously equal to 0. Assign a value of 1 if the smoothing option was not selected.
- IW2 Weight assigned to the cross cells of the 3 by 3 smoothing window (cells up, down, right and left of the center cell). The value for the weight can be between 0 and 100, however, all three weights IW1, IW2 and IW3 cannot be simultaneously equal to 0. Assign a value of 1 if the smoothing option was not selected.
- IW3 Weight assigned to the diagonal cells of the 3 by 3 smoothing window (cells located off the diagonal corners of the center cell). The value for the weight can be between 0 and 100, however, all three weights IW1, IW2 and IW3 cannot be simultaneously equal to 0. Assign a value of 1 if the smoothing option was not selected.
- IOPT2 Option to analyze and breach the depression outlets when the latter are narrow.
 0 = do not perform the analysis and lowering of outlets;
 1 = perform the analysis and lower those outlets that are 1 cell wide;
 2 = perform the analysis and lower those outlets that are 2 or less cells wide.
- IOPT3 Option to perform a partial processing of program DEDNM as opposed to a full run:
 0 = perform a full run of program DEDNM;
 1 = perform only the aggregation/resampling, smoothing, depression analysis and filling, and relief imposition on the DEM.
 2 = perform DEM elevation pre-processing and full network generation (in addition to option 1 this include the generation of flow vectors, flow paths, upstream area and the network for the entire DEM.)
- IOPT5 Option to use the more than 1 CSA and MSCL parameter value to simulate the effect of spatially variable geophysical landscape properties on the generated drainage network and subcatchment properties. The CSA and MSCL parameters are defined below under variable name ARMIN and DISMIN, respectively.
 0 = use of a single CSA and MSCL parameter value (file NTGCOD.INP is not needed);
 1 = use up to 5 different CSA and MSCL parameters (file NTGCOD.INP is required).
- ARMIN Critical source area (CSA) in hectares which is defined as the drainage area at the bottom of which a first order channel begins. The value for the critical source area must be larger than 0.001 hectares or the area of a single cell after aggregation or resampling if such option was selected by the user. The larger of the two values defines the minimum critical source area. Up to 5 different values can be entered for the ARMIN (CSA) variable to simulate the effect of spatially variable geophysical landscape properties on the generation of the drainage network and subcatchment subdivision. A smaller value of the CSA variable results in the generation on a high drainage density than a larger CSA value. The spatial distribution of the 5 CSA values over the DEM is given by file NTGCOD.INP.

DISMIN Threshold first order channel length in meters for a source channel (MSCL := maximum source channel length) to be considered as a channel and not a spurious drainage feature. The value for MSCL must be greater than 1.0 meter or the side length of a cell after aggregation or resampling if such option was selected by the user. The larger of the two values defines the minimum value for the MSCL. Up to 5 different values can be entered for the DISMIN (MSCL) variable to simulate the effect of spatially variable geophysical landscape properties on the generation of the drainage network and subcatchment subdivision. A smaller value of the MSCL variable results in the generation of shorter source channels than a larger MSCL value. The spatial distribution of the 5 CSA values over the DEM is given by file NTGCOD.INP.

IOPT10 Option to perform a calibration run (for a calibration run DEM pre-processing is not repeated, instead the data is read from the previous run of program DEDNM):

- 0 = perform a full run of program DEDNM;
- 1 = perform a calibration run with new ARMIN (CSA) and DISMIN (MSCL) parameter values;
- 2 = perform a calibration run with a new watershed outlet location;
- 3 = perform a calibration run with a new input raster file NTGCOD.INP.

IOPT11 Option to check the generated rasters for errors, completeness and consistency.

- 0 = do not perform the checking;
- 1 = perform the checking.

*** User output options

IOPT13 Option to write the program capabilities and limitations to the report file DEDNM.RPT.

- 0 = do not write information to output file;
- 1 = do write information to output file.

IOPT12 Option to write the program input and processing option data to the report file DEDNM.RPT.

- 0 = do not write information to output file;
- 1 = do write information to output file.

IOPT16 Option to write the drainage network report file NETW.TAB. The drainage network information includes: index, coordinates, elevation, length, upstream drainage area, upstream tributary inflows and topology for each channel link.

- 0 = do not write information to output file;
- 1 = do write information to output file.

IOPT15 Option to write the subcatchment report file SBCT.TAB. The subcatchment information includes: index and direct drainage areas for each subcatchment (right, left and upstream (source) inflow into each channel link).

- 0 = do not write information to output file;
 - 1 = do write information to output file.
-

Table 2.3 List of output files from program DEDNM.

The report and tabular data files are sequential, formatted ASCII files that are directly accessible to the user.

DEDNM.RPT Program execution report file.
NETW.TAB Table of channel link properties.
SBCT.TAB Table of subcatchment properties.
CATWIN.TAB Subcatchment window definition.

The unformatted raster output files are unformatted files that are not accessible to the user; to be user accessible they must be processed by program RASFOR.

INELEV.OUT Raster of initial DEM elevations; either original, aggregated or resampled input DEM elevation values.
SMOOTH.OUT Raster of optionally smoothed DEM elevations, after the input DEM has been optionally aggregated or resampled.
FILDEP.OUT Raster of depression filled DEM elevations, after the input DEM has been optionally aggregated or resampled, and/or optionally smoothed.
RELIEF.OUT Raster of relief corrected DEM elevations, after the input DEM has been optionally aggregated or resampled, optionally smoothed, and depression filled.
FLOVEC.OUT Raster of drainage directions.
UPAREA.OUT Raster of upstream drainage area.
NTGCOD.OUT Raster of codes for the CSA and MSCL parameters.
NETFUL.OUT Raster of the drainage network for the full DEM coverage.
BOUND.OUT Raster of the watershed definition.
FLOPAT.OUT Raster of definition of beginning and ending of flow paths.
NETW.OUT Raster of the drainage network within the watershed boundary.
INDTAR.OUT Location of indeterminate areas.
SUBWTA.OUT Raster of the subcatchment definitions.

The unformatted parameter output files are unformatted files that are not accessible to the user.

OUTCNT.UNF General TOPAZ parameters.
OUTCHA.UNF Channel link properties.
OUTCAT.UNF Subcatchment properties.

The unformatted program files are unformatted raster files that are not accessible to the user

NTWINT.FIL Drainage network identification.

Table 3.1 List of input files for program RASPRO

RASPRO.INP	File reformatting options. User created sequential formatted file.
OUTCNT.UNF	General TOPAZ parameters. TOPAZ generated sequential unformatted file.
FILDEP.OUT	Raster of depression filled DEM elevations, after the input DEM has been optionally aggregated or resampled, and/or optionally smoothed.
INELEV.OUT	Raster of initial DEM elevations; either original, aggregated or resampled input DEM elevation values.
RELIEF.OUT	Raster of relief corrected DEM elevations, after the input DEM has been optionally aggregated or resampled, optionally smoothed, and depression filled.
FLOVEC.OUT	Raster of drainage directions.
UPAREA.OUT	Raster of upstream drainage area.
BOUND.OUT	Raster of the watershed definition.
FLOPAT.OUT	Raster of definition of beginning and ending of flow paths.
NETW.OUT	Raster of the drainage network within the watershed boundary.
INDTAR.OUT	Location of indeterminate areas.
SUBWTA.OUT	Raster of the subcatchment definitions.

Notes:

All input raster files with extension .OUT are unformatted files and should not be accessed by the user.

Additional file content information is given in Section 2.3.3 "Unformatted Raster Files".

Table 3.2 List of user options for program RASPRO.

Option Content

IOPT69:	Option to rewrite user options to the report file.
IOPT70:	Option to compute the elevation data for depressions and flat areas; and bands of equal elevations.
NCLASS:	Number of user entered elevation classes (Maximum 100).
IOPT71:	Option to compute the local slope and aspect of the grid cells.
IOPT72:	Option to compute the raster enhancements (network widening, subcatchment boundaries and subcatchment aggregation).
IOPT73:	Option to compute flow path distances (distance to watershed outlet, distance to next downstream channel).

Table 3.3 List of output files from program RASPRO.

RASPRO.RPT	Program execution report file; sequential formatted file.
DEPFLT.OUT	Location and extent of depressions and flat areas.
ELVCLA.OUT	Reclassified DEM elevations into a user specified number of elevation classes.
FVASPE.OUT	Aspect of the flow vector at each raster cell.
FVSLOPE.OUT	Slope of the flow vector at each raster cell.
HSLOPE.OUT	Hydraulic effective slope at each raster cell.
TSLOPE.OUT	Terrain slope at each cell as computed from a surface interpolation.
TASPEC.OUT	Terrain aspect at each cell as computed from a surface interpolation.
NETWE.OUT	Enhanced (widened) drainage network for display.
SUBBDA.OUT	Subcatchment boundaries; for display only.
SUBWTB.OUT	Aggregated subcatchments for each channel link.
SUBBDB.OUT	Aggregated subcatchment boundaries; for display only.
ELDCHA.OUT	Elevation drop from each cell to the next downstream channel.
ELDOUT.OUT	Elevation drop from each cell to the watershed outlet.
DISCHA.OUT	Distance from each cell to the next downstream channel.
DISOUT.OUT	Distance from each cell to the watershed outlet.
OUTCNT.UNF	General TOPAZ parameters; TOPAZ generated sequential unformatted file.

Table 4.1 List of input files for program RASFOR.

RASFOR.INP	File reformatting options. User created sequential formatted file.
OUTCNT.UNF	General TOPAZ parameters. TOPAZ generated sequential unformatted file.

All .OUT files listed below are unformatted sequential raster files generated by programs DEDNM or RASPRO.

File name Program of Contents

	origin	
INELEV.OUT	DEDNM	Elevation values
SMOOTH.OUT	DEDNM	Elevation values
FILDEP.OUT	DEDNM	Elevation values
RELIEF.OUT	DEDNM	Elevation values
FLOVEC.OUT	DEDNM	Flow vectors
UPAREA.OUT	DEDNM	Upstream drainage areas
NTGCOD.OUT	DEDNM	CSA/MSCL codes
NETFUL.OUT	DEDNM	Network over entire DEM
BOUND.OUT	DEDNM	Watershed boundary
FLOPAT.OUT	DEDNM	Flow path definition
NETW.OUT	DEDNM	Network within watershed boundary
INDTAR.OUT	DEDNM	Location of indeterminate areas
SUBWTA.OUT	DEDNM	Subcatchment indexes
DEPFLT.OUT	RASPRO	Depressions
ELVCLA.OUT	RASPRO	Bands of equal elevation
FVASPE.OUT	RASPRO	Flow-vector aspect
FVSLOP.OUT	RASPRO	Flow-vector slope
HSLOPE.OUT	RASPRO	Hydraulic slope
TSLOPE.OUT	RASPRO	Terrain slope
TASPEC.OUT	RASPRO	Terrain aspect
NETWE.OUT	RASPRO	Enhanced network in watershed boundary
SUBBDA.OUT	RASPRO	Subcatchment boundaries
SUBWTB.OUT	RASPRO	Aggregated subcatchments
SUBBDB.OUT	RASPRO	Aggregated subcatchment boundaries
ELDCHA.OUT	RASPRO	Elevation drop from cell to channel
ELDOUT.OUT	RASPRO	Elevation drop from cell to outlet
DISCHA.OUT	RASPRO	Distance from cell to channel
DISOUT.OUT	RASPRO	Distance form cell to outlet

Notes:

All input raster files with extension .OUT are unformatted files and are not accessible to the user. Additional file content information is given in Section 4.1.3 "Unformatted Raster Files" and in Section 2.3.3 "Unformatted Raster Files", and in Section 3.3.3 "Unformatted Raster Files".

Table 4.2 List of user options for program RASFOR.

ICHOIC	User specified reformatting option.
IOPT29:	Option to re-write input parameters.
IOPT30:	Option to reformat raster file INELEV.OUT.
IOPT31:	Option to reformat raster file SMOOTH.OUT.
IOPT32:	Option to reformat raster file FILDEP.OUT.
IOPT33:	Option to reformat raster file RELIEF.OUT.
IOPT34:	Option to reformat raster file FLOVEC.OUT.
IOPT35:	Option to reformat raster file UPAREA.OUT.
IOPT36:	Option to reformat raster file BOUND.OUT.
IOPT37:	Option to reformat raster file NETW.OUT.
IOPT38:	Option to reformat raster file SUBWTA.OUT.
IOPT39:	Option to reformat raster file NETFUL.OUT.
IOPT40:	Option to reformat raster file NTGCOD.OUT.
IOPT41:	Option to reformat raster file FLOPAT.OUT.
IOPT42:	Option to reformat raster file INDTAR.OUT.
IOPT45:	Option to reformat raster file DEPFLT.OUT.
IOPT46:	Option to reformat raster file ELVCLA.OUT.
IOPT47:	Option to reformat raster file FVASPE.OUT.
IOPT48:	Option to reformat raster file FVSLOP.OUT.
IOPT49:	Option to reformat raster file HSLOPE.OUT.
IOPT50:	Option to reformat raster file TSLOPE.OUT.
IOPT51:	Option to reformat raster file TASPEC.OUT.
IOPT52:	Option to reformat raster file NETWE.OUT.
IOPT53:	Option to reformat raster file SUBBDA.OUT.
IOPT54:	Option to reformat raster file SUBWTB.OUT.
IOPT55:	Option to reformat raster file SUBBDB.OUT.
IOPT56:	Option to reformat raster file DISCHA.OUT.
IOPT57:	Option to reformat raster file DISOUT.OUT.
IOPT58:	Option to reformat raster file ELDCHA.OUT.
IOPT59:	Option to reformat raster file ELDOUT.OUT.

Table 4.3 List of output files from program RASFOR.

 RASFOR.RPT Program execution report file; sequential formatted ASCII file.
 OUTCNT.UNF General TOPAZ parameters; TOPAZ generated sequential unformatted file.

All files listed below are produced with extensions .DAT, .ARC, or .IMG and .DOC, depending on the user selected reformatting option. The .DAT files are for raster reformatting options ASCII 1-D and ASCII 2-D; the .ARC files are for the raster reformatting option ARCTOOLS; the .IMG and .DOC files are for the raster reformatting option IDRISI. All files are sequential formatted ASCII files. The content of the files is the same as for the files listed in Section 8, Table 4.1 "List of input files".

Note: the "data type" below refers only to the .DAT, .ARC and .IMG files.

File name	Data type
INELEV	Real (1)
SMOOTH	Real (1)
FILDEP	Real (1)
RELIEF	Real (5)
FLOVEC	Integer
UPAREA	Integer
NTGCOD	Integer
NETFUL	Integer
BOUND	Integer
FLOPAT	Integer
NETW	Integer
SUBWTA	Integer
DEPFLT	Integer
ELVCLA	Real (1)
FVASPE	Integer
FVSLOP	Real (5)
HSLOPE	Real (5)
TSLOPE	Real (5)
TASPEC	Integer
NETWE	Integer
SUBBDA	Integer
SUBWTB	Integer
SUBBDB	Integer
ELDCHA	Real (1)
ELDOUT	Real (1)
DISCHA	Integer
DISOUT	Integer

Notes:

Value in brackets after the data type indicates the precision of the values in number of digits after the decimal point.

Additional information on the file content is given in Section 2.3.3 "Unformatted Raster Files" and in Section 8, Table 2.3 "List of output files from program DEDNM", and in Section 3.3.3 "Unformatted Raster Files" and in Section 8, Table 3.3 "List of output files from program RASPRO".

If reformatting is done in IDRISI format (.IMG) INTEGER files exceeding 32766 will be converted to REAL.

Table 5.1 List of input files for program RASBIN.

OUTCNT.UNF	General TOPAZ parameters. TOPAZ generated sequential unformatted file.
OUTCHA.UNF	Channel link properties of the raster drainage network. Sequential unformatted file generated by program DEDNM.
OUTCAT.UNF	Subcatchment properties of the raster drainage network. Sequential unformatted file generated by program DEDNM.

Table 5.2 List of output files from program RASBIN.

RASBIN.RPT	Program execution report file; sequential formatted file.
NETWB.TAB	Channel link properties for the binary drainage network. Tabular ASCII data.
SBCTB.TAB	Subcatchment properties for the binary drainage network. Tabular ASCII data.
OUTCNT.UNF	General TOPAZ parameters; TOPAZ generated sequential unformatted file.
RBNET.UNF	Channel link properties of the binary drainage network. Sequential unformatted file.
RBSBC.UNF	Subcatchment properties of the binary drainage network. Sequential unformatted file.
RBKEY.UNF	Raster to Binary transformation key. Sequential unformatted file.

Table 6.1 List of input files for program NSSTAT.

OUTCNT.UNF	General TOPAZ parameters. TOPAZ generated sequential unformatted file.
OUTCHA.UNF	Channel link properties of the raster drainage network. Sequential unformatted file generated by program DEDNM.
OUTCAT.UNF	Subcatchment properties of the raster drainage network. Sequential unformatted file generated by program DEDNM.
RBNET.UNF	Channel link properties of the binary drainage network. Sequential unformatted file.
RBSBC.UNF	Subcatchment properties of the binary drainage network. Sequential unformatted file.
RBKEY.UNF	Raster to Binary transformation key. Sequential unformatted file.

Table 6.2 List of output files for program NSSTAT.

NSSTAT.RPT	Program execution report file; sequential formatted file.
OUTCNT.UNF	General TOPAZ parameters; TOPAZ generated sequential unformatted file.
NETWT.EVL	Statistics of the network and channel properties for the raster and binary drainage network representations. ASCII formatted file.
SBCTT.EVL	Statistics of the subcatchment properties for the raster and binary drainage network representations. ASCII formatted file.

Table 7.1 List of input files for program PARAM.

PARAM.INP	Subcatchment parameter calculation options. User created sequential formatted file.
OUTCNT.UNF	General TOPAZ parameters. TOPAZ generated sequential unformatted file.
OUTCAT.UNF	Subcatchment properties of the raster drainage network. TOPAZ generated sequential unformatted file.
FVSLOPE.OUT	Slope of the flow vector at each raster cell.
HSLOPE.OUT	Hydraulic effective slope at each raster cell.
TSLOPE.OUT	Terrain slope at each cell as computed from a surface interpolation.
RELIEF.OUT	Raster of relief corrected DEM elevations, after the input DEM has been optionally aggregated or resampled, optionally smoothed, and depression filled.
FLOVEC.OUT	Raster of drainage directions.
FLOPAT.OUT	Raster of definition of beginning and ending of flow paths.
NETW.OUT	Raster of the drainage network within the watershed boundary.
SUBWTA.OUT	Raster of the subcatchment definitions.
ELDCHA.OUT	Elevation drop in meters from each cell to the first downstream channel it flows into.
DISCHA.OUT	Distance from each cell to the first downstream channel it flows into.
NTWINT.FIL	Drainage network identification.

Notes:

All input raster files with extension .OUT are unformatted files and should not be accessed by the user.

Additional file content information is given in Section 2.3.3 and Section 3.3.2 "Unformatted Raster Files".

Table 7.2 List of output files from program PARAM.

PARAM.RPT	Program execution report file; sequential formatted file.
OUTCNT.UNF	General TOPAZ parameters; TOPAZ generated sequential unformatted file.
SBCTA.TAB	Subcatchment area calculation alternatives.
SBCTL.TAB	Subcatchment length calculation alternatives.
SBCTS.TAB	Subcatchment slope calculation alternatives.

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9. FIGURES

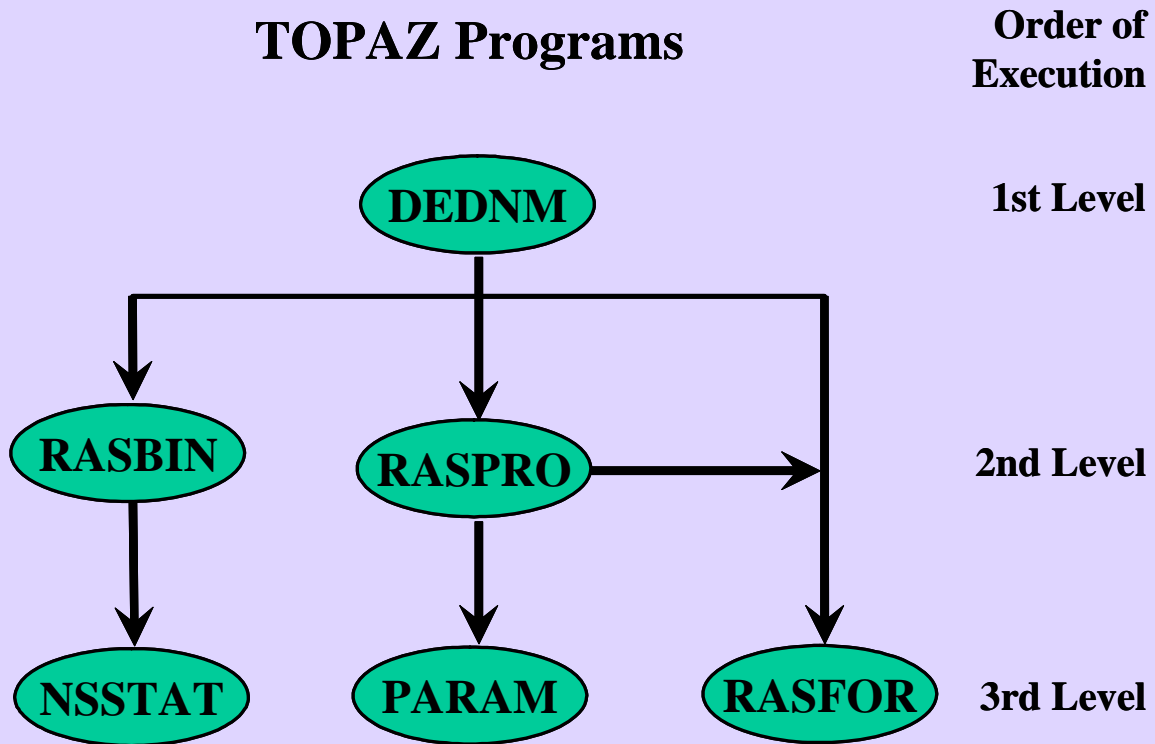


Figure 1.1 Program interdependence and application order.

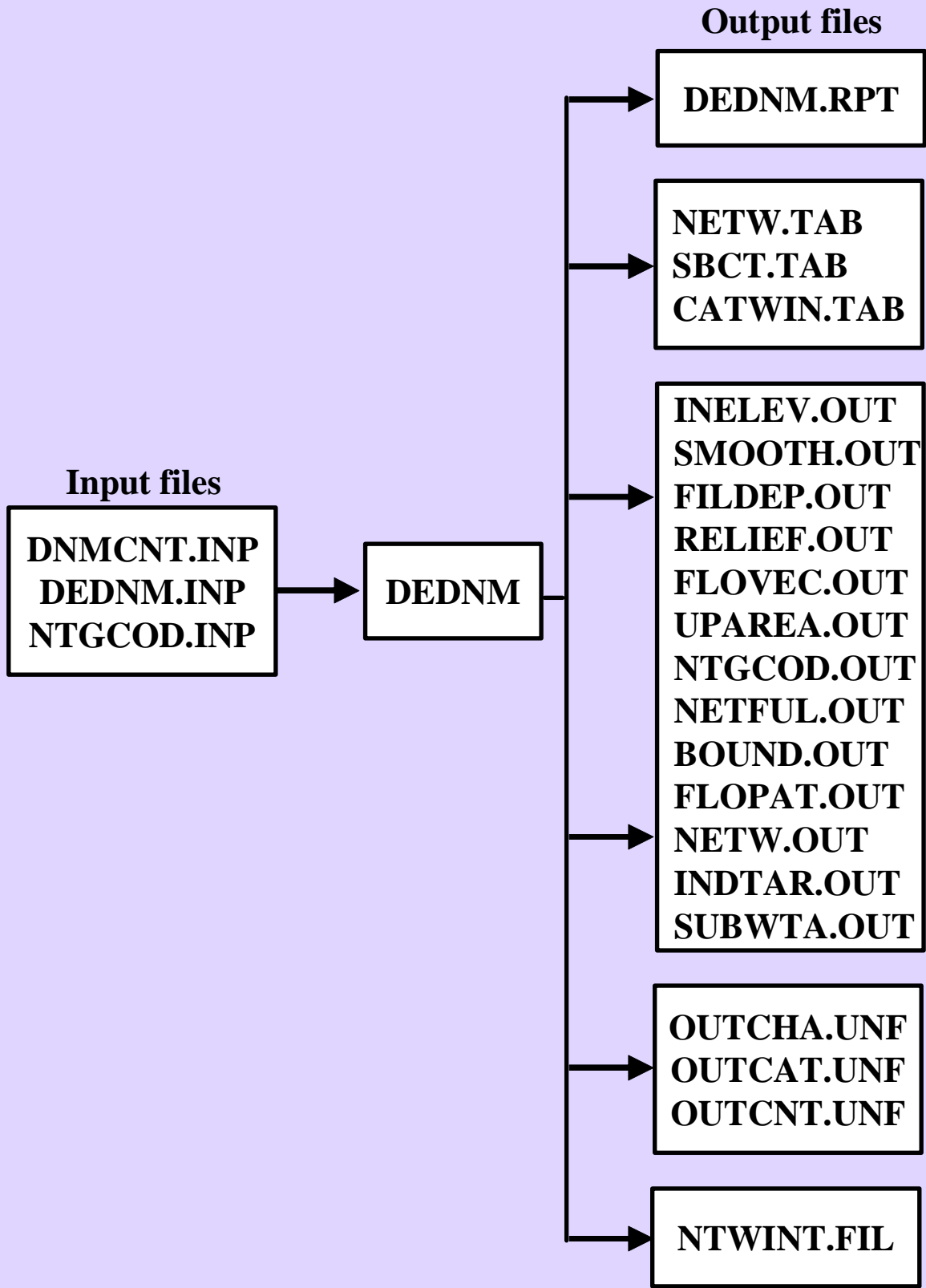


Figure 2.1 General input/output organization of program DEDNM.

	a) Example DEM raster			b) Input file DEDNM.INP		
	Col	Col	Col			
	1	2	3		1.1	
Row 1	1.1	1.2	1.3		1.2	
Row 2	2.1	2.2	2.3		1.3	
Row 3	3.1	3.2	3.3		2.1	
					2.2	
					2.3	
					3.1	
					3.2	
					3.3	

Figure 2.2 Example of the data sequence in input file DEDNM.INP

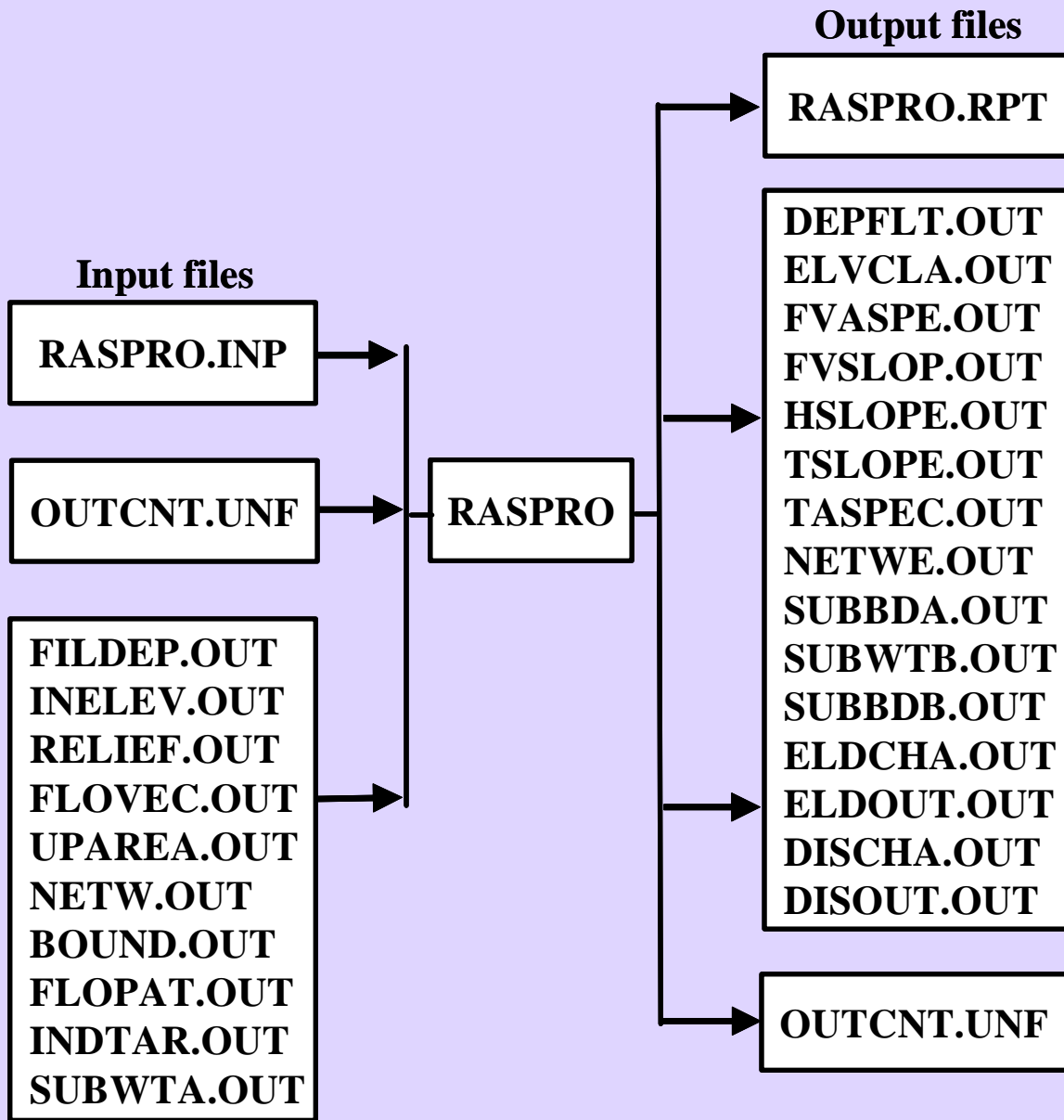


Figure 3.1 General input/output organization of program RASPRO.

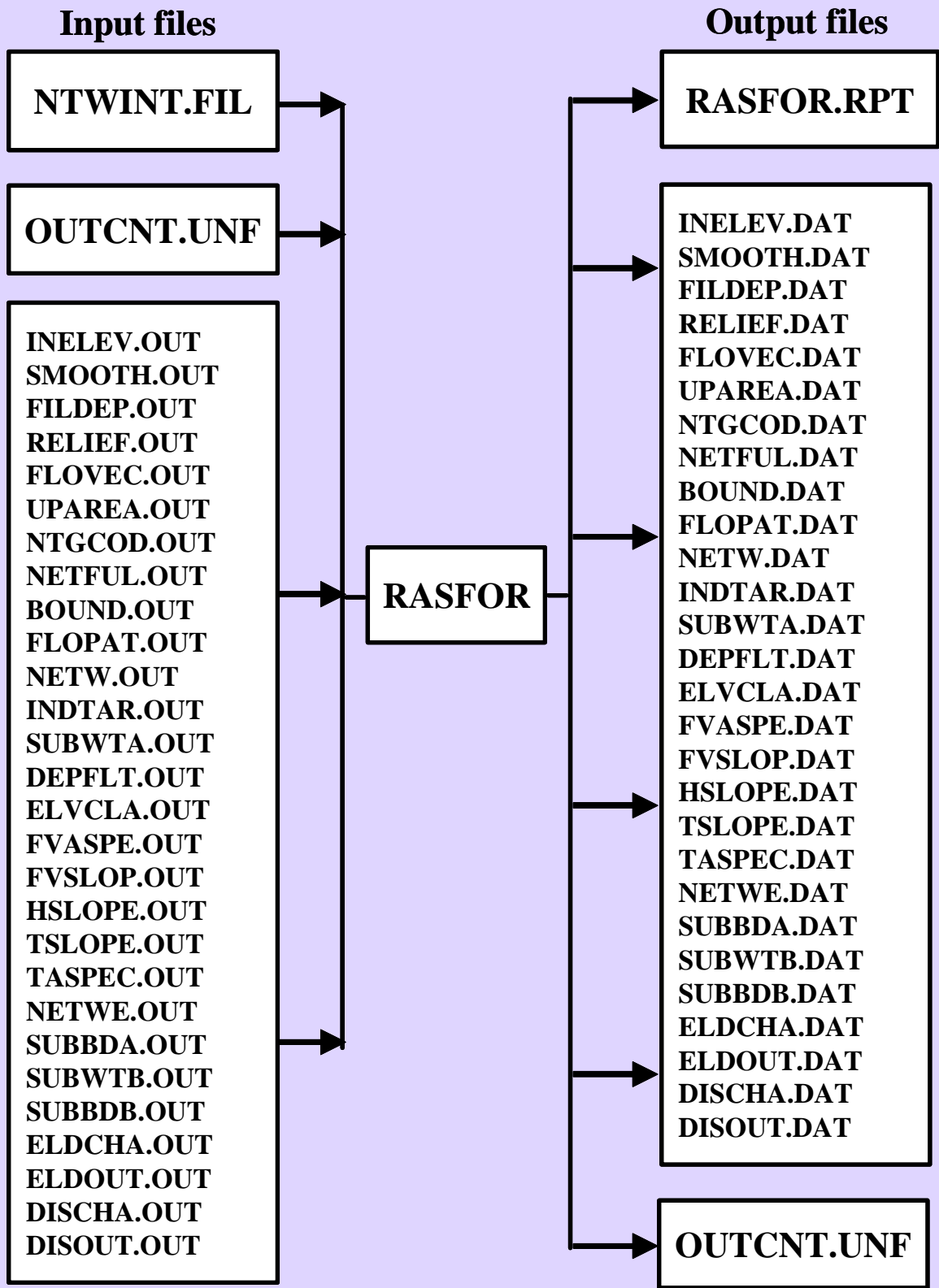


Figure 4.1 General input/output organization of program RASFOR.

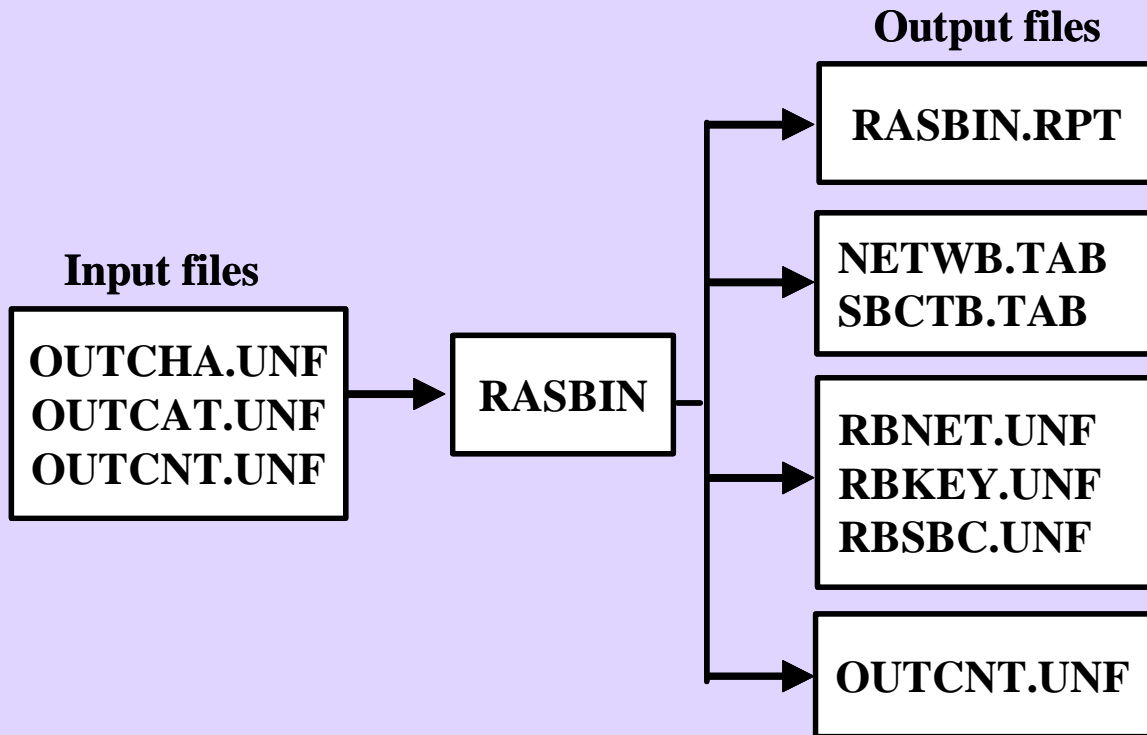


Figure 5.1 General input/output organization of program RASBIN

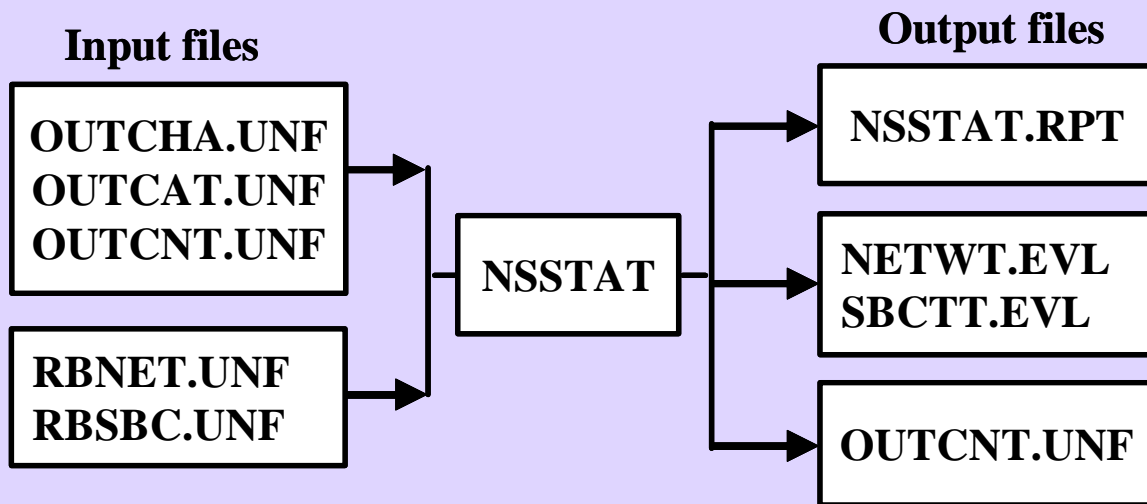


Figure 6.1 General input/output organization of program NSSTAT

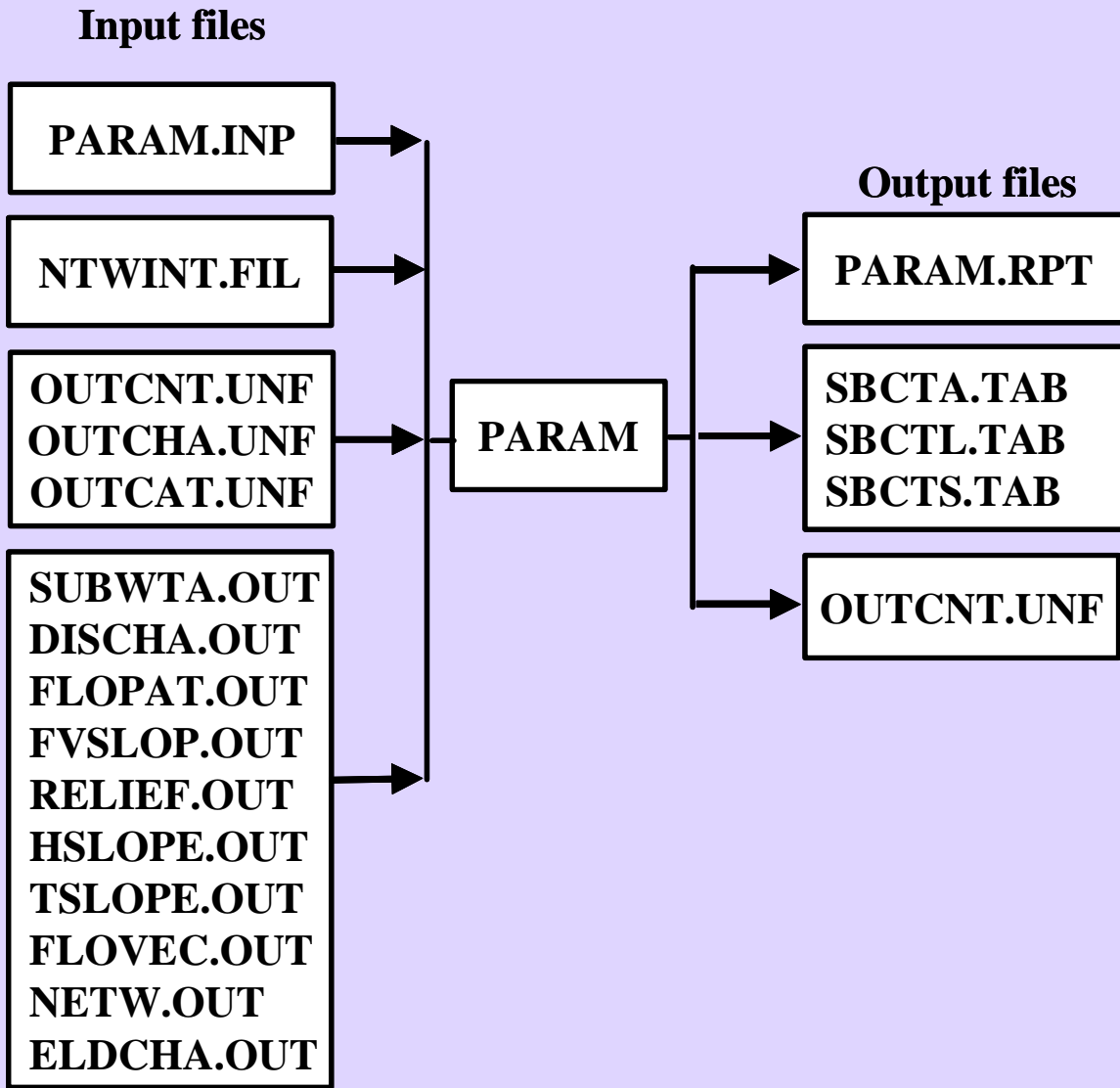


Figure 7.1 General Input/Output organization of Program PARAM.

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10. APPENDICES

10.1 APPENDIX I. Input/Output File Specifications

10.1.1 File DNMCNT.INP

FILE NAME: DNMCNT.INP
CONTENTS: DEM parameters, network and subwatershed generation parameters, and user options.
INPUT TO: Program DEDNM.
OUTPUT FROM: n/a.
FILE TYPE: Sequential, formatted, ASCII .
DATA TYPE: Mixed (character, real, and integer).
FILE FORMAT: For format see file DNMCNT.INP (also Sect. 10.2.1, Appendix II)
DATA FORMAT: Free format read; also see file DNMCNT.INP
COMMENTS: none.

10.1.2 File DEDNM.INP

FILE NAME: DEDNM.INP
CONTENTS: DEM elevation values.
INPUT TO: Program DEDNM.
OUTPUT FROM: n/a.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Real, with one decimal point after the floating point; additional digits are rounded to the nearest decimeter.
FILE FORMAT: One ASCII value per record, ordered column first, row second. Example:

```
Row 1 - column 1 through NCOL;  
Row 2 - column 1 through NCOL; etc.  
DO 2 K=1,NROW  
DO 1 L=1,NCOL  
VALUE(K,L)  
1 CONTINUE  
2 CONTINUE
```

DATA FORMAT: Free format read.
COMMENTS: DEM elevations must be values greater than 1.0 and smaller than 9999.0 meters.

10.1.3 File NTGCOD.INP

FILE NAME: NTGCOD.INP
CONTENTS: CSA and MSCL codes.
INPUT TO: Program DEDNM.
OUTPUT FROM: n/a.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Integer.
FILE FORMAT: One ASCII value per record, ordered column first, row second. Example:

```
Row 1 - column 1 through NCOL;  
Row 2 - column 1 through NCOL; etc.  
DO 2 K=1,NROW  
DO 1 L=1,NCOL  
VALUE(K,L)  
1 CONTINUE  
2 CONTINUE
```

DATA FORMAT: Free format read.
COMMENTS: A code value (0-5) must exist for each corresponding DEM elevation value.

10.1.4 File DEDNM.RPT

FILE NAME: DEDNM.RPT
CONTENTS: Text file of program execution report: Program header, disclaimer, capabilities and limitations; titles, input parameter values, program execution trace, raster error checking summary, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program DEDNM
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file DEDNM.RPT (Sect. 10.2.4, Appendix II)
DATA FORMAT: n/a; see output file DEDNM.RPT (Sect. 10.2.4, Appendix II)
COMMENTS: none.

10.1.5 File NETW.TAB

FILE NAME: NETW.TAB
CONTENTS: Tabular file of channel links properties for the raster drainage network: index, coordinates, elevations, length, upstream drainage areas, and topology information.
INPUT TO: n/a.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file NETW.TAB (Sect. 10.2.5, Appendix II)
DATA FORMAT: n/a; see output file NETW.TAB (Sect. 10.2.5, Appendix II)
COMMENTS: none.

10.1.6 File SBCT.TAB

FILE NAME: SBCT.TAB
CONTENTS: Tabular data of subcatchment properties for the raster drainage network:
index and drainage areas.
INPUT TO: n/a.
OUTPUT FROM: Program DEDNM
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCT.TAB (Sect. 10.2.6, Appendix II)
DATA FORMAT: n/a; see output file SBCT.TAB (Sect. 10.2.6, Appendix II)
COMMENTS: none.

10.1.7 Files from program DEDNM with extension .OUT

FILE NAMES: BOUND.OUT, FILDEP.OUT, FLOVEC.OUT, INELEV.OUT, NETFUL.OUT,
NETW.OUT, RELIEF.OUT, SMOOTH.OUT, SUBWTA.OUT, UPAREA.OUT,
NTGCOD.OUT, FLOPAT.OUT, INDTAR.OUT.
CONTENTS: Refer to user manual for individual file contents.
INPUT TO: Programs RASPRO, PARAM and RASFOR.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Sequential, unformatted.
DATA TYPE: Integer.
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.8 File NTWINT.FIL

FILE NAMES: NTWINT.FIL
CONTENTS: Refer to user manual for individual file contents.
INPUT TO: Programs DEDNM and PARAM.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Sequential, unformatted.
DATA TYPE: Integer.
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.9 File OUTCNT.UNF

FILE NAME: OUTCNT.UNF
CONTENTS: Raster parameters, DEM processing options, network and subcatchment
generation parameters, user options, and selected program internal
parameters.
INPUT TO: Programs RASPRO, PARAM, RASFOR, RASBIN AND NSSTAT.
OUTPUT FROM: All TOPAZ programs.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (character, real, and integer).
FILE FORMAT: FORTRAN Unformatted.
DATA FORMAT: FORTRAN Unformatted.
COMMENTS: none.

10.1.10 File OUTCHA.UNF

FILE NAME: OUTCHA.UNF
CONTENTS: Channel link parameters: channel index, beginning and ending coordinates and elevations, length upstream drainage areas, network topology, number of channel links, and channel Strahler order.
INPUT TO: Programs RASBIN, PARAM and NSSTAT.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (real and integer).
DATA FORMAT: FORTRAN unformatted.
FILE FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.11 File OUTCAT.UNF

FILE NAME: OUTCAT.UNF
CONTENTS: Channel order, channel index, drainage area for the right, left, and upstream contributing areas.
INPUT TO: Programs RASBIN, PARAM and NSSTAT.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (real and integer).
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.12 File CATWIN.TAB

FILE NAME: OUTWIN.UNF
CONTENTS: Window identification of subcatchment areas defined in file SBCT.TAB.
INPUT TO: n/a.
OUTPUT FROM: Program DEDNM.
FILE TYPE: Sequential formatted, ASCII.
DATA TYPE: Mixed (character, real and integer).
FILE FORMAT: n/a.
DATA FORMAT: Mixed n/a.
COMMENTS: none.

10.1.13 File RASPRO.INP

FILE NAME: RASPRO.INP
CONTENTS: Raster reprocessing options.
INPUT TO: Program RASPRO.
OUTPUT FROM: none.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: For format see input file RASPRO.INP (Sect. 10.2.7, Appendix II).
DATA FORMAT: Free format read; also see file RASPRO.INP (Sect. 10.2.7, Appendix II).
COMMENTS: none.

10.1.14 File RASPRO.RPT

FILE NAME: RASPRO.RPT
CONTENTS: Text file of program execution report: program titles and headers, disclaimer, current input parameter values, elevation class data, program execution trace, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program RASPRO.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file RASPRO.RPT (Sect. 10.2.8, Appendix II). DATA
FORMAT: n/a; see output file RASPRO.RPT (Sect. 10.2.8, Appendix II).
COMMENTS none.

10.1.15 Files from program RASPRO with extension .OUT

FILE NAMES: DEPFLT.OUT, ELVCLA.OUT, FVASPE.OUT, FVSLOP.OUT, HSLOPE.OUT, TSLOPE.OUT, TASPEC.OUT, NETWE.OUT, SUBBDA.OUT, SUBWTB.OUT, SUBBDB.OUT, ELDCHA.OUT, ELDOUT.OUT, DISCHA.OUT, DISOUT.OUT.
CONTENTS: Refer to user manual for individual file contents.
INPUT TO: Program RASFOR.
OUTPUT FROM: Program RASPRO.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Integer.
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.16 File RASFOR.INP

FILE NAME: RASFOR.INP
CONTENTS: Raster reformatting and raster output options.
INPUT TO: Program RASFOR.
OUTPUT FROM: none.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: For format see input file RASFOR.INP (Sect. 10.2.9, Appendix II).
DATA FORMAT: Free format read; also see file RASFOR.INP (Sect. 10.2.9, Appendix II).
COMMENTS: none.

10.1.17 File RASFOR.RPT

FILE NAME: RASFOR.RPT
CONTENTS: Text file of program execution report: program titles and headers, disclaimer, current input parameter values, program execution trace, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program RASFOR.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file RASFOR.RPT (Sect. 10.2.10,Appendix II).
DATA FORMAT: n/a; see output file RASFOR.RPT (Sect. 10.2.10,Appendix II).
COMMENTS: none.

10.1.18 ASCII 1-D files NAME.DAT from program RASFOR

FILE NAME: INELEV.DAT, SMOOTH.DAT, FILDEP.DAT, RELIEF.DAT, FLOVEC.DAT, UPAREA.DAT, NTGCOD.DAT, NETFUL.DAT, BOUND.DAT, FLOPAT.DAT, INDTAR.DAT, NETW.DAT, SUBWTA.DAT, DEPFLT.DAT, ELVCLA.DAT, FVASPE.DAT, FVSLOP.DAT, HSLOPE.DAT, TSLOPE.DAT, TASPEC.DAT, NETWE.DAT, SUBBDA.DAT, SUBWTB.DAT, SUBBDB.DAT, ELDCHA.DAT, ELDOUT.DAT, DISCHA.DAT, DISOUT.DAT.
CONTENTS: Content is a function of file name.
INPUT TO: Not needed for TOPAZ; for user review or user selected display package.
OUTPUT FROM: Program RASFOR.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Integer or real.
FILE FORMAT: One formatted value per record, ordered column first, row second.
DATA FORMAT: Function of the largest value in file:
- real value: up to 11 significant digits; and,
- integer value: up to 6 digits.
COMMENTS: none.

10.1.19 ASCII 2-D files name.DAT from program RASFOR

FILE NAME: INELEV.DAT, SMOOTH.DAT, FILDEP.DAT, RELIEF.DAT, FLOVEC.DAT, UPAREA.DAT, NTGCOD.DAT, NETFUL.DAT, BOUND.DAT, FLOPAT.DAT, INDTAR.DAT, NETW.DAT, SUBWTA.DAT, DEPFLT.DAT, ELVCLA.DAT, FVASPE.DAT, FVSLOP.DAT, HSLOPE.DAT, TSLOPE.DAT, TASPEC.DAT, NETWE.DAT, SUBBDA.DAT, SUBWTB.DAT, SUBBDB.DAT, ELDCHA.DAT, ELDOUT.DAT, DISCHA.DAT, DISOUT.DAT.

CONTENTS: Content is a function of file name.

INPUT TO: Not needed for TOPAZ; for user review or user selected display package.

OUTPUT FROM: Program RASFOR.

FILE TYPE: Sequential, formatted, ASCII.

DATA TYPE: Integer or real.

FILE FORMAT: One record for each row of data in the raster array; values within a record are in increasing column order up to 12'500 values per record (row); records increase with array row starting in row 1.

DATA FORMAT: Function of the largest value in file:

- real value: each value up to 11 significant digits;
- integer value: each value up to 6 digits.

COMMENTS: none.

10.1.20 Files name.IMG from program RASFOR

FILE NAME: INELEV.IMG, SMOOTH.IMG, FILDEP.IMG, RELIEF.IMG, FLOVEC.IMG, UPAREA.IMG, NTGCOD.IMG, NETFUL.IMG, BOUND.IMG, FLOPAT.IMG, INDTAR.IMG, NETW.IMG, SUBWTA.IMG, DEPFLT.IMG, ELVCLA.IMG, FVASPE.IMG, FVSLOP.IMG, HSLOPE.IMG, TSLOPE.IMG, TASPEC.IMG, NETWE.IMG, SUBBDA.IMG, SUBWTB.IMG, SUBBDB.IMG, ELDCHA.IMG, ELDOUT.IMG, DISCHA.IMG, DISOUT.IMG.

CONTENTS: Content is a function of file name.

INPUT TO: Not needed for TOPAZ; for IDRISI GIS software package.

OUTPUT FROM: Program RASFOR.

FILE TYPE: Sequential, formatted, ASCII.

DATA TYPE: Integer or real.

FILE FORMAT: One formatted value per record, ordered column first, row second.

DATA FORMAT: Function of the largest value in file:

- real value: up to 11 significant digits; and,
- integer value: up to 6 digits.

COMMENTS: none.

10.1.21 Files name.DOC from program RASFOR

FILE NAME: INELEV.DOC, SMOOTH.DOC, FILDEP.DOC, RELIEF.DOC, FLOVEC.DOC, UPAREA.DOC, NTGCOD.DOC, NETFUL.DOC, BOUND.DOC, FLOPAT.DOC, INDTAR.DOC, NETW.DOC, SUBWTA.DOC, DEPFLT.DOC, ELVCLA.DOC, FVASPE.DOC, FVSLOP.DOC, HSLOPE.DOC, TSLOPE.DOC, TASPEC.DOC, NETWE.DOC, SUBBDA.DOC, SUBWTB.DOC, SUBBDB.DOC, ELDCHA.DOC, ELDOUT.DOC, DISCHA.DOC, DISOUT.DOC.

CONTENTS: File parameters for file name.IMG

INPUT TO: Not needed for TOPAZ; for IDRISI GIS software package.

OUTPUT FROM: Program RASFOR.

FILE TYPE: Sequential, formatted, ASCII.

DATA TYPE: Mixed (character, integer and real).

FILE FORMAT: n/a; see Section 10.2.13

DATA FORMAT: n/a; see Section 10.2.13

COMMENTS: none.

10.1.22 Files name.ARC from program RASFOR

FILE NAME: INELEV.ARC, SMOOTH.ARC, FILDEP.ARC, RELIEF.ARC, FLOVEC.ARC, UPAREA.ARC, NTGCOD.ARC, NETFUL.ARC, BOUND.ARC, FLOPAT.ARC, INDTAR.ARC, NETW.ARC, SUBWTA.ARC, DEPFLT.ARC, ELVCLA.ARC, FVASPE.ARC, FVSLOP.ARC, HSLOPE.ARC, TSLOPE.ARC, TASPEC.ARC, NETWE.ARC, SUBBDA.ARC, SUBWTB.ARC, SUBBDB.ARC, ELDCHA.ARC, ELDOUT.ARC, DISCHA.ARC, DISOUT.ARC.

CONTENTS: Content is a function of file name.

INPUT TO: Not needed for TOPAZ; for user review or user selected display package.

OUTPUT FROM: Program RASFOR.

FILE TYPE: Sequential, formatted, ASCII.

DATA TYPE: Mixed (character, integer and real).

FILE FORMAT: One record for each row of data in the raster array; values within a record are in increasing column order up to 12'500 values per record (row); records increase with array row starting in row 1.

DATA FORMAT: Function of the largest value in file:

COMMENTS: none.

10.1.23 File RASBIN.RPT

FILE NAME: RASBIN.RPT
CONTENTS: Text file of program execution report: program titles and headers, disclaimer, program execution trace, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program RASBIN.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file RASBIN.RPT (Sect. 10.2.15,Appendix II).
DATA FORMAT: n/a; see output file RASBIN.RPT (Sect. 10.2.15,Appendix II).
COMMENTS: none.

10.1.24 File NETWB.TAB

FILE NAME: NETWB.TAB
CONTENTS: Tabular data of channel links properties for the binary drainage network: index, elevations, length, upstream drainage areas, and topology information.
INPUT TO: n/a.
OUTPUT FROM: Program RASBIN.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file NETWB.TAB (Sect. 10.2.16,Appendix II).
DATA FORMAT: n/a; see output file NETWB.TAB (Sect. 10.2.16,Appendix II).
COMMENTS: none.

10.1.25 File SBCTB.TAB

FILE NAME: SBCTB.TAB
CONTENTS: Tabular data of subcatchment properties for the binary drainage network: index and drainage areas.
INPUT TO: n/a.
OUTPUT FROM: Program RASBIN
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCTB.TAB (Sect. 10.2.17,Appendix II).
DATA FORMAT: n/a; see output file SBCTB.TAB (Sect. 10.2.17,Appendix II).
COMMENTS: none.

10.1.26 File RBNET.UNF

FILE NAME: RBNET.UNF
CONTENTS: Channel link properties for the binary drainage network: channel index, elevations, length, upstream drainage areas, network topology, number of channel links, and channel Strahler order.
INPUT TO: Program NSSTAT.
OUTPUT FROM: Program RASBIN.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (real and integer).
DATA FORMAT: FORTRAN unformatted.
FILE FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.27 File RBSBC.UNF

FILE NAME: RBSBC.UNF
CONTENTS: Subcatchment properties for the binary drainage network: channel order, channel index, drainage area for the right, left, and upstream contributing areas.
INPUT TO: Program NSSTAT.
OUTPUT FROM: Program RASBIN.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (real and integer).
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.28 File RBKEY.UNF

FILE NAME: RBKEY.UNF
CONTENTS: Raster to binary transformation key containing information on the correspondence of raster and binary channel link and subcatchment data.
INPUT TO: Program NSSTAT.
OUTPUT FROM: Program RASBIN.
FILE TYPE: Unformatted, sequential.
DATA TYPE: Mixed (real and integer).
FILE FORMAT: FORTRAN unformatted.
DATA FORMAT: FORTRAN unformatted.
COMMENTS: none.

10.1.29 File NSSTAT.RPT

FILE NAME: NSSTAT.RPT
CONTENTS: Text file of program execution report: program titles and headers, disclaimer, program execution trace, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program NSSTAT.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file NSSTAT.RPT (Sect. 10.2.18,Appendix II).
DATA FORMAT: n/a; see output file NSSTAT.RPT (Sect. 10.2.18,Appendix II).
COMMENTS: none.

10.1.30 File NETWT.EVL

FILE NAME: NETWT.EVL
CONTENTS: Tabular data of statistics of the network and channel properties of the raster and binary drainage network representations.
INPUT TO: n/a.
OUTPUT FROM: Program NSSTAT.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file NETWT.EVL (Sect. 10.2.19,Appendix II).
DATA FORMAT: n/a; see output file NETWT.EVL (Sect. 10.2.19,Appendix II).
COMMENTS: none.

10.1.31 File SBCTT.EVL

FILE NAME: SBCTT.EVL
CONTENTS: Tabular data of statistics of the subcatchment properties of the raster and binary drainage network representations.
INPUT TO: n/a.
OUTPUT FROM: Program NSSTAT.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCTT.EVL (Sect. 10.2.20,Appendix II).
DATA FORMAT: n/a; see output file SBCTT.EVL (Sect. 10.2.20,Appendix II).
COMMENTS: none.

10.1.32 File PARAM.RPT

FILE NAME: PARAM.RPT
CONTENTS: Text file of program execution report: program titles and headers, disclaimer, program execution trace, and program error messages.
INPUT TO: n/a.
OUTPUT FROM: Program PARAM.
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer, and real).
FILE FORMAT: n/a; see output file PARAM.RPT (Sect. 10.2.22,Appendix II).
DATA FORMAT: n/a; see output file PARAM.RPT (Sect. 10.2.22,Appendix II).
COMMENTS: none.

10.1.33 File SBCTA.TAB

FILE NAME: SBCTA.TAB
CONTENTS: Tabular data of subcatchment area calculation alternatives for the subcatchments: index and order values.
INPUT TO: n/a.
OUTPUT FROM: Program PARAM
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCTA.TAB (Sect. 10.2.23,Appendix II).
DATA FORMAT: n/a; see output file SBCTA.TAB (Sect. 10.2.23,Appendix II).
COMMENTS: none.

10.1.34 File SBCTL.TAB

FILE NAME: SBCTL.TAB
CONTENTS: Tabular data of subcatchment area calculation alternatives for the subcatchments: index and order values.
INPUT TO: n/a.
OUTPUT FROM: Program PARAM
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCTL.TAB (Sect. 10.2.24,Appendix II).
DATA FORMAT: n/a; see output file SBCTL.TAB (Sect. 10.2.24,Appendix II).
COMMENTS: none.

10.1.35 File SBCTS.TAB

FILE NAME: SBCTS.TAB
CONTENTS: Tabular data of subcatchment slope calculation alternatives for the subcatchments: index and order values.
INPUT TO: n/a.
OUTPUT FROM: Program PARAM
FILE TYPE: Sequential, formatted, ASCII.
DATA TYPE: Mixed (character, integer and real).
FILE FORMAT: n/a; see output file SBCTS.TAB (Sect. 10.2.25,Appendix II).
DATA FORMAT: n/a; see output file SBCTS.TAB (Sect. 10.2.25,Appendix II).
COMMENTS: none.

10.2 APPENDIX II. Example of Input/Output Files from Program DEDNM

10.2.1 Input file DNMCNT.INP

```
C*****
C INPUT DATA FILE DNMCNT.INP
C THIS INPUT DATA FILE CONTAINS DEM RASTER PARAMETERS, DEM AGGREGATION,
C RESAMPLING AND NETWORK EXTRACTION PARAMETERS, DEM PROCESSING OPTIONS,
C AND USER OUTPUT OPTIONS.
C*****
C
C THE FOLLOWING THREE LINES ARE RESERVED FOR TITLES AND INFORMATION DESCRIBING
C THE CURRENT APPLICATION OF DEDNM. THIS INFORMATION IS PRINTED AT THE
C BEGINNING OF EVERY REPORT AND EVALUATION FILE GENERATED BY DEDNM.
C MAXIMUM OF 79 CHARACTERS PER LINE.
C
C DATE: AUGUST 1999 TOPAZ VERSION 3.10
C APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
C TESTING AND CALIBRATION.
C
C *****
C DEM RASTER PARAMETERS.
C *****
C
C * UTM ZONE OF THE INPUT DEM (UPPER LEFT CORNER OF THE DEM COVERAGE).
C ENTER THE ZONE NUMBER OF THE UTM PROJECTION CONTAINING THE UPPER LEFT
C CORNER OF THE DEM COVERAGE.
C INTEGER VALUE BETWEEN 1 AND 60 INCLUSIVE; ENTER A 0 FOR ZONE UNKNOWN.
C
C 0
C
C * UTM EASTING OF THE INPUT DEM (UPPER LEFT CORNER OF THE DEM COVERAGE).
C ENTER THE EASTING OF THE UPPER LEFT CORNER OF THE DEM COVERAGE IN METERS.
C POSITIVE INTEGER VALUE NOT EXCEEDING 1'000'000 METERS. A VALUE OF 0
C INDICATES THAT THE UTM EASTING IS NOT KNOWN.
C
C 0
C
C * UTM NORTHING OF THE INPUT DEM (UPPER LEFT CORNER OF THE DEM COVERAGE).
C ENTER THE NORTHING OF THE UPPER LEFT CORNER OF THE DEM COVERAGE IN METERS.
C POSITIVE INTEGER VALUE NOT EXCEEDING 10'000'000 METERS. A VALUE OF 0
C INDICATES THAT THE UTM NORTHING IS NOT KNOWN.
C
C 0
C
C * NUMBER OF ROWS IN THE DEM.
C INTEGER GREATER THAN 1; NOT TO EXCEED THE DEM RASTER ARRAY SIZE DEFINED
C IN THE PARAMETER STATEMENTS BY PARAMETER IRS, UNLESS DEM AGGREGATION OR
C RESAMPLING IS SELECTED.
C
C 72
C
C * NUMBER OF COLUMNS IN THE DEM.
C INTEGER GREATER THAN 1; NOT TO EXCEED THE DEM RASTER ARRAY SIZE DEFINED
C IN THE PARAMETER STATEMENTS BY PARAMETER ICS, UNLESS DEM AGGREGATION OR
C RESAMPLING IS SELECTED.
C
C 102
```


C
C * MINIMUM DEM ELEVATION VALUE IN METERS. VALUES ARE INTERNALLY ROUNDED
C TO THE NEAREST DECIMETER.
C REAL VALUE BETWEEN AND INCLUDING 1.0 AND 9'999.0
C
1.0
C
C * MAXIMUM DEM ELEVATION VALUE IN METERS. VALUES ARE INTERNALLY ROUNDED
C TO THE NEAREST DECIMETER.
C REAL VALUE BETWEEN AND INCLUDING 1.0 AND 9'999.0
C
256.0
C
C * DEM ELEVATION VALUE SPECIFYING INDETERMINATE ELEVATIONS (UNKNOWN
C ELEVATION).
C POSITIVE OR NEGATIVE REAL VALUE, INCLUDING ZERO; MUST BE OUTSIDE THE RANGE
C DEFINED BY THE PREVIOUSLY ENTERED MINIMUM AND MAXIMUM ELEVATION VALUES
C IN METERS.
C
0.0
C
C * LENGTH OF A SQUARE CELL OF THE DEM RASTER IN METERS.
C REAL VALUE, MUST BE EQUAL OR GREATER THAN 1.0
C
30.0
C
C * ORIENTATION OF THE DEM RASTER.
C THE ORIENTATION OF THE RASTER IS GIVEN BY THE VECTOR ALONG THE LEFT EDGE
C OF THE DEM RASTER AND POINTING TOWARD THE UPPER LEFT CORNER OF THE DEM.
C ORIENTATION VALUES ARE BETWEEN 0 TO 359 DEGREES, WHERE 0 IS FOR NORTH;
C 90 FOR EAST; 180 FOR SOUTH; AND 270 FOR WEST. ALL OTHER VALUES IN BETWEEN
C ARE ACCEPTABLE.
C INTEGER VALUE.
C
0
C
C * ROW COORDINATE OF THE DEM RASTER DEFINING THE WATERSHED OUTLET.
C AN APPROXIMATE ROW VALUE MAY BE ENTERED. IT CAN SUBSEQUENTLY BE REVISED
C TO COINCIDE WITH THE EXTRACTED CHANNEL NETWORK.
C THE WATERSHED OUTLET CANNOT BE LOCATED ON THE OUTER EDGE OF THE DEM RASTER.
C INTEGER LARGER THAN 1, AND SMALLER THAN THE PREVIOUSLY ENTERED NUMBER OF
C ROWS IN THE DEM.
C
58
C
C * COLUMN COORDINATE OF THE DEM RASTER DEFINING THE WATERSHED OUTLET.
C AN APPROXIMATE ROW VALUE MAY BE ENTERED. IT CAN SUBSEQUENTLY BE REVISED
C TO COINCIDE WITH THE EXTRACTED CHANNEL NETWORK.
C THE WATERSHED OUTLET CANNOT BE LOCATED ON THE OUTER EDGE OF THE DEM RASTER.
C INTEGER LARGER THAN 1, AND SMALLER THAN THE PREVIOUSLY ENTERED NUMBER OF
C ROWS IN THE DEM.
C
94
C
C
C
C *****
C DEM PRE-PROCESSING OPTIONS:
C DEM AGGREGATION, RESAMPLING, SMOOTHING, AND DEPRESSION OUTLET ANALYSIS AND
C ADJUSTMENT.
C *****
C

```

C * AGGREGATION OR RESAMPLING OF THE DEM RASTER.
C   ENTER  0  FOR NO AGGREGATION OR RESAMPLING;
C   ENTER  1  FOR AGGREGATION;
C   ENTER  2  FOR RESAMPLING.
C INTEGER VALUE.
C
0
C
C * LEVEL OF DEM AGGREGATION OR RESAMPLING.
C   ENTER 2 FOR A 2*2 CELL AGGREGATION OR RESAMPLING WINDOW;
C   ENTER 3 FOR A 3*3 CELL AGGREGATION OR RESAMPLING WINDOW; ETC.
C FOR NO AGGREGATION OR RESAMPLING, ENTER 1 .
C MAXIMUM LEVEL OF AGGREGATION OR RESAMPLING WINDOW IS 20*20.
C INTEGER VALUE BETWEEN AND INCLUDING 1 AND 20.
C
5
C
C * SMOOTHING OF DEM RASTER.
C WEIGHTED SMOOTHING IS PERFORMED OVER A MOVING 3 BY 3 CELL AREA. DIFFERENT
C WEIGHTS ASSIGNED TO THE CENTER CELL, DIAGONAL CELLS AND CROSS CELLS.
C ENTER  0  FOR NO SMOOTHING OF THE DEM; ENTER  1  FOR SMOOTHING OF THE DEM.
C INTEGER VALUE.
C
0
C
C * NUMBER OF SMOOTHING PASSES.
C ENTER THE NUMBER OF CONSECUTIVE SMOOTHING PASSES TO BE PERFORMED ON THE
C DEM RASTER. THE VALUE MUST BE GREATER THAN 0 AND SMALLER THAN 100.
C IF SMOOTHING IS NOT DESIRED ENTER A VALUE OF 1
C INTEGER VALUE.
C
2
C
C * WEIGHTING PARAMETERS.
C ENTER THE WEIGHTS TO BE ASSIGNED TO THE CELLS OF THE 3 BY 3 CELL AREA.
C THE FIRST WEIGHT IS ASSIGNED TO THE CENTER CELL OF THE 3 BY 3 CELL AREA;
C THE SECOND WEIGHT TO THE CROSS CELLS, AND THE THIRD WEIGHT TO THE
C DIAGONAL CELLS. THE THREE WEIGHTS MUST BE ENTERED ON THREE CONSECUTIVE
C LINES. IF SMOOTHING IS NOT DESIRED, ENTER A VALUE OF 1 FOR EACH WEIGHT.
C THE USER CANNOT ENTER THREE VALUES OF 0 (ZERO).
C INTEGER VALUE BETWEEN 0 AND 100.
C
2
1
1
C
C * DEPRESSION OUTLET ANALYSIS AND ADJUSTMENT OPTION.
C ENTER  0  FOR NO ANALYSIS AND ADJUSTMENT OF DEPRESSION OUTLETS;
C ENTER  1  FOR ANALYSIS AND ADJUSTMENT OF DEPRESSION OUTLETS THAT HAVE A
C   WIDTH OF ONE CELL ONLY.
C ENTER  2  FOR ANALYSIS AND ADJUSTMENT OF DEPRESSION OUTLETS THAT HAVE A
C   WIDTH OF TWO CELLS.
C INTEGER VALUE.
C
2
C
C * PARTIAL DEM PROCESSING OPTIONS:
C THIS OPTION ALLOWS THE USER TO ONLY RUN A PORTION OF THE DEM PROCESSING:
C ENTER  0  FOR FULL DEM PROCESSING;
C ENTER  1  FOR DEM ELEVATION PRE-PROCESSING ONLY (AGGREGATION/RESAMPLING,
C   SMOOTHING, DEPRESSION BREACHING/FILLING, FLAT AREA RELIEF
C   IMPOSITION);

```

```

C ENTER 2 FOR DEM ELEVATION PRE-PROCESSING AND FULL NETWORK GENERATION
C (IN ADDITION TO OPTION 1 THIS INCLUDES THE GENERATION OF FLOW
C VECTOR, FLOW PATH, UPSTREAM AREA AND FULL NETWORK.)
C
0
C
C *****
C DEM PROCESSING OPTIONS AND NETWORK EXTRACTION PARAMETERS:
C NETWORK PARAMETERS, AND CALIBRATION AND ERROR CHECKING OPTIONS.
C *****
C
C * OPTION FOR SPATIALLY VARIABLE CSA AND MSCL PARAMETERS (DEFINED BELOW).
C VARYING CSA/MSCL VALUES CAN BE ASSIGNED TO DIFFERENT AREAS OF THE WATERSHED.
C 0 DO NOT USE SPATIALLY VARIABLE CSA/MSCL VALUES;
C 1 VARIABLE CSA/MSCL VALUES; SPATIAL DISTRIBUTION DEFINED BY FILE NTGCOD.INP.
C
1
C
C * CRITICAL SOURCE AREA (CSA) IN HECTARES, AND
C * MINIMUM SOURCE CHANNEL LENGTH (MSCL) IN METERS.
C THE CRITICAL SOURCE AREA IS THE THRESHOLD (MINIMUM) UPSTREAM DRAINAGE AREA
C BELOW WHICH A SOURCE CHANNEL IS INITIATED AND MAINTAINED.
C THE MINIMUM SOURCE CHANNEL LENGTH IS THE MINIMUM ACCEPTABLE LENGTH FOR
C SOURCE CHANNELS TO EXIST.
C TO MODEL SPATIALLY VARIABLE CSA AND MSCL PARAMETERS UP TO 5 VALUES CAN
C BE ENTERED. IN ADDITION TO THE CSA AND MSCL VALUES ENTERED BELOW, THE USER
C MUST ALSO PROVIDE A SEPARATE RASTER FILE DEFINING THE SPATIAL VARIABILITY
C OF THE CSA AND MSCL PARAMETERS (FILE NTGCOD.INP).
C COLUMN 1: CSA-MSCL CODE VALUE, INTEGER 0 THROUGH 5 AS SHOWN BELOW.
C COLUMN 2: CSA VALUE IS A REAL VALUE GREATER THAN 0.001 HECTARES AND GREATER
C THAN THE AREA OF ONE CELL AFTER AGGREGATION OR RESAMPLING
C (IF SELECTED BY THE USER), OR -1.0 FOR UNDEFINED CSA VALUE.
C COLUMN 3: MSCL VALUE IS A REAL VALUE GREATER THAN 1.0 METER AND GREATER THAN
C THE SIDE OF ONE CELL AFTER AGGREGATION OR RESAMPLING (IF SELECTED
C BY THE USER), OR 0.0 FOR NO PRUNING AT ALL, OR -1.0 FOR UNDEFINED
C MSCL VALUE.
C NOTE: - A CSA-MSCL CODE 0 (ZERO) IS PREDEFINED TO CORRESPONDS TO RASTER
C CELLS WITH INDETERMINATE ELEVATION VALUE. THE USER CANNOT ASSIGN
C A CODE OF 0 TO RASTER CELLS IN FILE NTGCOD.INP THAT HAVE A DEFINED
C DEM ELEVATION VALUE.
C - CODE VALUES CANNOT BE CHANGED OR RE-ORDERED BY THE USER.
C - THE USER CANNOT ASSIGN A CSA OR MSCL VALUE FOR CODE 0.
C - A DEFINED CSA AND MSCL VALUE MUST BE PROVIDED FOR CSA-MSCL CODE 1.
C VALUES OF -1.0 CANNOT BE ASSIGNED FOR CODE 1.
C - CSA AND MSCL VALUES OF -1.0 MUST ALWAYS BE ASSIGNED IN PAIRS.
C A VALUE OF -1.0 CANNOT BE ASSIGNED FOR CSA WITHOUT ALSO ASSIGNING A
C VALUE OF -1.0 FOR MSCL, AND VICE VERSA.
C - CSA AND MSCL VALUES OF -1.0 MUST BE GROUPED AT THE END OF THE TABLE
C BELOW. THEY CANNOT BE PLACED BEFORE DEFINED CSA AND MSCL VALUES.
C ANY CSA OR MSCL VALUES ENTERED AFTER AN UNDEFINED CSA AND MSCL VALUE
C OF -1.0 WILL NOT BE CONSIDERED.
C
C
C CODE CSA VALUE MSCL VALUE
C
C 0 INDETERMINATE CSA VALUE INDETERMINATE MSCL VALUE
C 1 10.0 100.0
C 2 30.0 400.0
C 3 10.0 200.0
C 4 5.0 100.0
C 5 -1.0 -1.0
C
C * RE-RUN FOR CALIBRATION PURPOSES ONLY.

```

```
C THIS OPTION CAN ONLY BE SELECTED IF AN INITIAL FULL RUN OF THE CURRENT DATA
C SET HAS ALREADY BEEN MADE AND ALL OUTPUT FILES ARE IN THE CURRENT DIRECTORY.
C ENTER 0 FOR FULL DEDNM RUN (NO CALIBRATION RUN);
C ENTER 1 FOR CALIBRATION RUN WITH NEW CSA AND MSCL PARAMETERS ONLY;
C ENTER 2 FOR CALIBRATION RUN WITH NEW WATERSHED OUTLET ONLY;
C ENTER 3 FOR CALIBRATION RUN WITH NEW ARRAY NTGCOD ONLY (NTGCOD: NETWORK
C GENERATION CODES FOR SPATIALLY VARIABLE CSA AND MSCL PARAMETERS).
C
0
C
C * RASTER CHECKING FOR ERRORS AND INCONSISTENCIES.
C ENTER 0 TO NOT PERFORM ERROR CHECKING;
C ENTER 1 TO PERFORM ERROR CHECKING.
C INTEGER VALUE.
C
1
C
C *****
C USER OUTPUT OPTIONS.
C *****
C
C FOR ALL OF THE FOLLOWING OPTIONS:
C ENTER A VALUE OF '1' TO WRITE THE DESIRED FILE TO OUTPUT, OR,
C ENTER A VALUE OF '0' NOT TO WRITE THE FILE TO OUTPUT.
C
C INTEGER VALUE.
C
C
C * WRITE THE PROGRAM CAPABILITIES, LIMITATIONS AND SPECIFICATIONS TO OUTPUT
C FILE DEDNM.RPT.
C
1
C
C * WRITE THE INPUT DATA REPORT (INPUT ECHO) TO OUTPUT FILE DEDNM.RPT.
C
1
C
C * WRITE THE DRAINAGE NETWORK TABLE TO OUTPUT FILE NETW.TAB.
C
1
C
C * WRITE THE SUBCATCHMENT AREA TABLE TO OUTPUT FILE SBCT.TAB.
C
1
```

10.2.2 Input file DEDNM.INP (DEM elevation data)

```
1.0  
1.0  
1.0  
1.0  
151.0  
151.2  
152.3  
154.4  
154.5  
1.0  
1.0  
1.0  
1.0  
1.0  
132.6  
132.8  
133.0  
135.2  
136.4  
1.0  
1.0  
1.0  
1.0  
.  
.  
.  
etc.
```

Total number of records in this file is equal to the number of rows times number of columns (NROW*NCOL) of the input DEM.

10.2.4 Output file DEDNM.RPT

The section on program capabilities, specifications and limitations can be turned off by option IOPT(13) in file DNMCNT.INP.

```
***** BEGINNING PROGRAM DEDNM.
***** BEGINNING INITIALIZATION AND INPUT OF CONTROL DATA FROM FILE DNMCNT.INP.
*** BEGINNING SBRT CHKKND.
*** ENDING SBRT CHKKND.
*** BEGINNING SBRT RUNOPT.
    *** BEGINNING SUBROUTINE CHKFIL.
*** ENDING SBRT RUNOPT.
*** BEGINNING SBRT HEADER.
```

```
TOPAZ SOFTWARE : TOPAZ PARAMETERIZATION SOFTWARE SYSTEM
                  VERSION 3.12, AUGUST 1999
PROGRAM DEDNM  : DIGITAL ELEVATION DRAINAGE NETWORK MODEL PROGRAM
                  VERSION 3.10, APRIL 1999
```

```
J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.
```

DISCLAIMER

THIS PROGRAM AND ITS SUBROUTINES ARE ACCEPTED AND USED BY THE RECIPIENT UPON THE EXPRESS UNDERSTANDING THAT THE DEVELOPERS MAKE NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY OR SUITABILITY FOR ANY ONE PURPOSE, AND THAT THE DEVELOPERS SHALL BE UNDER NO LIABILITY TO ANY PERSON BY REASON OF ANY USE MADE THEREOF.

THE SUBROUTINES IN THIS PROGRAM CANNOT BE LIFTED, EXTRACTED OR TRANSFERRED OUT OF THIS PROGRAM FOR USE WITH OTHER PROGRAMS OR OTHER PURPOSES BECAUSE INPUT VARIABLES INTO SUBROUTINES MUST HAVE BEEN PROCESSED AND ASSIGNED SPECIFIC VALUES BY PRECEDING SUBROUTINES THAT REFLECT PROGRAM, CODE AND TERRAIN SPECIFIC PARTICULARITIES. THE USE OF A SUBROUTINE FOR OTHER PURPOSES THAN IN THIS PROGRAM MAY PRODUCE, AT BEST, INEXECUTABLE CODE, OR, AT WORST, ERRONEOUS RESULTS THAT GO UNRECOGNIZED.

THE AUTHORS AND DEVELOPERS OF THIS PROGRAM AND ITS SUBROUTINES SHALL BE ACKNOWLEDGED WHEN THE CODE, THE MODEL AND/OR THE NUMERICAL SOLUTION TECHNIQUES USED HEREIN ARE DIRECTLY APPLIED IN CONJUNCTION WITH ANOTHER CODE, OR DESCRIBED AND/OR REFERRED TO IN A PUBLICATION OR PRESENTATION.

```
*** ENDING SBRT HEADER.
*** BEGINNING SBRT CAPLIM.
```

CAPABILITIES, LIMITATIONS AND SPECIFICATIONS OF SOFTWARE TOPAZ:

- PROGRAM DEDNM PROCESSES THE RASTER DIGITAL ELEVATION MODEL (DEM) OF A WATERSHED TO DEFINE THE DRAINAGE NETWORK, SUBDIVIDE THE WATERSHED INTO SUBCATCHMENTS, AND EXTRACT SELECTED CHANNEL AND SUBCATCHMENT GEOMETRIC PARAMETERS. THE DEM SHOULD REPRESENT LANDSCAPES THAT ARE DISSECTED BY CONCENTRATED-FLOW CHANNELS AND THAT DISPLAY SUFFICIENT RELIEF TO TOPOGRAPHICALLY DEFINE FLOW CONVERGENCE AND DOWNSTREAM FLOW PATHS. INCLINED AND PERFECTLY FLAT SURFACES WITHIN THE DIGITAL LANDSCAPE ARE ACCEPTED BY PROGRAM DEDNM, BUT THE ABSENCE OF ANY DETAILED RELIEF OVER LARGE SURFACES MAY RESULT IN LOCAL FLOW PATHS THAT DEVIATE FROM ACTUAL CONDITIONS.

- PROGRAM DEDNM EXTRACTS THE FOLLOWING RASTER IMAGES FROM A GIVEN DEM:
 - * WATERSHED INPUT ELEVATIONS AFTER AGGREGATION OR RESAMPLING;
 - * WATERSHED ELEVATIONS AFTER AGGREGATION OR RESAMPLING, AND SMOOTHING;
 - * WATERSHED ELEVATIONS AFTER AGGREGATION OR RESAMPLING, SMOOTHING, AND DEPRESSION ANALYSIS, DEPRESSION OUTLET ADJUSTMENT, AND FILLING;
 - * WATERSHED ELEVATIONS AFTER AGGREGATION OR RESAMPLING, SMOOTHING, DEPRESSION ANALYSIS, DEPRESSION OUTLET ADJUSTMENT, FILLING, AND RELIEF MODIFICATION TO ESTABLISH POSITIVE DRAINAGE IN FLAT AREAS;
 - * LOCAL FLOW VECTORS;
 - * FLOW PATH CODES;
 - * DEFINITION OF FLOW PATHS (BEGINNING AND ENDING POINTS);
 - * LOCAL UPSTREAM DIRECT DRAINAGE AREAS;
 - * CODES FOR CSA AND MSCL PARAMETERS AFTER AGGREGATION OR RESAMPLING;
 - * DRAINAGE NETWORK FOR ENTIRE DEM COVERAGE;
 - * OUTLINE OF WATERSHED;
 - * DRAINAGE NETWORK WITH STRAHLER ORDERS WITHIN WATERSHED BOUNDARIES ONLY;
 - * SUBCATCHMENT LOCATION, EXTENT AND INDEXES, WITHIN WATERSHED BOUNDARIES ONLY, INCLUDING DRAINAGE NETWORK.

- PROGRAM DEDNM PROVIDES THE FOLLOWING REPORT AND TABULAR OUTPUT:
 - * REPORT OF PROGRAM EXECUTION FOR PROGRAM DEDNM;
 - * TABLE OF GEOMETRIC AND TOPOLOGIC CHANNEL PARAMETERS;
 - * TABLE OF SUBCATCHMENT AREA PARAMETERS;
 - * TABLE OF SUBCATCHMENT WINDOW SITES.

- PROGRAM DEDNM PROVIDES A COMPREHENSIVE INDEXING OF THE CHANNEL LINKS AND SUBCATCHMENTS. THIS INDEXING (NUMBERING) FOLLOWS THE SCHEME DESCRIBED IN: DETERMINATION OF THE EXECUTION SEQUENCE OF CHANNELS IN A DRAINAGE NETWORK FOR CASCADE ROUTING; J. GARBRECHT; 1988; HYDROSOFT; SOFTWARE FOR HYDRAULICS, HYDROLOGY AND HYDRODYNAMICS; COMPUTATIONAL MECHANICS PUBLICATIONS; VOL. 1, NO. 3, JULY 1988.

- THE IDENTIFICATION OF THE SOURCES OF A GENERATED DRAINAGE NETWORK REQUIRES THE INPUT OF A CRITICAL SOURCE AREA (CSA), I.E. A REPRESENTATIVE THRESHOLD (MINIMUM) DRAINAGE AREA AT THE BOTTOM OF WHICH A SOURCE CHANNEL (1ST ORDER CHANNEL) IS INITIATED AND MAINTAINED. ALSO REQUIRED IS A MINIMUM SOURCE CHANNEL LENGTH (MSCL) FOR FIRST ORDER CHANNELS TO BE CLASSIFIED AS FIRST ORDER CHANNELS. BOTH THESE INPUT PARAMETERS CAN BE USED TO INTRODUCE THE EFFECT OF SCALE AND RESOLUTION INTO THE DEM PROCESSING. THE DRAINAGE NETWORK, THE ORDER OF THE NETWORK, THE DRAINAGE DENSITY, THE CHANNEL GEOMETRIC PARAMETERS, THE WATERSHED SUBDIVISION AND THE SUBCATCHMENT GEOMETRIC PARAMETERS ARE ALL A FUNCTION OF THESE TWO INPUT PARAMETERS. THE CSA AND MSCL PARAMETERS CAN BE PROVIDED AS SPATIALLY VARIABLE PARAMETERS. UP TO 5 DIFFERENT VALUES ARE ALLOWED TO GENERATE A DRAINAGE NETWORK WITH SPATIALLY VARIABLE CHARACTERISTICS.

- THE BASIC UNITS OF PROGRAM DEDNM ARE METERS FOR LENGTHS AND HECTARES FOR AREAS; ELEVATION VALUES ARE ROUNDED TO THE NEAREST DECIMETER. THIS ROUNDING IS NECESSARY TO ALLOW THE TREATMENT OF FLAT AREAS WITH INDETERMINATE FLOW PATHS. THIS TREATMENT USES ELEVATION INCREMENTS SMALLER THAN A DECIMETER (0.01 MILLIMETERS) TO IMPOSE LIKELY FLOW GRADIENTS ON FLAT AREAS.

- THE DEM MUST BE OF SUFFICIENT VERTICAL AND HORIZONTAL RESOLUTION TO FULLY DEFINE THE DETAILS OF THE FEATURES THAT ARE TO BE EXTRACTED.

- THE DRAINAGE NETWORK LOCATION AND EXTENT IS DEFINED BY STRINGS OF CELLS. THE WIDTH OF A CHANNEL CANNOT BE INFERRED FROM THE CELLS THAT IDENTIFY THE EXISTENCE OF A CHANNEL. ALSO, CELL VALUES REPRESENT THE AVERAGE ELEVATION UNDER THE ENTIRE CELL, AND THEREFORE THEY MAY NOT BE REPRESENTATIVE OF ACTUAL CHANNEL THALWEG ELEVATIONS. THIS IS PARTICULARLY TRUE FOR NARROW INCISED CHANNELS THAT ARE OF THE SAME ORDER OF MAGNITUDE OR SMALLER THAN THE CELL SIZE. THIS CAN LEAD TO POOR APPROXIMATIONS OF CHANNEL SLOPE VALUES. SIMILARLY, CHANNEL SINUOSITY WITHIN A VALLEY CAN ONLY BE PROPERLY REPRODUCED IF THE CELL SIZE AND ELEVATIONS CAN REFLECT THE SINUOUS PATTERN OF THE CHANNEL. THE SINUOSITY OF THE VALLEY BETWEEN LATERAL RISING TERRAIN IS ALWAYS REPRODUCED.
- THE OUTPUT OF THIS PROGRAM QUANTIFIES THE DIGITAL LANDSCAPE (INPUT DEM) WHICH MAY NOT NECESSARILY BE A GOOD REPRESENTATION OF THE ACTUAL LANDSCAPE. IF THE INPUT DEM IS OF POOR QUALITY OR RESOLUTION AND DOES NOT ACCURATELY REFLECT THE LANDSCAPE CONDITIONS, THEN THE OUTPUT OF THIS PROGRAM CANNOT BE EXPECTED TO PROVIDE A GOOD CHARACTERIZATION OF THE ACTUAL LANDSCAPE.
- LANDSCAPE DRAINAGE PATTERNS EXTRACTED BY PROGRAM DEDNM MAY NOT BE SUITABLE FOR FLOW ANALYSIS IF RUNOFF GRADIENTS ARE NOT CONTROLLED BY LANDSCAPE TOPOGRAPHY, AS IN THE PRESENCE OF BACKWATER OR TIDAL EFFECTS, WHICH MAY HAVE WATER SURFACE GRADIENTS THAT ARE REVERSE TO THE TERRAIN GRADIENTS.
- THE WATERSHED OF INTEREST MUST BE ENTIRELY INCLUDED IN THE DEM AND SHOULD NOT TOUCH THE EDGE OF THE DEM. IF IT DOES TOUCH THE EDGE OF THE DEM OR IF IT IS ADJACENT TO AN AREA OF INDETERMINATE ELEVATIONS, THEN IT IS LIKELY THAT THE TRUE WATERSHED BOUNDARIES EXTEND BEYOND THE DEM BOUNDARIES OR INTO THE AREA OF INDETERMINATE ELEVATIONS. UNDER THESE CONDITIONS THE COMPUTED WATERSHED BOUNDARIES, DRAINAGE NETWORK AND SUBCATCHMENTS WOULD BE INCOMPLETE. THE USER MAY HOWEVER OVERRIDE THE PROGRAM TERMINATION AND PROCEED WITH THE LIKELY INCOMPLETE WATERSHED.
- THE USER MUST PROVIDE A ROW COLUMN-CELL COORDINATE THAT IDENTIFIES THE WATERSHED OUTLET. FOR NUMERICAL REASONS THE WATERSHED OUTLET CANNOT BE SITUATED ON THE EDGE OF THE DEM.
- PROGRAM DEDNM IS BASED ON THE D-8 METHOD (DETERMINISTIC 8 NEIGHBORS). ALL ASSUMPTIONS AND LIMITATION OF THE D-8 METHOD APPLY (FAIRFIELD AND LEYMARIE, 1991; COSTA-CABRAL AND BURGESS, 1994). PARTICULARLY, THE FLOW DIRECTION AT ANY ONE CELL CAN BE IN ERROR BY AS MUCH AS 22.5 DEGREES. HOWEVER, IN DISSECTED LANDSCAPES WITH CONVERGENT FLOW THE GENERAL DRAINAGE DIRECTION OVER THE DISTANCE OF SEVERAL CELLS IS RELATIVELY WELL REPRODUCED BECAUSE BEGINNING AND ENDING POINTS OF DRAINAGE PATHS ARE LOCATION CONTROLLED AND NOT LIMITED TO THE 8 DIRECTIONS THAT APPLY TO A SINGLE CELL. ALSO, THE D-8 METHOD IS NOT CAPABLE OF HANDLING DIVERGENT FLOW.
- PROGRAM DEDNM IS BASED ON THE DOWNSLOPE FLOW ROUTING CONCEPT. AS SUCH UPSTREAM DRAINAGE AREAS AND DRAINAGE PATHS ARE ASSUMED TO BE ADEQUATELY DESCRIBE BY DOWNSLOPE FLOW ROUTING FROM ONE CELL SPILLING ONTO THE NEIGHBORING CELL LOCATED IN THE DIRECTION OF STEEPEST DESCENT.
- CALIBRATION IS NECESSARY TO OPTIMIZE THE EXTRACTED DRAINAGE NETWORK AND SUBCATCHMENT PARAMETERS WITH REGARD TO FIELD CONDITIONS. THE USER MAY SPEED-UP PROGRAM EXECUTION FOR CALIBRATION PURPOSES BY CHOOSING THE CALIBRATION OPTION. HOWEVER, THE USER MUST HAVE MADE AT LEAST ONE INITIAL FULL RUN OF PROGRAM DEDNM BEFORE THE CALIBRATION OPTION CAN BE EXERCISED.

- PROGRAM DEDNM ACCEPTS ONLY RASTER CELLS THAT ARE SQUARES.
- THE ELEVATION VALUES IN THE DEM MUST BE POSITIVE INTEGER OR DECIMAL NUMBERS; THE ELEVATION VALUE OF ZERO IS NOT ACCEPTABLE.
- IF DESIRED BY THE USER, THE INPUT DEM CAN BE AGGREGATED OR RESAMPLED INTO ONE WITH A COARSER GRID DURING THE INITIAL READING OF THE DEM DATA. THIS AGGREGATION OR RESAMPLING MAY BE DESIRABLE TO OVERCOME MACHINE MEMORY, OPERATING SYSTEM AND EXECUTION SPEED LIMITATIONS.
- WHEN AGGREGATION IS PERFORMED, THE AGGREGATION OF THE INPUT DEM INTO ONE WITH A COARSER GRID IS ACCOMPLISHED BY LINEAR AVERAGING OF RASTER ELEVATION VALUES OVER A SQUARE HAVING THE SAME NUMBER OF HORIZONTAL AND VERTICAL RASTER CELLS (NNOD). THE USER CANNOT AGGREGATE OVER A DIFFERENT NUMBER OF HORIZONTAL AND VERTICAL RASTER CELLS. THE MAXIMUM NUMBER FOR NNOD IS CURRENTLY SET TO 20 (A SQUARE OF 400 RASTER CELLS). THIS VALUE CAN BE CHANGED WITH VERY MINOR CHANGES TO THE SOFTWARE.
- WHEN RESAMPLING IS PERFORMED, THE RESAMPLING OF THE INPUT DEM INTO ONE WITH A COARSER GRID IS ACCOMPLISHED BY SELECTING THE DEM ELEVATION VALUE OF THE CENTER CELL OF THE RESAMPLING BOX (NNOD*NNOD). IF THIS ELEVATION IS INDETERMINATE, THEN THE DEM ELEVATION VALUE OF THE CELL WHICH IS CLOSEST TO THE CENTER AND WHICH HAS A VALID DEM ELEVATION VALUE IS PICKED AS THE RESAMPLED VALUE.
- IF AGGREGATION OR RESAMPLING IS PERFORMED ON THE INPUT DEM ELEVATIONS, THEN A CORRESPONDING AGGREGATION OR RESAMPLING IS PERFORMED ON THE INPUT CODES FOR THE CSA AND MSCL PARAMETERS. AGGREGATION IS ACCOMPLISHED BY RETAINING THE MOST FREQUENTLY OCCURRING CODE VALUE IN THE AGGREGATION WINDOW, AND RESAMPLING IS ACCOMPLISHED BY SELECTING THE CODE VALUE AT THE CENTER OR CLOSEST TO THE CENTER OF THE RESAMPLING WINDOW.
- IF DESIRED BY THE USER, THE ENTERED ELEVATION DATA CAN BE SMOOTHED USING A WEIGHTED, SINGLE OR MULTIPLE PASS, 3 BY 3 BOX-CAR FILTER. THE CELL WEIGHTING AND NUMBER OF SMOOTHING PASSES IS USER PROVIDED. AFTER SMOOTHING THE ELEVATION DATA IS ROUNDED TO THE NEAREST DECIMETER. THIS ROUNDING IS NECESSARY TO ALLOW THE TREATMENT OF FLAT AREAS WITH INDETERMINATE FLOW PATHS.

BOTH TYPES OF DEPRESSIONS ARE ANALYZED, FILLED AND TREATED AS FLAT SURFACES. IF DESIRED BY THE USER, THE OUTLET OF IMPOUNDMENT DEPRESSIONS CAN BE ANALYZED AND MODIFIED IF THE NARROW SWELL OR LOCAL BLOCKAGE DOES NOT EXCEED TWO CELLS IN WIDTH. UNDER THESE CONDITIONS THE SWELL OR BLOCKAGE CAN BE LOWERED TO THE LEVEL OF THE HIGHEST OF THE TWO ADJACENT CELL ELEVATIONS THAT DEFINE THE SWELL OR BLOCKAGE.

- FLAT AREAS IN THE DEM ELEVATION DATA (INCLUDING FLAT AREAS AS A RESULT OF DEPRESSION FILLING) ARE MODIFIED TO PRODUCE THE MOST LIKELY DRAINAGE PATHS AND TO PRODUCE A FULLY CONNECTED DRAINAGE NETWORK. THE MODIFICATIONS ARE A FUNCTION OF THE FALLING AND RISING TERRAIN THAT SURROUNDS THE FLAT AREA. THE RELIEF MODIFICATION USES INCREMENTAL ELEVATIONS OF 2/100,000 OF A DEM ELEVATION UNIT (1 METER) TO BUILD GRADIENTS OVER FLAT SURFACES THAT DRAIN FLOW AWAY FROM RISING TERRAIN AND TOWARDS THE NEAREST OUTLET OF THE FLAT SURFACE. THIS ALSO PROMOTES FLOW CONVERGENCE. IN MOST CASES THE FINAL ELEVATION INCREMENTATION IS NOT EXPECTED TO ALTER THE ORIGINAL TOPOGRAPHY BY A SIGNIFICANT AMOUNT, YET IT IS SUFFICIENT TO REMOVE THE DRAINAGE INDETERMINACY OF FLAT AREAS. FLAT AREAS THAT ARE OVER 1500 CELLS LONG MAY BE EXCESSIVELY LARGE AND MAY EXCEED THE CAPABILITIES OF THE ALGORITHM.

- THE EDGE OF THE DEM IS CONSIDERED A SPECIAL BOUNDARY. RASTER CELLS ON THE EDGE OF THE DEM THAT DO NOT HAVE ANY NEIGHBOR AT A LOWER ELEVATION ARE ASSUMED TO HAVE A FLOW VECTOR POINTING OFF THE DEM.
- THE DEPRESSION FILLED AND RELIEF CORRECTED ELEVATIONS, THE FLOW VECTORS, FLOW PATH CODES, THE UPSTREAM AREAS AND THE DRAINAGE NETWORK ARE COMPUTED FOR THE ENTIRE DEM RASTER. THE FOLLOWING RASTERS AND PARAMETERS ARE COMPUTED FOR THE DRAINAGE AREA UPSTREAM OF A USER SPECIFIED POINT (USUALLY THE WATERSHED OUTLET POINT): THE FULLY CONNECTED DRAINAGE NETWORK, THE WATERSHED SUBDIVISION, THE SUBCATCHMENTS AND ALL CORRESPONDING NETWORK, CHANNEL AND SUBCATCHMENT PARAMETERS.
- PROGRAM DEDNM DOES NOT HAVE GIS DISPLAY CAPABILITIES.
- PROGRAM DEDNM IS AN INTERACTIVE PROGRAM WRITTEN IN FORTRAN 90. THE INTERACTIVE PORTION OF THE PROGRAM REQUIRES THE USER TO DEFINE THE EXACT LOCATION OF THE WATERSHED OUTLET GIVEN A DISPLAY OF THE COMPUTED CHANNEL NETWORK.
- THE SIZE OF THE DEM THAT CAN BE PROCESSED BY PROGRAM DEDNM IS LIMITED BY THE ACCESSIBLE MACHINE MEMORY AND OPERATING SYSTEM LIMITATIONS UNDER WHICH PROGRAM DEDNM IS COMPILED AND EXECUTED. THE SIZE OF THE DEM (IN NUMBER OF ROWS AND COLUMNS) IS SET DYNAMICALLY BY THE PROGRAM AS A FUNCTION OF USER INPUT OF NUMBER OF ROWS AND COLUMNS FOR THE DEM.
- THE SIZE OF THE INTEGER ELEVATION VALUES OF THE DEM MUST BE COMPATIBLE WITH THE COMPILER LIMITATIONS REGARDING THE REPRESENTATION AND PROCESSING OF INTEGER VALUES. CONSIDERATION SHOULD BE GIVEN TO THE FACT THAT, FOR COMPUTATIONAL PURPOSES, THE INPUT ELEVATION VALUES ARE INTERNALLY MULTIPLIED BY 100,000 (TO ALLOW THE TREATMENT OF LOW RELIEF TERRAIN). THEREFORE, A 32 BIT INTEGER (INTEGER*4) REPRESENTATION MUST BE USED. THE 32 BIT INTEGER REPRESENTATION CAN PROCESS ELEVATION VALUES BETWEEN 1.0 AND +9,999.0 METERS.
- THE SIZE OF THE WATERSHED AREA, IN NUMBER OF CELLS, MUST BE WITHIN THE RANGE OF VALUES THAT CAN BE REPRESENTED BY AN INTEGER*4 NUMBER (2,147,483,648).
- SOME COMPILERS TAKE ADVANTAGE OF THE GREATER PRECISION OF CURRENT VARIABLE VALUES IN A REGISTER AS OPPOSED TO THE LESSER PRECISION OF THE VALUE WHEN RELOADED FROM MEMORY. A DIFFERENCE IN PRECISION MAY OCCUR BECAUSE THE PRECISION OF THE DATUM IS GREATER IN A REGISTER THAN IN MEMORY. UNDER CERTAIN CONDITIONS PROGRAM DEDNM IS SENSITIVE TO DIFFERENCES IN PRECISION OF COMPUTED VARIABLE VALUES WHEN THEY ARE USED DIRECTLY FROM THE REGISTER AS OPPOSED TO BEING RELOADED FROM MEMORY. TO ENSURE CONSISTENT RESULTS THE USER SHOULD SET THE SWITCH OF THE COMPILER TO CONSISTENTLY CHOOSE THE MEMORY REFERENCE PRECISION FOR NON-INTEGGER OPERATIONS, IF AVAILABLE. IF NOT AVAILABLE IT IS POSSIBLE THAT THE VERIFICATION TESTS PRODUCE SLIGHTLY DIFFERENT RESULTS DUE TO ROUNDING ERROR.
- SOME OPERATIONS IN TOPAZ ARE PERFORMED AT THE DOUBLE PRECISION LEVEL (SUCH AS SUMMATIONS OF SMALL AND LARGE VALUES). AFTER COMPLETION OF THE OPERATIONS THE RESULT IS CONVERTED BACK TO SINGLE PRECISION. THE INTRINSIC FUNCTION FOR BACK CONVERSION TRUNCATES THE DOUBLE PRECISION TO A SINGLE PRECISION NUMBER. IT DOES NOT ROUND THE NUMBER! AS A RESULT, DOUBLE PRECISION NUMBERS SUCH AS 4.44999999 ARE TRUNCATED TO SINGLE PRECISION VALUES OF 4.449999 EVEN THOUGH IT SHOULD HAVE BEEN ROUNDED TO 4.450000. THIS MAY, UNDER CERTAIN CIRCUMSTANCES, LEAD TO A SLIGHT ROUNDING ERROR AS THE VALUE IS PRINTED WITH A LIMITED NUMBER OF SIGNIFICANT DIGITS.

*** ENDING SBRT CAPLIM.
*** BEGINNING SBRT IOINIT.
*** ENDING SBRT IOINIT.
*** BEGINNING SBRT INITIL.
*** ENDING SBRT INITIL.
*** BEGINNING SBRT INCNT.
*** ENDING SBRT INCNT.

TITLE OF THE CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

*** BEGINNING SBRT OTCNT.

PRINT-OUT OF INPUT DATA FROM FILE DNMCNT.INP AND RELATED DATA.

>>> DEM RASTER PARAMETERS <<<

- TITLE OF CURRENT TOPAZ APPLICATION (3 LINES):

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

- ZONE OF THE DEM: 0
- EASTING AND NORTHING COORDINATE OF THE UPPER LEFT CORNER OF THE DEM:
 0 0
- NUMBER OF ROWS AND COLUMNS IN THE INPUT DEM: 23 36
- PRELIMINARY NUMBER OF ROWS AND COLUMNS IN THE DEM AFTER AGGREGATION/
RESAMPLING (VALUES WILL BE FINALIZED AFTER READING ACTUAL DEM DATA):
 23 36
- ARRAY SIZE LIMIT BEYOND WHICH A WARNING FOR LARGE ARRAY SIZE IS PRINTED:
 1500
- ARRAY SIZE FOR COLUMNS BEFORE AGGREGATION/RESAMPLING: 36
- ARRAY SIZE FOR ROWS AND COLUMNS AFTER AGGREGATION/RESAMPLING:
 23 36
- USER ENTERED MAXIMUM AND MINIMUM ELEVATION IN METERS ROUNDED
TO THE NEAREST DECIMETER: 256.0 1.0
- NUMBER OF DIGITS IN THE MAXIMUM ELEVATION VALUE BEFORE THE
DECIMAL POINT: 3
- INITIAL USER ENTERED MAXIMUM AND MINIMUM ELEVATION VALUE IN METERS
TIMES 100000 (VALUE MAY CHANGE AFTER RELIEF INCREMENTATION OF FLAT AREA.):
 25600000 100000
- MAXIMUM AND MINIMUM DEM ELEVATION VALUE IN PROGRAM INTERNAL UNITS:
 25600000 100000
- USER ENTERED ELEVATION VALUE SPECIFYING INDETERMINATE ELEVATIONS: 0.00
- DEM ELEVATION VALUE SPECIFYING INDETERMINATE ELEVATIONS IN
PROGRAM INTERNAL UNITS: 0
- PROGRAM INTERNAL INDETERMINATE ELEVATION VALUE: -400000
- LENGTH OF A CELL IN METERS OF THE INPUT DEM RASTER BEFORE AND AFTER
AGGREGATION/RESAMPLING: 30.000 30.000
- AREA OF A CELL IN HECTARES OF THE INPUT DEM RASTER BEFORE AND AFTER
AGGREGATION/RESAMPLING: 0.090 0.090
- ORIENTATION OF THE DEM RASTER: 0
- USER ENTERED ROW AND COLUMN COORDINATES OF THE OUTLET OF THE WATERSHED
BEFORE AGGREGATION/RESAMPLING:
 ROW:= 20 COL:= 22

- INITIAL ROW AND COLUMN COORDINATES OF THE OUTLET OF THE WATERSHED:
 ROW:= 20 COL:= 22
 NOTE: IF AGGREGATION/RESAMPLING WAS SELECTED THE COORDINATES REFER TO
 THE AGGREGATED/RESAMPLED DEM RASTER.

>>> DEM ELEVATION PRE-PROCESSING AND PARTIAL PROCESSING OPTIONS <<<

- OPTION FOR AGGREGATING/RESAMPLING THE DEM RASTER: 0
 - AGGREGATION/RESAMPLING FACTOR: 1
 - OPTION FOR SMOOTHING THE INPUT DEM DATA: 0
 - NUMBER OF SMOOTHING PASSES TO BE MADE: 2
 - WEIGHT ASSIGNED TO THE CENTER, CROSS AND DIAGONAL CELLS:
 2 1 1
 - OPTION FOR ANALYSIS AND ADJUSTMENT OF THE DEPRESSION OUTLET: 0
 - OPTION FOR FULL OR PARTIAL DEM PROCESSING: 0

>>> DEM PROCESSING OPTIONS AND NETWORK EXTRACTION PARAMETERS <<<

CSA-MSCL CODE	CSA VALUE [HA]	MSCL VALUE [M]	THRESHOLD NUMBER OF CELLS DEFINING A CHANNEL
0	N/A	N/A	N/A
1	1.00	30.0	11
2	-1.00	-1.0	-1
3	-1.00	-1.0	-1
4	-1.00	-1.0	-1
5	-1.00	-1.0	-1

- OPTION FOR CALIBRATION RUN OF DEDNM: 0
 - RASTER CHECKING FOR ERRORS AND INCONSISTENCIES: 1

>>> USER OUTPUT OPTIONS <<<

FOR ALL OF THE FOLLOWING OPTIONS:

A VALUE OF 1 INDICATES WRITE A FILE TO OUTPUT, OR,
 A VALUE OF 0 INDICATES DO NOT WRITE A FILE.

- WRITE INPUT DATA TO FILE DEDNM.RPT: 1
 - WRITE MODULE CAPABILITIES TO DEDNM.RPT: 1
 - WRITE TABULAR DRAINAGE NETWORK DATA FILE NETW.TAB: 1
 - WRITE TABULAR SUBCATCHMENT DATA FILE SBCT.TAB: 1

*** ENDING SBRT OTCNT.

***** BEGINNING DEM INPUT AND DEM PRE-PROCESSING.

=== ALLOCATING IEL ARRAY.

*** BEGINNING SBRT INDEM.

FINAL NUMBER OF ROWS AND COLUMNS OF THE RASTER ARRAYS:

ROW = 23 COLUMN = 36

NOTE: IF AGGREGATION OR RESAMPLING WAS SELECTED THE NUMBERS REPRESENT
 THE NEW SIZE OF THE AGGREGATED OR RESAMPLED RASTER ARRAYS.

*** ENDING SBRT INDEM.

*** BEGINNING SBRT ERCHK.

MINIMUM VALUE ALLOWED\DETECTED:	100000	100000
MAXIMUM VALUE ALLOWED\DETECTED:	25600000	900000
NUMBER OF MINIMUM AND MAXIMUM VALUES:	8	738
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:		82
INDETERMINATE VALUE AND COUNT:	-400000	0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:	828	828
NUMBER OF UNRESOLVED VALUES:		0

*** ENDING SBRT ERCHK.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

=== ALLOCATING INDTR ARRAY.

*** BEGINNING SBRT INDTR.

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*** ENDING SBRT INDTAR.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           1           2
MAXIMUM VALUE ALLOWED\DETECTED:           2           2
NUMBER OF MINIMUM AND MAXIMUM VALUES:    414          414
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
INDETERMINATE VALUE AND COUNT:           0           0
NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
***** BEGINNING DEPRESSION AND FLAT AREA TREATMENT.
=== ALLOCATING IT1A ARRAY.
=== ALLOCATING IT1B ARRAY.
*** BEGINNING SBRT FILDEP.
*** ENDING SBRT FILDEP.
=== DEALLOCATING IT1A ARRAY.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           100000       100000
MAXIMUM VALUE ALLOWED\DETECTED:          25600000     900000
NUMBER OF MINIMUM AND MAXIMUM VALUES:      8           738
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
INDETERMINATE VALUE AND COUNT:           -400000       0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828          828
NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IT2A ARRAY.
=== ALLOCATING IT3A ARRAY.
*** BEGINNING SBRT RELIEF.
*** ENDING SBRT RELIEF.
=== DEALLOCATING IT3A ARRAY.
=== DEALLOCATING IT2A ARRAY.
=== DEALLOCATING IT1B ARRAY.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           100000       100000
MAXIMUM VALUE ALLOWED\DETECTED:          25600000     900006
NUMBER OF MINIMUM AND MAXIMUM VALUES:      1           27
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
INDETERMINATE VALUE AND COUNT:           -400000       0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828          828
NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
***** BEGINNING FLOW VECTOR, FLOW PATH AND DRAINAGE AREA COMPUTATIONS.
=== ALLOCATING IFV ARRAY.
*** BEGINNING SBRT FLOVEC.
*** ENDING SBRT FLOVEC.
=== DEALLOCATING IEL ARRAY.
=== DEALLOCATING INDTR ARRAY.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           1           1
MAXIMUM VALUE ALLOWED\DETECTED:           9           9
NUMBER OF MINIMUM AND MAXIMUM VALUES:     26          36
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
INDETERMINATE VALUE AND COUNT:           0           0
UNACCEPTABLE VALUE AND COUNT:            5           0
NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
NUMBER OF UNRESOLVED VALUES:              0

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*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFLP ARRAY.
*** BEGINNING SBRT FLOPAT.
*** ENDING SBRT FLOPAT.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           1           1
    MAXIMUM VALUE ALLOWED\DETECTED:           4           4
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     96          371
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 361
    INDETERMINATE VALUE AND COUNT:            0           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING ICA ARRAY.
*** BEGINNING SBRT UPAREA.
*** ENDING SBRT UPAREA.
=== DEALLOCATING IFLP ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:          568          568
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     361           1
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 466
    INDETERMINATE VALUE AND COUNT:            -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
***** BEGINNING CHANNEL NETWORK DEFINITION.
=== ALLOCATING ICMCOD ARRAY.
*** BEGINNING SBRT INPCOD.
*** ENDING SBRT INPCOD.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           1           1
    MAXIMUM VALUE ALLOWED\DETECTED:           5           1
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     414          414
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 0
    INDETERMINATE VALUE AND COUNT:            0           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING NTW ARRAY.
*** BEGINNING SBRT NETFUL.
*** ENDING SBRT NETFUL.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           1           1
    MAXIMUM VALUE ALLOWED\DETECTED:          103          102
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     5           1
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 83
    INDETERMINATE VALUE AND COUNT:            0           739
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** BEGINNING SBRT PRUNE.
=== ALLOCATING LOCAL JRST, JCST, NORT, TDIST AND VMINLG ARRAYS.
=== DEALLOCATING LOCAL JRST, JCST AND NORT ARRAYS.

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*** ENDING SBRT PRUNE.
=== DEALLOCATING ICMCOD ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           1           1
    MAXIMUM VALUE ALLOWED\DETECTED:          103          100
    NUMBER OF MINIMUM AND MAXIMUM VALUES:      5           84
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
    INDETERMINATE VALUE AND COUNT:             0          739
    NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
=== ALLOCATING IT1A ARRAY.
*** BEGINNING SBRT PRUNE1.
*** ENDING SBRT PRUNE1.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           1
    MAXIMUM VALUE ALLOWED\DETECTED:           1           1
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     44          45
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
    INDETERMINATE VALUE AND COUNT:             0          739
    NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT1A ARRAY.
***** BEGINNING WATERSHED OUTLET AND BOUNDARY DEFINITION.
=== ALLOCATING IT3A ARRAY.
*** BEGINNING SBRT OUTLET.
*** ENDING SBRT OUTLET.
=== DEALLOCATING IT3A ARRAY.
=== ALLOCATING BND ARRAY.
=== ALLOCATING INDTR ARRAY.
*** BEGINNING SBRT RSTIO.
*** END SBRT RSTIO.
*** BEGINNING SBRT RSTIO.
*** END SBRT RSTIO.
*** BEGINNING SBRT BOUND.
*** ENDING SBRT BOUND.
*** BEGINNING SBRT ERCHK.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:           1           1
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     274          554
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
    INDETERMINATE VALUE AND COUNT:            -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828          828
    NUMBER OF UNRESOLVED VALUES:              0
*** END SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING INDTR ARRAY.
*** BEGINNING SBRT MAPBOD.
*** ENDING SBRT MAPBOD.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:           9           9
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     274          35
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM:
    INDETERMINATE VALUE AND COUNT:            -1           0

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UNACCEPTABLE VALUE AND COUNT:                5          0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:    828         828
NUMBER OF UNRESOLVED VALUES:                0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:              0          0
MAXIMUM VALUE ALLOWED\DETECTED:             100        100
NUMBER OF MINIMUM AND MAXIMUM VALUES:       742        81
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 5
INDETERMINATE VALUE AND COUNT:              -1         0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:    828        828
NUMBER OF UNRESOLVED VALUES:                0
*** ENDING SBRT ERCHK.
=== DEALLOCATING BND ARRAY.
***** BEGINNING CHANNEL LINK AND NETWORK NODE COMPUTATIONS.
=== ALLOCATING IEL ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING ALL ARRAYS IN MODULE DTCHAL.
*** BEGINNING SBRT NETAN.
*** ENDING SBRT NETAN.
=== DEALLOCATING IEL ARRAY.
=== DEALLOCATING ICA ARRAY.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:              0          0
MAXIMUM VALUE ALLOWED\DETECTED:              2          2
NUMBER OF MINIMUM AND MAXIMUM VALUES:       742        5
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 81
INDETERMINATE VALUE AND COUNT:              -1         0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:    828        828
NUMBER OF UNRESOLVED VALUES:                0
*** ENDING SBRT ERCHK.
=== ALLOCATING IT1A ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT1A ARRAY.
*** BEGINNING SBRT NETNUM.
*** ENDING SBRT NETNUM.
*** BEGINNING SBRT OTCHA.
*** ENDING SBRT OTCHA.
***** BEGINNING CATCHMENT COMPUTATIONS.
=== ALLOCATING NSBC ARRAY.
*** BEGINNING SBRT SUBWT1.
*** ENDING SBRT SUBWT1.
=== DEALLOCATING NTW ARRAY.
=== ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
=== ALLOCATING IT1A ARRAY.
*** BEGINNING SBRT SUBWTA.
*** ENDING SBRT SUBWTA.
=== DEALLOCATING IT1A ARRAY.
=== DEALLOCATING IFV ARRAY.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:              20         22
MAXIMUM VALUE ALLOWED\DETECTED:             104        104
NUMBER OF MINIMUM AND MAXIMUM VALUES:       8          10
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 536
INDETERMINATE VALUE AND COUNT:              0          274
NUMBER OF CELLS IN RASTER ENTERED/TESTED:    828        828
NUMBER OF UNRESOLVED VALUES:                0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.

```

```
*** ENDING SBRT RSTIO.  
=== DEALLOCATING NSBC ARRAY.  
*** BEGINNING SBRT OTWIN.  
*** ENDING SBRT OTWIN.  
***** BEGINNING TO WRITE UNFORMATTED FILES.  
*** BEGINNING SBRT IOCHA.  
*** ENDING SBRT IOCHA.  
*** BEGINNING SBRT IOCAT.  
*** ENDING SBRT IOCAT.  
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHA1.  
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCAT1.  
*** BEGINNING SBRT OTCNT1.  
*** ENDING SBRT OTCNT1.  
***** ENDING PROGRAM DEDNM.
```

10.2.5 Output file NETW.TAB

Note: This file has been abbreviated to accommodate the format requirements of this manual. Access the actual file to view all included parameters

TOPAZ SOFTWARE : TOPAZ PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM DEDNM : DIGITAL ELEVATION DRAINAGE NETWORK MODEL PROGRAM
 VERSION 3.10, APRIL 1999

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
 L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

CHAN. CNTR	CHANNEL ORDER	COORDINATES						CHANNEL LENGTH IN # CELL WIDTHS	TERRAIN ELEVATION IN METERS	
		UPSTREAM PREV.		DOWNSTREAM LAST		UPSTR.	DWSTR.			
#	#	ROW	COL	ROW	COL	ROW	COL			
1	2	3	4	5	6	7	8	9	10	11
1	1	13	55	24	54	25	54	12.41	85.7	66.4
2	1	17	21	18	23	18	24	3.41	102.8	95.5
3	1	20	62	26	60	27	59	8.24	77.8	61.4
4	1	24	20	19	24	18	24	7.66	111.4	95.5
5	1	26	65	29	63	30	62	5.24	69.6	8.4
6	1	33	32	47	49	48	49	29.56	98.3	63.8
7	1	41	20	48	48	48	49	32.73	117.0	63.8
8	2	18	24	25	53	25	54	34.56	95.5	66.4
9	2	25	54	27	58	27	59	5.83	66.4	61.4
10	2	27	59	29	61	30	62	4.24	61.4	58.4
11	2	30	62	53	78	54	79	31.63	58.4	44.2
12	2	48	49	54	78	54	79	35.56	63.8	44.2
13	3	54	79	59	93	58	94	20.73	44.2	34.6
14	3	58	94	58	94	58	94	0.00	34.6	34.6

-1

** NOTES **

- COLUMNS 1 THROUGH 22 ARE COMPUTED BY PROGRAM DEDNM; COLUMNS 23 AND 24 ARE COMPUTED BY PROGRAM PARAM.
- FOR COMPLEX JUNCTION NODES THE CHANNEL LINK INFORMATION RELATES TO THE FIRST NODE NUMBER ONLY.
- BECAUSE THE NETWORK MAY CONTAIN COMPLEX JUNCTIONS, THE NUMBER OF CHANNEL LINKS MAY BE SMALLER THAN THE THEORETICALLY EXPECTED NUMBER BASED ON THE COUNT OF SOURCE NODES.
- THE LAST LINE OF DATA DOES NOT REPRESENT A CHANNEL LINK. IT REPRESENTS THE WATERSHED OUTLET CELL.
- ELEVATION VALUES ARE REPORTED TO THE NEAREST DECIMETER.
- THE THREE DRAINAGE AREA COLUMNS UNDER THE HEADING OF UPSTREAM AREA DO NOT INCLUDE THE AREA OF THE CURRENT CELL ITSELF. THEY INCLUDE ALL (CHANNEL AND OVERLAND) INFLOWS FLOWING INTO THE CURRENT CELL. THIS LAST COMMENT IS PARTICULARLY RELEVANT FOR THE COLUMN LABELED *UPSTR.*.

- THE DIRECT DRAINAGE AREA IS ALL OVERLAND AREA FLOWING DIRECTLY INTO A CHANNEL LINK. THIS DOES NOT INCLUDE UPSTREAM CHANNEL INFLOW, BUT IT DOES INCLUDE UPSTREAM OVERLAND INFLOW INTO THE FIRST CELL OF A CHANNEL LINK. ALSO, THE DIRECT DRAINAGE AREA FOR FIRST ORDER CHANNELS DOES NOT INCLUDE THE DRAINAGE AREA FLOWING INTO THE CHANNEL SOURCE NODE OR CELL. THIS SOURCE DRAINAGE AREA IS GIVEN FOR FIRST ORDER CHANNELS BY THE COLUMN LABELED *UPSTR.*.
- THE DIRECT DRAINAGE AREA INTO THE OUTLET CELL, AS WELL AS THE AREA OF THE OUTLET CELL ITSELF, ARE ACCOUNTED FOR IN THE LAST CHANNEL LINK (PREVIOUS TO LAST DATA LINE). AS A RESULT, THE VALUE OF THE DIRECT DRAINAGE AREA OF THE LAST CHANNEL LINK INCLUDES, IN ADDITION TO ITS OWN DIRECT DRAINAGE AREA, THE DIRECT DRAINAGE AREA INTO THE OUTLET CELL, AS WELL AS THE AREA OF THE OUTLET CELL ITSELF. THIS NECESSITATES THAT THE UPSTREAM AREA LABELED "DWSTR.-1" OF THE LAST CHANNEL LINK ALSO INCLUDES THE DIRECT DRAINAGE AREA OF THE OUTLET CELL, AS WELL AS THE AREA OF THE OUTLET CELL ITSELF.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.

10.2.6 Output file SBCT.TAB

TOPAZ SOFTWARE : TOPAZ PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM DEDNM : DIGITAL ELEVATION DRAINAGE NETWORK MODEL PROGRAM
 VERSION 3.10, APRIL 1999

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
 L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

TABLE OF RASTER-NETWORK SUBCATCHMENT INFORMATION AS COMPUTED BY PROGRAM DEDNM

NOTE: FOR COMPLEX JUNCTION NODES ONLY THE SUBCATCHMENT INFORMATION
 PERTAINING TO THE FIRST NODE NUMBER IS GIVEN. SUBSEQUENT NODES
 ARE HYPOTHETICAL NODES AND HAVE NO CORRESPONDING SUBCATCHMENT INFORMATION.

CHAN. CNTR.	CHAN. ORDER	CHAN. INDEX	SUBCATCHMENT AREA IN NUMBER OF CELLS				TOTAL
			SOURCE	LEFT	RIGHT	CHANNEL	
1	1	7	11	18	18	12	59
2	1	9	15	35	38	10	98
3	1	5	18	47	94	31	190
4	1	3	11	27	60	18	116
5	1	10	20	28	12	10	70
6	2	2	-1	8	8	5	21
7	2	1	-1	-1	-1	-1	-1
-1							

** NOTE **

- BECAUSE THERE MAY BE JUNCTIONS WITH MULTIPLE TRIBUTARIES, THE NUMBER OF SUBCATCHMENTS MAY BE SMALLER THAN THE THEORETICALLY EXPECTED NUMBER.
- THE LAST LINE OF DATA DOES NOT REPRESENT A SUBCATCHMENT. IT REPRESENTS THE WATERSHED OUTLET CELL.
- THE SUBCATCHMENT AREAS INTO THE OUTLET CELL ARE ACCOUNTED FOR IN THE LAST CHANNEL LINK (PREVIOUS TO LAST DATA LINE). AS A RESULT, THE VALUE OF THE SUBCATCHMENT AREAS OF THE LAST CHANNEL LINK INCLUDE, IN ADDITION TO THEIR OWN SUBCATCHMENT AREAS, THE SUBCATCHMENT AREAS INTO THE OUTLET CELL.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.

10.2.7 Input file RASPRO.INP

```
C
C*****
C INPUT DATA FILE RASPRO.INP
C THIS INPUT DATA FILE IS THE GENERAL INPUT FILE FOR PROGRAM RASPRO.
C THE INPUT ALLOWS THE USER TO SELECT THE OPTIONS FOR ADDITIONAL RASTER
C PROCESSING FROM RASTERS GENERATED BY PROGRAM DEDNM.
C*****
C
C WRITE THE PROGRAM INPUT VALUES AND USER OPTIONS TO REPORT FILE RASPRO.RPT.
C ENTER 0 FOR NO; ENTER 1 FOR YES:
C
1
C
C FOR ALL OPTIONS SELECT:          1 TO ENABLE THE OPTION, OR
C (INTEGER VALUE REQUIRED)         0 TO DISABLE THE OPTION.
C
C ***** PROCESS NETWORK AND SUBCATCHMENT DATA: ENHANCE NETWORK; AGGREGATE
C SUBCATCHMENT AREAS; CREATE SUBCATCHMENT BOUNDARY LINES FOR AGGREGATED
C AND UNAGGREGATED SUBCATCHMENTS.
1
C
C ***** PROCESS ELEVATION DATA: IDENTIFY LOCATION AND EXTENT OF DEPRESSIONS
C AND FLAT AREAS; DEFINE BANDS OF EQUAL ELEVATION; COMPUTE ELEVATION
C DROP TO NEXT CHANNEL AND TO WATERSHED OUTLET.
1
30 DESIRED NUMBER OF BANDS OF EQUAL ELEVATIONS (MAXIMUM 100).
C
C ***** COMPUTE LOCAL SLOPE AND ASPECT ALTERNATIVES: FLOW VECTOR SLOPE;
C HYDRAULIC SLOPE; TERRAIN SLOPE; FLOW VECTOR ASPECT; TERRAIN ASPECT.
1
C
C ***** COMPUTE FLOW PATH DISTANCES: FLOW PATH DISTANCE TO OUTLET; FLOW PATH
C DISTANCE TO THE FIRST DOWNSTREAM CHANNEL.
1
```

10.2.8 Output file RASPRO.RPT

```
***** BEGINNING PROGRAM RASPRO.
***** INITIALIZING AND READING GENERAL I/O.
*** BEGINNING SBRT OUTITL.
TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
                 VERSION 3.12, AUGUST 1999
PROGRAM RASPRO: RASTER PROCESSING PROGRAM
                 VERSION 3.10, APRIL 1999
```

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.
J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

DISCLAIMER

THIS PROGRAM AND ITS SUBROUTINES ARE ACCEPTED AND USED BY THE RECIPIENT UPON THE EXPRESS UNDERSTANDING THAT THE DEVELOPERS MAKE NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY OR SUITABILITY FOR ANY ONE PURPOSE, AND THAT THE DEVELOPERS SHALL BE UNDER NO LIABILITY TO ANY PERSON BY REASON OF ANY USE MADE THEREOF.

THE SUBROUTINES IN THIS PROGRAM CANNOT BE LIFTED, EXTRACTED OR TRANSFERRED OUT OF THIS PROGRAM FOR USE WITH OTHER PROGRAMS OR OTHER PURPOSES BECAUSE INPUT VARIABLES INTO SUBROUTINES MUST HAVE BEEN PROCESSED AND ASSIGNED SPECIFIC VALUES BY PRECEDING SUBROUTINES THAT REFLECT PROGRAM, CODE AND TERRAIN SPECIFIC PARTICULARITIES. THE USE OF A SUBROUTINE FOR OTHER PURPOSES THAN IN THIS PROGRAM MAY PRODUCE, AT BEST, INEXECUTABLE CODE, OR, AT WORST, ERRONEOUS RESULTS THAT GO UNRECOGNIZED.

THE AUTHORS AND DEVELOPERS OF THIS PROGRAM AND ITS SUBROUTINES SHALL BE ACKNOWLEDGED WHEN THE CODE, THE MODEL AND/OR THE NUMERICAL SOLUTION TECHNIQUES USED HEREIN ARE DIRECTLY APPLIED IN CONJUNCTION WITH ANOTHER CODE, OR DESCRIBED AND/OR REFERRED TO IN A PUBLICATION OR PRESENTATION.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*** ENDING SBRT OUTITL.
*** BEGINNING SBRT PROPTA.
*** BEGINNING SUBROUTINE CHKFIL.
*** ENDING SBRT PROPTA.
*** BEGINNING SBRT IOINIT.
*** ENDING SBRT IOINIT.
*** BEGINNING SBRT INPCNT.
*** ENDING SBRT INPCNT.
*** BEGINNING SBRT INPBAT.
*** ENDING SBRT INPBAT.
*** BEGINNING SBRT INPBAT.
    DEM RASTER PARAMETERS.
        NUMBER OF ROWS AND COLUMNS IN RASTER:        23        36
        SIZE OF A PIXEL SIDE IN METERS:                30.00
        MINIMUM AND MAXIMUM ELEVATION VALUES IN METERS:
            1.0000        9.0001
```

```

USER PROVIDED INDETERMINATE ELEVATION VALUE:      0.0
USER PROVIDED INDETERMINATE ELEVATION VALUE IN PROGRAM INTERNAL UNITS:
      0
INTERNAL INDETERMINATE ELEVATION VALUE AS ASSIGNED AND USED
BY THE PROGRAM:      -400000
STRAHLER ORDER OF THE DRAINAGE NETWORK:      2
USER OPTIONS
FOR ALL OF THE FOLLOWING OPTIONS:
  A VALUE OF 1 INDICATES THAT COMPUTATIONS ARE PERFORMED, OR
  A VALUE OF 0 INDICATES THAT COMPUTATIONS ARE NOT PERFORMED.
WRITE USER INPUT OPTIONS TO RASPRO.RPT: 1
PROCESSING OF NETWORK AND SUBCATCHMENT DATA: 1
PROCESSING OF ELEVATION DATA: 1
PROCESSING OF LOCAL SLOPE AND ASPECT ALTERNATIVES: 1
PROGRAM EXECUTION STATUS: 1 EXECUTED 0 NOT EXECUTED
PROGRAM DEDNM: 1
PROGRAM RASPRO: 0
PROGRAM RASFOR: 0
PROGRAM RASBIN: 0
PROGRAM NSSTAT: 0
*** ENDING SBRT INPBAT.
***** BEGINNING DEPRESSION AND FLAT AREA DEFINITION.
=== ALLOCATING IT1A ARRAY.
=== ALLOCATING IEL ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IT3A ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SBRT DEPFLT.
*** ENDING SBRT DEPFLT.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:                1            3
MAXIMUM VALUE ALLOWED\DETECTED:                6            6
NUMBER OF MINIMUM AND MAXIMUM VALUES:        410            8
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 410           410
INDETERMINATE VALUE AND COUNT:                0            0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:    828           828
NUMBER OF UNRESOLVED VALUES:                 0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT1A ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SBRT ELVCLA.
*** ENDING SBRT ELVCLA.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:        100000    113333
MAXIMUM VALUE ALLOWED\DETECTED:        900006    886677
NUMBER OF MINIMUM AND MAXIMUM VALUES:      8         738
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 82
INDETERMINATE VALUE AND COUNT:        -400000    0
NUMBER OF CELLS IN RASTER ENTERED/TESTED:  828       828
NUMBER OF UNRESOLVED VALUES:           0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT3A ARRAY.
*** BEGINNING SBRT OTELCL.
*** ENDING SBRT OTELCL.

```



```

=== ALLOCATING BND ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFV ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFLP ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING NTW1 ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IDPCHA ARRAY.
=== ALLOCATING IDPOUT ARRAY.
=== DEALLOCATING IEL ARRAY.
=== DEALLOCATING BND ARRAY.
=== DEALLOCATING IFLP ARRAY.
=== DEALLOCATING NTW1 ARRAY.
=== DEALLOCATING IFV ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IDPCHA ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IDPOUT ARRAY.
***** BEGINNING LOCAL SLOPE AND ASPECT COMPUTATIONS.
=== ALLOCATING IFV ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFVAS ARRAY.
*** BEGINNING SBRT FVASPE.
*** ENDING SBRT FVASPE.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           0           0
MAXIMUM VALUE ALLOWED\DETECTED:          360          315
NUMBER OF MINIMUM AND MAXIMUM VALUES:    231           26
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 571
INDETERMINATE VALUE AND COUNT:           -1           0
NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828           828
NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IEL ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFVS ARRAY.
*** BEGINNING SBRT FVSLOP.
*** ENDING SBRT FVSLOP.
*** BEGINNING SBRT ERCHK.
MINIMUM VALUE ALLOWED\DETECTED:           1           3
MAXIMUM VALUE ALLOWED\DETECTED:    2000000000    1600000
NUMBER OF MINIMUM AND MAXIMUM VALUES:    51           2
NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 663
INDETERMINATE VALUE AND COUNT:           -1          112
NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828           828
NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING ITAAS ARRAY.

```

```

=== ALLOCATING ITASL ARRAY.
=== ALLOCATING Z ARRAY.
=== ALLOCATING INDTR ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SBRT TAS.
*** ENDING SBRT TAS.
=== DEALLOCATING Z ARRAY.
=== DEALLOCATING IFVS ARRAY.
=== DEALLOCATING IFVAS ARRAY.
=== DEALLOCATING INDTR ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:          360          349
    NUMBER OF MINIMUM AND MAXIMUM VALUES:    188            9
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 631
    INDETERMINATE VALUE AND COUNT:           -1            0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828            828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:    2000000000    1600000
    NUMBER OF MINIMUM AND MAXIMUM VALUES:    36             2
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 678
    INDETERMINATE VALUE AND COUNT:           -1            112
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828            828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING ITASL ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING ITAAS ARRAY.
=== ALLOCATING ICA ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IHDS ARRAY.
*** BEGINNING SBRT HSLOPE.
*** ENDING SBRT HSLOPE.
=== DEALLOCATING IEL ARRAY.
=== DEALLOCATING ICA ARRAY.
=== DEALLOCATING IFV ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           1           3
    MAXIMUM VALUE ALLOWED\DETECTED:    2000000000    1600000
    NUMBER OF MINIMUM AND MAXIMUM VALUES:    30             2
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 780
    INDETERMINATE VALUE AND COUNT:           -1            16
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828            828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IHDS ARRAY.
***** BEGINNING NETWORK AND BOUNDARY ENHANCEMENT COMPUTATIONS.
=== ALLOCATING NTW1 ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING NTWE ARRAY.

```

```

*** BEGINNING SBRT NETWE.
*** ENDING SBRT NETWE.
=== DEALLOCATING NTW1 ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:           2           2
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     528          21
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 279
    INDETERMINATE VALUE AND COUNT:           -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING NTWE ARRAY.
=== ALLOCATING IT1A ARRAY.
=== ALLOCATING NSBC ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SBRT SUBBDA.
*** ENDING SBRT SUBBDA.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:           2           2
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     274          73
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 481
    INDETERMINATE VALUE AND COUNT:           -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT1A ARRAY.
=== ALLOCATING IT3A ARRAY.
*** BEGINNING SBRT SUBWTB.
*** ENDING SBRT SUBWTB.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:          104          100
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     274          70
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 484
    INDETERMINATE VALUE AND COUNT:           -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT3A ARRAY.
=== ALLOCATING IT1A ARRAY.
*** BEGINNING SBRT SUBBDA.
*** ENDING SBRT SUBBDA.
=== DEALLOCATING NSBC ARRAY.
*** BEGINNING SBRT ERCHK.
    MINIMUM VALUE ALLOWED\DETECTED:           0           0
    MAXIMUM VALUE ALLOWED\DETECTED:           2           2
    NUMBER OF MINIMUM AND MAXIMUM VALUES:     274          315
    NUMBER OF VALUES BETWEEN MINIMUM AND MAXIMUM: 239
    INDETERMINATE VALUE AND COUNT:           -1           0
    NUMBER OF CELLS IN RASTER ENTERED/TESTED: 828          828
    NUMBER OF UNRESOLVED VALUES:             0
*** ENDING SBRT ERCHK.

```

```
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IT1A ARRAY.
***** BEGINNING FLOW PATH DISTANCE COMPUTATIONS.
=== ALLOCATING IFV ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IFLP ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING BND ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING RT2A ARRAY.
=== ALLOCATING IDSOUT ARRAY.
*** BEGINNING SBRT DISOUT.
*** ENDING SBRT DISOUT.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IDSOUT ARRAY.
=== ALLOCATING NTW1 ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IDSCHA ARRAY.
*** BEGINNING SBRT DISCHA.
*** ENDING SBRT DISOUT.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== DEALLOCATING IDSCHA ARRAY.
=== DEALLOCATING BND ARRAY.
=== DEALLOCATING IFLP ARRAY.
=== DEALLOCATING IFV ARRAY.
=== DEALLOCATING NTW1 ARRAY.
=== DEALLOCATING RT2A ARRAY.
*** WRITING OUTPUT CONTROL FILE; SBRT IOCNT.
***** ENDING PROGRAM RASPRO.
```

10.2.9 Input file RASFOR.INP

```
C*****
C INPUT DATA FILE RASFOR.INP
C THIS INPUT DATA FILE CONTAINS THE PARAMETERS REQUIRED BY PROGRAM RASFOR.FOR
C TO REFORMAT THE UNFORMATTED RASTER FILES PRODUCED BY DEDNM.
C*****
C
C THE FOLLOWING ARE THE REFORMATTING OPTIONS AVAILABLE WITH PROGRAM RASFOR:
C
C 0 - ASCII FILE HAVING ONE VALUE PER RECORD. THE ORDER OF THE VALUES
C ARE: COLUMN FIRST, ROW SECOND; I.E. X(R,C) FOR COLUMNS 1 THROUGH NCOLUMN
C (C=1,NCOLUMN), THIS FOR SUCCESSIVE ROWS 1 THROUGH NROW (R=1,NROW).
C
C 1 - ASCII FILE IN 2-DIMENSIONAL ARRAY FORM. THE FILE HAS ONE RECORD FOR
C EACH ROW OF DATA IN THE RASTER ARRAY. THE VALUES WITHIN A RECORD ARE
C IN INCREASING COLUMN ORDER; I.E. X(R,C) FOR COLUMNS 1 THROUGH NCOLUMN
C (C=1,NCOLUMN) REPEATED FOR EACH ROW 1 THROUGH NROW (R=1,NROW).
C
C 2 - IDRISI (NOTE 1) 4.0 FORMAT. THIS FORMAT PROVIDES THE RASTER FILES FOR
C THE COMMERCIAL GIS PACKAGE IDRISI (NOTE 1). THE FILES COME IN PAIRS:
C ONE IMAGE FILE AND ONE CORRESPONDING DOCUMENTATION FILE. THE IMAGE
C FILE IS A SINGLE VALUE PER RECORD FORMAT.
C NOTE: THESE FILES CAN BE VIEWED DIRECTLY IN IDRISI 4.0 USING THE MODULE
C 'COLOR A'. HOWEVER, AUTOMATIC RECLASSIFICATION, GROUPING AND
C COLOR WRAPPING MAY AFFECT THE VISUAL REPRESENTATION OF THE DATA.
C THE USER MUST PERFORM ADDITIONAL FILE MANIPULATIONS WITHIN IDRISI
C TO DISPLAY THE DATA ACCORDING TO THEIR SPECIFICATIONS AND NEEDS.
C
C 3 - ARC/INFO (NOTE 1) ASCIIGRID INPUT FORMAT. THIS FORMAT PROVIDES AN ASCII
C FILE WHICH CAN BE USED AS AN INPUT FORMAT FOR USE WITH THE COMMERCIAL
C GIS PACKAGE ARC/INFO (NOTE 1). THIS FORMAT CAN BE USED WITH THE
C ARC/INFO COMMAND ASCIIGRID TO GET THE DATA INTO ARC/INFO'S GRID FORMAT.
C THE FILE IS IN ASCII FORMAT WITH A HEADER CONTAINING FILE INFORMATION
C DATA. THE RASTER DATA IS IN 2-DIMENSIONAL ARRAY FORM. THE FILE HAS
C ONE RECORD FOR EACH ROW IN THE RASTER ARRAY. THE VALUES WITHIN ONE
C RECORD ARE IN INCREASING COLUMN ORDER; I.E. COLUMNS 1 THROUGH NCOLUMN
C (C=1,NCOLUMN), REPEATED FOR EACH ROW 1 THROUGH NROW (R=1,NROW).
C MAXIMUM NUMBER OF COLUMNS ALLOWED BY THE FORMAT STATEMENTS IN THIS
C MODULE IS 12500.
C
C ARC/INFO VERSION 7.0.X ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE
C 380 NEW YORK STREET
C REDLANDS, CA 92373
C U.S.A.
C
C - NOTE 1: USE OF MANUFACTURER OR TRADE NAMES IS FOR INFORMATIONAL PURPOSES
C ONLY AND DOES NOT IMPLY ENDORSEMENT BY THE UNITED STATES DEPARTMENT
C OF AGRICULTURE.
C-----
C * ENTER YOUR CHOICE FOR OUTPUT FORMAT 0, 1, 2 OR 3 (INTEGER VALUE):
C
C 1
C
C * WRITE THE PROGRAM INPUT VALUES AND USER OPTIONS TO REPORT FILE RASFOR.RPT.
C ENTER 0 FOR NO; ENTER 1 FOR YES:
C
C 1
C
```

```

C FOR ALL OF THE FOLLOWING OPTIONS:
C     ENTER 1 TO WRITE DESIRED OUTPUT (INTEGER VALUE)
C     ENTER 0 NOT TO WRITE THE OUTPUT (INTEGER VALUE)
C
C NOTE: ALL OUTPUT FILE NAMES LISTED BELOW ARE GIVEN WITH THE EXTENSION .DAT;
C       HOWEVER, THEY CAN ALSO HAVE EXTENSION .DOC AND .IMG WHEN THE USER
C       SELECTS THE IDRISI FORMAT.
C
C-----
C *** SELECT REFORMATTING FOR FILES PRODUCED BY PROGRAM DEDNM.
C-----
C
C * INITIAL (OR OPTIONALLY AGGREGATED OR RESAMPLED) DEM INPUT ELEVATION RASTER
C   TO OUTPUT FILE INELEV.DAT
C   1
C * INITIAL (OR OPTIONALLY AGGREGATED OR RESAMPLED) AND OPTIONALLY SMOOTHED
C   DEM ELEVATION RASTER TO OUTPUT FILE SMOOTH.DAT. IF DEM SMOOTHING OPTION
C   WAS NOT SELECTED, THIS OPTION CANNOT BE EXERCISED AND A VALUE OF 0 SHOULD
C   BE ENTERED.
C   1
C * INITIAL (OR OPTIONALLY AGGREGATED OR RESAMPLED), OPTIONALLY SMOOTHED,
C   OPTIONALLY DEPRESSION ANALYZED AND DEPRESSION FILLED DEM RASTER TO OUTPUT
C   FILE FILDEP.DAT
C   1
C * INITIAL (OR OPTIONALLY AGGREGATED OR RESAMPLED), OPTIONALLY SMOOTHED,
C   OPTIONALLY DEPRESSION ANALYZED, DEPRESSION FILLED DEM RASTER AND RELIEF
C   MODIFIED DEM RASTER TO OUTPUT FILE RELIEF.DAT
C   1
C * FLOW VECTOR RASTER TO OUTPUT FILE FLOVEC.DAT
C   1
C * FLOW PATH DEFINITION RASTER TO OUTPUT FILE FLOPAT.DAT
C   1
C * INDETERMINATE AREA DEFINITION RASTER TO OUTPUT FILE INDTAR.DAT
C   1
C * UPSTREAM CATCHMENT AREA RASTER TO OUTPUT FILE UPAREA.DAT
C   1
C * CODES FOR SPATIALLY VARIABLE CSA AND MSCL PARAMETERS.
C   1
C * DRAINAGE CHANNELS FOR THE ENTIRE DEM TO OUTPUT FILE NETFUL.DAT
C   1
C * WATERSHED AREA DEFINITION TO OUTPUT FILE BOUND.DAT
C   1
C * DRAINAGE NETWORK RASTER TO OUTPUT FILE NETW.DAT
C   1
C * SUBWATERSHED AREA RASTER TO OUTPUT FILE SUBWTA.DAT
C   1
C
C-----
C *** SELECT REFORMATTING FOR FILES PRODUCED BY PROGRAM RASPRO.
C-----
C
C * DEPRESSION AND FLAT AREA RASTER TO OUTPUT FILE DEPFLT.DAT.
C   1
C * EQUAL ELEVATION BAND RASTER TO OUTPUT FILE ELVCLA.DAT.
C   1
C * FLOW VECTOR ASPECT RASTER TO OUTPUT FILE FVASPE.DAT.
C   1
C * TERRAIN ASPECT RASTER FILE TO OUTPUT FILE TASPEC.DAT.
C   1
C * FLOW VECTOR SLOPE RASTER TO OUTPUT FILE FVSLOP.DAT.
C   1

```

C * HYDRAULIC SLOPE RASTER TO OUTPUT FILE HSLOPE.DAT.
1
C * TERRAIN SLOPE RASTER FILE TO OUTPUT FILE TSLOPE.DAT.
1
C * ENHANCED NETWORK RASTER TO OUTPUT FILE NETWE.DAT.
1
C * AGGREGATED SUBWATERHED BOUNDARY LINE FILE TO OUTPUT FILE SUBBDA.DAT.
1
C * AGGREGATED SUBWATERSHED AREA RASTER TO OUTPUT FILE SUBWTB.DAT.
1
C * SUBWATERHED BOUNDARY LINE FILE TO OUTPUT FILE SUBBDB.DAT.
1
C * FLOW PATH DISTANCE TO NEAREST CHANNEL TO OUTPUT FILE DISCHA.DAT.
1
C * FLOW PATH DISTANCE TO WATERSHED OUTLET TO OUTPUT FILE DISOUT.DAT.
1
C * FLOW PATH ELEVATION DROP TO NEAREST CHANNEL TO OUTPUT FILE ELDCHA.DAT.
1
C * FLOW PATH ELEVATION DROP TO WATERSHED OUTLET TO OUTPUT FILE ELDOUT.DAT.
1

10.2.10 Output file RASFOR.RPT

***** BEGINNING PROGRAM RASFOR.
*** BEGINNING SBRT OUTITL.
TOPAZ SOFTWARE: TOPAZ PARAMETERIZATION SOFTWARE SYSTEM
 VERSION 3.12, AUGUST 1999
PROGRAM RASFOR: RASTER REFORMATTING PROGRAM
 VERSION 3.11, AUGUST 1999

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.
J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

DISCLAIMER

THIS PROGRAM AND ITS SUBROUTINES ARE ACCEPTED AND USED BY THE RECIPIENT UPON THE EXPRESS UNDERSTANDING THAT THE DEVELOPERS MAKE NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY OR SUITABILITY FOR ANY ONE PURPOSE, AND THAT THE DEVELOPERS SHALL BE UNDER NO LIABILITY TO ANY PERSON BY REASON OF ANY USE MADE THEREOF.

THE SUBROUTINES IN THIS PROGRAM CANNOT BE LIFTED, EXTRACTED OR TRANSFERRED OUT OF THIS PROGRAM FOR USE WITH OTHER PROGRAMS OR OTHER PURPOSES BECAUSE INPUT VARIABLES INTO SUBROUTINES MUST HAVE BEEN PROCESSED AND ASSIGNED SPECIFIC VALUES BY PRECEDING SUBROUTINES THAT REFLECT PROGRAM, CODE AND TERRAIN SPECIFIC PARTICULARITIES. THE USE OF A SUBROUTINE FOR OTHER PURPOSES THAN IN THIS PROGRAM MAY PRODUCE, AT BEST, INEXECUTABLE CODE, OR, AT WORST, ERRONEOUS RESULTS THAT GO UNRECOGNIZED.

THE AUTHORS AND DEVELOPERS OF THIS PROGRAM AND ITS SUBROUTINES SHALL BE ACKNOWLEDGED WHEN THE CODE, THE MODEL AND/OR THE NUMERICAL SOLUTION TECHNIQUES USED HEREIN ARE DIRECTLY APPLIED IN CONJUNCTION WITH ANOTHER CODE, OR DESCRIBED AND/OR REFERRED TO IN A PUBLICATION OR PRESENTATION.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

*** ENDING SBRT OUTITL.
*** BEGINNING SBRT INIT.
*** ENDING SBRT INIT.
*** BEGINNING SBRT INPCNT.
*** ENDING SBRT INPCNT.
*** BEGINNING SBRT INPBAT.
*** ENDING SBRT INPBAT.
*** BEGINNING SBRT OUTINP.
DEM RASTER PARAMETERS.
 USER SELECTION OF OUTPUT FORMAT (ICHOIC): 1
 NUMBER OF ROWS AND COLUMNS IN RASTER: 23 36
 SIZE OF A PIXEL SIDE IN METERS: 30.00
 MINIMUM AND MAXIMUM ELEVATION VALUES IN METERS:
 1.0000 9.0001
 MAXIMUM NUMBER OF DIGITS IN THE LARGEST ELEVATION VALUE: 3
 USER PROVIDED INDETERMINATE ELEVATION VALUE: 0.0

NUMBER OF DIGITS PRECEDING THE DECIMAL POINT FOR THE INDETERMINATE
 ELEVATION VALUE: 1
 USER PROVIDED INDETERMINATE ELEVATION VALUE IN PROGRAM INTERNAL UNITS:
 0
 INTERNAL INDETERMINATE ELEVATION VALUE AS ASSIGNED AND USED
 BY THE PROGRAM: -400000
 MAXIMUM NUMBER OF DIGITS IN THE SUBCATCHMENT INDEX VALUE
 REPRESENTATION: 3
 MAXIMUM NUMBER OF DIGITS IN THE UPSTREAM AREA VALUE
 REPRESENTATION: 3
 STRAHLER ORDER OF THE DRAINAGE NETWORK: 2
 SLOPE RASTER PARAMETERS.
 MINIMUM AND MAXIMUM FLOW VECTOR SLOPE VALUES: 0.00000 0.26667
 INDETERMINATE SLOPE VALUE: -0.01778
 NUMBER OF DIGITS PRECEDING THE DECIMAL POINT FOR FLOW VECTOR
 SLOPE VALUE: 2
 MINIMUM AND MAXIMUM HYDRAULIC SLOPE VALUES: 0.00000 0.26667
 INDETERMINATE SLOPE VALUE: -0.01778
 NUMBER OF DIGITS PRECEDING THE DECIMAL POINT FOR HYDRAULIC
 SLOPE VALUE: 2
 MINIMUM AND MAXIMUM TERRAIN SLOPE VALUES: 0.00000 0.26667
 INDETERMINATE SLOPE VALUE: -0.01569
 NUMBER OF DIGITS PRECEDING THE DECIMAL POINT FOR TERRAIN
 SLOPE VALUE: 2
 USER OUTPUT OPTIONS
 FOR ALL OF THE FOLLOWING OPTIONS:
 A VALUE OF 1 INDICATES THAT THE FILE IS WRITTEN TO OUTPUT, OR,
 A VALUE OF 0 INDICATES THAT THE FILE IS NOT WRITTEN TO OUTPUT.
 WRITE PROGRAM OUTPUT OPTIONS TO RASFOR.RPT: 1
 WRITE INPUT/AGGREGATED/RESAMPLED ELEVATION RASTER TO FILE INELEV.DAT: 1
 WRITE SMOOTHED ELEVATION RASTER TO FILE SMOOTH.DAT: 1
 WRITE DEPRESSION FILLED RASTER TO FILE FILDEP.DAT: 1
 WRITE DEPRESSION FILLED/DRAINAGE MODIFIED RASTER TO FILE RELIEF.DAT: 1
 WRITE FLOW VECTOR RASTER TO FILE FLOVEC.DAT: 1
 WRITE FLOW PATH DEFINITION RASTER TO FILE FLOPAT.DAT: 1
 WRITE UPSTREAM DRAINAGE AREA RASTER TO FILE UPAREA.DAT: 1
 WRITE WATERSHED EXTENT DEFINITION TO FILE BOUND.DAT: 1
 WRITE DRAINAGE NETWORK RASTER TO FILE NETW.DAT: 1
 WRITE SUBCATCHMENT AREA RASTER TO FILE SUBWTA.DAT: 1
 WRITE EXTRACTED DEPRESSIONS AND FLAT AREAS TO FILE DEPFLT.DAT: 1
 WRITE USER DEFINED BANDS OF EQUAL ELEVATIONS TO FILE ELVCLA.DAT: 1
 WRITE FLOW VECTOR ASPECT RASTER TO FILE FVASPE.DAT 1
 WRITE FLOW VECTOR SLOPE RASTER TO FILE FVSLOP.DAT 1
 WRITE HYDRAULIC SLOPE RASTER TO FILE HSLOPE.DAT 1
 WRITE TERRAIN SLOPE RASTER TO FILE TSLOPE.DAT 1
 WRITE TERRAIN ASPECT RASTER TO FILE TASPEC.DAT 1
 WRITE ENHANCE DRAINAGE NETWORK RASTER TO FILE NETWE.DAT 1
 WRITE SUBCATCHMENT BOUNDARY LINE RASTER TO FILE SUBBDA.DAT 1
 WRITE AGGREGATED SUBCATCHMENT RASTER TO FILE SUBWTB.DAT 1
 WRITE AGGREGATED SUBCATCHMENT BOUNDARY RASTER TO FILE SUBBDB.DAT 1
 PROGRAM EXECUTION STATUS: 1 EXECUTED 0 NOT EXECUTED
 PROGRAM DEDNM: 1
 PROGRAM RASPRO: 1
 PROGRAM RASFOR: 1
 PROGRAM RASBIN: 0
 PROGRAM NSSTAT: 0
 *** ENDING SBRT OUTINP.
 === ALLOCATING IT3A ARRAY.
 === ALLOCATING IT2A ARRAY.
 === ALLOCATING IT1A ARRAY.
 *** PROCESSING FILE: INELEV.OUT

*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: FILDEP.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: RELIEF.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: FLOVEC.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: FLOPAT.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: UPAREA.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: NTGCOD.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: NETFUL.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: BOUND.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: NETW.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: SUBWTA.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: INDTAR.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: DEPFLT.OUT
*** BEGINNING SBRT CONPAR.

*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: ELVCLA.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: FVASPE.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: FVSLOP.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: HSLOPE.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: TSLOPE.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: TASPEC.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: NETWE.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: SUBBDA.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: SUBWTB.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: SUBBDB.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: DISCHA.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.
*** BEGINNING SBRT OUT1.
*** ENDING SBRT OUT1.
*** PROCESSING FILE: DISOUT.OUT
*** BEGINNING SBRT CONPAR.
*** ENDING SBRT CONPAR.

```
*** BEGINNING SBRT OUT1.  
*** ENDING SBRT OUT1.  
*** PROCESSING FILE: ELDCHA.OUT  
*** BEGINNING SBRT CONPAR.  
*** ENDING SBRT CONPAR.  
*** BEGINNING SBRT OUT1.  
*** ENDING SBRT OUT1.  
*** PROCESSING FILE: ELDOUT.OUT  
*** BEGINNING SBRT CONPAR.  
*** ENDING SBRT CONPAR.  
*** BEGINNING SBRT OUT1.  
*** ENDING SBRT OUT1.  
=== DEALLOCATING IT3A ARRAY.  
=== DEALLOCATING IT2A ARRAY.  
=== DEALLOCATING IT1A ARRAY.  
*** WRITING OUTPUT CONTROL FILE; SBRT IOCNT.  
***** ENDING PROGRAM RASFOR.
```

10.2.11 Files UPAREA.DAT and RELIEF.DAT in ASCII 1-D format from program RASFOR

File UPAREA.DAT

```
.  
.   
.   
0   
0   
0   
0   
6   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
0   
0   
2   
4   
6   
8   
10   
11   
0   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
-1   
.   
.   
.
```

10.2.11 Continued

File RELIEF.DAT

```
.  
. .  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
0.00000  
133.90000  
126.90000  
136.00000  
129.50000  
123.30000  
123.10000  
125.70000  
129.00000  
130.50000  
128.80000  
. .  
. .  
. .
```

10.2.12 Files SUBWTA.DAT and FILDEP.DAT in ASCII 2-D format from program RASFOR

File SUBWTA.DAT

0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	52	52	52	52	52	52
0	0	52	52	52	52	52	54	52
0	0	52	52	52	52	54	53	54
0	0	52	52	52	54	53	53	53
0	52	52	52	54	53	53	53	53
0	52	52	54	53	53	53	53	53
0	52	54	53	53	53	53	53	53
0	52	52	54	54	54	54	54	54
0	52	52	52	52	52	52	52	52
0	52	52	52	52	52	52	52	52
0	0	0	52	52	52	52	52	52
0	0	31	31	33	33	33	33	33
0	0	31	31	33	33	33	33	33
0	0	31	34	34	34	34	34	34
0	0	31	31	32	32	32	32	32
0	0	31	31	32	32	32	32	32
0	0	31	31	32	32	32	32	32
0	0	0	0	32	32	32	32	32
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

File FILDEP.DAT

0.0	0.0	0.0	0.0	0.0	127.9	125.9	123.9	121.9	129.5	135.8
0.0	0.0	0.0	0.0	121.9	126.3	125.9	122.1	118.7	120.8	124.0
0.0	0.0	0.0	119.9	117.9	126.8	124.1	118.2	113.9	114.6	115.4
0.0	0.0	0.0	115.9	127.8	126.8	121.6	118.1	114.3	110.2	108.1
0.0	0.0	111.9	109.9	130.6	127.4	127.1	132.1	128.9	123.5	112.6
0.0	105.9	145.3	141.0	135.6	134.0	135.4	141.0	134.7	123.0	115.9
0.0	103.9	150.3	144.4	138.1	138.2	140.4	139.2	131.6	122.4	122.3
0.0	101.9	99.9	149.0	140.3	138.6	139.5	134.2	127.4	122.4	122.2
0.0	0.0	97.9	150.9	143.3	138.4	133.4	128.1	125.4	121.1	117.0
0.0	0.0	95.9	150.7	146.2	137.9	132.5	130.6	128.4	122.6	117.2
0.0	0.0	93.9	91.9	144.6	137.9	135.3	131.9	125.5	117.6	113.2
0.0	0.0	0.0	89.9	137.7	135.0	129.5	124.8	120.2	116.6	117.0
0.0	0.0	0.0	87.9	135.5	131.4	127.2	126.4	122.6	121.7	122.3
0.0	0.0	0.0	85.9	135.6	133.6	131.0	132.3	125.5	126.3	126.3
0.0	0.0	0.0	83.9	138.8	136.4	133.6	131.9	128.4	131.2	133.3
0.0	0.0	0.0	81.9	143.1	139.7	138.0	134.4	131.9	135.8	142.0
0.0	0.0	0.0	79.9	77.9	144.0	140.7	137.8	136.3	138.8	149.6
0.0	0.0	0.0	0.0	75.9	147.7	143.8	140.3	139.2	141.3	151.4
0.0	0.0	0.0	0.0	73.9	151.0	148.6	144.2	142.7	142.9	145.5
0.0	0.0	0.0	0.0	71.9	69.9	151.4	147.1	146.5	144.2	139.7

10.2.13 Files HSLOPE.IMG and HSLOPE.DOC in IDRISI format from program RASFOR

File HSLOPE.IMG

```
.  
.   
.   
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
-0.25137  
0.53333  
0.24142  
0.30877  
0.24749  
0.14333  
0.14667  
0.29333  
0.47000  
0.58667  
0.73000  
0.12661  
0.09428  
-0.25137  
.   
.   
.
```

10.2.13 Continued

file title : HSLOPE.
data type : real
file type : ascii
columns : 102
rows : 72
ref. system : utm
ref. units : m
unit dist. : 30.000000
min. X : 0
max. X : 3060
min. Y : -2160
max. Y : 0
pos"n error : unknown
resolution : unknown
min. value : -0.25
max. value : 4.27
value units : unspecified
value error : unknown
flag value : none
flag def"n : none
legend cats : 0

10.2.15 Example of Output file RASBIN.RPT

```
***** BEGINNING PROGRAM RASBIN.
***** BEGINNING INITIALIZATION.
*** BEGINNING SBRT IOINIT.
*** ENDING SBRT IOINIT.
*** BEGINNING SBRT OUTITL.
TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
                VERSION 3.12, AUGUST 1999
PROGRAM RASBIN: RASTER-TO-BINARY TRANSFORMATION PROGRAM
                VERSION 3.10, APRIL 1999
```

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TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*** ENDING SBRT OUTITL.
*** BEGINNING SBRT INPCNT.
*** ENDING SBRT INPCNT.
=== ALLOCATING ALL ARRAYS IN MODULE DTCHAL.
*** BEGINNING SBRT IOCHA.
*** ENDING SBRT IOCHA.
***** BEGINNING RASTER-BINARY NETWORK TRANSFORMATION.
=== ALLOCATING ALL ARRAYS IN MODULE DTCHAB.
=== ALLOCATING ALL ARRAYS IN MODULE DTSEQ1.
*** BEGINNING SBRT BINNET.
=== ALLOCATING DAUPB ARRAY (SBRT BINNET).
=== ALLOCATING DADWB ARRAY (SBRT BINNET).
=== ALLOCATING DADRB ARRAY (SBRT BINNET).
***** BEGINNING PROGRAM SEQENC.
```

```

*** INITIALIZING VARIABLES; SBRT SEQINI.
*** CHECKING INPUT DATA; SBRT SEQCHK.
*** BEGINNING DETERMINATION OF CHANNEL EXECUTION SEQUENCE; SBRT SEQMAS.
***** ENDING PROGRAM SEQENC.
=== DEALLOCATING DAUPB ARRAY (SBRT BINNET).
=== DEALLOCATING DADWB ARRAY (SBRT BINNET).
=== DEALLOCATING DADRB ARRAY (SBRT BINNET).
*** ENDING SBRT BINNET.
***** BEGINNING RASTER-BINARY CHANNEL LINK OUTPUT.
*** BEGINNING SBRT OTCHAB.
*** ENDING SBRT OTCHAB.
*** BEGINNING SBRT IOCHAB.
*** ENDING SBRT IOCHAB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSEQ1.
***** BEGINNING RASTER-BINARY SUBCATCHMENT TRANSFORMATION.
=== ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
*** BEGINNING SBRT IOCAT.
*** ENDING SBRT IOCAT.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHA1.
=== ALLOCATING ALL ARRAYS IN MODULE DTCATB.
*** BEGINNING SBRT SBCTRB.
*** ENDING SBRT SBCTRB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
***** BEGINNING RASTER-BINARY SUBCATCHMENT OUTPUT.
*** BEGINNING SBRT IOCTB.
*** ENDING SBRT IOCTB.
*** BEGINNING SBRT OTSBCB.
*** ENDING SBRT OTSBCB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCATB.
*** BEGINNING SBRT IOKEY.
*** ENDING SBRT IOKEY.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHAB.
*** BEGINNING SBRT IOCNT.
*** END SBRT IOCNT.
***** ENDING PROGRAM RASBIN.

```

10.2.16 Output file NETWB.TAB

Note: The right side of the table has been truncated to accommodate the format requirements of this manual. The actual data file must be viewed in an editor to view all parameters in the table.

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM RASBIN: RASTER-TO-BINARY TRANSFORMATION PROGRAM
 VERSION 3.10, APRIL 1999

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 L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.
 J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

TABLE OF BINARY-NETWORK CHANNEL LINK INFORMATION AS COMPUTED BY PROGRAM RASBIN

NODE INDEX	STRAHLER ORDER	NODE CODE	EXECUTION SEQUENCE	INFLOWS		NEXT NODE DOWNSTREAM INDEX	TERRAIN ELEVATION [M]	CHANNEL LENGTH [M]	DRAINAGE AREA	
				INDEX 1	INDEX 2				UPSTREAM [HA]	DIRECT [HA]
1	2	3	4	5	6	7	8	9	10	11
1	2	2	10	2	-1	-1	1.0	-1.	49.860	-1.000
2	2	3	9	3	4	1	1.0	141.	47.973	1.887
3	1	1	8	-1	-1	2	2.0	540.	0.990	9.450
4	2	3	7	5	6	2	1.0	3.	37.532	0.001
5	1	1	6	-1	-1	4	3.0	1116.	1.620	15.480
6	2	3	5	7	8	4	1.0	3.	20.431	0.001
7	1	1	4	-1	-1	6	2.0	360.	0.990	4.320
8	2	3	3	9	10	6	1.0	3.	15.120	0.001
9	1	1	1	-1	-1	8	3.0	424.	1.350	7.470
10	1	1	2	-1	-1	8	2.0	300.	1.800	4.500

** NOTES **

- COLUMNS 1 THROUGH 11 ARE COMPUTED BY PROGRAM RASBIN
 COLUMNS 12 AND 13 ARE COMPUTED BY PROGRAM PARAM.
- THE FIRST LINE OF DATA DOES NOT REPRESENT A CHANNEL LINK. IT REPRESENTS
 THE WATERSHED OUTLET NODE.
- THE UPSTREAM AREA INTO FIRST ORDER CHANNELS IS THE SOURCE INFLOW.
 IN THE ABOVE TABLE THE SOURCE INFLOW IS NOT INCLUDED IN THE DIRECT DRAINAGE
 AREA OF THE FIRST ORDER CHANNELS.

10.2.17 Output file SBCTB.TAB

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM RASBIN: RASTER-TO-BINARY TRANSFORMATION PROGRAM
 VERSION 3.10, APRIL 1999

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
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 J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

TABLE OF BINARY-NETWORK SUBCATCHMENT INFORMATION AS COMPUTED BY MODULE RASBIN

NODE INDEX	CHAN. ORDER	NETW. ADJ.	SUBCATCHMENT AREA IN HECTARES			
			SOURCE AREA	LEFT AREA	RIGHT AREA	TOTAL AREA
1	2	0	0.00	0.00	0.00	0.00
2	2	-3	-1	0.94	0.94	1.89
3	1	0	0.99	3.24	6.21	10.44
4	2	1	-1	0.00	0.00	0.00
5	1	0	1.62	5.63	9.85	17.10
6	2	1	-1	0.00	0.00	0.00
7	1	0	0.99	2.16	2.16	5.31
8	2	1	-1	0.00	0.00	0.00
9	1	0	1.35	3.60	3.87	8.82
10	1	0	1.80	2.97	1.53	6.30

NOTE: - VALUES OF -1 INDICATE NOT APPLICABLE.

- THE ABOVE SUBCATCHMENT AREA VALUES ARE ROUNDED TO THE NEAREST
 100TH OF A HECTARE. THE FULL VALUE OF THE SUBCATCHMENT AREA
 (TO THE LEVEL OF THE MACHINE PRECISION) IS RETAINED IN THE
 UNFORMATTED FILE RBSCB.UNF.

10.2.18 Output file NSSTAT.RPT

```
***** BEGINNING PROGRAM NSSTAT.
***** BEGINNING INITIALIZATION AND INPUT OF DATA.
*** BEGINNING SUBROUTINE OUTITL.
TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
                VERSION 3.12, AUGUST 1999
PROGRAM NSSTAT: NETWORK AND SUBCATCHMENT STATISTICS
                VERSION 3.10, APRIL 1999
```

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J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

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TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*** ENDING SUBROUTINE OUTITL.
*** BEGINNING SUBROUTINE INPCNT.
*** ENDING SUBROUTINE INPCNT.
***** BEGINNING CHANNEL EVALUATION OF RASTER NETWORK.
=== ALLOCATING ALL ARRAYS IN MODULE DTCHA1.
*** BEGINNING SUBROUTINE IOCHA.
*** ENDING SUBROUTINE IOCHA.
=== ALLOCATING ALL ARRAYS IN MODULE DTSTA1.
=== ALLOCATING ALL ARRAYS IN MODULE DTSTA5.
*** BEGINNING SUBROUTINE CHANER.
*** BEGINNING SUBROUTINE CHANMR.
*** ENDING SUBROUTINE CHANMR.
*** BEGINNING SUBROUTINE CHALNR.
*** ENDING SUBROUTINE CHALNR.
*** BEGINNING SUBROUTINE CHAELR.
*** ENDING SUBROUTINE CHAELR.
*** BEGINNING SUBROUTINE CHASLR.
*** ENDING SUBROUTINE CHASLR.
*** BEGINNING SUBROUTINE CHASWR.
*** ENDING SUBROUTINE CHASWR.
*** BEGINNING SUBROUTINE CHAARR.
```



```

*** ENDING SUBROUTINE CHAARR.
*** BEGINNING SUBROUTINE CHADDR.
*** ENDING SUBROUTINE CHADDR.
*** BEGINNING SUBROUTINE CHASIR.
*** ENDING SUBROUTINE CHASIR.
*** ENDING SUBROUTINE CHANER.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSTA5.
***** BEGINNING CHANNEL EVALUATION OF BINARY NETWORK.
=== ALLOCATING ALL ARRAYS IN MODULE DTCHAB.
=== ALLOCATING ALL ARRAYS IN MODULE DTSEQ1.
*** BEGINNING SUBROUTINE IOCHAB.
*** ENDING SUBROUTINE IOCHAB.
=== ALLOCATING ALL ARRAYS IN MODULE DTSTA3.
=== ALLOCATING ALL ARRAYS IN MODULE DTSTA6.
*** BEGINNING SUBROUTINE CHANEB.
*** BEGINNING SUBROUTINE CHANMB.
*** ENDING SUBROUTINE CHANMB.
*** BEGINNING SUBROUTINE CHALNB.
*** ENDING SUBROUTINE CHALNB.
*** BEGINNING SUBROUTINE CHAELB.
*** ENDING SUBROUTINE CHAELB.
*** BEGINNING SUBROUTINE CHASLB.
*** ENDING SUBROUTINE CHASLB.
*** BEGINNING SUBROUTINE CHASWB.
*** ENDING SUBROUTINE CHASWB.
*** BEGINNING SUBROUTINE CHAARB.
*** ENDING SUBROUTINE CHAARB.
*** BEGINNING SUBROUTINE CHADDB.
*** ENDING SUBROUTINE CHADDB.
*** ENDING SUBROUTINE CHANEB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSTA6.
***** BEGINNING OUTPUT OF RASTER AND BINARY CHANNEL PARAMETERS.
*** BEGINNING SUBROUTINE OTCHAN.
*** ENDING SUBROUTINE OTCHAN.
***** BEGINNING SUBCATCHMENT EVALUATION FOR RASTER AND BINARY NETWORKS.
=== ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
*** BEGINNING SUBROUTINE IOCAT.
*** ENDING SUBROUTINE IOCAT.
=== ALLOCATING ALL ARRAYS IN MODULE DTSBV1.
*** BEGINNING SUBROUTINE SUBER.
*** ENDING SUBROUTINE SUBER.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSTA1.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHA1.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
=== ALLOCATING ALL ARRAYS IN MODULE DTCATB.
*** BEGINNING SUBROUTINE IOCTB.
*** ENDING SUBROUTINE IOCTB.
=== ALLOCATING ALL ARRAYS IN MODULE DTSBV3.
*** BEGINNING SUBROUTINE SUBEB.
*** ENDING SUBROUTINE SUBEB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSTA3.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSEQ1.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCATB.
*** BEGINNING SUBROUTINE OTSBCA.
*** ENDING SUBROUTINE OTSBCA.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHAB.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSBV3.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTSBV1.
*** BEGINNING SUBROUTINE IOCNT.
*** ENDING SUBROUTINE IOCNT.
***** ENDING PROGRAM NSSTAT.

```

10.2.19 Output file NETWT.EVL

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
PROGRAM NSSTAT: NETWORK AND SUBCATCHMENT STATISTICS
VERSION 3.10, APRIL 1999

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J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*****  
*****  
***  
***   STATISTICS OF PARAMETERS DERIVED FROM THE DRAINAGE NETWORK TABLES:   ***  
***   "NETW.TAB AND NETWB.TAB"                                             ***  
***  
*****  
*****
```

NOTE: - FIRST/SECOND COLUMN REFERS TO THE RASTER/BINARY NETWORK, RESPECTIVELY.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.
- EXT. AND INT. STAND FOR EXTERNAL AND INTERNAL, RESPECTIVELY.
- DD. STANDS FOR DRAINAGE DENSITY.

```
*****
```

***** GENERAL INFORMATION

SIZE OF A CELL IN METERS: 30.00 -1
AREA OF A CELL IN HECTARES: 0.0900 -1
NUMBER OF CHANNEL LINKS IN NETW.TAB AND NETWB.TAB: 6 9
LARGEST STRAHLER ORDER OF ALL DEFINED CHANNEL LINKS: 2 2
DRAINAGE NETWORK CONTAINS COMPLEX JUNCTIONS (SEE NOTE 2).
THE WATERSHED OUTLET IS NOT A SIMPLE OR COMPLEX JUNCTION.
DRAINAGE NETWORK STRAHLER ORDER AT THE OUTLET NODE: 2 2

```
*****
```

***** NUMBER OF CHANNELS AND CHANNEL LINKS (SEE NOTE 1)

NUMBER OF ADDITIONAL CHANNEL LINKS IN THE BINARY NETWORK (SEE NOTE 3): 3 3
 1 ORDER JUNCTION: -1 0
 2 ORDER JUNCTION: -1 3

NUMBER OF CHANNEL LINKS IN EACH CHANNEL ORDER:

 1 ORDER CHANNEL LINKS: 5 5
 2 ORDER CHANNEL LINKS: 1 4

TOTAL NUMBER OF EXT. LINKS: 5 5
TOTAL NUMBER OF INT. LINKS: 1 4
TOTAL NUMBER OF CHANNEL LINKS: 6 9

NUMBER OF CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNELS:	5	5
2 ORDER CHANNELS:	1	1

 ***** LENGTH OF CHANNELS AND CHANNEL LINKS IN METERS (SEE NOTE 1 AND 2)

MEAN CHANNEL LINK LENGTH IN EACH STRAHLER ORDER:

1 ORDER CHANNEL LINKS:	548.1	548.1
	[329.9]	[329.9]
2 ORDER CHANNEL LINKS:	150.0	37.5
	[0.0]	[69.0]

MINIMUM AND MAXIMUM CHANNEL LINK LENGTH IN EACH STRAHLER ORDER:

1 ORDER CHANNEL LINKS:	300.0	1116.4	300.0	1116.4
2 ORDER CHANNEL LINKS:	150.0	150.0	3.0	141.0

MEAN EXT. LINK LENGTH:	548.1	548.1
	[329.9]	[329.9]
MEAN INT. LINK LENGTH:	150.0	37.5
	[0.0]	[69.0]
MEAN CHANNEL LINK LENGTH:	481.8	321.2
	[336.9]	[358.6]

TOTAL LENGTH OF EXT. CHANNELS:	2740.7	2740.7
TOTAL LENGTH OF INT. CHANNELS:	150.0	150.0
TOTAL CHANNEL LENGTH IN THE BASIN:	2890.7	2890.7
RATIO OF TOTAL EXT. TO INT. CHANNEL LENGTHS :	18.2711	18.2711
RATIO OF TOTAL EXT. TO TOTAL CHANNEL LENGTH:	0.9481	0.9481
RATIO OF TOTAL INT. TO TOTAL CHANNEL LENGTH:	0.0519	0.0519

MEAN CHANNEL LENGTH BY STRAHLER ORDER IN METERS:

1 ORDER CHANNELS:	548.13	548.13
	[329.89]	[329.89]
2 ORDER CHANNELS:	150.00	150.00
	[0.00]	[0.00]

TOTAL CHANNEL LENGTH IN EACH STRAHLER ORDER IN METERS:

1 ORDER CHANNELS:	2740.66	2740.66
2 ORDER CHANNELS:	150.00	150.00

 ***** ELEVATION OF CHANNELS AND CHANNEL LINKS IN METERS (SEE NOTE 1 AND 2)

MEAN ELEVATION OF UPPER AND LOWER END OF CHANNEL LINKS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL LINKS:	2.40	1.00	2.40	1.00
	[0.55]	[0.00]	[0.55]	[0.00]
2 ORDER CHANNEL LINKS:	1.00	1.00	1.00	1.00
	[0.00]	[0.00]	[0.00]	[0.00]

MEAN ELEVATION OF UPPER AND LOWER END:

EXT. LINKS:	2.40	1.00	2.40	1.00
	[0.55]	[0.00]	[0.55]	[0.00]
INT. LINKS:	1.00	1.00	1.00	1.00
	[0.00]	[0.00]	[0.00]	[0.00]
ALL CHANNEL LINKS:	2.17	1.00	1.78	1.00
	[0.75]	[0.00]	[0.83]	[0.00]

MAXIMUM ELEVATION DROP FROM SOURCE TO OUTLET: 2.00 2.00
 MEAN ELEVATION DROP FROM SOURCE TO OUTLET: 1.40 1.40
 MEAN ELEVATION DROP OF EXT. CHANNEL LINKS: 1.40 1.40
 MEAN ELEVATION DROP OF INT. CHANNEL LINKS: 0.00 0.00

 RATIO OF ELEVATION DROP OF EXT. TO INT. CHANNEL LINKS: ***** *****
 RATIO OF ELEVATION DROP OF EXT. TO MEAN SOURCE TO OUTLET: 0.9999 0.9999
 RATIO OF ELEVATION DROP OF INT. TO MEAN SOURCE TO OUTLET: 0.0001 0.0000

MEAN ELEVATION OF UPPER AND LOWER END OF CHANNELS BY STRAHLER ORDER:
 1 ORDER CHANNELS: 2.40 1.00 2.40 1.00
 [0.55][0.00][0.55][0.00]
 2 ORDER CHANNELS: 1.00 1.00 1.00 1.00
 [0.00][0.00][0.00][0.00]

 ***** SLOPE OF CHANNELS AND CHANNEL LINKS (SEE NOTE 1 AND 2)

MEAN CHANNEL SLOPE OF THE CHANNEL LINKS IN EACH STRAHLER ORDER:
 1 ORDER CHANNEL LINKS: 0.28939E-02 0.28938E-02
 [0.12061E-02][0.12061E-02]
 2 ORDER CHANNEL LINKS: 0.53333E-06 0.26418E-05
 [0.00000E+00][0.13830E-05]

MEAN SLOPE OF EXT. CHANNEL LINKS: 0.28939E-02 0.28938E-02
 [0.12061E-02][0.12061E-02]
 MEAN SLOPE OF INT. CHANNEL LINKS: 0.53333E-06 0.26418E-05
 [0.00000E+00][0.13830E-05]
 MEAN SLOPE OF ALL CHANNEL LINKS: 0.24117E-02 0.16089E-02
 [0.15997E-02][0.17462E-02]

MEAN SLOPE OF THE CHANNELS IN EACH STRAHLER ORDER:
 1 ORDER CHANNELS: 0.28939E-02 0.28938E-02
 [0.12061E-02][0.12061E-02]
 2 ORDER CHANNELS: 0.53333E-06 0.73333E-06
 [0.00000E+00][0.00000E+00]

 ***** LENGTH WEIGHTED SLOPE OF CHANNELS AND CHANNEL LINKS (SEE NOTE 1 AND 2)

MEAN WEIGHTED CHANNEL SLOPE OF THE CHANNEL LINKS IN EACH STRAHLER ORDER:
 1 ORDER CHANNEL LINKS: 0.25544E-02 0.25543E-02
 [0.10625E-02][0.10625E-02]
 2 ORDER CHANNEL LINKS: 0.53333E-06 0.73333E-06
 [0.00000E+00][0.65688E-06]

MEAN WEIGHTED SLOPE OF EXT. CHANNEL LINKS: 0.25544E-02 0.25543E-02
 [0.10625E-02][0.10625E-02]
 MEAN WEIGHTED SLOPE OF INT. CHANNEL LINKS: 0.53333E-06 0.73333E-06
 [0.00000E+00][0.65688E-06]
 MEAN WEIGHTED SLOPE OF ALL CHANNEL LINKS: 0.24218E-02 0.24218E-02
 [0.11795E-02][0.11795E-02]
 RATIO OF WEIGHTED SLOPE OF EXT. TO INT. CHANNEL LINKS: ***** *****
 RATIO OF WEIGHTED SLOPE OF EXT. TO MEAN CHANNEL LINKS: 1.0547 1.0547
 RATIO OF WEIGHTED SLOPE OF INT. TO MEAN CHANNEL LINKS: 0.0002 0.0003

MEAN WEIGHTED SLOPE OF THE CHANNELS IN EACH STRAHLER ORDER.

1 ORDER CHANNELS:	0.25544E-02	0.25543E-02
	[0.10625E-02][	0.10625E-02]
2 ORDER CHANNELS:	0.53333E-06	0.73333E-06
	[0.00000E+00][	0.00000E+00]

 ***** DIRECT AND TOTAL DRAINAGE AREAS IN HECTARES (SEE NOTE 1 AND 2)

MEAN DIRECT DRAINAGE AREA INTO CHANNEL LINKS:

1 ORDER CHANNEL LINKS:	9.59	9.59
	[4.66][	4.66]
2 ORDER CHANNEL LINKS:	1.89	0.47
	[0.00][	0.94]

MEAN SIZE OF DRAINAGE AREA INTO:

SOURCE NODES:	1.35	1.35
	[0.37][	0.37]
EXT. LINKS:	9.59	9.59
	[4.66][	4.66]
INT. LINKS:	1.89	0.47
	[0.00][	0.94]
ALL CHANNEL LINKS	8.31	5.54
	[5.22][	5.86]

TOTAL WATERSHED DRAINAGE AREA:	49.86	49.86
TOTAL DIRECT DRAINAGE AREA INTO SOURCE NODES:	6.75	6.75
TOTAL DIRECT DRAINAGE AREA INTO EXT. LINKS:	47.97	47.97
TOTAL DIRECT DRAINAGE AREA INTO INT. LINKS:	1.89	1.89
RATIO OF DRAINAGE AREA OF EXT. TO INT. CHANNEL LINKS:	25.3810	25.3810
RATIO OF DRAINAGE AREA OF EXT. CHANNELS TO WATERSHED AREA:	0.9621	0.9621
RATIO OF DRAINAGE AREA OF INT. CHANNELS TO WATERSHED AREA:	0.0379	0.0379

MEAN DRAINAGE AREA AT THE DOWNSTREAM END OF EACH STRAHLER CHANNEL ORDER:

1 ORDER CHANNEL:	9.59	9.59
	[4.66][	4.66]
2 ORDER CHANNEL:	49.86	49.86
	[0.00][	0.00]

MEAN DRAINAGE AREA AT THE TOP OF EACH STRAHLER CHANNEL ORDER (SEE NOTE 5):

1 ORDER CHANNEL:	1.35	1.35
	[0.37][	0.37]
2 ORDER CHANNEL:	47.97	15.12
	[0.00][	0.00]

 ***** DRAINAGE DENSITY IN 1 / METERS (SEE NOTE 1, 2 AND 4)

MEAN DD. OF CHANNEL LINKS BY STRAHLER ORDER:

1 ORDER CHANNEL:	0.56106E-02	0.56106E-02
	[0.96984E-03][	0.96984E-03]
2 ORDER CHANNEL:	0.79365E-02	0.25187E+00
	[0.00000E+00][	0.16293E+00]

MEAN DD. OF EXT. CHANNEL LINKS:	0.56106E-02	0.56106E-02
	[0.96984E-03][	0.96984E-03]
MEAN DD. OF INT. CHANNEL LINKS:	0.79365E-02	0.25187E+00
	[0.00000E+00][	0.16293E+00]

MEAN TOTAL DD.: 0.59982E-02 0.11506E+00
[0.12861E-02][0.16371E+00]

OVERALL DD. OF EXT. CHANNEL LINKS: 0.57133E-02 0.57133E-02
OVERALL DD. OF INT. CHANNEL LINKS: 0.79365E-02 0.79365E-02
OVERALL TOTAL DD.: 0.57976E-02 0.57976E-02
RATIO OF OVERALL DD. OF EXT. TO INT. CHANNEL LINKS: 0.7199 0.7199
RATIO OF OVERALL DD. OF EXT. CHANNELS TO TOTAL DENSITY: 0.9855 0.9855
RATIO OF OVERALL DD. OF INT. CHANNELS TO TOTAL DENSITY: 1.3689 1.3689

OVERALL DD. BY STRAHLER ORDER:
1 ORDER CHANNEL: 0.57133E-02 0.57133E-02
2 ORDER CHANNEL: 0.79365E-02 0.79365E-02

**** CHANNEL LINK SINUOSITY

MEAN CHANNEL SINUOSITY OF ALL CHANNEL LINKS: 1.4190 -1
[0.9093]
MEAN CHANNEL SINUOSITY OF EXT. CHANNEL LINKS : 1.4528 -1
[1.0124]
MEAN CHANNEL SINUOSITY OF INT. CHANNEL LINKS : 1.2500 -1
[0.0000]

**** SIMPLIFIED DRAINAGE NETWORK COMPOSITION(SEE NOTE 1 AND 2)

BIFURCATION RATIO: 5.0000 5.0000
LENGTH RATIO: 3.6542 3.6542
SLOPE RATIO: 4789.4434 3483.1868
AREA RATIO: 0.1924 0.1924

NOTE 1: - FOR THE CONDITION WHERE THE WATERSHED OUTLET IS A SIMPLE OR COMPLEX JUNCTION, AN ADDITIONAL SHORT CHANNEL LINK AND CORRESPONDING OUTLET NODE (WITHOUT A JUNCTION) IS ADDED AT THE WATERSHED OUTLET OF THE BINARY NETWORK. AS A RESULT THE TOTAL LENGTH OF THE INT. CHANNELS AND OF THE NETWORK IS SLIGHTLY LONGER, AND TOTAL DRAINAGE AREA IS SLIGHTLY LARGER. PARAMETERS DERIVED FROM CHANNEL LENGTH AND AREA VALUES, SUCH AS DRAINAGE DENSITY OR SLOPE, MAY, AS A RESULT, ALSO DISPLAY A SLIGHT DIFFERENCE WHEN COMPARED TO THE RASTER NETWORK.
FOR THE CONDITION WHERE THE WATERSHED OUTLET IS A COMPLEX JUNCTION, ONE OR SEVERAL ADDITIONAL SHORT CHANNEL LINKS BEYOND THE ONE JUST DESCRIBED MAY BE REQUIRED BY THE STRUCTURE OF THE COMPLEX JUNCTION. THE SUMMATION OF ALL THE SHORT CHANNEL LINKS AND CORRESPONDING DRAINAGE AREAS THAT ARE CREATED AS DESCRIBED IN THIS NOTE 1 WILL ALWAYS BE LESS THAN THAT OF ONE RASTER CELL.

NOTE 2: - NUMBER OF CHANNEL LINKS, LENGTH, ELEVATION, SLOPE, DRAINAGE AREA, DENSITY, AND NETWORK COMPOSITION VALUES ARE AFFECTED BY THE NUMBER OF ADDITIONAL CHANNEL LINKS DUE TO THE DECOMPOSITION OF COMPLEX JUNCTIONS INTO A SEQUENCE OF SIMPLE JUNCTIONS.

- NOTE 3: - THE ADDITIONAL CHANNEL LINKS ARE CREATED DUE TO:
- A) THE DECOMPOSITION OF COMPLEX JUNCTIONS INTO A SEQUENCE OF SIMPLE JUNCTIONS; AND,
 - B) THE PRESENCE OF A COMPLEX OR SIMPLE JUNCTION AT THE OUTLET AS DISCUSSED IN NOTE 1.
- THE FIRST VALUE GIVEN IS THE NUMBER OF ADDITIONAL CHANNEL LINKS ESTIMATED FROM THE RASTER NETWORK, AND THE SECOND VALUE IS THE ACTUAL NUMBER OF ADDITIONAL CHANNEL LINKS IN THE BINARY NETWORK.
- NOTE 4: - OVERALL DRAINAGE DENSITY REFERS TO TOTAL CHANNEL LENGTH DIVIDED BY CORRESPONDING TOTAL DIRECT DRAINAGE AREA. OVERALL DRAINAGE DENSITY CORRESPONDS TO THE MEAN OF THE AREA WEIGHTED DRAINAGE DENSITY OF THE INDIVIDUAL CHANNEL LINKS.
- MEAN DRAINAGE DENSITY REFERS TO THE AVERAGE OF THE INDIVIDUAL CHANNEL LINK LENGTHS OVER CORRESPONDING DIRECT DRAINAGE AREAS.
- NOTE 5: - UPSTREAM DRAINAGE AREA FOR FIRST ORDER CHANNELS INCLUDES SOURCE AREA ONLY; FOR ALL OTHER ORDER CHANNELS THE UPSTREAM AREA IS THAT DEFINED BY THE TWO UPSTREAM INFLOW CHANNELS; IT DOES NOT INCLUDE THE DIRECT OVERLAND AREA FLOWING DIRECTLY INTO THE UPSTREAM NODE OF THE CHANNEL LINK.

10.2.20 Output file SBCTT.EVL

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
PROGRAM NSSTAT: NETWORK AND SUBCATCHMENT STATISTICS
VERSION 3.10, APRIL 1999

J. GARBRECHT, USDA-ARS, EL RENO, OKLAHOMA, USA.
L. MARTZ, UNIVERSITY OF SASKATCHEWAN, SASKATOON, CANADA.
J. CAMPBELL, USDA-ARS, EL RENO, OKLAHOMA, USA.

TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*****  
*****  
***  
***   STATISTICS OF PARAMETERS DERIVED FROM THE SUBCATCHMENT TABLES:   ***  
***   SBCT.TAB AND SBCTB.TAB                                           ***  
***  
*****  
*****
```

NOTE: - FIRST/SECOND COLUMN REFERS TO THE RASTER/BINARY NETWORK, RESPECTIVELY.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.
- EXT. AND INT. STAND FOR EXTERNAL AND INTERNAL, RESPECTIVELY.

```
*****  
*****   GENERAL INFORMATION  
  
SIZE OF A CELL IN METERS:      30.00      -1  
AREA OF A CELL IN HECTARES:    0.0900      -1  
NUMBER OF CHANNEL LINKS IN NETW.TAB AND NETWB.TAB:      6      9  
LARGEST STRAHLER ORDER OF ALL DEFINED CHANNEL LINKS:  2      2  
DRAINAGE NETWORK CONTAINS COMPLEX JUNCTIONS (SEE NOTE 2).  
THE WATERSHED OUTLET IS NOT A SIMPLE OR COMPLEX JUNCTION.  
DRAINAGE NETWORK STRAHLER ORDER AT THE OUTLET NODE:  2      2
```

```
*****  
*****   SUBCATCHMENT DRAINAGE AREAS  
  
MEAN DIRECT DRAINAGE AREA INTO CHANNEL LINKS:  
  1 ORDER CHANNEL LINKS:      9.59      9.59  
                               [  4.66][  4.66]  
  2 ORDER CHANNEL LINKS:      1.89      0.47  
                               [  0.00][  0.94]  
  
EXT. LINKS:                    9.59      9.59  
                               [  4.66][  4.66]  
INT. LINKS:                     1.89      0.47  
                               [  0.00][  0.94]  
ALL CHANNEL LINKS              8.31      5.54  
                               [  5.22][  5.86]
```


TOTAL WATERSHED DRAINAGE AREA:	49.86	49.86
TOTAL DIRECT DRAINAGE AREA INTO EXT. LINKS:	47.97	47.97
TOTAL DIRECT DRAINAGE AREA INTO INT. LINKS:	1.89	1.89

MEAN DIRECT DRAINAGE AREA FOR THE CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL:	9.59	9.59
	[4.66][	4.66]
2 ORDER CHANNEL:	1.89	1.89
	[0.00][	0.00]

***** CHANNEL DRAINAGE AREA (SEE NOTE 3)

MEAN CHANNEL DRAINAGE AREA OF CHANNEL LINKS:

1 ORDER CHANNEL LINKS:	1.46	-1.00
	[0.80][	-1.00]
2 ORDER CHANNEL LINKS:	0.45	-1.00
	[0.00][	-1.00]

EXT. LINKS:	1.46	-1.00
	[0.80][	-1.00]
INT. LINKS:	0.45	-1.00
	[0.00][	-1.00]
ALL CHANNEL LINKS	1.29	-1.00
	[0.83][	-1.00]

TOTAL CHANNEL DRAINAGE AREA:	7.74	-1.00
TOTAL CHANNEL DRAINAGE AREA OF EXT. LINKS:	7.29	-1.00
TOTAL CHANNEL DRAINAGE AREA OF INT. LINKS:	0.45	-1.00

MEAN CHANNEL DRAINAGE AREA OF THE CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL:	1.46	-1.00
	[0.80][	-1.00]
2 ORDER CHANNEL:	0.45	-1.00
	[0.00][	-1.00]

***** RIGHT DRAINAGE AREA

MEAN RIGHT SIDE DRAINAGE AREA INTO CHANNEL LINKS:

1 ORDER CHANNEL LINKS:	4.00	4.72
	[3.02][	3.39]
2 ORDER CHANNEL LINKS:	0.72	0.24
	[0.00][	0.47]

EXT. LINKS:	4.00	4.72
	[3.02][	3.39]
INT. LINKS:	0.72	0.24
	[0.00][	0.47]
ALL CHANNEL LINKS	3.45	2.73
	[3.01][	3.38]

TOTAL RIGHT SIDE DRAINAGE AREA:	20.70	24.57
TOTAL RIGHT SIDE DRAINAGE AREA INTO EXT. LINKS:	19.98	23.62
TOTAL RIGHT SIDE DRAINAGE AREA INTO INT. LINKS:	0.72	0.94

MEAN RIGHT SIDE DRAINAGE AREA FOR THE CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL:	4.00	4.72
	[3.02][	3.39]
2 ORDER CHANNEL:	0.72	0.94
	[0.00][	0.00]

 ***** LEFT DRAINAGE AREA

MEAN LEFT SIDE DRAINAGE AREA INTO CHANNEL LINKS:

1 ORDER CHANNEL LINKS:	2.79	3.52
	[0.97][	1.29]
2 ORDER CHANNEL LINKS:	0.72	0.24
	[0.00][	0.47]

EXT. LINKS:	2.79	3.52
	[0.97][	1.29]
INT. LINKS:	0.72	0.24
	[0.00][	0.47]
ALL CHANNEL LINKS	2.44	2.06
	[1.21][	1.98]

TOTAL LEFT SIDE DRAINAGE AREA:	14.67	18.54
TOTAL LEFT SIDE DRAINAGE AREA INTO EXT. LINKS:	13.95	17.59
TOTAL LEFT SIDE DRAINAGE AREA INTO INT. LINKS:	0.72	0.94

MEAN LEFT SIDE DRAINAGE AREA FOR THE CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL:	2.79	3.52
	[0.97][	1.29]
2 ORDER CHANNEL:	0.72	0.94
	[0.00][	0.00]

 ***** SOURCE DRAINAGE AREA

MEAN SOURCE DRAINAGE AREA INTO CHANNEL LINKS:

1 ORDER CHANNEL LINKS:	1.35	1.35
	[0.37][	0.37]

EXT. LINKS:	1.35	1.35
	[0.37][	0.37]
INT. LINKS:	-1.00	-1.00
	[-1.00][	-1.00]
ALL CHANNEL LINKS	1.12	0.75
	[0.67][	1.35]

TOTAL SOURCE DRAINAGE AREA:	6.75	6.75
TOTAL SOURCE DRAINAGE AREA INTO EXT. LINKS:	6.75	6.75
TOTAL SOURCE DRAINAGE AREA INTO INT. LINKS:	-1.00	-1.00

MEAN SOURCE DRAINAGE AREA FOR THE CHANNELS IN EACH STRAHLER ORDER:

1 ORDER CHANNEL:	1.35	1.35
	[2.65][	0.37]

- NOTE 1: - FOR THE CONDITION WHERE THE WATERSHED OUTLET IS A SIMPLE OR COMPLEX JUNCTION, AN ADDITIONAL SHORT CHANNEL LINK AND CORRESPONDING OUTLET NODE (WITHOUT A JUNCTION) IS ADDED AT THE WATERSHED OUTLET OF THE BINARY NETWORK. AS A RESULT THE TOTAL LENGTH OF THE INT. CHANNELS AND OF THE NETWORK IS SLIGHTLY LONGER, AND TOTAL DRAINAGE AREA IS SLIGHTLY LARGER. PARAMETERS DERIVED FROM CHANNEL LENGTH AND AREA VALUES, SUCH AS DRAINAGE DENSITY OR SLOPE, MAY, AS A RESULT, ALSO DISPLAY A SLIGHT DIFFERENCE WHEN COMPARED TO THE RASTER NETWORK.
- FOR THE CONDITION WHERE THE WATERSHED OUTLET IS A COMPLEX JUNCTION, ONE OR SEVERAL ADDITIONAL SHORT CHANNEL LINKS BEYOND THE ONE JUST DESCRIBED MAY BE REQUIRED BY THE STRUCTURE OF THE COMPLEX JUNCTION. THE SUMMATION OF ALL THE SHORT CHANNEL LINKS AND CORRESPONDING DRAINAGE AREAS THAT ARE CREATED AS DESCRIBED IN THIS NOTE 1 WILL ALWAYS BE LESS THAN THAT OF ONE RASTER CELL.
- NOTE 2: - NUMBER OF CHANNEL LINKS, LENGTH, ELEVATION, SLOPE, DRAINAGE AREA, DENSITY, AND NETWORK COMPOSITION VALUES ARE AFFECTED BY THE NUMBER OF ADDITIONAL CHANNEL LINKS DUE TO THE DECOMPOSITION OF COMPLEX JUNCTIONS INTO A SEQUENCE OF SIMPLE JUNCTIONS.
- NOTE 3: - CHANNEL SUBCATCHMENT AREA INCLUDES ONLY THE CELLS DEFINING THE CHANNEL ITSELF. THE BINARY NETWORK HAS NO CHANNEL AREA ASSOCIATED WITH IT.

10.2.21 Input file PARAM.INP

```
C
C*****
C INPUT DATA FILE PARAM.INP
C THIS INPUT DATA FILE IS THE GENERAL INPUT FILE FOR PROGRAM PARAM.
C THE INPUT ALLOWS THE USER TO SELECT THE OPTIONS FOR ADDITIONAL SUBCATCHMENT
C PARAMETER PROCESSING FROM DATA GENERATED BY OTHER TOPAZ PROGRAMS.
C*****
C
C WRITE THE PROGRAM INPUT VALUES AND USER OPTIONS TO REPORT FILE PARAM.RPT.
C ENTER  0  FOR NO;  ENTER  1  FOR YES:
C
1
C
C FOR ALL OPTIONS SELECT:          1  TO ENABLE THE OPTION, OR
C (INTEGER VALUE REQUIRED)         0  TO DISABLE THE OPTION.
C
C ***** CALCULATION OF SUBCATCHMENT PROPERTIES :
C   - SUBCATCHMENT AREAS;
C   - REPRESENTATIVE SUBCATCHMENT LENGTHS ALTERNATIVES;
C   - REPRESENTATIVE SUBCATCHMENT SLOPES ALTERNATIVES.
C
1
```

10.2.22 Output file PARAM.RPT

```
***** BEGINNING PROGRAM PARAM.
***** INITIALIZING AND READING GENERAL I/O.
*** BEGINNING SBRT INPCNT.
*** ENDING SBRT INPCNT.
*** BEGINNING SBRT OUTITL.
TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
                VERSION 3.12, AUGUST 1999
PROGRAM PARAM:  SUBCATCHMENT PARAMETERIZATION
                VERSION 3.10, APRIL 1999
```

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TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

```
*** ENDING SBRT OUTITL.
*** BEGINNING SBRT IOINIT.
*** ENDING SBRT IOINIT.
*** BEGINNING SBRT INPBAT.
*** ENDING SBRT INPBAT.
*** BEGINNING SBRT INPBAT.
DEM RASTER PARAMETERS.
  NUMBER OF ROWS AND COLUMNS IN RASTER:        23        36
  SIZE OF A PIXEL SIDE IN METERS:                30.00
  MINIMUM AND MAXIMUM ELEVATION VALUES IN METERS:
          1.0000        9.0001
  USER PROVIDED INDETERMINATE ELEVATION VALUE:        0.0
  USER PROVIDED INDETERMINATE ELEVATION VALUE IN PROGRAM INTERNAL UNITS:
                                                  0
  INTERNAL INDETERMINATE ELEVATION VALUE AS ASSIGNED AND USED
  BY THE PROGRAM:                                -400000
  STRAHLER ORDER OF THE DRAINAGE NETWORK:        2
```

USER OPTIONS

FOR ALL OF THE FOLLOWING OPTIONS:

A VALUE OF 1 INDICATES THAT COMPUTATIONS ARE PERFORMED, OR

A VALUE OF 0 INDICATES THAT COMPUTATIONS ARE NOT PERFORMED.

WRITE USER INPUT OPTIONS TO PARAM.RPT: 1

PROCESSING OF SUBCATCHMENT DATA: 1

PROGRAM EXECUTION STATUS: 1 EXECUTED 0 NOT EXECUTED

PROGRAM DEDNM: 1

PROGRAM RASPRO: 1

PROGRAM RASFOR: 1

PROGRAM RASBIN: 1

PROGRAM NSSTAT: 1

PROGRAM PARAM: 1

*** ENDING SBRT INPBAT.

***** CALCULATE SUBCATCHMENT AREA AND DISTANCE.

=== ALLOCATING ALL ARRAYS IN MODULE DTCHA1.

*** BEGINNING SBRT IOCHA.

*** ENDING SBRT IOCHA.

=== ALLOCATING ALL ARRAYS IN MODULE DTCAT1.

*** BEGINNING SUBROUTINE IOCAT.

*** ENDING SUBROUTINE IOCAT.

*** BEGINNING SUBROUTINE CATARE.

*** ENDING SUBROUTINE CATARE.

=== ALLOCATING NSBC ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

=== ALLOCATING IDSCHA ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

*** BEGINNING SUBROUTINE DISMOM.

*** ENDING SUBROUTINE DISMOM.

=== ALLOCATING IFLP ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

*** BEGINNING SUBROUTINE MLENFP.

*** BEGINNING SUBROUTINE MLENFP.

=== DEALLOCATING IDSCHA ARRAY.

***** CALCULATE SUBCATCHMENT SLOPE ALTERNATIVES.

*** CALCULATE GLOBAL SUBCATCHMENT SLOPE.

=== ALLOCATING IFVS ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

=== ALLOCATING IEL ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

=== ALLOCATING IT2A ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

*** BEGINNING SUBROUTINE SGLOB.

=== ALLOCATING IFV ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

=== ALLOCATING ICA ARRAY.

*** BEGINNING SBRT RSTIO.

*** ENDING SBRT RSTIO.

*** ENDING SUBROUTINE SGLOB.

=== DEALLOCATING ICA ARRAY.

=== DEALLOCATING IFV ARRAY.

=== DEALLOCATING IT2A ARRAY.

=== DEALLOCATING IEL ARRAY.

*** CALCULATE TOPOGRAPHIC SLOPE ALTERNATIVES.

```

=== ALLOCATING IHDS ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING ITASL ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SUBROUTINE SLTOPO.
*** ENDING SUBROUTINE SLTOPO.
=== DEALLOCATING IHDS ARRAY.
=== DEALLOCATING ITASL ARRAY.
*** CALCULATE FLOW PATH AND CELL INTEGRATED SLOPE ALTERNATIVES.
=== ALLOCATING IFV ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING NTW1 ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SUBROUTINE SINTFP.
*** ENDING SUBROUTINE SINTFP.
*** BEGINNING SUBROUTINE SINTCL.
*** ENDING SUBROUTINE SINTCL.
=== DEALLOCATING NTW1 ARRAY.
=== DEALLOCATING IFV ARRAY.
*** BEGINNING SUBROUTINE OTSBCA.
*** ENDING SUBROUTINE OTSBCA.
*** BEGINNING SUBROUTINE OTSBCL.
*** ENDING SUBROUTINE OTSBCL.
*** BEGINNING SUBROUTINE OTSBCS.
*** ENDING SUBROUTINE OTSBCS.
=== ALLOCATING IDSCHA ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
=== ALLOCATING IDPCHA ARRAY.
*** BEGINNING SBRT RSTIO.
*** ENDING SBRT RSTIO.
*** BEGINNING SUBROUTINE SLOPEA.
*** ENDING SUBROUTINE SLOPEA.
*** BEGINNING SUBROUTINE SLOPEB.
*** ENDING SUBROUTINE SLOPEB.
=== DEALLOCATING IDPCHA ARRAY.
=== DEALLOCATING IDSCHA ARRAY.
=== DEALLOCATING IFVS ARRAY.
*** BEGINNING SUBROUTINE OTSLFP.
*** ENDING SUBROUTINE OTSLFP.
*** BEGINNING SUBROUTINE OTSLCL.
*** ENDING SUBROUTINE OTSLCL.
*** BEGINNING SUBROUTINE OTLSTR.
*** ENDING SUBROUTINE OTLSTR.
=== DEALLOCATING IFLP ARRAY.
=== DEALLOCATING NSBC ARRAY.
*** BEGINNING SUBROUTINE IOCAT.
*** ENDING SUBROUTINE IOCAT.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCHA1.
=== DE-ALLOCATING ALL ARRAYS IN MODULE DTCAT1.
*** BEGINNING SBRT OTCNT1.
*** ENDING SBRT OTCNT1.
***** ENDING PROGRAM PARAM.

```

10.2.23 Output file SBCTA.TAB

PROGRAM PARAM: SUBCATCHMENT PARAMETERIZATION
VERSION 3.10, APRIL 1999

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TITLE OF CURRENT TOPAZ APPLICATION:
TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
TESTING AND CALIBRATION.

TABLE OF RASTER-NETWORK SUBCATCHMENT AREA INFORMATION AS COMPUTED
BY PROGRAM PARAM

NOTE: FOR COMPLEX JUNCTION NODES ONLY THE SUBCATCHMENT INFORMATION
PERTAINING TO THE FIRST NODE NUMBER IS GIVEN. SUBSEQUENT NODES
ARE HYPOTHETICAL NODES AND HAVE NO CORRESPONDING SUBCATCHMENT INFORMATION.

CNTR.	NODE ORDER	NODE INDEX	X	SUBCATCHMENT AREA IN NUMBER OF CELLS					X	SUBCATCHMENT AREA IN CELLS			
				SOURCE	LEFT	RIGHT	CHANNEL	TOTAL		SOURCE	LEFT	RIGHT	TOTAL
1	2	3	X	4	5	6	7	8	X	9	10	11	12
1	1	7	X	11	18	18	12	59	X	11.0	24.0	24.0	59.0
2	1	9	X	15	35	38	10	98	X	15.0	40.0	43.0	98.0
3	1	5	X	18	47	94	31	190	X	18.0	62.5	109.5	190.0
4	1	3	X	11	27	60	18	116	X	11.0	36.0	69.0	116.0
5	1	10	X	20	28	12	10	70	X	20.0	33.0	17.0	70.0
6	2	2	X	-1	8	8	5	21	X	-1.0	10.5	10.5	21.0
7	2	1	X	-1	-1	-1	-1	-1	X	-1.0	-1.0	-1.0	-1.0

THE FOLLOWING IS A LIST OF DEFINITIONS CORRESPONDING TO THE COLUMN NUMBERS
IN THE TABLE.

THE SUBCATCHMENT AREA IS CALCULATED BY SUMMING THE CELL AREAS THAT ARE WITHIN
A SUBCATCHMENT.

1. NODE (ALSO SUBCATCHMENT) COUNTER.
2. STRAHLER ORDER OF THE CHANNEL LINK INTO WHICH THE SUBCATCHMENT DRAINS.
3. NODE INDEX NUMBER.
4. DRAINAGE AREA OF THE SOURCE AREA SUBCATCHMENT IN NUMBER OF CELLS.
5. DRAINAGE AREA OF THE LEFT SUBCATCHMENT IN NUMBER OF CELLS WITHOUT CHANNEL CELL AREA.
6. DRAINAGE AREA OF THE RIGHT SUBCATCHMENT IN NUMBER OF CELLS WITHOUT CHANNEL CELL AREA.
7. AREA DEFINING THE CHANNEL IN NUMBER OF CELLS.
8. SUM OF THE ABOVE FOUR AREAS INTO TOTAL DIRECT DRAINAGE AREA IN NUMBER OF CELLS FOR THE CHANNEL LINK.
9. DRAINAGE AREA OF THE SOURCE AREA SUBCATCHMENT IN NUMBER OF CELLS.

10. DRAINAGE AREA OF THE LEFT SUBCATCHMENT INCLUDING 1/2 OF THE CHANNEL AREA IN NUMBER OF CELLS.
11. DRAINAGE AREA OF THE RIGHT SUBCATCHMENT INCLUDING 1/2 OF THE CHANNEL AREA IN NUMBER OF CELLS.
12. SUM OF THE ABOVE THREE AREAS INTO TOTAL DIRECT DRAINAGE AREA IN NUMBER OF CELLS FOR THE CHANNEL LINK.

** NOTE **

- BECAUSE THERE MAY BE JUNCTIONS WITH MULTIPLE TRIBUTARIES, THE NUMBER OF SUBCATCHMENTS MAY BE SMALLER THAN THE THEORETICALLY EXPECTED NUMBER.
- THE LAST LINE OF DATA DOES NOT REPRESENT A SUBCATCHMENT. IT REPRESENTS THE WATERSHED OUTLET CELL.
- THE SUBCATCHMENT AREAS INTO THE OUTLET CELL ARE ACCOUNTED FOR IN THE LAST CHANNEL LINK (PREVIOUS TO LAST DATA LINE). AS A RESULT, THE VALUE OF THE SUBCATCHMENT AREAS OF THE LAST CHANNEL LINK INCLUDE, IN ADDITION TO THEIR OWN SUBCATCHMENT AREAS, THE SUBCATCHMENT AREAS INTO THE OUTLET CELL.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.

10.2.24 Output file SBCTL.TAB

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM PARAM: SUBCATCHMENT PARAMETERIZATION
 VERSION 3.10, APRIL 1999

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TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

TABLE OF RASTER-NETWORK SUBCATCHMENT LENGTH INFORMATION AS COMPUTED
 BY PROGRAM PARAM

NOTE: FOR COMPLEX JUNCTION NODES ONLY THE SUBCATCHMENT INFORMATION
 PERTAINING TO THE FIRST NODE NUMBER IS GIVEN. SUBSEQUENT NODES
 ARE HYPOTHETICAL NODES AND HAVE NO CORRESPONDING SUBCATCHMENT INFORMATION.

CNTR.	NODE ORDER	NODE INDEX	X X	LENGTH TO SUBCATCHMENT CENTROID IN METERS FROM CHANNEL			X X	MEAN LENGTH OF ALL FLOW PATHS IN METERS FROM CHANNEL		
				SOURCE	RIGHT	LEFT		SOURCE	RIGHT	LEFT
1	2	3	X	4	5	6	X	7	8	9
			X				X			
1	1	7	X	56.2	39.5	39.5	X	70.8	60.0	60.0
2	1	9	X	64.3	65.5	60.5	X	77.0	74.6	69.7
3	1	5	X	74.2	50.8	34.3	X	93.7	66.5	41.7
4	1	3	X	57.3	64.1	34.5	X	70.8	112.5	54.0
5	1	10	X	71.6	34.1	60.3	X	90.9	51.4	105.0
6	2	2	X	-1.0	44.8	44.8	X	-1.0	60.0	60.0
7	2	1	X	-1.0	-1.0	-1.0	X	-1.0	-1.0	-1.0
-1										

THE FOLLOWING IS A LIST OF DEFINITIONS CORRESPONDING TO THE COLUMN NUMBERS
 IN THE TABLE.

1. NODE (ALSO SUBCATCHMENT) COUNTER.
2. STRAHLER ORDER OF THE CHANNEL LINK INTO WHICH THE SUBCATCHMENT DRAINS.
3. NODE INDEX NUMBER.
4. LENGTH TO CENTROID FROM CHANNEL FOR THE SOURCE SUBCATCHMENT IN METERS.
 THE LENGTH TO CENTROID IS ESTIMATED AS THE MEAN CELL-AREA WEIGHTED LENGTH
 FROM EACH CELL TO THE CHANNEL.
5. LENGTH TO CENTROID FROM CHANNEL FOR THE RIGHT SUBCATCHMENT IN METERS.
 THE LENGTH TO CENTROID IS ESTIMATED AS THE MEAN CELL-AREA WEIGHTED LENGTH
 FROM EACH CELL TO THE CHANNEL.
6. LENGTH TO CENTROID FROM CHANNEL FOR THE LEFT SUBCATCHMENT IN METERS.
 THE LENGTH TO CENTROID IS ESTIMATED AS THE MEAN CELL-AREA WEIGHTED LENGTH
 FROM EACH CELL TO THE CHANNEL.
7. MEAN FLOW PATH LENGTH FROM CHANNEL FOR THE SOURCE SUBCATCHMENT IN METERS.
8. MEAN FLOW PATH LENGTH FROM CHANNEL FOR THE RIGHT SUBCATCHMENT IN METERS.
9. MEAN FLOW PATH LENGTH FROM CHANNEL FOR THE LEFT SUBCATCHMENT IN METERS.

** NOTE **

- BECAUSE THERE MAY BE JUNCTIONS WITH MULTIPLE TRIBUTARIES, THE NUMBER OF SUBCATCHMENTS MAY BE SMALLER THAN THE THEORETICALLY EXPECTED NUMBER.
- THE LAST LINE OF DATA DOES NOT REPRESENT A SUBCATCHMENT. IT REPRESENTS THE WATERSHED OUTLET CELL.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.

10.2.25 Output file SBCTS.TAB

TOPAZ SOFTWARE: TOPOGRAPHIC PARAMETERIZATION SOFTWARE SYSTEM
 PROGRAM PARAM: SUBCATCHMENT PARAMETERIZATION
 VERSION 3.10, APRIL 1999

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TITLE OF CURRENT TOPAZ APPLICATION:

DATE: 23 AUGUST 1999 DEDNM VERSION 3.1
 APPLICATION FOR TESTING AND VERIFICATION; INPUT FILE "VARIABLE".
 TESTING AND CALIBRATION.

TABLE OF RASTER-NETWORK SUBCATCHMENT SLOPE INFORMATION AS COMPUTED
 BY PROGRAM PARAM

NOTE: FOR COMPLEX JUNCTION NODES ONLY THE SUBCATCHMENT INFORMATION
 PERTAINING TO THE FIRST NODE NUMBER IS GIVEN. SUBSEQUENT NODES
 ARE HYPOTHETICAL NODES AND HAVE NO CORRESPONDING SUBCATCHMENT INFORMATION.

NODE CNTR.	NODE ORDER	NODE INDEX	X	MEAN TERRAIN SLOPE			X	MEAN FLOW PATH SLOPE (FLOW VECTOR INTEG.)			X	MEAN CELL-TO-CHANNEL SLOPE (FLOW VECTOR INTEG.)		
				SOURCE	RIGHT	LEFT		SOURCE	RIGHT	LEFT		SOURCE	RIGHT	LEFT
1	2	3	X	4	5	6	X	7	8	9	X	10	11	12
1	1	7	X	0.0293	0.0567	0.0567	X	0.1108	0.1426	0.1426	X	0.1440	0.1685	0.1685
2	1	9	X	0.0139	0.0218	0.0237	X	0.0746	0.1169	0.1215	X	0.1044	0.1129	0.1189
3	1	5	X	0.0154	0.0334	0.0558	X	0.0711	0.1144	0.1706	X	0.0964	0.1259	0.1657
4	1	3	X	0.0293	0.0311	0.0637	X	0.1130	0.0644	0.1400	X	0.1419	0.1254	0.1815
5	1	10	X	0.0161	0.0656	0.0333	X	0.0739	0.1611	0.0705	X	0.1127	0.1815	0.1299
6	2	2	X	-1.0000	0.0653	0.0653	X	-1.0000	0.1833	0.1833	X	-1.0000	0.1861	0.1861
7	2	1	X	-1.0000	-1.0000	-1.0000	X	-1.0000	-1.0000	-1.0000	X	-1.0000	-1.0000	-1.0000

THE FOLLOWING IS A LIST OF DEFINITIONS CORRESPONDING TO THE COLUMN NUMBERS
 IN THE TABLE.

1. NODE (ALSO SUBCATCHMENT) COUNTER.
2. STRAHLER ORDER OF THE CHANNEL LINK IN WHICH THE SUBCATCHMENT DRAINS.
3. NODE INDEX NUMBER.
4. MEAN OF THE TERRAIN SLOPE OF THE SOURCE SUBCATCHMENT. THE MEAN IS COMPUTED BY SUMMATION OVER ALL CELLS IN THE SUBCATCHMENT DIVIDED BY THE NUMBER OF CELLS.
5. MEAN OF THE TERRAIN SLOPE OF THE RIGHT SUBCATCHMENT . THE MEAN IS COMPUTED BY SUMMATION OVER ALL CELLS IN THE SUBCATCHMENT DIVIDED BY THE NUMBER OF CELLS.
6. MEAN OF THE TERRAIN SLOPE OF THE LEFT SUBCATCHMENT . THE MEAN IS COMPUTED BY SUMMATION OVER ALL CELLS IN THE SUBCATCHMENT DIVIDED BY THE NUMBER OF CELLS.
7. MEAN FLOW PATH SLOPE IN THE SOURCE AREA, WHERE EACH FLOW PATH SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM THE SOURCE CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.
8. MEAN FLOW PATH SLOPE IN THE RIGHT AREA, WHERE EACH FLOW PATH SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM THE SOURCE CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.

9. MEAN FLOW PATH SLOPE IN THE LEFT AREA, WHERE EACH FLOW PATH SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM THE SOURCE CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.
10. MEAN CELL SLOPE IN THE SOURCE AREA, WHERE EACH CELL SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM EVERY CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.
11. MEAN CELL SLOPE IN THE RIGHT AREA, WHERE EACH CELL SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM EVERY CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.
12. MEAN CELL SLOPE IN THE LEFT AREA, WHERE EACH CELL SLOPE IS COMPUTED BY SUMMING THE FLOW VECTOR ALONG THE FLOW PATH FROM EVERY CELL TO THE CHANNEL, DIVIDED BY THE NUMBER OF CELLS.
13. MEAN SLOPE IN THE SOURCE AREA, WHERE SLOPE IS COMPUTED BY DETERMINING THE MEAN ELEVATION OF THE SUBCATCHMENT, DETERMINING THE ELEVATION OF THE CHANNEL SOURCE, THE DIVIDING THE DIFFERENCE BY THE DISTANCE-TO-CENTER OF MOMENT.
14. MEAN SLOPE IN THE RIGHT AREA, WHERE SLOPE IS COMPUTED BY DETERMINING THE MEAN ELEVATION OF THE SUBCATCHMENT, DETERMINING THE MEAN ELEVATION OF THE CHANNEL, THE DIVIDING THE DIFFERENCE BY THE DISTANCE-TO-CENTER OF MOMENT.
15. MEAN SLOPE IN THE LEFT AREA, WHERE SLOPE IS COMPUTED BY DETERMINING THE MEAN ELEVATION OF THE SUBCATCHMENT, DETERMINING THE MEAN ELEVATION OF THE CHANNEL, THE DIVIDING THE DIFFERENCE BY THE DISTANCE-TO-CENTER OF MOMENT.

** NOTE **

- BECAUSE THERE MAY BE JUNCTIONS WITH MULTIPLE TRIBUTARIES, THE NUMBER OF SUBCATCHMENTS MAY BE SMALLER THAN THE THEORETICALLY EXPECTED NUMBER.
- THE LAST LINE OF DATA DOES NOT REPRESENT A SUBCATCHMENT. IT REPRESENTS THE WATERSHED OUTLET CELL.
- VALUE OF -1 INDICATES TERM NOT APPLICABLE.

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