National Mapping Program
Technical Instructions
Data Users Guide 3

USGeoData

Digital Line Graphs from 1:2,000,000-Scale Maps

Data Users Guide

Department of the Interior
U. S. Geological Survey

DATA USERS GUIDES

1: Digital Line Graphs from 1:24,000-Scale Maps
2: Digital Line Graphs from 1:100,000-Scale Maps
3: Digital Line Graphs from 1:2,000,000-Scale Maps
4: Land Use and Land Cover Digital Data from 1:250,000- and 1:100,000-Scale Maps
5: Digital Elevation Models
6: Geographic Names Information System
7: Alaska Interim Land Cover Mapping Program

Data Users Guides 1-7 generally replace the Geological Survey Circular 895.

Questions regarding availability and ordering of US GeoData (all types of digital cartographic and geographic data produced and distributed by the U.S. Geological Survey) should be addressed to:

Earth Science Information Center
U.S. Geological Survey
507 National Center
Reston, Virginia 22092
(703)860-6045

Technical questions and comments should be addressed to:

Branch of Technical Management
U.S. Geological Survey
510 National Center
Reston, Virginia 22092

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

Data Users Guide 3

Reston, Virginia
1990

First printing, 1986
Second printing (revised), 1990

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS--continued

TABLES

DIGITAL LINE GRAPHS FROM 1:2,000,000-SCALE MAPS

INTRODUCTION

The Earth Science Information Centers (ESIC) distribute digital cartographic/geographic data files produced by the U.S. Geological Survey (USGS) as part of the National Mapping Program. Digital cartographic data files may be grouped into four basic types. The first of these, called a Digital Line Graph (DLG), is line map information in digital form. These data files include information on planimetric base categories, such as transportation, hydrography, and boundaries. The second type, called a Digital Elevation Model (DEM), consists of a sampled array of elevations for a number of ground positions that are usually at regularly spaced intervals. The third type is Land Use and Land Cover digital data, which provides information on nine major classes of land use such as urban, agricultural, or forest as well as associated map data such as political units and Federal land ownership. The fourth type, the Geographic Names Information System, provides primary information for all known places, features, and areas in the United States identified by a proper name.

The digital cartographic data files from selected sources currently available from ESIC include the following:

- Digital Line Graphs (DLG)
  --1:24,000-scale
  --1:62,500-scale
  --1:63,360-scale
  --1:100,000-scale
  --1:2,000,000-scale

- Digital Elevation Models (DEM)
  --7.5-minute
  --15-minute
  --30-minute
  --1-degree

- Land Use and Land Cover digital data
  --1:250,000- and 1:100,000-scale Land Use and Land Cover and associated maps
  --1:250,000-scale Alaska Interim Land Cover

- Geographic Names

The digital data are useful for the production of cartographic products such as plotting base maps and for various kinds of spatial analysis. A major use of these digital cartographic/geographic data is to combine them with other geographically referenced data enabling scientists to conduct automated analyses in support of various decisionmaking processes.

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government. Manuscript approved for publication September 4, 1986.

This document describes DLG's prepared from the 1:2,000,000-scale sectional maps (U.S. regions) of the National Atlas of the United States of America.

DATA CONTENT

The DLG data files derived from the 1:2,000,000-scale maps contain selected base categories of cartographic data in digital form. The data files are derived from the sectional maps of the 1970 National Atlas of the United States of America. The following categories are included in current 1:2,000,000-scale DLG files:

- Boundaries -- This category of data includes boundary information collected in two separate subcategories: (1) Political Boundaries and (2) Administrative Boundaries.
- Hydrography -- This category of data includes features collected in three separate subcategories: (1) Streams, (2) Water Bodies, and (3) Hypsography (Continental Divide only).
- Transportation -- This category of data includes major transportation systems collected in three separate subcategories: (1) Roads and Trails, (2) Railroads, and (3) Cultural Features (airports and Alaska pipeline).

DATA STRUCTURE

Levels of Structuring

The term DLG is employed by the USGS to describe a digital map data set in vector form. Originally, three levels of DLG data (DLG-1, DLG-2, and DLG-3) were proposed; these levels were differentiated by their positional accuracy, level of attribute coding, and relational spatial information. It was found, however, that the widest user-community would be served by producing DLG-3 data, which have the full range of attribute codes and are fully topologically structured. These two properties are required by users whose work includes both graphic and analytic applications. Therefore, all DLG data in the National Digital Cartographic Data Base are level 3.

Topology

Data collection from 1:2,000,000-scale maps was exclusively directed toward producing fully topologically structured level-3 DLG data referred to as DLG-3. The DLG-3 concept is based on graph theory in which a two-dimensional diagram is expressed as a set of nodes (points in space) and links (line segments connecting nodes) in a manner that explicitly expresses logical relationships. Applied to a map, this concept is used to encode the digital data with the spatial relationships among map elements that are obvious when the map is examined visually. The spatial relationships include such concepts as adjacency and connectivity between features on the map. The abstraction of the map data according to the rules of graph theory preserves the spatial relationships inherent in the map graphic and creates a logical and consistent data file structure for computer processing. A digital file of cartographic or geographic data that maintains the spatial relationships inherent in the map is called a topologically structured data file. A topologically

structured data file can support simple graphic applications, such as plotting streams and roads for base maps, as well as more advanced applications, such as computations involving areas and lines and their spatial relationships.

Topological Elements

A DLG-3 file is composed of three separate, but related, types of elements: nodes, lines, and areas. Nodes define the location of the end-points of every line, and a single node may mark the start or end of one or more lines. Intersections of linear features and significant points on linear features are marked by nodes because at that point the linear feature is subdivided into line segments.

A line is an ordered set of points that describes the position and shape of a linear feature on the map. Each line starts at a node and ends at a node and, thus, has both an explicit direction and a left-right connotation. The direction of the line is arbitrarily chosen at the time of digitizing. Lines connect to each other at nodes, and, by this definition, a line does not cross itself or any other line. A line may describe the boundary between two map features, such as counties, or may define a map feature by itself, such as a road. A special line, called a degenerate line, is used to define features symbolized as independent points on a map. A degenerate line starts and ends at the same node, has two identical coordinate pairs, has zero length, and is totally enclosed inside one map area.

An area is a portion of the map bounded by lines. All portions of the map must be assigned to some area. Each area is identified in a DLG-3 data file by an arbitrary point chosen to represent the characteristics of the area; the point is not required to be inside the area it represents. Every DLG data file will have at least two areas identified: one representing the area covered by the file and the other representing the area outside the coverage of the file. Additional areas will be defined as necessary to subdivide the area covered by the file. Polygons as unique features are not defined explicitly in a standard DLG file. However, polygons can be constructed using line-area linkages built into the DLG data structure.

ATTRIBUTE CODES

In addition to locational and topological information, DLG data elements may have explicitly encoded attributes. Attribute codes, also called feature codes or classification attributes, are used to describe the map information represented by a node, area, or line. For example, the attribute code for an area might identify a lake or glacier; the attribute code for a line might identify a road, railroad, stream, or shoreline (fig. 1). The codes are based on the cartographic features symbolized on the sectional maps of the 1970 National Atlas of the United States of America.

The map symbology of the source material used during digitizing and encoding of data elements has a strong influence on the overall classification strategy. A listing of all the attribute codes currently assigned and used in the 1:2,000,000-scale DLG files is given in Appendix E.

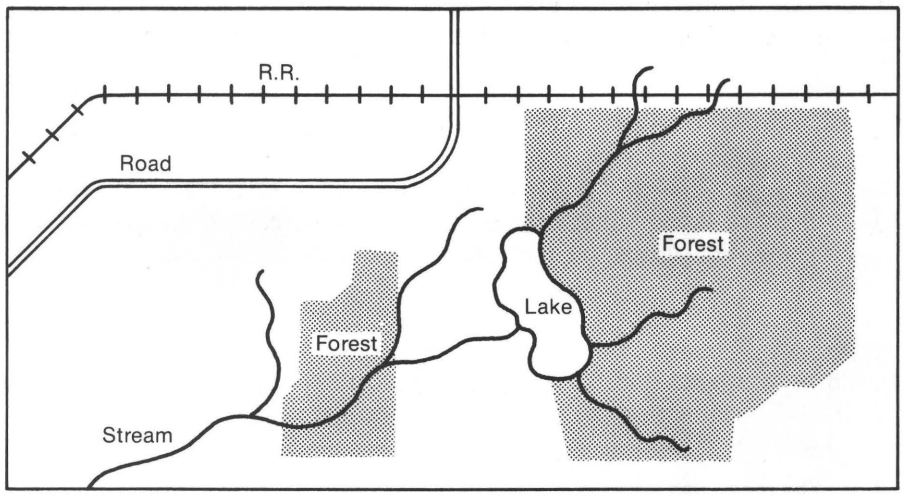

Figure 1.--Map elements showing roads, railroads, buildings, streams, lake, and forest areas.

Each attribute code identifies the major category to which a data element belongs, as well as the specific nature of the element. Codes also may provide additional descriptive information. Most elements are uniquely described by a single attribute code. Others, however, may require two or more codes for a complete description. If multiple attributes are needed to describe an element, the order is not significant. Allowing for a variable number of attribute codes creates an open-ended structure to which information may be added at any time. It is not necessary for each element to have associated attributes; in general, attribute codes are not assigned to an element if the attributes can be derived based on relationships to adjacent elements.

In conventional DLG data files, features are described as they are symbolized or labeled on the source map. For the 1:2,000,000-scale data, however, additional information about the map features is included through a special attribute coding scheme. These codes not only describe the digitized features in a generic sense, but provide a means of selecting map features based on some indices of the significance of the features. These special attribute codes are provided to assist the user in selecting the features to be displayed on maps of various scales and themes. Because of the varying nature of the themes of data digitized, the indices of feature "significance" differs between data overlays.

A DLG attribute code is composed of two distinct numeric fields: a three-digit major code, and a four-digit minor code. In the digital file, the major and minor attributes are encoded in two integer fields of six digits, flush right with leading blanks (FORTRAN 2I6 format). In this document, major codes are presented as three digits, and minor codes are presented as four digits. Leading zeros are shown for clarity; for example: 090 0104.

Major Attribute Codes

A list of the major codes and the categories they represent is contained in table 1. The first two digits of the major code (including leading zeroes) uniquely identify the category to which the described element belongs. The third digit of the major code is used to modify the minor code in two ways:

- If zero, the minor code represents a description or classification of the element.
- If non-zero, the minor code which follows is a parameter requiring special interpretation according to instructions given in the codes for each category (see next section).

Table 1.--Major codes used for DLG base categories

Major Code	Base Category
040	Water Bodies
090	Political and Administrative Boundaries
100	Transportation systems -- Roads and Trails
290	Special line attribute codes for 1:2,000,000-scale data

NOTE: The coding scheme utilizing the major codes 040, 090, 100, and 290 applies only to 1:2,000,000-scale DLG data sets. The codes in the series 040, 090, and 100 are available only in the standard and optional DLG formats (described below). In the graphic data format, only the last two digits of the 290-code series are carried in the data.

Minor Attribute Codes

In the 1:2,000,000-scale data sets, two separate schemes are used to encode minor attribute codes: scheme one is used with the major code series 040, 090, and 100, and scheme two is used with major code series 290. These two schemes will be addressed separately.

Scheme One: Minor Codes in the 040, 090, and 100 Series

The codes in the 040 and 090 code series are used for area elements in the water body and boundary (both political and administrative) categories, respectively. The codes in the 100 code series are applied to the roads and trails category. If the third digit of the major code is zero, the minor code is interpreted to describe the file element in a generic sense (for example, as a lake, forest, or park). If the third digit of the major code is non-zero, the minor code is interpreted as identifying the file element representing part of a particular feature (for example, as the State of Virginia, Fairfax County, or Interstate 95). These codes are not included in the graphic data distribution format.

Examples of these attribute codes include:

040 0100	The major code 040 indicates the water body category. The minor code 0100 identifies the feature as a perennial lake or pond.
090 0104	The major code 090 indicates one of the boundary categories. The minor code 0104 identifies the feature as a national forest or grassland.
091 0051, 092 0059	The major code 091 indicates a State in the boundary category. Because the last digit of the major code is non-zero, the minor code is a parameter. The minor code 0051 is the Federal Information Processing Standards (FIPS) code for the State of Virginia. Similarly, the major code 092 indicates a county in the boundary category. The minor code 0059 is the FIPS code for Fairfax County.
102 0095	The major code 102 indicates an interstate highway in the roads and trails category. Because the last digit of the major code is non-zero, the minor code is interpreted as a parameter code. The minor code 0095 indicates that the element with which this code is associated is part of Interstate 95.

Scheme Two: Minor Codes in the 290 Series

During the planning of the 1:2,000,000-scale data sets, it was decided that the data should support the generation of a variety of maps of different scales and themes. During the process of making different maps, it is necessary to change the amount of data displayed to support the theme or scale of the map. One of these changes is to control the selection of features to be displayed based on some indices of significance or importance.

The 290-code series represents an attempt to encode selected indices of significance or importance in the data. By careful selection of features through the use of these attribute codes, one can control the amount of information displayed.

The minor codes in the 290 series are composed of four digits. The first digit indicates the category of data. The second digit is always zero. The last two digits both identify the feature in a generic sense and contain some index of significance. A description of the minor codes for each numeric series follows:

2000-2099:	Hypsography. The only feature currently stored is the Continental Divide.
3000-3099:	Streams. Examples of the features encoded include perennial, intermittent, and braided streams, and canals. In addition to the generic description, each feature is further categorized based on an approximate measure of overall feature length. In estimating the length of a feature, the path of a stream was determined by following the named (labeled) channel as far as possible, and then following the longest tributary.
4000-4099:	Water Bodies. Examples of these features include perennial, intermittent, and dry lakes. Each feature is further classified by length along the longest dimension of the feature.

5000-5069: Roads and Trails. Examples of these features include Interstate, U.S., and State highways. Each feature is further classified by such characteristics as length, access type (limited or non-limited access), proximity to a parallel route of a higher class, and as serving as a connector in a network of highways of a higher class.

5070-5080: Railroads. Railroads are classified based on a U.S. Department of Transportation classification scheme.

6000-6019: Political Boundaries. Classification is based on a hierarchical scheme of national, State, and county boundaries. Maritime boundary areas are usually closed by unattributed arbitrary extension lines and do not follow the shoreline.

6020-6099: Administrative Boundaries. Examples of these features include national parks, forests, wilderness areas, and Indian reservations. Each feature is further classified by length along the longest dimension of the feature.

7000-7099: Cultural Features (also referred to as Miscellaneous Transportation). Includes civilian and military airports and the Alaskan pipeline. Airports are only available in the standard and optional data distribution formats (refer to the Distribution format section).

An example of the use of these codes to control feature selection is illustrated in figures 2a through c. A map produced at a scale of 1:2,000,000 might include all streams from feature codes 3003 through 3016 and 3008 through 3030 (fig. 2a). A map at a scale of 1:5,000,000 might include streams with a length of greater than 50 kilometers (using feature codes 3007 through 3016 and 3021 through 3030) (fig. 2b).

Finally, at a scale of 1:10,000,000, a map might only display those features with a length greater than 100 kilometers (using codes 3010 through 3016 and 3024 through 3030) (fig. 2c).

These figures also illustrate the use of the "centerline in water body" codes (3035 through 3059). In generating a graphic of drainage for an area, normally data from both the stream and water body overlays is portrayed. When controlling the number of water bodies displayed in a graphic, it is possible that gaps will appear in a stream network where small bodies of water were not selected for display. The "centerline in water body" codes were meant to fill these gaps. For example, the codes were designed so that, if perennial lakes of length of 2 to less than 4 kilometers (code 4002) were not selected for display, the centerline in perennial lakes of 2 to less than 4 kilometers (code 3036) would be selected to maintain connectivity in the stream network. Unfortunately, these centerline codes only reference the body of water in which they reside and not the stream to which they are connected. It is possible that centerlines might be requested for display and the stream to which they connect not be selected for display.

SAMPLE LINE GRAPH STRUCTURE

Examples of a line graph and its corresponding digital records are given in figure 3 and table 2. These examples are simplified representations of the concepts used in the DLG-3 structure; they are not actual data files. The example shown is composed of 13 nodes, labeled N1 through N13, 5 areas, labeled A1 through A5, and 15 lines, labeled L1 through L15. Each element type is maintained as a separate list in the digital data.

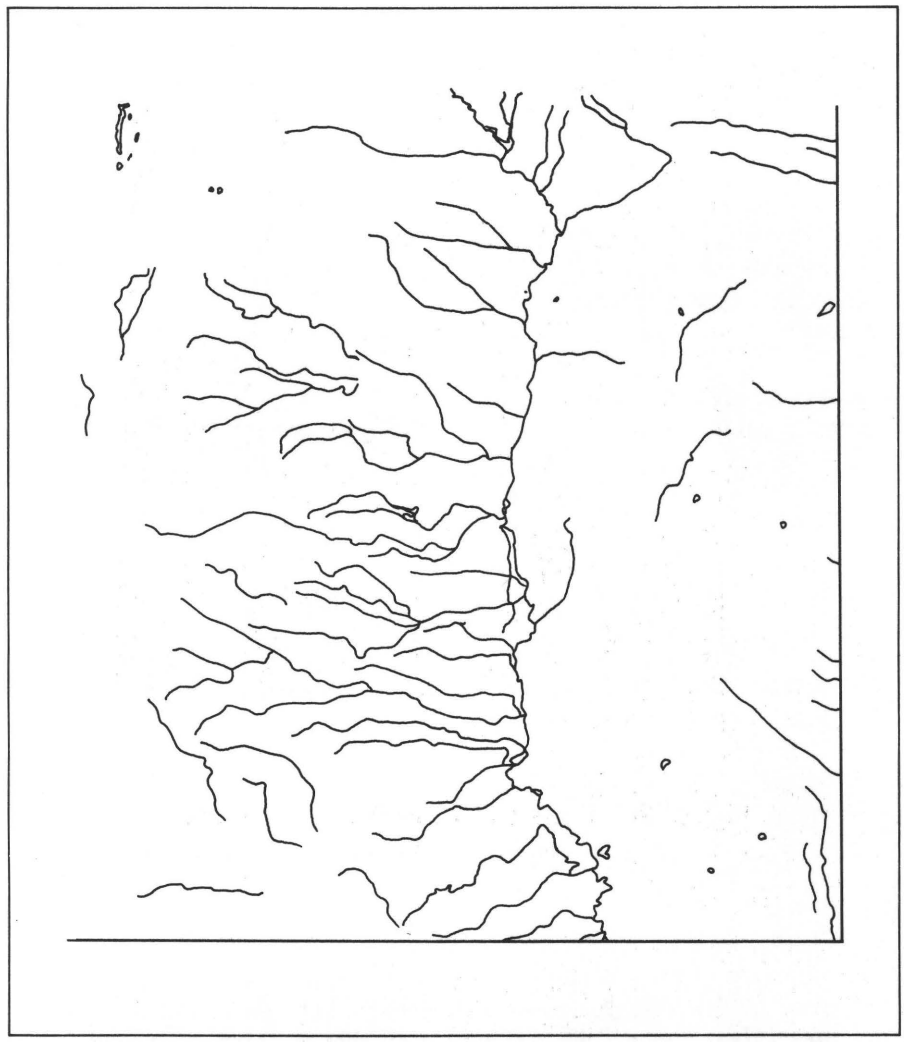

Figure 2a.--Pecos River, southeastern New Mexico.
Scale: 1:2,000,000.

The map represented by the example is divided into five distinct areas. Area Al represents the area outside of the map border. There is one outside area for each DLG-3. It is always the first area encountered and has the attribute code 000 0000. In the example given in figure 3, the portion of the map inside the border is divided into four areas, each bounded (closed) by lines. Area A2 is bounded by lines Ll4, Ll, L4, and L5. Area A3 is bounded by lines L3, Ll3, L4, L6, L7, L8, L15, and L9. Area A4 is bounded by lines L8, L15, and L9. Area A5 is bounded by lines L5, L6, L7, and Ll0 and L2.

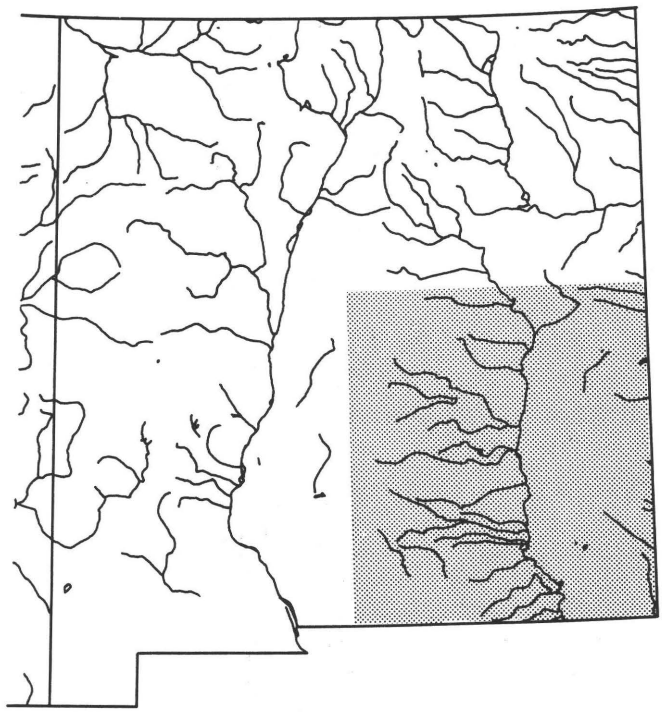

Figure 2b.--Rivers and water bodies, New Mexico.
Scale: 1:5,000,000.

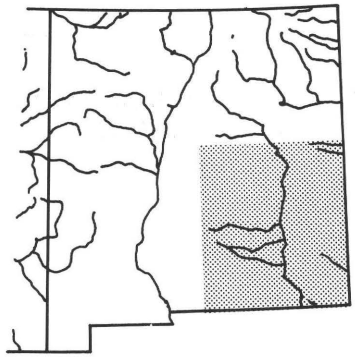

Figure 2c.--Rivers and water bodies, New Mexico.
Scale: 1:10,000,000.

In this example, line elements contain the only explicit topological references. Each line contains pointers to its bounding nodes (starting and ending) and the areas that it bounds (left and right of the line). This format is similar in concept to the standard DLG-3 data structure, which minimizes redundant linkages to achieve efficient data encoding and storage.

The lines in figure 3 are labeled L1 through L15. The lines can be identified by their starting node number, ending node number, number of the area to the left of the direction of travel, number of the area to the right of the direction of travel, and string of coordinates describing the alignment of the line. In this example, only two pairs of coordinates are shown; however, in an actual file, an irregular line would have a variable number of coordinate pairs up to a limit of 1,500 coordinate pairs. The direction of travel of the line is arbitrarily determined during the digitizing operation. In this example, L1 is encoded as proceeding clockwise around area A2. Thus line L1 starts at node N1, ends at node N3, has area A1 to the left of the direction of travel, and has area A2 to the right of the direction of travel. The coordinate string describing the alignment of the line will start with the same coordinate values as that of node N1 and will end with the same coordinate values as that of node N3. Because the area to the left of its direction of travel, A1, is different from the area to the right of its direction of travel, A2, the line is known to be a boundary between the two areas.

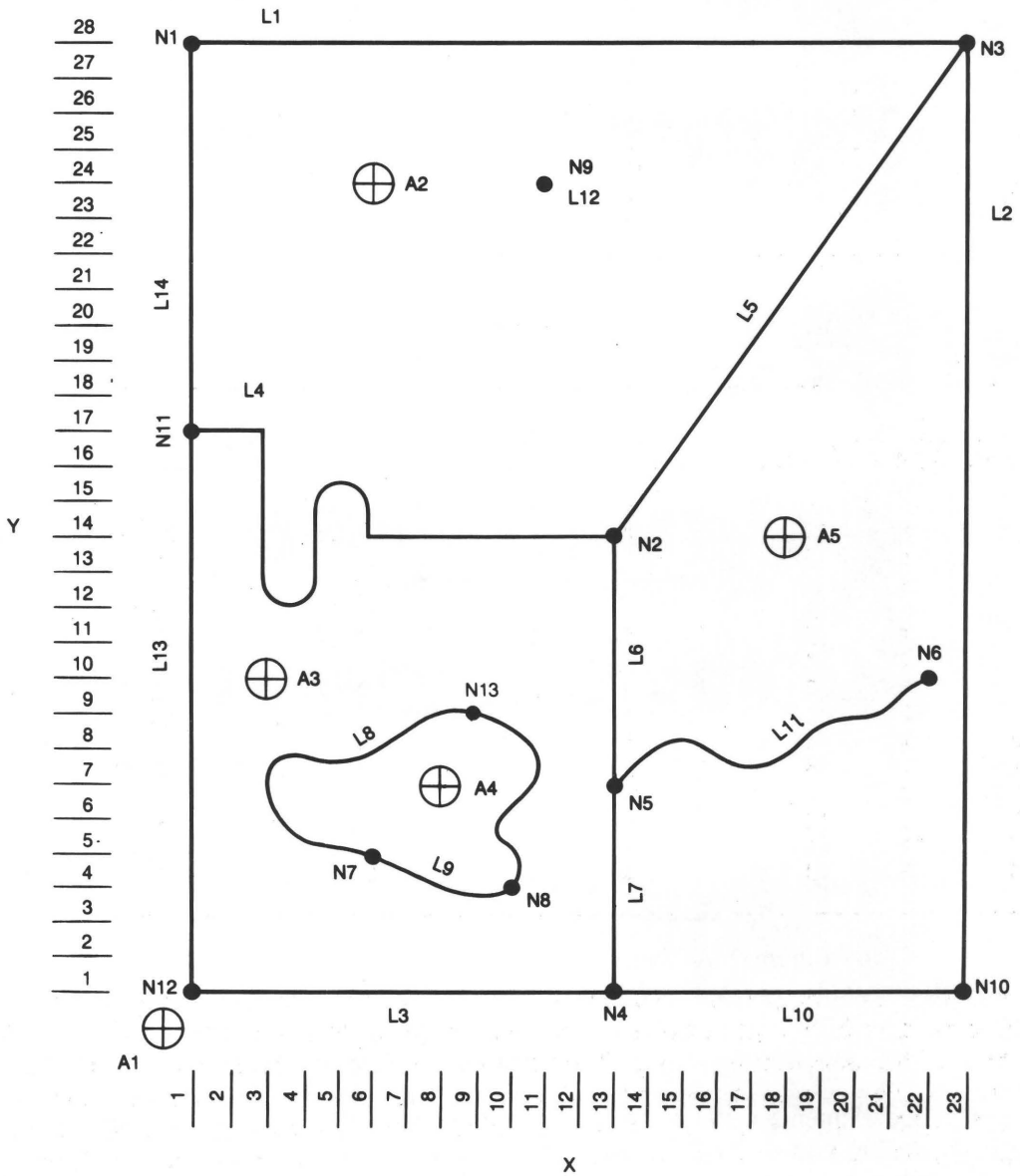

Figure 3.--Sample line graph.

Table 2.--Description of the topological elements and relationships of a sample line graph (see fig. 3)

Nodes

Internal Id Number	X Coordinate	Y Coordinate
N1	1	28
N2	13	14
N3	23	28
N4	13	1
N5	13	7
N6	22	10
N7	6	5
N8	10	4
N9	11	24
N10	23	1
N11	1	17
N12	1	1
N13	9	9

Areas

Internal Id Number	X Coordinate	Y Coordinate
A1	0	0
A2	6	24
A3	3	10
A4	8	7
A5	18	14

Lines

	Nodes		Area		Coordinates	
Number	Starting	Ending	Left	Right	(first x y	last x y)
L1	1	3	1	2	1, 28	23, 28
L2	3	10	1	5	23, 28	23, 1
L3	4	12	1	3	13, 1	1, 1
L4	11	2	2	3	1, 17	13, 14
L5	2	3	2	5	13, 14	23, 28
L6	2	5	5	3	13, 14	13, 7
L7	5	4	5	3	13, 7	13, 1
L8	13	7	4	3	9, 9	6, 5
L9	7	8	4	3	6, 5	10, 4
L10	4	10	5	1	13, 1	23, 1
L11	5	6	5	5	13, 7	22, 10
L12	9	9	2	2	11, 24	11, 24
L13	12	11	1	3	1, 1	1, 17
L14	11	1	1	2	1, 17	1, 28
L15	8	13	4	3	10, 4	9, 9

Lines L11 and L12 are examples of lines that lie within one area. In this example, line L11 starts at node N5, ends at node N6, has area A5 to the left of the direction of travel, and again has area A5 to the right of the direction of travel. The coordinate string for the line will start with the same coordinate values as that of node N5 and will end with the same coordinate value as that of node N6. Line L12 is an example of a degenerate line. The line starts at node N9, ends at node N9, and has area A2 as both the area to its left and right. There are only two coordinate pairs in

the string defining the line: both points have the same coordinate values as node N9; thus, the two points are the same and the line has zero length.

The line graph concept allows all of the points on the map to be described as a member of a line graph element (node, area, or line) with minimal redundancy. The relationships between the various elements are indicated by the structure. Note that in this example the x and y coordinates are numbered from the lower left corner to simplify the drawing. In an actual DLG-3 file, the origin is the center of the map and the internal file coordinates are numbered plus or minus 1 to 32,767 expressed in thousandths of inches. See the section labeled "Coordinate Systems" for more detail.

GRAPH THEORY IN DLG DATA

There are two ways to implement the line graph concept in DLG files: the area case and the network case. These cases are differentiated by the nature of the information contained in the categories.

Area line graphs are used to represent areal features such as political entities or water bodies. Area line graphs correspond directly to the general line graph case in that each closed area on the map is represented by a distinct area element. Data categories that are collected as area line graphs include:

- Political Boundaries
- Administrative Boundaries
- Water Bodies

Network line graphs are used to represent linear features in digital form. The network case differs from the area case in that, irrespective of the number of closed areas forming the graph, only two area elements are encoded: (1) the area outside the graph, termed the outside area; and (2) the area within the graph, termed the background area. All lines except the graph boundary are considered to be contained within the background area. The major topological relationship expressed by network data is that of connectivity. Data encoded in network line graph form are suitable for various forms of network analysis, such as minimum path computations. Data categories that can be collected as network line graphs include:

- Roads and Trails
- Railroads
- Cultural Features
- Streams
- Hypsography (Continental Divide only)

In the area case, such as the boundary data collected from 1:2,000,000-scale maps, all areas on the graph have an identity pertinent to the category and are assigned attribute codes to describe them. The lines in such cases derive their significance from the areas they border. In the network case, as implemented in roads and trails collected from 1:2,000,000-scale maps, the lines themselves have the identity and are assigned attribute codes to describe them. The background area, represented by a single area record, does not have an attribute code assigned to it.

Figure 4 shows a window in the vicinity of Catron County, New Mexico, taken from the Arizona and New Mexico 1:2,000,000-scale map. Figure 5 shows the line graph encoded for the boundaries of the same area. Certain nodes, areas, and lines are labeled.

Table 3 contains some of the digital data records extracted from the node, area, and line lists which describe this portion of the graph. (Note: Descriptions of DLG-3 formats are contained in Appendixes A, B, and C, and a list of attribute codes is contained in Appendix E.)

In the example, each node and area element is described by one or two logical records: (1) a type D.1 record that describes the element, and (2) an optional type F record that lists the attribute codes associated with the element. The first record (type D.1) for each node and area element contains the following fields:

1. Type of record indicator, N for node or A for area.
2. Internal sequence identification number.
3. x coordinate of node or representative area point.
4. y coordinate of node or representative area point.
5. Number of attribute codes that describe the element.
6. Number of pairs of characters in the text string that describes the element.

The second record (type F) for each node and area element contains n attribute codes (expressed as major and minor code pairs), where n is the number specified in field 5 of the first (type D.1) record.

Each line element in the example is described by two or three logical records: (1) a type D.2 line description record, and (2) a type E record that lists the x,y coordinate pairs that define the shape of the line, and, if appropriate, (3) a type F (attribute code) record. The first record (type D.2) for each line element contains the following fields:

1. Type of record indicator (L).
2. Internal sequence identification number.
3. Internal sequence number of starting node.
4. Internal sequence number of ending node.
5. Internal sequence number of the area to the left of the line.
6. Internal sequence number of the area to the right of the line.
7. Number of x,y coordinate pairs that locate the line on the map.
8. Number of attribute codes that describe the line.
9. Number of pairs of characters in the text string that describes the line.

The second logical record (type E) for each line element contains n coordinate pairs, where n is the number specified in field 7 of the first (type D.2) record. The type F record is as described above.

The topological pointers contained in the DLG-3 line elements enable a user to manipulate the data based on the spatial relationships. For example, some applications require areal data to be expressed as closed strings of x,y coordinate pairs. For such applications the user can request that the data be supplied in the optional distribution format. In this format the references to the boundary lines of each area are explicitly coded into the area record. For other applications the standard format may be preferable.

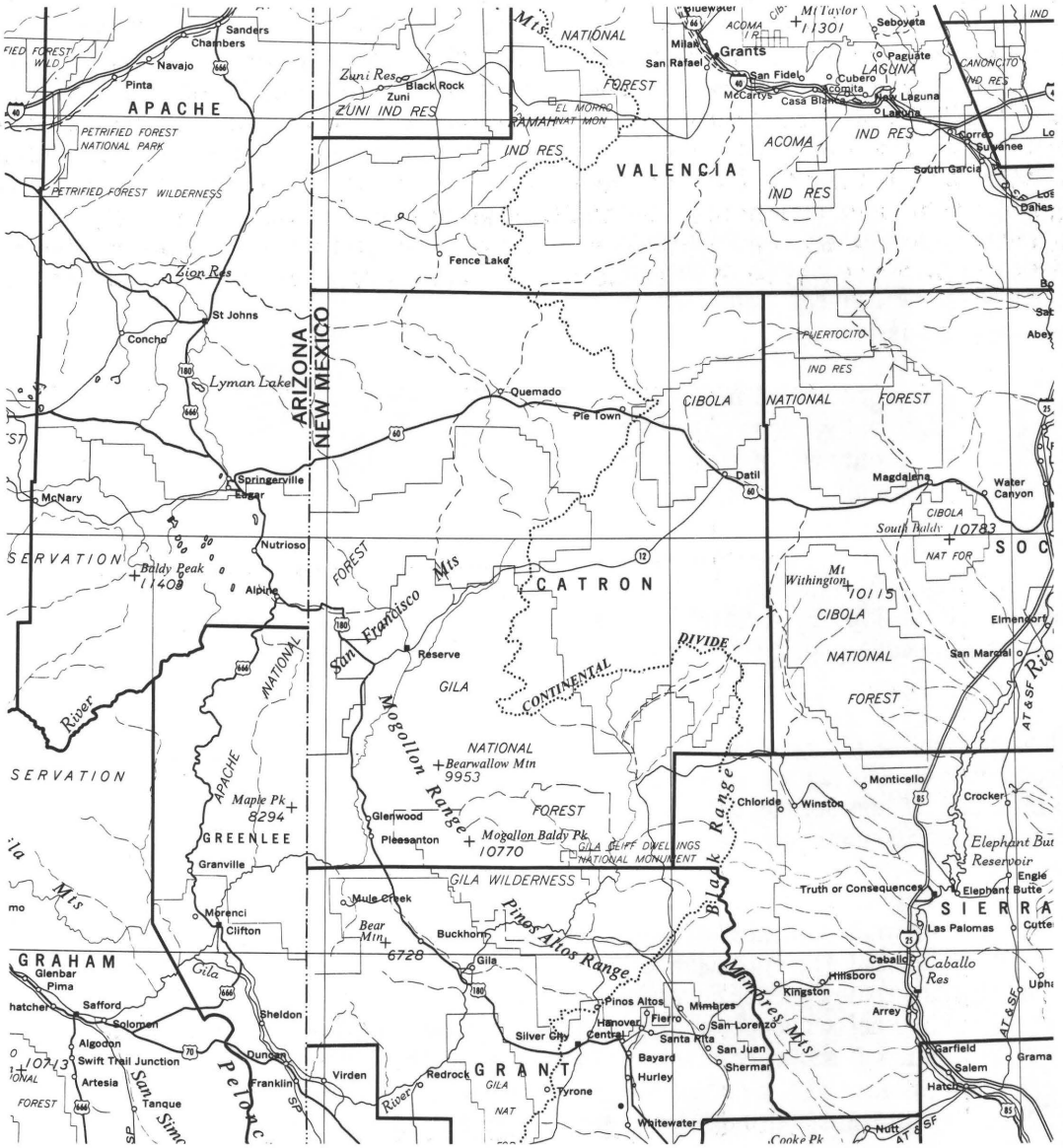

Figure 4.--Window from the Arizona-New Mexico, 1:2,000,000-scale sectional map of the National Atlas of the United States of America.

The specific records in table 3 describe Catron County, New Mexico. The county is described by 6 nodes, 1 area, and 6 lines. The area information, encoded in area record 10, includes the position of the area record (428, -934) and the attribute codes 091 0035 and 092 0003 identifying the area as being in the State of New Mexico and Catron County respectively. The boundary of the county is formed by lines 76, 79, 80, 85, 86, and 87. They can be verified as forming the boundary of this area by noting that each line has area 10 as the area to the left or right of the direction in which the line was digitized. In addition, the lines have attribute codes identifying them as portions of State boundaries (code 290 6005) or county boundaries (290 6009). The lines

may be connected to form a closed loop around the area. This may be accomplished by reordering the line elements in a clockwise direction (where area 10 is always to the right of the direction of travel) or in a counterclockwise direction (where area 10 is always to the left of the direction of travel). (In reordering the direction of a line element, the starting node becomes the ending node (and vice versa), the area left becomes the area right (and vice versa), and the points describing the line are reordered (the first point becomes the last point, the second point becomes the second to the last point, etc.).) Once the lines are ordered correctly, the lines may be connected by using the starting and ending node information. Island-like features must be handled separately. Users whose applications will require this sort of structure should consider purchasing the optional format of the DLG data, which contains these forward and inverse pointers between lines and area and line and nodes.

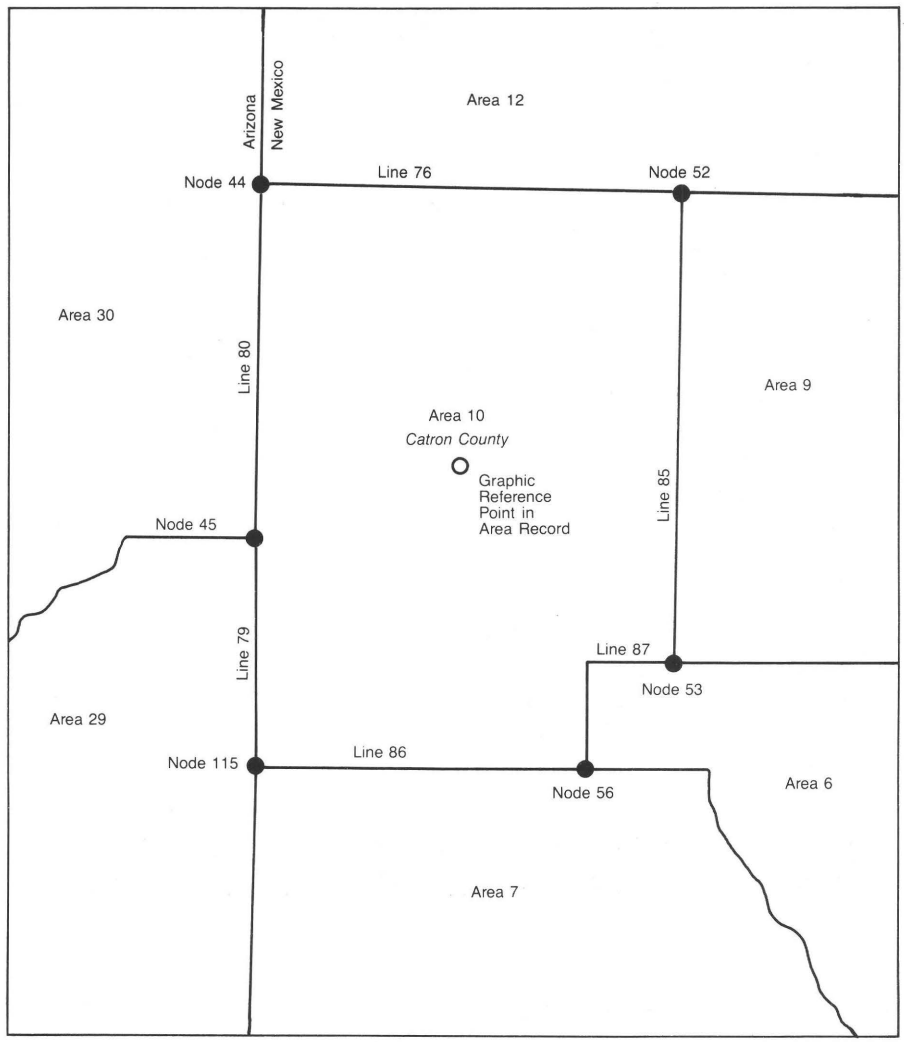

Figure 5.--Sample topology, Catron County, New Mexico.

Table 3.--Selected sample of standard format DLG-3 records of Catron County, New Mexico [N, node; A, area; L, line]

```
N       44    -86    948      0      0
N       45    -90   -831      0      0
   .
   .
   .
N       52   2297    947      0      0
N       53   2361  -1484      0      0
   .
   .
   .
N       56   1840  -2085      0      0
   .
   .
   .
N      115    -91  -2102      0      0
   .
   .
   .
A       10    428   -934      2      0
      91     35     92      3
   .
   .
   .
L      76     44     52     12     10      4      1      0
    -86    948   1155    938   1565    940   2297    947
    290   6009
   .
   .
   .
L      79    115     45     29     10      3      1      0
    -91  -2102    -91  -1770    -90   -831
    290   6005

L      80     45     44     30     10      3      1      0
    -90   -831    -86      8    -86       948
    290   6005
   .
   .
   .
L      85     53     52     10      9      4      1      0
   2361  -1484   2329   -706   2319    252   2297    947
    290   6009

L      86    115     56     10      7      3      1      0
    -91   2102    195  -2091   1840  -2085
    290   6009

L      87     56     53     10      6      4      1      0
   1840  -2085   1842  -1482   2285  -1484   2361  -1484
    290     6009
```

DISTRIBUTION FORMATS

The 1:2,000,000-scale DLG data are available in three distribution formats: (1) standard, (2) optional, and (3) graphic.

The standard distribution format was designed to minimize storage requirements. Explicit topological linkages are contained only in the line elements. A sample DLG data file in standard format is illustrated in Appendix G.

The optional distribution format was designed for data interchange. These files are typically larger than those in the standard format but, for certain applications, can simplify processing requirements. Topological linkages are explicitly encoded between all line and node elements, and all line and area elements. This structure allows a polygon data structure to be easily created. A sample DLG data file in optional format is illustrated in Appendix H.

The graphic distribution format was designed to be compatible with the GS-CAM (Geological Survey - Cartographic Automatic Mapping) software. This software provides for plotting line and point information using a variety of map projections, scales, and graphic symbologies. To obtain information on the availability of the GS-CAM software, please refer to the inside front cover of this publication. The files in the graphic distribution format are derived from the topologically structured DLG data described above, and contain a subset of the line and attribute code information in the DLG files. No node or area information is stored in these files. These files are not topologically structured.

The characteristics of the standard, optional, and graphic DLG formats are summarized in table 4.

Table 4.--Standard, optional, and graphic DLG format

	Standard	Optional	Graphic
Character set	8-bit ASCII	8-bit ASCII	8-bit ASCII
Logical record length	144 bytes	80 bytes	20 bytes
Physical record length (blocksize)	variable in multiples of 144 bytes	variable in multiples of 80 bytes	variable in multiples of 20 bytes
Coordinate system	internal file (thousandths of a map inch)	ground planimetric (Albers Equal-Area Conic)	geographic (latitude and longitude)
Topological linkages	contained only in line elements	contained in node, area, and line elements	none (only contains line elements)

These formats are described in detail in Appendixes A, B, and C.

SOURCE MATERIALS

The data described in this document are derived from USGS 1:2,000,000-scale reference maps from The National Atlas of the United States of America. Selective updating of the maps was done prior to digitizing. Data source and currency information may be found in Appendix I.

The data for the conterminous United States and Hawaii were collected from 1:2,000,000-scale map manuscripts. For Alaska, the boundary and transportation data were digitized from 1:2,000,000-scale source documents; the hydrographic data were digitized from 1:1,000,000-scale source documents. The scale of the source materials used to generate a DLG is contained in the file header. The scale is also reflected in the resolution field, which states the ground length in meters of the smallest data collection unit 0.001 inch (50.8 meters for 1:2,000,000-scale data; 25.4 meters for 1:1,000,000-scale data).

CELL SIZE AND FILE EXTENT

The DLG's are distributed predominantly in multistate cells (fig. 6). There are a total of 21 cells for the United States: 15 for the conterminous United States, 5 for Alaska, and 1 for Hawaii. In general, States are not divided between cells. Three States (California, Texas, and Montana) are divided between two cells along county boundaries. Alaska is divided among five cells along arcs of longitude and/or latitude.

The data for each cell are encoded in multiple thematic categories (Political Boundaries, Administrative Boundaries, Roads and Trails, Railroads, Cultural Features, Streams, Water Bodies, and (where appropriate) Hypsography). Normally, there is one file per category. Due to software limitations at the time of digitizing, however, some categories with a large number of elements may be encoded in several files. Files are not horizontally integrated (edge joined) between cells.

COORDINATE SYSTEMS

The positional descriptions for DLG data elements are expressed in one of three coordinate systems, dependent upon the distribution format selected. These distribution formats - standard, optional, and graphic - are described below.

Standard Distribution Format

The DLG data in the standard distribution format are encoded using an internal file coordinate system to minimize storage requirements. The characteristics of this system are as follows:

1. The coordinate system is Cartesian.
2. The origin (x=0, y=0) is at the center of the cell (fig. 7).
3. The x-axis of the coordinate system is parallel to a theoretical straight line connecting the southwest and southeast registration points of the cell, y-axis is perpendicular to that line.
4. One unit is equal to 0.001-inch at map scale.
5. The coordinate domain is limited to the range -32768 to +32767.

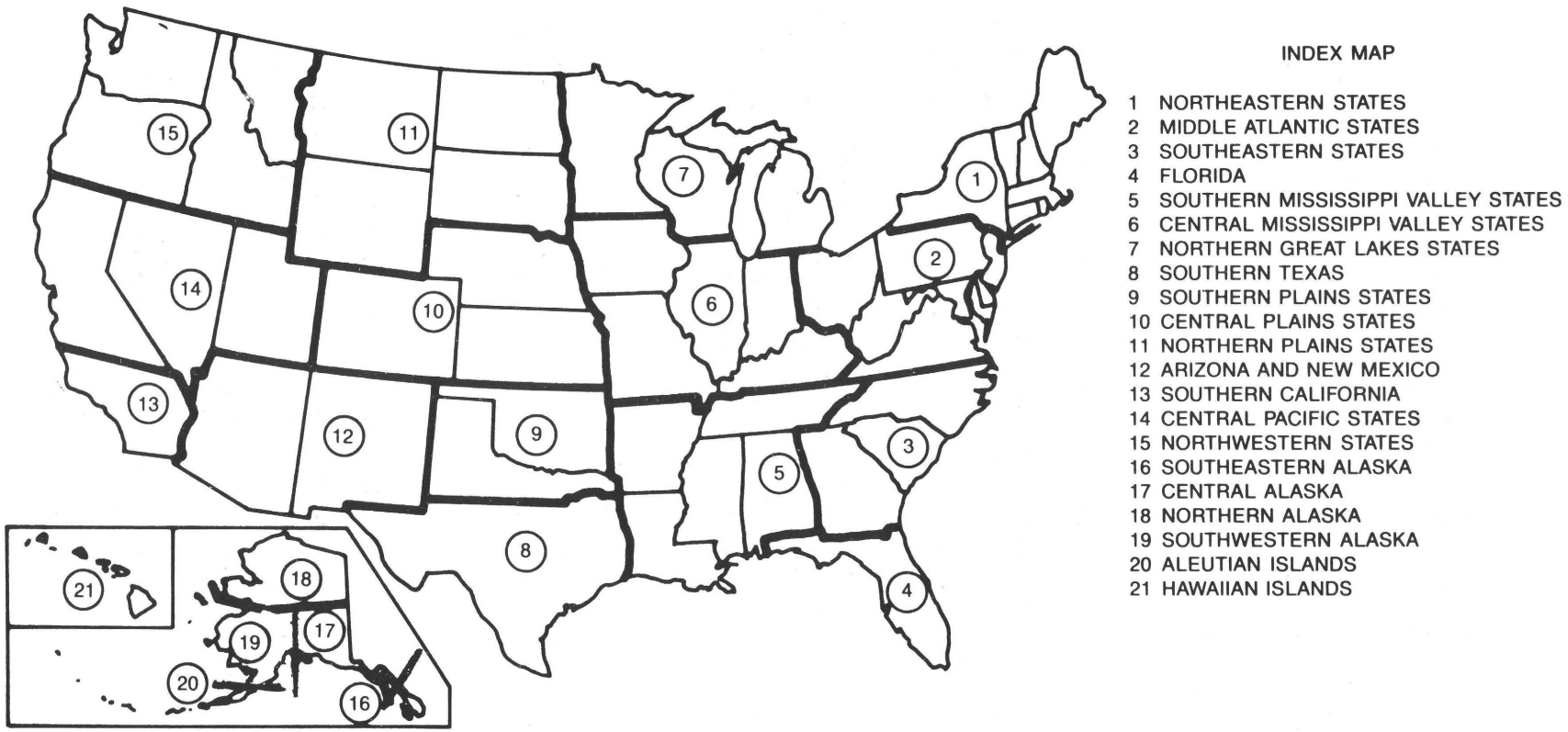

Figure 6.--Multistate cells used for Digital Line Graphs from 1:2,000,000-scale maps.

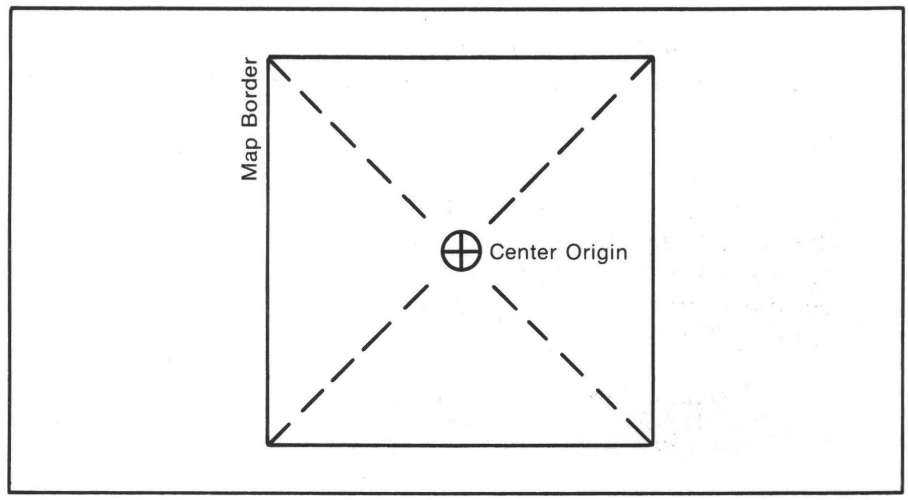

Figure 7.--Location of origin of file reference coordinates.

The file header contains the parameters of a transformation which can be used to convert the internal file coordinates to the ground coordinate system, which is the Albers Equal-Area Conic Projection for 1:2,000,000-scale DLG's. An example of this transformation is given in Appendix F.

Optional Distribution Format

The DLG data in the optional distribution format are expressed in the units of the ground coordinate system, that is, meters in the Albers Equal-Area Conic coordinate systems described in Appendix D.

Graphic Distribution Format

The data in the graphic distribution format are expressed in geographic coordinates (latitude-longitude). These values are expressed in degrees-minutes-seconds.

DATA VALIDATION

The DLG data do not currently carry quantified accuracy statements. The following procedures, however, are used to validate the data files before they are released for distribution:

1. File fidelity and completeness -- The data are manually digitized using equipment with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch. The positional accuracy of the data and completeness of the file are checked by visually comparing proof plots with the original stable-base source material. These proof plots are generated using automated drafting machines with a resolution of 0.001 inch and an absolute accuracy of from 0.003 to 0.005 inch.

2. Attribute accuracy -- Validating the codes for correct application is currently a manual process involving the correlation of formatted listings with proof plots.

3. Topological fidelity -- The topological structure of each DLG file is fully validated by software. There are no extraneous intersections; that is, a line does not join or cross another line, or itself, except at a node. No line extends through a node. Polygon (area) adjacency is also validated; that is, area left and right topological attributes of lines are consistent throughout the file. The neatline is free of gaps. Validation of DLG data is performed for each category within a file.

[Note: A deficiency in the topological validation software was discovered after the data were processed. For some graphic representations the software did not check the topology of island-like features correctly; some features of this type may have incorrect topology in the files.]

APPENDIXES

APPENDIX A.--Standard DLG Distribution Format (Record Contents)

In the standard DLG distribution format, the topological linkages are contained only in the line elements. The files are physically comprised of standard 8-bit ASCII characters organized into fixed-length logical records of 144 characters. Nine distinct record types are defined.

Logical record type	Content
A	Header record containing DLG identification information.
B	Header record containing projection information and registration points.
C	Header record identifying data categories contained in this DLG and indicating the number of nodes, areas, and lines in each category.
D.1	A node or an area record.
D.2	A line record.
E	Record containing x,y coordinate string.
F	Record containing attribute codes.
G	Record containing text string (not currently used).
H	Accuracy estimate (not currently used).

The actual sequence of records in a standard distribution DLG file is as follows:

1. Header records
   - Type A (one record)
   - Type B (one record)
   - Type C (one record)

2. Data records
   - Node records
     - Node description (D.1)
     - Attribute codes (F)
     - Text string (G)

     } Repeated for each node within a data category

   - Area records
     - Area description (D.1)
     - Attribute codes (F)
     - Text string (G)

     } Repeated for each area within a data category

   - Line records
     - Line description (D.2)
     - x,y coordinates (E)
     - Attribute codes (F)
     - Text string (G)

     } Repeated for each line within a data category

   } Repeated for each data category

3. Accuracy estimate
   - Type H (one record) (not currently used)

Descriptions of the contents of records A-F are contained in the following tables. The tables also reflect the relationship between these record types and 144-byte logical records.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

[Integer fields with a value of zero will have leading zeros suppressed. For example, an I6 field would be "bbbbb0". (b = blank)]
[Any field with the format of D24.15 which has a value of zero will be represented as "bbb0.0bbbbbbbbbbbbbbbbbb", the last four positions of the fractional portion being reserved for a decimal exponent. (b=blank)]

Logical Record Type A

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.1	1	Name of digital cartographic unit	ALPHA	A40	1	40	The name of the map will be used when practical.
---	---	Filler	---	---	41	41	1 space
A.1	2	Date of original source materials	ALPHA	A10	42	51	Year of original source material, followed by latest revision date if applicable, for example, 1956, 1965.
---	---	Filler	---	---	52	52	1 space
A.1	3	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material, for example, 2000000.
---	---	Filler	---	---	61	144	84 spaces
A.2	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
A.2	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=3, Albers Equal-Area Conic projection
A.2	3	Code defining zone in ground plan-imetric reference system	INTEGER*2	I6	13	18	Code=9999

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.2	4	Map projection parameters	REAL*8	5D24.15	19	138	This field contains the first 5 of 15 map projection parameters. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
---	---	Filler	---	---	139	144	6 spaces
A.3	1	Map projection parameters	REAL*8	6D24.15	1	144	This record contains projection parameters 6 thru 11. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
A.4	1	Map projection parameters	REAL*8	4D24.15	1	96	This field contains the last 4 projection parameters. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
A.4	2	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	97	102	Code=2, meters
A.4	3	Resolution	REAL*8	D24.15	103	126	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal reference system. For 1:2,000,000-scale 0.001 inch equals 50.8 meters.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type A--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
A.4	4	Accuracy code of planimetric data	INTEGER*2	I6	127	132	Code=0, unknown accuracy
A.4	5	Number (n) of registration points	INTEGER*2	I6	133	138	n=4
---	---	Filler	---	---	139	144	6 spaces
A.5 A.6	1	A (4,2) array containing geographic coordinates of the registration points	REAL*8	3(2D24.15) 2D24.15	1 1	144 48	Coordinates are in geographic longitude and latitude in units of degrees and decimal degrees and are expressed in the order=SW, NW, NE, SE.
---	---	Filler	---	---	49	144	96 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type B							
Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
B.1	1	Parameters (A1, A2, A3, A4) of file-to-ground projection transformation; the explicit form of the transformation is: X=A1x+A2y+A3 Y=A1y-A2x+A4 where: x,y are coordinates in file internal reference system X,Y are coordinates in map projection reference system	REAL*8	4D24.15	1	96	X,Y coordinates resulting from this transformation will be in ground meters in the Albers Equal-Area Conic projection coordinate system defined by the data elements in records A.2 - A.4.
B.1	2	Number (m) of registration points	INTEGER*2	I6	97	102	m=4
---	---	Filler	---	---	103	144	42 spaces

Logical Record Type B--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
B.2	1	A (4,3) array containing identifications and coordinates of registration points. Coordinates are expressed in the file internal reference system	ALPHA/ INTEGER*2	4(A2, 2I6)	1	56	The corners of a four-sided polygon are used as registration points. The identification sequence is SW, NW, NE, SE. The array is stored by row. Coordinates in the file internal reference system are expressed in units of thousandths of an inch and fall in the range -32768 to +32767. These coordinates correspond to the geographic coordinates contained in records A.5 and A.6.
---	---	Filler	---	---	57	144	88 spaces

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type C

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
C.1	1	Number (q) of categories in the DLG file	INTEGER*4	I6	1	6	$1 \leq q \leq 32$. Up to 32 categories can be represented in a given file, however, all 1:2,000,000-scale data files include only one.
---	---	Filler	---	---	7	144	138 spaces
C.2[1] to C.N	1	A (q,7) array containing category names as well as maximum and actual number of node, area, and line elements in each category	ALPHA/ INTEGER*2	q (A20,6I6)	1 (57	56 112)	This array is stored by row. The first element is the category name consisting of 20 alphanumeric characters, the first four of which are unique. Columns 2 and 3 of the array contain maximum and actual number of nodes in the category. Columns 4 and 5 contain maximum and actual number of areas in the category. Columns 6 and 7 are the maximum and actual number of line segments. (Note: the maximum number of any element type within a category is 4,770. This field is used only during initial processing of data).
---	---	Filler	---	---	---	---	32 or 88 spaces

[1]The number of categories "q" is given in record C.1. There will be 56 bytes of data per category, and thus a maximum of two categories can be described on a 144-character record. The space filler will vary in size depending on the value of "q."

Logical Record Type D

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.1	1	Type of element code	ALPHA	A2	1	2	Code ='Nb' for Node element, 'Ab' for Area element.
D.1	2	Element's internal identification number	INTEGER*2	I6	3	8	Unique within each category and element type.
D.1	3	x,y file coordinate of node point or representative point for the area element	INTEGER*2	2I6	9	20	The representative area point is usually, but not always, contained within the area it represents.
D.1	4	Number (t) of attribute codes which are attached to the node or area element ($t \geq 0$)	INTEGER*2	I6	21	26	Absence of attribute codes is indicated by t=0.
D.1	5	Number (k) of pairs of text characters which are attached to the node or area element ($k \geq 0$)	INTEGER*2	I6	27	32	k=0. Not currently used.
---	---	Filler	---	---	33	144	112 spaces
D.2	1	Code indicating a line segment graph element	ALPHA	A2	1	2	Code='Lb' for line segment
D.2	2	Line segment's internal identification number	INTEGER*2	I6	3	8	This number is unique within each category and element type.
D.2	3	Internal identification number of starting node	INTEGER*2	I6	9	14	Number refers to data element 2 in record D.1.

Logical Record Type D--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
D.2	4	Internal identification number of ending node	INTEGER*2	I6	15	20	Number refers to data element 2 in record D.1.
D.2	5	Internal identification number of left area	INTEGER*2	I6	21	26	Number refers to data element 2 in record D.1.
D.2	6	Internal identification number of right area	INTEGER*2	I6	27	32	Number refers to data element 2 in record D.1.
D.2	7	Number (v) of coordinate pairs which define the line segment	INTEGER*2	I6	33	38	The value of v is between 2 and 1500.
D.2	8	Number (t) of attribute codes which are attached to the line segment ($t \geq 0$)	INTEGER*2	I6	39	44	Absence of classification attribute codes is indicated by t=0.
D.2	9	Number (k) of pairs of text characters which are attached to the line segment ($k \geq 0$)	INTEGER*2	I6	45	50	k=0. Not currently used.
	---	Filler	---	---	51	144	94 spaces

Logical Record Type E

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
E.1 to[2] E.n	1	A (v,2) array containing an ordered sequence of coordinate pairs which define the image presentation of a line element	INTEGER*2	v(2I6)	1		Coordinates are expressed in internal file reference system, in units of thousandths of an inch. The array is stored by row.
---	---	Filler	---	---	---	---	0 to 132 spaces

[2]The number of coordinate pairs, "v", is given in record D.2. There will be v(2I6) coordinate pairs of which a maximum of 12 pairs will fit on a 144 character ASCII record. The space filler will vary in size depending on the value of "v." If "v" equals 12 or is an integer multiple of 12, there will be no spaces as filler at the end of the record.

APPENDIX A.--Standard DLG Distribution Format (Record Contents)--continued

Logical Record Type F

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
F.1[3] to F.n	1	A (t,2) array containing major and minor attribute codes for a graph element	INTEGER* 2	t(2I6)	1		The array is stored by row with the first column containing the major attribute code and the second column containing the minor attribute code.
---	---	Filler	---	---	---	---	0 to 132 spaces

[3]The number of feature (attribute) codes, "t" is given in the D.1 and D.2 records. The F record is an array of t(2I6) codes of which a maximum of 12(2I6) will fit on a 144 character ASCII record. The space filler will vary depending on the value of "t". If "t" is 12 or an integer multiple of 12 there will be no spaces as filler at the end of the record.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)

In the optional DLG distribution format, topological linkages are explicitly encoded for node and area elements as well as for line elements. The files are physically comprised of 8-bit ASCII characters organized into fixed-length logical records of 80 characters (bytes). Bytes 1-72 of each record may contain DLG data, and bytes 73-80 may contain a record sequence number.

The 11 distinct record types used in the optional DLG distribution format may be categorized as header and data records.

Four types of records are considered header records:

- File identification and description records
- Accuracy records (not currently used)
- Control-point identification records
- Data-category identification records

Seven types of records are considered data records:

- Node and area identification records
- Node-to-line linkage records
- Area-to-line linkage records
- Line identification records (also contains line-to-node and line-to-area linkages)
- Coordinate string records
- Attribute code records
- Text records (not currently used)

The actual sequence of records in an optional distribution format DLG file is as follows:

1. Header records
   - Ten file identification and description records
   - Accuracy records (not currently used)
   - Control point identification records (one per control-point)
   - Data category identification records (one per data category in the file)

2. Data records

Node identification record Node-to-line linkage record(s) Attribute code record(s) Text record(s)	}	Repeated for each node within a data category	Repeated for each data category
Area identification record Area-to-line linkage record(s) Attribute code record(s) Text record(s)	}	Repeated for each area within a data category	
Line identification records Coordinate string record(s) Attribute code record(s) Text record(s)	}	Repeated for each line within a data category	

Descriptions of the contents of the various types of records in an optional distribution format DLG are contained in the following tables.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1	1	Banner	ALPHA	A72	1	72	Descriptive text
2	1	Name of digital cartographic unit	ALPHA	A40	1	40	The name of the map
---	---	Filler	---	---	41	41	1 space
2	2	Date of original source material	ALPHA	A10	42	51	Year of original source material followed by latest revision date if applicable, for example, 1956, 1965.
---		Filler	---	---	52	52	1 space
2	3	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material, for example, 2000000.
---		Filler	---		61	72	12 spaces
3		Filler	---	---	1	80	80 spaces

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	1	DLG level code	INTEGER*2	I6	1	6	Code=3, DLG-3
4	2	Code defining ground planimetric reference system	INTEGER*2	I6	7	12	Code=3, Albers Equal-Area Conic
4	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	Code=9999
4	4	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	19	24	Code=2, meters
4	5	Resolution	REAL*4	D18.11	25	42	The true ground distance corresponding to one unit (0.001 inch at map scale) in the file internal coordinate system used in data collection. For 1:2,000,000-scale 0.001 inch equals 50.8 meters.
4	6	Number of file-to-map transformation parameters	INTEGER*2	I6	43	48	Usually 4
4	7	Number of accuracy/ miscellaneous records	INTEGER*2	I6	49	54	Currently=0, none included

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

FILE IDENTIFICATION AND DESCRIPTION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	8	Number (n) of control-points	INTEGER*2	I6	55	60	Usually 4
4	9	Number (q) of categories in the DLG file	INTEGER*2	I6	61	66	$1 \leq q \leq 32$. Up to 32 categories can be represented in a given file; however, all 1:2,000,000-scale data files include only one.
---	---	Filler	---	---	67	72	6 spaces
5-9	1	Projection parameters for map transformation	REAL*8	3D24.15	1	72	Three parameters on each of 5 records. Parameters for the Albers Equal-Area Conic projection are given in Appendix D.
10	1	Internal file-to-map projection transformation parameters	REAL*4	4D18.11	1	72	A transformation of this type is not required, since coordinates are expressed in a ground planimetric coordinate system (Albers Equal-Area Conic). These parameters are, however, valid for transformation as described in record B.1, data element 1, of the standard format.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

CONTROL-POINT IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-n	1	Control-point label	ALPHA	A2	1	2	"SW," "NW," "NE," or "SE" for four quadrangle corners.
		Filler			3	6	4 spaces
	2	Latitude	REAL*4	F12.6	7	18	In degrees and decimal degrees.
	3	Longitude	REAL*4	F12.6	19	30	In degrees and decimal degrees.
		Filler			31	36	6 spaces
	4	Internal file x	REAL*4	F12.2	37	48	In units in the appropriate zone of the ground planimetric coordinate system.
	5	Internal file y	REAL*4	F12.2	49	60	In units in the appropriate zone of the ground planimetric coordinate system.
---	---	Filler	---	---	61	72	12 spaces

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

DATA CATEGORY IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	1	Category name	ALPHA	A20	1	20	The first 4 characters are unique.
	2	Attribute format codes	INTEGER*2	I4	21	24	Blank or zero (0) indicates default (2I6) attribute formatting in major-minor pairs.
	3	Number of nodes referenced in file	INTEGER*2	I6	25	30	Number of nodes referenced in file as start and end nodes of lines.
	4	Actual number of nodes in file	INTEGER*2	I6	31	36	Only if some or all node records were excluded from the file, would this number be different from data element 3.
		Filler	---	---	37	37	1 space
	5	Presence of node-to-area linkage records	INTEGER*2	I1	38	38	Flag=0, node-to-area linkage records not present.[1]
	6	Presence of node-to-line linkage records	INTEGER*2	I1	39	39	Flag=1, node-to-line linkage records are included.[1]
	---	Filler	---	---	40	40	1 zero or space
	7	Number of areas referenced in file	INTEGER*2	I6	41	46	Number of areas referenced in file as areas left and areas right of lines.

[1]The flags for lists present or absent are the current default values, and are the only current values used.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

DATA CATEGORY IDENTIFICATION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	8	Actual number of areas in file	INTEGER*2	I6	47	52	Only if some or all area records were excluded from the file would the number be different from the data element 7.
	---	Filler	---	---	53	53	1 space
	9	Presence of area-to-node linkage records	INTEGER*2	I1	54	54	Flag=0, area-to-node linkage records not present.[1]
	10	Presence of area-to-line linkage records	INTEGER*2	I1	55	55	Flag=1, area-to-line linkage records are included.[1]
	11	Presence of area-coordinate lists	INTEGER*2	I1	56	56	Flag=0, area-coordinate lists not present.[1]
	12	Number of lines referenced in file	INTEGER*2	I6	57	62	Number of lines referenced in area-to-line and node-to-line records.
	13	Actual number of lines in file	INTEGER*2	I6	63	68	Only if some lines were excluded from the file would this number be different from data element 12.
	---	Filler	---	---	69	71	3 spaces
	14	Presence of line-coordinate lists	INTEGER*2	I1	72	72	Flag=1, line-coordinate lists are included.[1]

[1]The flags for lists present or absent are the current default values, and are the only current values used.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

NODE AND AREA IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type	ALPHA	A1	1	1	"N" or "A"
	2	Element internal ID number	INTEGER*2	I5	2	6	This value is unique within each category and element type.
	3	Coordinates of node point or representative point for area	REAL*4	2F12.2	7	30	The area point is usually, but not always within the polygon it represents.
	4	Number of elements in an area list (for nodes), or in a node list (for areas)	INTEGER*2	I6	31	36	Blank or zero (0). These lists are not currently included.
	5	Number of elements in line segment list	INTEGER*2	I6	37	42	Number of line segments that intersect at the node, or bound the area.
	6	Number of x,y or lat-long points in area-coordinate list	INTEGER*2	I6	43	48	Blank or zero (0). These lists are not currently included.
	7	Number of attribute codes listed	INTEGER*2	I6	49	54	Number of attribute codes listed.
	8	Number of text characters listed	INTEGER*2	I6	55	60	Zero (0). There are no text attributes for 1:2,000,000-scale DLG data.
	9	Number of islands within area	INTEGER*2	I6	61	66	Area records only, 6 spaces for node records.
---	---	Filler	---	---	67	72	6 spaces

NODE-TO-LINE LINKAGE RECORDS

FORTRAN FORMAT (12I6), for each node: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records). The line segments which begin at this node are included in the list as positive ID numbers. The line segments which terminate at this node are included as negative ID numbers. There is no logical order to the list.

AREA-TO-LINE LINKAGE RECORDS

FORTRAN format (1216), for each area: The list consists of line segment internal ID numbers (which appear in bytes 2-6 of the line identification records) and, for those areas with islands (indicated by bytes 61-66 of the area's first record), zero (0) elements marking the beginning of islands. Line segments with this area to the right are included as positive ID numbers. Line segments with this area to the left are included as negative ID numbers. The list is ordered clockwise around the perimeter of the area and counterclockwise around each island, if any (counterclockwise around an island of an area is still a clockwise direction in reference to the area itself). A zero (0) element is inserted in the list before each island sublist.

APPENDIX B.--Optional DLG Distribution Format (Record Contents)--continued

LINE IDENTIFICATION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
	1	Record type		A1	1	1	"L"
	2	Element internal ID number		I5	2	6	This number is unique within each category and element type.
	3	Starting node		I6	7	12	Internal ID number. This refers to data element 2 of the node identification record.
	4	Ending node		I6	13	18	Internal ID number. This refers to data element 2 of the node identification record.
	5	Left area		I6	19	24	Internal ID number. This refers to data element 2 of the area identification record.
	6	Right area		I6	25	30	Internal ID number. This refers to data element 2 of the area identification record.
	---	Filler		---	31	42	12 spaces
	7	Number of x,y coordinates listed		I6	43	48	Number of coordinate pairs listed.
	8	Number of attribute codes listed		I6	49	54	Number of attributes (or two element attribute pairs) listed.
	9	Number of text characters listed		I6	55	60	Zero (0). There are no text data associated with 1:2,000,000-scale DLG data.

COORDINATE STRING RECORDS

FORTRAN format (3(2F12.2)): The coordinates are in appropriate units in the designated ground planimetric coordinate system (Albers Equal-Area Conic projection). The file-to-map projection parameters in Header record 10 are set to (1.0,0.0,0.0,0.0) for real map projection coordinates (the transformation formulas still apply).

CODE RECORDS

As major-minor attribute code pairs, FORTRAN format (6(2I6)): Within each pair, the first integer is the major code and the second integer is the minor code. Each major and minor code is a one-to-four-digit integer, right justified within the six-byte field.

APPENDIX C.--Graphic Format

The simplified, graphic format that can be used with the GS-CAM plotting package is described below. In this format, each line record from the DLG format has been reformatted into two record types: one line identifier record and multiple latitude-longitude records (one for each coordinate pair). Supplementary coordinate pairs have been added to Graphic Format data in instances where the distance between two adjacent vertices was greater than 0.01" in the original DLG line description. These additional points assure that the distance between any two data points of a line are no greater than 0.01" and minimizes distortion of the line when projection transformations are applied. If a line record has more than one attribute code associated with it in the DLG format, that line record appears in the graphic format files multiple times (once for each attribute code). The graphic format files are organized by feature type.

Record 1: Line identifier record

	Position	Length	Format
1. Line identifier	1-7	7	I7
2. Rank (last two digits of attribute code (described in Appendix E--unique within category)	8-9	2	I2
3. Number of points in the line (NP) (latitude and longitude)	10-15	6	I6
4. First five digits of attribute code (described in Appendix E)	16-20	5	I5

Record 2: Latitude-longitude record (repeated NP times)

1. Latitude (DDMMSSI)	1-7	7	3I2, A1
2. Longitude (DDDMMSSI)	8-15	8	I3, 2I2, A1
3. Sequence count	16-20	5	I5

APPENDIX D.--Map Projection Parameters Albers Equal-Area Conic Projection

The standard and optional DLG distribution formats include 15 fields reserved for map projection parameters. These parameters are typically used as input for a coordinate transformation package such as the USGS General Coordinate Transformation Package (GCTP).

When the ground coordinate system of a DLG is the Albers Equal-Area Conic projection, as in the case for all DLG's digitized from 1:2,000,000-scale maps, the first eight parameter fields are used:

1. Semimajor axis of ellipsoid
2. Eccentricity squared of ellipsoid
3 Latitude of first standard parallel
4. Latitude of second standard parallel
5. Longitude of central meridian
6. Latitude of projection origin
7. False easting
8. False northing

9-15. Not used

For the 1:2,000,000-scale files, the following parameters were used:

For all maps:
- Spheroid parameters: Clarke 1866
- False easting: 0.0
- False northing: 0.0

For conterminous United States:
- First standard parallel: 29.5° North
- Second standard parallel: 45.5° North
- Longitude of central meridian: 96° West
- Latitude of projection origin: 23° North

For Hawaii:
- First standard parallel: 8° North
- Second standard parallel: 18° North
- Longitude of central meridian: 157° West
- Latitude of projection origin: 3° North

For Alaska:
- First standard parallel: 55° North
- Second standard parallel: 65° North
- Longitude of central meridian: 154° West
- Latitude of projection origin: 50° North

A transformation to or from Albers Equal-Area Conic projection coordinates using GCTP can be controlled by specifying the parameters stated above. In the projection parameters of a DLG file, the longitude-latitude parameter values are encoded as packed, degrees-minutes-seconds (DMS) as follows:

degrees * 1000000 + minutes * 1000 + seconds

For example, if degrees = +50, minutes = 30, and seconds = 36.25, then the parameter value is 50030036.25 stored as a REAL*8 variable, and "bbb0.500300362500000D 08" encoded in FORTRAN D24.15 format.

APPENDIX E.--DLG Attribute Codes

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
AREA ATTRIBUTES - Available in standard and optional DLG formats (only)			
Water Bodies	040	0100	Perennial lake or pond
		0102	Intermittent lake or pond
		0104	Dry lake or pond
		0105	Alkali flat
		0106	Reservoir
		0107	Intermittent reservoir
		0110	Glacier or snowfield
		0150	Island
		0199	Area not in water body (remainder of map)
Political Boundaries	090	0100	Civil township, district, precint, or barrio
		0101	Incorporated city, village, town, borough, or hamlet
		0197	Canada
		0198	Mexico
		0199	Area outside a national boundary
Administrative Boundaries	090	0103	National park, monument, lakeshore, parkway, battlefield, or recreation area
		0104	National forest or grassland
		0105	National wildlife refuge, game preserve, or fish hatchery
		0106	National scenic waterways or wilderness area
		0107	Indian reservation
		0108	Military reservation
PARAMETER CODES - Available in standard and optional DLG formats (only)			
Line records			
Roads and Trails	102	0---	Interstate route number, two or three digits flush right
	103	0---	U.S. route number, two or three digits flush right
	104	0---	State route number, two or three digits flush right

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			Area records
Political Boundaries	091	00--	State FIPS code, two digits flush right
	092	0---	County or county equivalent FIPS code, three digits, flush right
			LINE ATTRIBUTES - available in standard and optional DLG and graphic format
Hypsography	290	2017	Continental Divide
Streams and Rivers	290	3001	River/stream (double line, shoreline)
		3002	River/stream (double line, centerline)
		3003*	River/stream (single line), perennial, length < 20 km, or < 12 mi
		3004	River/stream (single line), perennial, length 20-< 30 km, or 12-< 19 mi
		3005	River/stream (single line), perennial, length 30-< 40 km, or 19-< 25 mi
		3006	River/stream (single line), perennial, length 40-< 50 km, or 25-< 31 mi
		3007	River/stream (single line), perennial, length 50-< 60 km, or 31-< 37 mi
		3008	River/stream (single line), perennial, length 60-< 80 km, or 37-< 50 mi
		3009	River/stream (single line), perennial, length 80-< 100 km, or 50-< 62 mi
		3010	River/stream (single line), perennial, length 100-< 125 km, or 62-< 78 mi
	290	3011	River/stream (single line), perennial, length 125-< 150 km, or 78-< 93 mi
		3012	River/stream (single line), perennial, length 150-< 200 km, or 93-< 124 mi
		3013	River/stream (single line), perennial, length 200-< 250 km, or 124-< 155 mi
		3014	River/stream (single line), perennial, length 250-< 300 km, or 155-< 186 mi
		3015	River/stream (single line), perennial, length 300-< 350 km, or 186-< 217 mi
		3016	River/stream (single line), perennial, length 350+ km, or 217+ mi

*This code was only used in the Alaskan drainage files.

Note: Listing of FIPS codes available as National Bureau of Standards (U.S.), Federal Information Processing Standards Publication (FIPS PUB) 6-3, 39 p. for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Streams and Rivers (cont'd.)		3017*	River/stream (single line), intermittent, length < 20 km, or < 12 mi
		3018	River/stream (single line), intermittent, length 20-< 30 km, or 12-< 19 mi
		3019	River/stream (single line), intermittent, length 30-< 40 km, or 19-< 25 mi
		3020	River/stream (single line), intermittent, length 40-< 50 km, or 25-< 31 mi
		3021	River/stream (single line), intermittent, length 50-< 60 km, or 31-< 37 mi
		3022	River/stream (single line), intermittent, length 60-< 80 km, or 37-< 50 mi
		3023	River/stream (single line), intermittent, length 80-< 100 km, or 50-< 62 mi
		3024	River/stream (single line), intermittent, length 100-< 125 km, or 62-< 78 mi
		3025	River/stream (single line), intermittent, length 125-< 150 km, or 78-< 93 mi
		3026	River/stream (single line), intermittent, length 150-< 200 km, or 93-< 124 mi
		3027	River/stream (single line), intermittent, length 200-< 250 km, or 124-< 155 mi
		3028	River/stream (single line), intermittent, length 250-< 300 km, or 155-< 186 mi
		3029	River/stream (single line), intermittent, length 300-< 350 km, or 186-< 217 mi
		3030	River/stream (single line), intermittent, length 350+ km, or 217+ mi
		3035*	River/stream, centerline in water body, perennial, length < 2 km, or < 1 mi
		3036	River/stream, centerline in water body, perennial, length 2-< 4 km, or 1-< 2 mi
		3037	River/stream, centerline in water body, perennial, length 4-< 6 km, or 2-< 4 mi
		3038	River/stream, centerline in water body, perennial, length 6-< 8 km, or 4-< 5 mi
		3039	River/stream, centerline in water body, perennial, length 8-< 10 km, or 5-< 6 mi
		3040	River/stream, centerline in water body, perennial, length 10-< 15 km, or 6-< 9 mi
		3041	River/stream, centerline in water body, perennial, length 15-< 20 km, or 90-< 12 mi
		3042	River/stream, centerline in water body, perennial, length 20-< 25 km, or 12-< 16 mi
		3043	River/stream, centerline in water body, perennial, length 25-< 30 km, or 16-< 19 mi
		3044	River/stream, centerline in water body, perennial, length 30-< 40 km, or 19-< 25 mi
		3045	River/stream, centerline in water body, perennial, length 40-< 50 km, or 25-< 31 mi
		3046	River/stream, centerline in water body, perennial, length 50-< 60 km, or 31-< 37 mi
	290	3047	River/stream, centerline in water body, perennial, length 60-< 80 km, or 37-< 50 mi
		3048	River/stream, centerline in water body, perennial, length 80+ km, or 50+ mi
		3050	River/stream, centerline in water body, intermittent, length < 2 km, or < 1 mi
		3051	River/stream, centerline in water body, intermittent, length 2-< 4 km, or 1-< 2 mi
		3052	River/stream, centerline in water body, intermittent, length 4-< 6 km, or 2-< 4 mi
		3053	River/stream, centerline in water body, intermittent, length 5-< 8 km, or 4-< 5 mi

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	CODE	MAJOR CODE	MINOR	DESCRIPTION
				LINE ATTRIBUTES--continued
Streams and Rivers (cont'd.)		3054		River/stream, centerline in water body, intermittent, length 8-< 10 km, or 5-< 6 mi
		3055		River/stream, centerline in water body, intermittent, length 10-< 15 km, or 6-< 9 mi
		3056		River/stream, centerline in water body, intermittent, length 15-< 20 km, or 9-< 12 mi
		3057		River/stream, centerline in water body, intermittent, length 20-< 25 km, or 12-< 16 mi
		3058		River/stream, centerline in water body, intermittent, length 25-< 30 km, or 16-< 19 mi
		3059		River/stream, centerline in water body, intermittent, length 30+ km, or 19+ mi
		3060		Braided stream, average width of braid 6+ km, or 4+ mi
		3061		Braided stream, average width of braid 0-< 2 km, or 0-< 1 mi
		3062		Braided stream, average width of braid 2-< 4 km, or 1-< 2 mi
		3063		Braided stream, average width of braid 4-< 6 km, or 2-< 4 mi
		3070*		Canal, navigable, length < 1 km, or < 1 mi
		3071		Canal, navigable, length 1-< 10 km, or 1-< 6 mi
		3072		Canal, navigable, length 10-< 20 km, or 6-< 12 mi
		3073		Canal, navigable, length 20-< 40 km, or 12-< 25 mi
		3074		Canal, navigable, length 40-< 60 km, or 25-< 37 mi
		3075		Canal, navigable, length 60-< 80 km, or 37-< 50 mi
		3076		Canal, navigable, length 80+ km, or 50+ mi
		3077		Canal, other, length < 1 km, or < 1 mi
		3078		Canal, other, length 1-< 10 km, or 1-< 6 mi
		3079		Canal, other, length 10-< 20 km, or 6-< 12 mi
		3080		Canal, other, length 20-< 40 km, or 12-< 25 mi
		3081		Canal, other, length 40-< 60 km, or 25-< 37 mi
		3082		Canal, other, length 60-< 80 km, or 37-< 50 mi
		3083		Canal, other, length 80+ km, or 50+ mi
		3086		Ditch (perennial)
		3095		Intercoastal waterway
Water Bodies...290		4000		U.S. coastline including Great Lakes
		4001*		Perennial water body, lake, reservoir, and island, length < 2 km, or < 1 mi
		4002		Perennial water body, lake, reservoir, and island, length 2-< 4 km, or 1-< 2 mi
		4003		Perennial water body, lake, reservoir, and island, length 4-< 6 km, or 2-< 4 mi

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water Bodies (cont'd.)		4004	Perennial water body, lake, reservoir, and island, length 6-< 8 km, or 4-< 5 mi
		4005	Perennial water body, lake, reservoir, and island, length 8-< 10 km, or 5-< 6 mi
		4006	Perennial water body, lake, reservoir, and island, length 10-< 15 km, or 16-< 9 mi
		4007	Perennial water body, lake, reservoir, and island, length 15-< 20 km, or 9-< 12 mi
		4008	Perennial water body, lake, reservoir, and island, length 20-< 25 km, or 12-< 16 mi
		4009	Perennial water body, lake, reservoir, and island, length 25-< 30 km, or 16-< 19 mi
		4010	Perennial water body, lake, reservoir, and island, length 30-< 40 km, or 19-< 25 mi
		4011	Perennial water body, lake, reservoir, and island, length 40-< 50 km, or 25-< 31 mi
		4012	Perennial water body, lake, reservoir, and island, length 50-< 60 km, or 31-< 37 mi
		4013	Perennial water body, lake, reservoir, and island, length 60-< 80 km, or 37-< 50 mi
		4014	Perennial water body, lake, reservoir, and island, length 80+ km, or 50+ mi
		4021*	Intermittent water body, lake or reservoir, length < 2 km, or < 1 mi
		4022	Intermittent water body, lake or reservoir, length 2-< 4 km, or 1-< 2 mi
		4023	Intermittent water body, lake or reservoir, length 4-< 6 km, or 2-< 4 mi
		4024	Intermittent water body, lake or reservoir, length 6-< 8 km, or 4-< 5 mi
		4025	Intermittent water body, lake or reservoir, length 8-< 10 km, or 5-< 6 mi
		4026	Intermittent water body, lake or reservoir, length 10-< 15 km, or 6-< 9 mi
		4027	Intermittent water body, lake or reservoir, length 15-< 20 km, or 9-< 12 mi
		4028	Intermittent water body, lake or reservoir, length 20-< 25 km, or 12-< 16 mi
		4029	Intermittent water body, lake or reservoir, length 25-< 30 km, or 16-< 19 mi
		4030	Intermittent water body, lake or reservoir, length 30-< 40 km, or 19-< 25 mi
		4031	Intermittent water body, lake or reservoir, length 40-< 50 km, or 25-< 31 mi
		4032	Intermittent water body, lake or reservoir, length 50-< 60 km, or 31-< 37 mi
		4033	Intermittent water body, lake or reservoir, length 60-< 80 km, or 37-< 50 mi
		4034	Intermittent water body, lake or reservoir, length 80+ km, or 50+ mi
		4040*	Marsh/swamp and salt marsh, length < 10 km, or < 6 mi
		4041	Marsh/swamp and salt marsh, length 10-< 17 km, or 6-< 11 mi
		4042	Marsh/swamp and salt marsh, length 17-< 25 km, or 11-< 16 mi
	290	4043	Marsh/swamp and salt marsh, length 25-< 37 km, or 16-< 23 mi
		4044	Marsh/swamp and salt marsh, length 37-< 50 km, or 23-< 31 mi
		4045	Marsh/swamp and salt marsh, length 50+ km, or 31+ mi
		4050	Dry lake and alkali flat, length < 2 km, or < 1 mi

*This code was only used in the Alaskan drainage files.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Water Bodies (cont'd.)		4051	Dry lake and alkali flat, length 2-< 4 km, or 1-< 2 mi
		4052	Dry lake and alkali flat, length 4-< 6 km, or 2-< 4 mi
		4053	Dry lake and alkali flat, length 6+ km, or 4+ mi
		4060*	Glacier, length < 4 km, or < 2 mi
		4061	Glacier, length 4-< 10 km, or 2-< 6 mi
		4062	Glacier, length 10-< 17 km, or 6-< 11 mi
		4063	Glacier, length 17-< 25 km, or 11-< 16 mi
		4064	Glacier, length 25-< 37 km, or 16-< 23 mi
		4065	Glacier, length 37-< 50 km, or 23-< 31 mi
		4066	Glacier, length 50+ km, or 31+ mi
Roads and Trails	290	5001	Interstate
		5002	Major U.S., limited access, divided
		5003	Major State, limited access, divided
		5004	Major other, limited access, divided
		5005	Toll road[1]
		5006	Interstate connector[1]
		5007	Limited access, divided connector[1]
		5008	Toll connector[1]
		5009	Interstate, under construction
		5010	Interstate, proposed
		5013	Minor U.S., limited access, 310 km (500 mi) and longer
		5014	U.S. non-limited access, 310 km (500 mi) and longer
		5015	Minor U.S. limited access, less than 310 km (500 mi)
	290	5016	U.S. non-limited access, less than 310 km (500 mi)
		5017	Other minor U.S. limited access
		5018	Other U.S.[2]
		5019	Other minor State primary, limited access

*This code was only used in the Alaskan drainage files.
[1]Redundant entry used to provide additional information.
[2]U.S. business, alternate, bypass, and routes paralleling U.S. or Interstate routes within 10 to 25 km.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Roads and Trails (cont'd.)		5020	Other State primary
		5021	Minor U.S. parallel, within 10 km (6 mi)
		5022	U.S. parallel, within 10 km (6 mi)
		5023	Minor State parallel, within 10 km (6 mi)
		5024	State parallel, within 10 km (6 mi)
		5028	State secondary (all weather, hard surface)
		5031	Light duty (all weather, improved)
		5041	Unimproved (fair or dry weather)
		5061	Tunnel, road
		5062	Ferry, auto
Railroads.....	290	5071	Class 1, category A, main line
		5072	Class 1, category B, main line
		5073	Class 1, category A, branch line
		5074	Class 1, category B, branch line
		5075	Other railroad
		5078	Tunnel, railroad
		5079	Ferry, railroad
		5080	Class 1, category A, main-line connector[1]
Political Boundaries[2]	290	6000	International treaty line
		6001	National (land)
		6002	National (water)
	290	6005	State/provincial (land)
		6006	State/provincial (water)
		6009	County, parish, Alaskan borough, or large independent city (land)
		6010	County, parish, Alaskan borough, or large independent city (water)
		6011	Corporate limit (1 million and over population)
		6012	Corporate limit (1/2 to less than 1 million population)
		6014	Small independent city (usually not shown as a county)

[1]Redundant entry used to provide additional information.
[2]Maritime boundary areas are usually closed by unattributed arbitrary extension lines.

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Administrative Boundaries	290	6021	National park, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6022	National park, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6023	National park, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6024	National park, length at longest dimension 4-< 20 km, or 9-< 12 mi
		6025	National park, length at longest dimension 20+ km, or 12+ mi
		6026	National monument, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6027	National monument, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6028	National monument, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6029	National monument, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6030	National monument, length at longest dimension 20+ km, or 12+ mi
		6031	National seashore or lakeshore, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6032	National seashore or lakeshore, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6033	National seashore or lakeshore, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6034	National seashore or lakeshore, length at longest dimension 4-< 20 km, or 9-< 12 mi
		6035	National seashore or lakeshore, length at longest dimension 20+ km, or 12+ mi
		6036	National recreation area, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6037	National recreation area, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6038	National recreation area, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6039	National recreation area, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6040	National recreation area, length at longest dimension 20+ km, or 12+ mi
		6041	National wilderness area, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6042	National wilderness area, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6043	National wilderness area, length at longest dimension 8-< 14 km, or 5-< 9 mi
	290	6044	National wilderness area, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6045	National wilderness area, length at longest dimension 20+ km, or 12+ mi
		6051	National forest, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6052	National forest, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6053	National forest, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6054	National forest, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6055	National forest, length at longest dimension 20+ km, or 12+ mi
		6056	National grassland, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6057	National grassland, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6058	National grassland, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6059	National grassland, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6060	National grassland, length at longest dimension 20+ km, or 12+ mi

APPENDIX E.--DLG Attribute Codes--continued

FEATURE	MAJOR CODE	MINOR CODE	DESCRIPTION
			LINE ATTRIBUTES--continued
Administrative Boundaries (cont'd.)		6061	National wildlife refuge, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6062	National wildlife refuge, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6063	National wildlife refuge, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6064	National wildlife refuge, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6065	National wildlife refuge, length at longest dimension 20+ km, or 12+ mi
		6066	Federal Indian reservation, length at longest dimension 0-< 2 km, or 0-< 1 mi
		6067	Federal Indian reservation, length at longest dimension 2-< 8 km, or 1-< 5 mi
		6068	Federal Indian reservation, length at longest dimension 8-< 14 km, or 5-< 9 mi
		6069	Federal Indian reservation, length at longest dimension 14-< 20 km, or 9-< 12 mi
		6070	Federal Indian reservation, length at longest dimension 20+ km, or 12+ mi
		6081	Federal Military reservation, areas of 1-< 405 ha, or 1-< 1000 acres
		6082	Federal Military reservation, areas of 405+ ha, or 1000+ acres
		6087	National park, closure line
		6088	National monument, closure line
		6089	National seashore or lakeshore, closure line
		6090	National recreation area, closure line
		6091	National wilderness area, closure line
		6092	National forest, closure line
		6093	National grassland, closure line
		6094	National wildlife refuge, closure line
	290	6095	Indian reservation, closure line
		6097	Military reservation, closure line
Cultural Features	290	7001	Commmercial airfield
		7002	Military airfield
		7020	Alaska pipeline

APPENDIX F.--Coordinate Conversion

This appendix illustrates the procedure for converting internal file coordinates to ground planimetric reference coordinates. The formulas for this conversion are as follows:

$$X=A1x+A2y+A3$$

$$Y=A1y-A2x+A4$$

where X and Y are the ground planimetric coordinate values and x and y are the internal file coordinates.

The parameters for these formulas (A1, A2, A3, and A4) are contained in Header Record B, as double-precision floating-point numbers.

This example converts four coordinate pairs from internal file coordinates to ground planimetric coordinate values (Albers Equal-Area Conic projection). The parameters are as follows:

A1= 50.325538142
A2= 6.9275199981
A3= -1185878.9723
A4= 1314164.3401

The internal file coordinates to be converted are:

	x	y
1st pair	-11238	-6583
2d pair	-10405	6583
3d pair	10405	6583
4th pair	11238	-6583

The calculation to determine the ground planimteric coordinates for the first pair are as follows:

X=(50.325538142)(-11238)+(6.9275199981)(-6583)+(-1185878.9723)
=-1797041.23

Y=(50.325538142)(-6583)-(6.9275199981)(-11238)+(1314164.3401)
=1060722.79

The resulting x,y coordinate values for the four pairs given above are as follows:

1st pair	-1,797,041.23	1,060,722.79
2d pair	-1,663,912.33	1,717,538.20
3d pair	-616,637.88	1,573,376.51
4th pair	-665,924.44	905,019.86

APPENDIX G.--Sample DLG data file (Standard Distribution Format)

```
ARIZONA AND NEW MEXICO                          1967, 1972  2000000.

     3     3  9999    0.637820640000000D+07    0.676865799729109D-02    0.2
90300000000000D+08    0.450300000000000D+08  -0.960000000000000D+08
   0.230000000000000D+08   0.0                      0.0
   0.0                     0.0                      0.0
   0.0                     0.0                      0.0
   0.0                       2   0.508000000000000D+02     0     4
  -0.115000000000000D+03   0.310000000000000D+02  -0.115000000000000D+03
   0.370000000000000D+02  -0.103000000000000D+03   0.370000000000000D+02
  -0.103000000000000D+03   0.310000000000000D+02

   0.503255381420000D+02   0.692751999810000D+01  -0.118587897230000D+07
   0.131416434010000D+07     4
SW-11238 -6583NW-10405  6583NE 10405  6583SE 11238 -6583

     1

HYPSOGRAPHY            795    18   795     2   530    13

N      1-11238 -6583     0     0

N      2-10405  6583     0     0

N      3 10405  6583     0     0

N      4 11238 -6583     0     0

N      5  1115 -3388     0     0

N      6   465 -6194     0     0

N      7  1307 -1163     0     0

N      8   932  1388     0     0

N      9  3513  4531     0     0

N     10  4036  6283     0     0

N     11     1 -6187     0     0

N     12 10635  2183     0     0

N     13  5207  6274     0     0

N     14     7  6246     0     0
```

```
N      15 -5201  6334      0      0

N      16-10031  3973      0      0

N      17-10023  -857      0      0

N      18 10402  6519      0      0

A       1   -96  5417      1      0

     0      0

A       2   287  3013      0      0

L       1      5      6      2      2   334      1      0

   1115 -3388  1102 -3399  1096 -3411  1090 -3423  1083 -3428  1075 -3434
   1067 -3444  1062 -3463  1062 -3480  1063 -3490  1062 -3497  1056 -3504
   1051 -3507  1046 -3512  1041 -3522  1038 -3530  1035 -3539  1033 -3544
   1030 -3549  1025 -3549  1017 -3549  1007 -3554   996 -3563   991 -3567
    986 -3570   982 -3572   979 -3578   977 -3585   977 -3594   976 -3600
    973 -3607   972 -3614   973 -3619   980 -3626   987 -3632   997 -3646
   1015 -3660  1035 -3674  1064 -3687  1089 -3701  1111 -3714  1142 -3730
   1191 -3767  1208 -3783  1232 -3810  1274 -3885  1279 -3913  1288 -3941
   1290 -3969  1288 -3982  1286 -4001  1287 -4015  1287 -4030  1288 -4041
   1287 -4055  1285 -4070  1285 -4085  1286 -4106  1284 -4120  1288 -4132
   1285 -4146  1283 -4162  1281 -4176  1278 -4187  1280 -4200  1285 -4223
   1291 -4231  1296 -4236  1300 -4244  1309 -4262  1325 -4283  1352 -4308
   1375 -4337  1396 -4363  1421 -4382  1450 -4410  1477 -4434  1496 -4450
   1501 -4457  1510 -4472  1513 -4483  1518 -4492  1521 -4503  1531 -4527
   1543 -4560  1550 -4595  1547 -4616  1538 -4631  1528 -4647  1510 -4658
   1494 -4666  1487 -4671  1479 -4686  1475 -4693  1469 -4705  1462 -4721
   1458 -4729  1449 -4738  1442 -4745  1429 -4751  1417 -4759  1401 -4762
   1386 -4764  1374 -4764  1360 -4765  1344 -4764  1325 -4762  1309 -4763
   1296 -4760  1286 -4759  1278 -4763  1267 -4764  1254 -4768  1231 -4780
   1206 -4790  1187 -4797  1174 -4803  1162 -4809  1149 -4816  1134 -4821
   1127 -4824  1121 -4831  1110 -4835  1098 -4839  1089 -4842  1079 -4839
   1071 -4834  1060 -4825  1055 -4817  1050 -4799  1040 -4784  1029 -4770
   1021 -4760  1006 -4744   992 -4727   972 -4710   949 -4690   939 -4678
    930 -4665   925 -4652   923 -4640   920 -4627   911 -4605   910 -4594
    903 -4578   899 -4568   891 -4561   880 -4552   870 -4545   859 -4538
    846 -4536   837 -4535   827 -4534   816 -4538   804 -4539   793 -4537
...........

290  2017

L       2      5      7      2      2   364      1      0
```

```
  1115 -3388  1124 -3380  1131 -3377  1142 -3376  1147 -3376  1150 -3374
  1157 -3369  1163 -3361  1168 -3353  1170 -3346  1172 -3336  1174 -3328
  1176 -3323  1181 -3320  1188 -3317  1198 -3312  1204 -3310  1210 -3306
  1215 -3301  1218 -3294  1217 -3283  1213 -3269  1212 -3255  1206 -3240
  1197 -3219  1194 -3204  1195 -3197  1196 -3186  1197 -3176  1204 -3166
  1211 -3152  1218 -3138  1230 -3128  1237 -3116  1244 -3101  1248 -3090
  1250 -3084  1249 -3073  1246 -3063  1239 -3045  1237 -3042  1238 -3034
  1246 -3020  1250 -3005  1251 -2994  1250 -2985  1251 -2977  1247 -2973
  1241 -2964  1231 -2960  1225 -2952  1216 -2940  1212 -2933  1208 -2928
  1195 -2910  1192 -2900  1188 -2892  1192 -2890  1201 -2890  1211 -2892
..................  1322 -1135  1316 -1140  1312 -1146  1307 -1163

   290  2017

L      3     9     8     2     2   461     1     0

  3513  4531  3504  4525  3494  4520  3488  4515  3482  4506  3473  4497
  3468  4480  3464  4470  3460  4462  3457  4451  3454  4439  3451  4432
  3446  4419  3443  4401  3436  4378  3431  4366  3426  4356  3421  4344
  3405  4336  3379  4331  3362  4326  3340  4317  3330  4309  3316  4300
  3309  4290  3303  4279  3290  4265  3285  4259  3276  4246  3266  4232
  3248  4225  3239  4222  3225  4217  3212  4215  3191  4215  3173  4218
  3155  4221  3133  4223  3124  4220  3108  4213  3093  4208  3075  4207
  3057  4208  3035  4209  3018  4210  2993  4209  2969  4206  2954  4197
.............  961  1412   951  1399   942  1393   936  1390   932  1388

   290  2017

L      4    10     9     2     2   229     1     0

  4036  6283  4028  6280  4022  6276  4012  6271  4005  6269  3995  6270
  3987  6270  3975  6274  3970  6272  3965  6267  3960  6258  3960  6252
  3962  6242  3965  6227  3961  6224  3955  6221  3947  6216  3953  6213
  3962  6207  3969  6201  3979  6193  3981  6188  3982  6180  3986  6172
  3990  6160  3993  6155  3996  6148  4004  6137  4005  6125  4006  6111
  4007  6106  4010  6098  4011  6090  4008  6089  4003  6087  3998  6084
  3990  6078  3984  6074  3980  6067  3976  6065  3970  6063  3950  6054
  3939  6047  3932  6046  3922  6035  3916  6028  3906  6015  3899  6009
..................  3513  4531

   290  2017

L      5    12     6     1     2   125     0     0

 10635  2183 10658  1872 10668  1729 10679  1579 10688  1469 10688  1379
 10682  1310 10690  1197 10702  1047 10710   888 10716   821 10720   732
 10735   533 10746   337 10764    37 10786  -390 10794  -568 10801  -786
```

```
 10810  -944 10820 -1133 10822 -1307 10828 -1399 10834 -1499 10847 -1778
 10859 -1986 10869 -2186 10877 -2330 10892 -2527 10904 -2707 10918 -2953
 10934 -3208 10944 -3383 10958 -3621 10974 -3868 10988 -4085 11002 -4334
 11005 -4403 10401 -4442  9737 -4473  9539 -4480  9366 -4489  9237 -4498
  9146 -4505  9066 -4509  8895 -4520  8761 -4530  8562 -4535  8432 -4540
  8242 -4546  8019 -4555  7920 -4556  7853 -4557  7806 -4561  7732 -4570
  7670 -4572  7607 -4575  7531 -4580  7402 -4587  7294 -4591  7151 -4598
  6944 -4608  6706 -4614  6393 -4625  6222 -4630  5917 -4644  5728 -4650
  5477 -4661  5086 -4668  4689 -4680  4431 -4683  4412 -4691  4400 -4702
  4376 -4719  4372 -4722  4370 -4733  4373 -4744  4390 -4753  4404 -4753
  4417 -4760  4414 -4786  4406 -4796  4401 -4813  4402 -4837  4403 -4856
  4404 -4865  4403 -4879  4395 -4886  4388 -4890  4384 -4894  4384 -4907
  4395 -4927  4399 -4936  4410 -4946  4418 -4964  4424 -4978  4421 -4992
  4412 -4999  4410 -5002  4421 -5019  4434 -5027  4438 -5050  4448 -5075
  4452 -5084  4455 -5088  4470 -5093  4478 -5097  4490 -5103  4500 -5108
  4506 -5113  4527 -5120  4544 -5124  4563 -5130  4569 -5133  4579 -5143
  4587 -5159  4227 -5162  3593 -5182  3138 -5195  2577 -5202  2122 -5206
  1622 -5212  1471 -5212  1473 -6186   881 -6190   465 -6194

L      6     6    11     1     2     3     0     0

   465 -6194   176 -6193     1 -6187

L      7    15    14     1     2    16     0     0

 -5201  6334 -4824  6327 -4194  6312 -3442  6299 -2851  6288 -2609  6286
 -2587  6283 -2578  6281 -2560  6276 -2544  6270 -2535  6262 -2517  6262
 -2413  6263 -1728  6251  -603  6245     7  6246

L      8    17    16     1     2   421     0     0

-10023  -857-10023  -845-10021  -828-10020  -818-10017  -805-10014  -793
-10016  -779-10021  -770-10028  -767-10032  -757-10026  -749-10015  -741
-10001  -736 -9987  -729 -9979  -727 -9969  -722 -9958  -715 -9954  -704
 -9953  -689 -9960  -680 -9966  -659 -9972  -644 -9977  -631 -9977  -616
 -9975  -603 -9969  -587 -9966  -569 -9962  -553 -9961  -538 -9965  -528
 -9968  -515 -9972  -499 -9983  -465 -9983  -445 -9983  -436 -9981  -428
 -9976  -423 -9972  -418 -9969  -411 -9969  -402 -9970  -397 -9973  -385
 -9977  -378 -9980  -367 -9980  -360 -9979  -354 -9975  -344 -9970  -333
 -9966  -326 -9958  -312 -9949  -300 -9946  -291 -9946  -284 -9947  -277
 -9948  -270 -9948  -255 -9938  -244 -9936  -243 -9934  -238 -9934  -231
 -9938  -218 -9950  -209 -9961  -201 -9970  -194 -9974  -187 -9978  -176
.............10031  3973

L      9    16    15     1     2   158     0     0
```

```
-10031  3973-10032  3984-10034  4003-10037  4012-10038  4027-10031  4035
-10023  4038-10016  4043-10011  4048-10004  4055 -9989  4062 -9980  4063
 -9974  4075 -9978  4084 -9992  4099-10003  4107-10019  4119-10029  4134
-10033  4145-10037  4158-10044  4176-10046  4190-10049  4203-10062  4212
-10077  4231-10078  4248-10079  4262-10079  4271-10082  4287-10089  4305
-10093  4326-10095  4335-10098  4344-10097  4359-10094  4372-10085  4387
-10076  4396-10068  4401-10059  4411-10054  4418-10051  4439-10056  4449
-10058  4460-10073  4486-10073  4504-10074  4527-10068  4543-10063  4554
-10053  4565-10039  4578-10018  4591 -9998  4603 -9958  4618 -9925  4637
 -9908  4649 -9894  4659 -9881  4661 -9876  4659 -9861  4652 -9856  4646
 -9850  4642 -9842  4639 -9824  4649 -9807  4657 -9792  4668 -9768  4676
 -9742  4677 -9720  4674 -9699  4659 -9666  4640 -9631  4615 -9617  4604
 -9597  4601 -9573  4608 -9563  4610 -9547  4612 -9532  4609 -9518  4611
 -9513  4613 -9504  4620 -9494  4628 -9488  4633 -9484  4637 -9477  4642
 -9460  4646 -9436  4644 -9419  4636 -9413  4631 -9404  4622 -9398  4611
 -9394  4600 -9390  4593 -9388  4585 -9384  4578 -9373  4574 -9366  4571
 -9358  4566 -9351  4560 -9344  4540 -9335  4532 -9331  4520 -9326  4508
 -9325  4491 -9327  4474 -9328  4463 -9328  4452 -9323  4441 -9315  4433
 -9294  4409 -9271  4386 -9250  4377 -9244  4372 -9237  4367 -9228  4353
 -9218  4345 -9207  4341 -9195  4337 -9179  4337 -9164  4337 -9148  4342
 -9136  4349 -9122  4352 -9110  4358 -9095  4358 -9082  4359 -9057  4361
 -9043  4367 -9033  4377 -9022  4393 -9012  4417 -9004  4447 -9000  4465
 -9000  4484 -8990  4513 -8982  4540 -8977  4551 -8970  4564 -8961  4578
 -8954  4591 -8942  4605 -8923  4627 -8911  4645 -8905  4658 -8895  4674
 -8886  4689 -8875  4700 -8869  4708 -8864  4714 -8857  4719 -8848  4728
 -8846  4738 -8845  4762 -8827  5100 -8788  5898 -8771  6255 -8754  6485
 -7383  6418 -5201  6334

L     10    14    10     1     2    17     0     0

     7  6246   391  6245  1156  6251  1872  6258  2457  6264  2815  6269
  3629  6289  3676  6290  3684  6289  3692  6286  3700  6283  3706  6278
  3712  6273  3719  6270  3744  6271  3858  6276  4036  6283

L     11    10    12     1     2    26     0     0

  4036  6283  4303  6291  4628  6299  5063  6316  5443  6328  6150  6349
  6791  6375  7331  6399  7927  6426  8231  6439  8680  6468  9248  6502
  9900  6547 10261  6570 10406  6581 10452  5824 10479  5460 10425  5459
 10456  4873 10483  4594 10494  4465 10508  4183 10528  3917 10538  3716
 10604  2704 10635  2183

L     12    11    17     1     2   333     0     0

     1 -6187 -1739 -6193 -3872 -6160 -3919 -6144 -8111 -4445-10703 -3356
-10696 -3344-10694 -3333-10691 -3324-10687 -3315-10681 -3305-10674 -3295
-10667 -3285-10667 -3273-10674 -3267-10682 -3260-10686 -3250-10684 -3242
```

APPENDIX G.--Sample DLG data file (Standard Distribution Format)--continued

```
-10677 -3242-10669 -3240-10664 -3239-10656 -3235-10652 -3220-10651 -3206
-10653 -3194-10656 -3185-10658 -3175-10659 -3169-10658 -3158-10656 -3149
-10654 -3138-10655 -3128-10656 -3117-10658 -3108-10659 -3097-10659 -3086
-10659 -3076-10657 -3066-10651 -3057-10644 -3053-10633 -3047-10621 -3045
-10613 -3046-10604 -3039-10594 -3030-10587 -3020-10579 -3012-10567 -2993
-10554 -2971-10547 -2961-10540 -2949-10532 -2938-10526 -2928-10523 -2921
-10519 -2912-10515 -2904-10511 -2895-10504 -2885-10501 -2878-10496 -2868
.............-10021  -869-10021  -863-10023  -857
L     13     7     8     2     2   408     1     0

  1307 -1163  1295 -1175  1286 -1188  1277 -1193  1265 -1194  1252 -1190
  1238 -1187  1230 -1187  1223 -1192  1211 -1198  1199 -1203  1184 -1208
  1176 -1213  1157 -1228  1136 -1243  1126 -1253  1117 -1261  1105 -1267
  1092 -1275  1085 -1277  1073 -1274  1062 -1270  1052 -1270  1039 -1272
  1022 -1279  1012 -1279   998 -1278   982 -1274   970 -1273   954 -1270
   946 -1270   932 -1268   933 -1258   935 -1248   933 -1244   921 -1233
   913 -1228   905 -1216   905 -1213   912 -1203   923 -1198   941 -1199
   957 -1203   963 -1200   970 -1196   976 -1186   982 -1180   983 -1179
   984 -1179   992 -1170  1006 -1162  1018 -1155  1042 -1145  1055 -1137
  1057 -1118  1048 -1109  1040 -1100  1033 -1093  1026 -1090  1017 -1084
.............  290  2017
```

APPENDIX H.--Sample DLG data file (Optional Distribution Format)

```
USGS-NMD  DLG DATA - CHARACTER FORMAT - 09-29-82 VERSION
ARIZONA AND NEW MEXICO                    1967, 1972  2000000.

     3     3  9999     2 0.50800000000D+02     4     0     4     1
   0.637820640000000D+07   0.676865799729109D-02   0.290300000000000D+08
   0.450300000000000D+08  -0.960000000000000D+08   0.230000000000000D+08
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
   0.0                     0.0                     0.0
 0.10000000000D+01 0.0               0.0               0.0
SW       31.000000 -115.000000       -1797041.23  1060722.79
NW       37.000000 -115.000000       -1663912.33  1717538.20
NE       37.000000 -103.000000        -616637.88  1573376.51
SE       31.000000 -103.000000        -665924.44   905019.85
HYPSOGRAPHY             0    18    18 010     2     2 010    13    13   1
N    1 -1797041.23  1060722.79           0          0     0
N    2 -1663912.33  1717538.20           0          0     0
N    3  -616637.88  1573376.51           0          0     0
N    4  -665924.44   905019.85           0          0     0
N    5 -1153236.44  1135937.23           2          0     0
     1     2
N    6 -1205386.66   999226.66           3          0     0
    -1    -5     6
N    7 -1128160.20  1246581.47           2          0     0
    -2    13
N    8 -1129360.17  1377559.74           2          0     0
    -3   -13
N    9  -977696.76  1517852.98           2          0     0
     3    -4
N   10  -939239.49  1602400.23           3          0     0
     4   -10    11
N   11 -1228689.21  1002793.31           2          0     0
    -6    12
N   12  -635544.10  1350350.81           2          0     0
     5   -11
N   13  -880370.63  1593835.17           0          0     0
N   14 -1142257.40  1628449.16           2          0     0
    -7    10
N   15 -1403743.18  1668956.33           2          0     0
     7    -9
N   16 -1663171.41  1583597.66           2          0     0
    -8     9
N   17 -1696228.73  1340469.89           2          0     0
     8   -12
N   18  -617232.22  1570176.46         -27          0     0
A    1 -1153183.85  1587442.82           8     0    1     0     0
   -12    -6    -5   -11   -10    -7    -9    -8
     0     0
```

```
A    2 -1150562.93  1463806.99            8     0     0     0     0
    12     8     9     7    10    11     5     6
L    1     5     6     2     2                334     1     0
 -1153236.44  1135937.23 -1153966.87  1135473.71 -1154351.95  1134911.37
 -1154737.04  1134349.03 -1155123.95  1134145.89 -1155568.12  1133899.36
 -1156040.00  1133451.52 -1156423.25  1132529.98 -1156541.02  1131674.44
 -1156559.97  1131164.26 -1156658.79  1130818.91 -1157009.23  1130508.19
 -1157281.64  1130391.85 -1157567.91  1130174.86 -1157888.81  1129706.25
 -1158095.21  1129324.42 -1158308.53  1128892.28 -1158443.82  1128654.50
 -1158629.44  1128423.66 -1158881.06  1128458.30 -1159283.67  1128513.72
 -1159821.56  1128331.36 -1160437.49  1127954.64 -1160716.83  1127787.97
 -1160989.24  1127671.63 -1161204.40  1127598.69 -1161396.94  1127317.52
 -1161546.08  1126979.10 -1161608.43  1126526.17 -1161700.32  1126231.14
 -1161899.79  1125899.65 -1161998.61  1125554.30 -1161982.92  1125295.74
 -1161679.13  1124894.97 -1161368.42  1124544.52 -1160962.15  1123770.69
.............-1205386.66   999226.66
   290  2017
L    2     5     7     2     2                364     1     0
 -1153236.44  1135937.23 -1152728.09  1136277.49 -1152355.02  1136379.97
 -1151794.52  1136354.10 -1151542.89  1136319.46 -1151378.06  1136399.33
 -1150991.14  1136602.46 -1150633.77  1136963.50 -1150326.72  1137331.47
 -1150177.57  1137669.89 -1150007.65  1138159.29 -1149851.58  1138548.04
 -1149716.29  1138785.81 -1149443.88  1138902.15 -1149070.82  1139004.64
 -1148532.92  1139186.99 -1148217.12  1139246.07 -1147887.45  1139405.81
 -1147601.19  1139622.80 -1147401.72  1139954.30 -1147375.84  1140514.81
 -1147480.16  1141247.07 -1147433.50  1141958.56 -1147631.54  1142755.01
 -1147938.99  1143874.19 -1147986.05  1144649.86 -1147887.24  1144995.21
 -1147760.71  1145541.86 -1147641.11  1146038.19 -1147219.55  1146492.95
 -1145050.03  1157783.39 -1145202.84  1158163.38 -1145369.50  1158442.72
 -1145899.04  1159438.64 -1145980.74  1159962.68 -1146126.62  1160392.99
 -1145911.46  1160465.93 -1145458.53  1160403.58 -1144969.13  1160233.66
 -1144495.42  1160322.29 -1143568.78  1160348.57 -1143159.25  1160343.47
 -1142900.69  1160359.16 -1142781.09  1160855.49 -1143020.70  1161349.98
 -1142951.42  1161853.24 -1142838.75  1162299.24 -1142616.66  1162422.51
 -1142243.60  1162524.99 -1141971.19  1162641.33 -1141726.49  1162556.37
.............-1128160.20  1246581.47
   290  2017
L    3     9     8     2     2                461     1     0
  -977696.76  1517852.98  -978191.26  1517613.37  -978729.15  1517431.02
  -979065.74  1517220.96  -979430.04  1516809.59  -979945.32  1516419.01
  -980314.72  1515598.11  -980585.29  1515122.57  -980842.02  1514747.67
  -981069.20  1514214.87  -981303.30  1513631.75  -981502.77  1513300.25
  -981844.46  1512680.66  -982120.13  1511795.58  -982631.74  1510686.59
  -982966.50  1510117.32  -983287.40  1509648.70  -983622.16  1509079.43
  -984482.79  1508787.67  -985825.89  1508716.16  -986716.06  1508582.30
  -987885.57  1508281.77  -988444.25  1507948.44  -989211.15  1507592.50
  -989632.71  1507137.74  -990010.86  1506625.72  -990762.08  1506011.22
```

```
  -991055.27  1505743.90  -991598.26  1505152.02  -992198.50  1504516.74
  -993152.85  1504289.15  -993626.56  1504200.52  -994365.76  1504045.88
  -995033.85  1504035.29  -996090.68  1504180.77  -996975.76  1504456.44
  -997860.84  1504732.11  -998954.14  1504985.17  -999427.86  1504896.54
 -1000281.56  1504655.10 -1001071.08  1504507.39 -1001983.87  1504581.76
 -1002882.80  1504756.78 -1003983.03  1504959.51 -1004831.64  1505127.60
.............-1129145.02  1377632.68 -1129360.17  1377559.74
   290  2017
L    4    10     9     2     2              229     1     0
  -939239.49  1602400.23  -939662.88  1602304.67  -939992.54  1602144.93
  -940530.44  1601962.58  -940896.57  1601910.42  -941392.90  1602030.02
  -941795.50  1602085.44  -942371.70  1602369.87  -942637.18  1602303.86
  -942923.45  1602086.87  -943237.42  1601668.58  -943278.99  1601366.63
  -943247.61  1600849.51  -943200.55  1600073.85  -943422.63  1599950.58
  -943745.37  1599841.17  -944182.61  1599644.96  -943901.44  1599452.42
  -943490.07  1599088.12  -943179.36  1598737.68  -942731.52  1598265.80
  -942665.51  1598000.31  -942670.61  1597590.78  -942524.72  1597160.47
  -942406.55  1596528.85  -942290.21  1596256.44  -942187.73  1595883.38
  -941861.33  1595274.38  -941894.13  1594663.54  -941940.79  1593952.06
  -941925.10  1593693.50  -941829.55  1593270.12  -941834.64  1592860.58
.............-977696.76  1517852.98
   290  2017
L    5    12     6     1     2              125     0     0
  -635544.10  1350350.81  -636541.07  1334540.24  -637028.45  1327274.41
  -637514.00  1319649.38  -637823.09  1314051.22  -638446.57  1309521.92
  -639226.52  1306091.03  -639606.73  1300348.82  -640041.95  1292716.86
  -640740.82  1284659.68  -640903.01  1281246.30  -641318.26  1276739.62
  -641941.95  1266620.92  -642746.17  1256680.92  -643918.56  1241458.56
  -645769.45  1219817.15  -646599.94  1210803.78  -647757.87  1199784.32
  -648399.48  1191770.54  -649205.53  1182189.74  -650310.27  1173419.24
  -650645.65  1168747.73  -651036.44  1163673.61  -652314.99  1149542.72
  -653152.01  1138991.88  -654034.26  1128857.50  -654629.22  1121555.20
  -655239.05  1111537.16  -655882.10  1102395.43  -656881.71  1089918.36
  -657843.02  1076974.51  -658552.08  1068098.27  -659496.28  1056023.80
  -660402.16  1043482.55  -661200.88  1032464.93  -662221.27  1019836.88
  -662548.30  1016343.64  -693215.09  1018565.16  -726846.00  1021604.95
  -736858.95  1022624.32  -745627.62  1023369.85  -752181.96  1023810.57
  -756810.08  1024088.69  -760863.83  1024441.59  -769545.70  1025072.62
  -776358.60  1025497.65  -786408.02  1026624.60  -792984.98  1027273.55
  -802588.39  1028287.82  -813873.34  1029379.73  -818862.49  1030015.23
.............-1184423.52   996546.11 -1205386.66   999226.66
L    6     6    11     1     2                3     0     0
 -1205386.66   999226.66 -1219923.81  1001279.04 -1228689.21  1002793.31
L    7    15    14     1     2               16     0     0
 -1403743.18  1668956.33 -1384818.95  1665992.38 -1353217.77  1660873.16
 -1315463.03  1655009.43 -1285796.84  1650361.68 -1273631.91  1648584.57
 -1272545.53  1648281.19 -1272106.46  1648118.19 -1271235.23  1647741.87
```

```
 -1270471.59  1647329.08 -1270074.08  1646864.12 -1269168.22  1646739.43
 -1263927.44  1646069.29 -1229537.57  1640720.03 -1172962.91  1632624.62
 -1142257.40  1628449.16
L    8    17    16     1     2              421     0     0
 -1696228.73  1340469.89 -1696145.60  1341073.79 -1695927.18  1341915.47
 -1695807.58  1342411.80 -1695566.54  1343045.25 -1695332.43  1343628.37
 -1695336.10  1344346.79 -1695525.38  1344834.35 -1695856.88  1345033.82
 -1695988.90  1345564.79 -1695631.53  1345925.83 -1695022.53  1346252.23
 -1694283.33  1346406.87 -1693530.28  1346662.17 -1693113.82  1346707.40
 -1692575.93  1346889.75 -1691973.86  1347165.82 -1691696.35  1347691.70
 -1691542.11  1348439.65 -1691832.05  1348941.07 -1691988.52  1350039.47
 -1692186.56  1350835.92 -1692348.13  1351524.79 -1692244.22  1352279.68
.............-1663171.41  1583597.66
L    9    16    15     1     2              158     0     0
 -1663171.41  1583597.66 -1663145.53  1584158.16 -1663114.56  1585128.20
 -1663203.19  1585601.92 -1663149.60  1586363.73 -1662741.90  1586717.84
 -1662318.52  1586813.40 -1661931.60  1587016.53 -1661645.33  1587233.52
 -1661244.56  1587537.31 -1660441.19  1587785.67 -1659981.33  1587773.65
 -1659596.25  1588335.99 -1659735.20  1588816.63 -1660335.84  1589668.50
 -1660834.01  1590147.31 -1661556.08  1590862.05 -1661955.43  1591686.21
 -1662080.53  1592267.50 -1662191.77  1592949.45 -1662419.35  1593903.80
 -1662423.02  1594622.21 -1662483.94  1595297.23 -1663075.82  1595840.21
 -1663699.08  1596900.31 -1663631.64  1597762.77 -1663584.98  1598474.26
 -1663522.63  1598927.19 -1663562.77  1599753.18 -1663790.35  1600707.53
 -1663846.18  1601792.08 -1663884.48  1602258.86 -1663973.11  1602732.57
.............-1512971.60  1688299.52 -1403743.18  1668956.33
L   10    14    10     1     2               17     0     0
 -1142257.40  1628449.16 -1122939.32  1625738.67 -1084398.72  1620741.07
 -1048317.14  1616133.24 -1018835.14  1612382.59 -1000783.96  1610154.17
  -959680.42  1605521.68  -957308.19  1605246.41  -956912.52  1605140.67
  -956530.69  1604934.27  -956148.87  1604727.87  -955881.56  1604434.68
  -955614.24  1604141.49  -955282.75  1603942.02  -954017.68  1603819.15
  -948245.93  1603281.05  -939239.49  1602400.23
L   11    10    12     1     2               26     0     0
  -939239.49  1602400.23  -925747.15  1600953.18  -909335.93  1599104.34
  -887326.56  1596946.41  -868119.72  1594917.85  -832394.09  1591076.93
  -799955.30  1587944.86  -772613.25  1585411.81  -742432.19  1582641.80
  -727043.17  1581190.06  -704246.10  1579539.05  -675425.66  1577315.28
  -642301.67  1575063.19  -623974.82  1573719.84  -616601.41  1573268.93
  -619530.57  1534853.84  -620693.40  1516348.30  -623417.91  1516672.06
  -625917.34  1486966.54  -626491.33  1472738.67  -626831.40  1466170.47
  -628080.40  1451881.69  -628916.61  1438356.54  -629805.79  1428171.83
  -633494.95  1376785.17  -635544.10  1350350.81
L   12    11    17     1     2              333     0     0
 -1228689.21  1002793.31 -1316297.21  1014545.24 -1423412.98  1030982.38
 -1425667.44  1032113.18 -1624862.24  1146656.44 -1747761.96  1219417.08
 -1747326.56  1219972.49 -1747149.70  1220512.22 -1746936.38  1220944.37
```

```
 -1746672.73  1221369.59 -1746301.50  1221831.28 -1745879.94  1222286.04
 -1745458.39  1222740.80 -1745375.26  1223344.71 -1745685.97  1223695.16
 -1746040.09  1224102.85 -1746172.11  1224633.82 -1746016.04  1225022.57
 -1745663.76  1224974.08 -1745247.30  1225019.31 -1744988.75  1225035.00
 -1744558.43  1225180.88 -1744253.22  1225908.05 -1744105.91  1226605.68
 -1744123.43  1227223.44 -1744212.06  1227697.15 -1744243.43  1228214.26
 -1744252.19  1228523.15 -1744125.67  1229069.80 -1743962.67  1229508.87
 -1743785.81  1230048.60 -1743766.86  1230558.78 -1743740.99  1231119.29
 -1743779.29  1231586.08 -1743753.41  1232146.58 -1743677.21  1232700.17
.........................
L   13     7     8     2     2              408     1     0
 -1128160.20  1246581.47 -1128847.24  1246060.69 -1129390.22  1245468.81
 -1129877.79  1245279.53 -1130488.63  1245312.33 -1131115.15  1245603.69
 -1131798.92  1245851.66 -1132201.53  1245907.08 -1132588.44  1245703.94
 -1133233.91  1245485.12 -1133872.46  1245316.62 -1134661.98  1245168.91
 -1135099.22  1244972.70 -1136159.32  1244349.44 -1137320.07  1243740.03
 -1137892.60  1243306.05 -1138400.95  1242965.80 -1139046.42  1242746.97
 -1139756.07  1242434.43 -1140122.21  1242382.27 -1140705.33  1242616.38
 -1141231.20  1242893.88 -1141734.46  1242963.16 -1142402.54  1242952.56
 -1143306.57  1242718.05 -1143809.83  1242787.33 -1144507.46  1242934.64
 -1145284.95  1243246.78 -1145881.93  1243380.24 -1146666.36  1243642.05
 -1147068.96  1243697.47 -1147759.67  1243895.11 -1147640.07  1244391.44
 -1147470.14  1244880.84 -1147543.08  1245095.99 -1148070.78  1245732.71
 -1148438.75  1246039.75 -1148758.22  1246699.08 -1148737.44  1246850.06
.............
  290  2017
```

APPENDIX I.--Data Sources and Currency

The published 1:2,000,000-scale National Atlas sectional maps were completely revised in 1972-73. Selected information from these maps was revised before digitizing. The source and date of the updated information are presented below:

Category	Source	Currency of Data
Political Boundaries, Alaskan borough boundaries	Bureau of the Census	1979
Administrative Boundaries	Administering Federal agency	Various
Roads and Trails	Various	1980
Railroads	Interstate Commerce Commission	1979
Streams, Alaska	Landsat imagery	1979
Water Bodies, major reservoirs	National Oceanic and Atmospheric Administration Sectional Aeronautical Charts	1979-80
Cultural Features, airports	Federal Aviation Administration	1980
Alaska pipeline	USGS maps	1979