National Mapping Program
Technical Instructions

Part 1
Data Description and Template Development

Standards for 1:24,000-Scale Digital Line Graphs-3 Core

U.S. Department of the Interior
U.S. Geological Survey
National Mapping Division

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A complete and current copy of Part 1 of Standards for 1:24,000-Scale Digital Line Graphs-3 Core consists of the pages (and most recent creation or revision dates) listed below.

1. DATA DESCRIPTION AND TEMPLATE DEVELOPMENT

The standards specified in this document pertain to the description, collection, processing, revision, and quality control of Digital Line Graphs-3 (DLG-3) Core data intended for entry into the National Digital Cartographic Data Base (NDCDB).

These standards are intended to facilitate the interchange and use of DLG-3 Core data. DLG-3 Core collection and processing systems must produce data that are compatible with other production systems not only within the Federal sector but also within other government and private sector organizations. These standards cover a broad range of collection and processing systems, because of rapidly changing technologies in the mapping industries. They are not intended to inhibit the use of any procedure, but to set common standards that will allow data to be acceptable for entry into the NDCDB.

This document also provides the NDCDB manager and the quality control units within the United States Geological Survey (USGS) with standards for testing DLG-3 Core data. Data generated by National Mapping Division (NMD) production units are collected according to the standards set forth in this document. DLG-3 Core data collected by other Federal agencies or acquired through procurement from the private sector will be accepted for entry into the NDCDB after verification according to these same standards.

1.1 DATA DESCRIPTION

DLG-3 Core contains data that are used on a regular basis by those who need geospatial data for geographic information systems. This product maintains a source of base geographic information that is consistent, accurate, and current. Additionally, because DLG-3 Core data are identical to traditional DLG-3 data except in content (refer to appendix 1.A), the data structure, record formats, and accuracy remain the same. Therefore, DLG-3 Core data can be brought into all software programs that now use DLG-3 data.

1.1.1 Attribute Coding

Maps convey a great deal of information, and representing real world features and relationships symbolically is not a simple process. Digitizing maps and encoding the resulting data using seven-digit attribute codes add yet another level of interpretation. It is not possible to provide absolute rules and guidelines to account for all possible situations, because DLG-3 Core collection is, at times, a map interpretation process. This standard does, however, provide information that will allow reasonable decisions to be made about how to encode the map information collected for DLG-3 Core.

1.1.1.1 Coding Structure

A DLG attribute code identifies the general data category to which an element belongs, as well as the specific nature of the element. Each attribute code is composed of two distinct numeric fields: (1) a three-digit major code in which the first two digits identify the data category to which the element belongs and the third digit may be used to designate the interpretation of the minor code, and (2) a four-digit minor code, which specifically describes the element. For DLG-3 Core data, the major and minor pair describing the element type will always be encoded in the first position, and additional descriptive codes will remain unordered except for the following cases:

- Boundary monument number exceeding four digits-

  The boundary monument number must be encoded by repeating the monument number parameter code. The parameter code carrying the initial digits of the monument number must precede the parameter code carrying the final digits of the monument number.

- Alphanumeric monument designators-

  The order of the alpha and numeric parameter attribute codes must be the same as that of the actual designator.

- Control station or monument that falls on a State boundary-

  The State Federal Information Processing Standard (FIPS) code for the State on each side of the boundary must precede the county FIPS code for the county on that same side of the boundary.

- Route designators-

  The route number must follow the descriptive attribute code for the route type with which it is associated.

- Alphanumeric route designators-

  The order of the alpha and numeric parameter attribute codes must be the same as that of the actual designator.

Some elements may be unattributed, many are uniquely described by a single attribute code, and others may require two or more attribute codes for a complete description. The attribute codes used in DLG-3 Core and traditional DLG-3 have the same meaning. However, many of the traditional DLG-3 codes are not used in DLG-3 Core, and several new codes have been added to describe the Federal Highway Administration (FHA) functional road classes (please refer to appendix 1.A, which provides a guide to aid in the translation of DLG-3 to DLG-3 Core attribute codes).

1.1.1.2 Major Code Description

The first two digits of the major code uniquely identify the data category to which the described element belongs. Table 1-1 lists currently used major codes and the categories they represent.

The third digit of the major code is used to designate the interpretation of the minor code in two ways:

- If it is zero, the minor code numbers represent a description or classification of a specific element; for example, 050 0412 identifies a stream.
- If it is not zero, the minor code numbers have special interpretations as a parameter. The interpretation of each parameter code is given in each category. For example, 055 ---- is used to encode the value of a river mile mark.

Table 1-1
DLG-3 Core Major Attribute Codes

Major Code	**Category**
050	Hydrography
090	Boundaries
170	Transportation - Roads and Trails
180	Transportation - Railroads
190	Transportation - Pipelines, Transmission Lines, and Miscellaneous Transportation Features
300	U.S. Public Land Survey System

1.1.1.3 Minor Code Description

The first digit of the minor code of a nonparameter code is zero. The remaining three digits of a nonparameter code are used to classify specific elements. The type of element described by a particular code can generally be determined from the value of these digits:

- node: 001-099
- area: 100-199

- line: 200-299
- single-point (degenerate line): 300-399
- general purpose codes: 400-499
- descriptive codes: 600-699

The general purpose codes are used on elements that may be digitized as nodes, areas, lines, or degenerate lines, depending on the size and position of the element in question.

A descriptive code is generally used with another code to qualify its meaning.

It has not been possible to maintain this structure completely, and changes in the standards have resulted in codes that no longer fit this scheme. Many node attribute codes apply to elements that are collected as degenerate lines if they do not fall on a line. Most degenerate line codes apply to elements that are collected as nodes if they happen to fall on a line. Some line or area codes are now used as general purpose codes and several general purpose codes are used for elements that can only be collected as areas or only as lines. Throughout these standards, if under general principles or under the list of valid attribute codes, the standards say, for example, that there are no node codes, it does not mean that no nodes in the category are ever attributed; it simply means that there are no codes in the list of node attribute codes. Codes listed under other topological element types may apply to nodes.

Parameter codes are used when a minor code can legitimately assume a range of values; for example, water elevation or highway route number. The meaning of a parameter code is derived from the nonzero third digit of the major code. Parameters are both category and element specific.

1.1.2 How to Measure an Element

It may be necessary to measure elements shown on the map to determine if they meet collection criteria and if they are to be collected as points, lines, or areas. Some small elements shown on the map are not collected in DLG's, and other elements shown to scale on the map and previously collected as areas in DLG's are now collected as degenerate lines.

Size criteria are given either in the category-specific general principles or in the individual coding descriptions. Size criteria can be given either in actual size on the ground or in inches at map scale. The size criteria assume 1:24,000-scale mapping, so some judgment must be used in applying the size criteria when collecting from maps at other scales.

The following guidelines apply when measuring elements:

- All measurements should be made from the outermost symbol edge to the

opposite outermost symbol edge. In general, elements are measured along the longest axis (length) or shortest axis (width).

- Square elements are measured along either axis.
- Round elements are measured across their diameter.
- Irregular elements are measured by using the concept of the best fitting rectangle. Using this concept, a rectangle is created around an irregularly shaped element, using the outermost edges of the element to define the sides of the rectangle. (This rectangle is aligned to best fit the element, rather than with the neatline.) Length is then measured using the longest axis of the rectangle, width is measured using the shortest axis of the rectangle, and area is measured as the total area of the rectangle.
- Size criteria are intended to be used as guidelines. It is assumed that the collector will develop a feel for the appropriate size of a feature, rather than having to measure each feature instance. It is understood that this means some features within a few mils of a certain size criteria will not be treated as specified in the standards. This is acceptable.
- Variations in the size of standard symbols that can reasonably be assumed to be a result of the map scribing and reproduction process are ignored.

1.1.3 Where to Digitize Elements

Determining where to digitize an element can depend on the methods used to collect the data. Although it is desirable for the DLG categories to be vertically aligned, in some cases this is not possible. Vertical alignment is the process by which elements from one DLG category are represented by the same numeric coordinates as elements from an overlapping DLG category. If all the DLG categories are collected at the same time using heads-up digitizing, elements that coincide should share numeric coordinates. For example, where a boundary runs along a Public Land Survey System (PLSS) line, the digitized PLSS line (without attributes) is copied to the boundary overlay, so that the two lines share the same coordinates. Appropriate attributes are then added as needed.

Because many elements are collected as centerlines or points in the DLG and therefore occupy less space in the DLG than they do when symbolized on the map, it is often necessary to extend lines slightly, either to reach the centerpoint of point symbols or to form unbroken outlines of areas. For example, if one side of a park borders a road, that edge of the park is digitized by following the centerline of the road; even though the lines that define the two adjoining sides of the park end at the road casing on the graphic, they are extended to meet the centerline of the road in the DLG.

- Lines - Lines are digitized as centerlines. For many elements, the symbol is a single line on the map, and the digitized centerline and the symbol are, for all practical purposes, the same. However, for most roads, multiple-track railroads, and other elements that are symbolized with casings, the centerline must be digitized by determining the center of the symbolized element.

- Areas - If the edge of an area element is formed by another linear element, the centerline of the linear element is digitized as the outline of the area element.

  If the edge of an area element is not formed by another linear element, the edge of the area element is digitized as the outline of the area element.

  The appropriate attribute code is assigned only to the area point.

- Degenerate Lines and Nodes - Degenerate lines and symbolized nodes are digitized in the center of the symbol, unless the coding description provides additional information.

1.1.4 Symbol Hierarchy and Symbol Suppression on Source Maps

Some symbols have been suppressed on source maps because of legibility constraints, but the elements must still be collected in the DLG. This occurs most often with boundary lines (civil and reservation) and PLSS lines. It is important to understand the rules for suppressing symbols on source maps, because the rule used affects how the elements are collected in the DLG.

PLSS lines have traditionally been suppressed if they coincide with another element. This means that if a road, pipeline, railroad, or boundary line follows a PLSS survey line, the survey line will not be shown on the source map. If a PLSS survey line is not shown on the source map because of coincidence with another element, a line needs to be collected in the DLG to complete the survey line.

Boundary lines (civil and reservation) often follow the centerlines of roads and the shorelines of lakes, streams, and oceans. The boundary lines generally are not suppressed on graphics. For roads, the lineweight of the boundary line symbol on the source map is usually reduced by one-half so that it can be seen. However, in some cases the boundary line may be dropped on the graphic. If a boundary line has been dropped on the source map and the boundaries have not been investigated and revised, a closure line needs to be collected in the DLG to complete the boundary line. There is also a hierarchy of boundary line symbolization that needs to be considered when interpreting boundary areas on source graphics.

1.1.5 Common Attribute Codes

In general, the meaning of an attribute code is unique to the element it describes. There are, however, several exceptions.

1.1.5.1 Outside Area

Each DLG provides a coherent description of that part of the Earth's surface covered by a 1:24,000-scale, 7.5-minute cell, or a specific subdivision of another scale source. To maintain topological consistency and to facilitate the combination (integration) of multiple DLG's, the area outside the cell is specifically identified for each DLG. This area element, which must be the first area present in each data category, is assigned a single attribute code with major and minor codes both equal to zero.

1.1.5.2 Void Area

This code is applied to the area beyond the national boundary. Digital data are not collected for any part of Canada or Mexico shown on the graphic, and this code indicates that although elements in a given category may exist, they have not been included in the digital file.

In the Boundaries category, there is no void area code. Instead, the codes for Canada (090 0197), Mexico (090 0198), and open water (090 0199) are used as appropriate. There is also no void area code in the PLSS category. Instead, the code for area outside the public domain (300 0114) is used.

The minor code for void area varies by category.

1.1.5.3 Photorevised Elements

Map elements obtained by photorevision methods are printed in purple on 1:24,000- and 1:25,000-scale maps. Map elements shown in purple are described by attribute codes from the appropriate category plus a code consisting of major code XX0, where XX are the two digits uniquely identifying the data category, and a minor code of zero. The parameter code for a photorevised element is applied to the elements shown in purple on the published map when unrevised collection is performed from a graphic only. If a DLG is revised, the photorevised attribute codes are deleted. The photorevised code is the first entry in the parameter attribute codes list.

The photorevised code does not apply in the PLSS or Boundaries categories.

The photorevised code is assigned to a linear element if the element is shown in purple.

For example, a road where the road symbol is shown in purple would be coded as follows:

170 0000 - photorevised feature
170 0201 - road

The presence of a purple label does not, in and of itself, necessitate the application of a photorevised code. For example, if a road is in standard colors but has a purple route shield, the road is not assigned the photorevised code.

Generally, if an element was added by photorevision methods, the symbology is a standard symbol, except that the symbol is printed in purple. One exception is photorevised water bodies, which are all shown using USGS pattern 6.

1.1.6 Data Content

The DLG-3 Core themes and content within those themes were selected to meet the three purposes identified by the Federal Geographic Data Committee (FGDC) in the *Development of a National Digital Geospatial Data Framework (1995)*. The framework was envisioned to provide data that are common to most applications, a base onto which other data can be compiled, and a way to link the results of an application to the landscape. For example, most users need roads. Beyond this, the type of road information needed varies depending on the user and the application, and there is little common agreement among users about the specifics. By concentrating on location, the USGS can continue to provide accurate, fundamental road data that can be kept current. Users can then attach the attributes that they require without spending their resources to collect and maintain location data. Given the limitations on USGS resources and the proliferation of data and user demand, the USGS must focus on DLG-3 Core data so that these fundamental data can be maintained to meet the high standards that users expect from the USGS.

- Hydrography - DLG-3 Core retains basic surface water elements, including shorelines, rivers and streams, canals and ditches, lakes and ponds, and reservoirs.

  DLG-3 Core omits many constructed elements like flumes, wells, and spillways. It also omits flow direction for surface water elements. Swamps and surface water elevations are not collected. Most elements do not have descriptive information beyond the code that identifies the element type. For example, perennial, intermittent, and composition or water characteristics are not described.

- Transportation - This category of data consists of major transportation systems collected in three separate subcategories: (1) Roads and Trails, (2) Railroads, and (3) Pipelines, Transmission Lines, and Miscellaneous Transportation Features. DLG-3 Core retains the basic transportation network elements, including roads with route designators, railroads, airports, ferries, and tunnels. The road classification has been modified to meet the FHA Functional Highway Classification Scheme.

  DLG-3 Core omits many elements related to, but not actually a part of, the transportation network: weigh stations, cul-de-sacs, footbridges, and roundhouses. It also omits road-width information, pipelines, and transmission lines. Most elements do not have descriptive information beyond the code that describes the element type.

- Boundaries - DLG-3 Core retains most of the content described in DLG-3. The Boundaries category contains civil boundaries from the level of minor civil division to large publicly administered parcels like National and State forests and parks and large county and city parks.

- U.S. Public Land Survey System - DLG-3 Core retains most of the content described in DLG-3. The PLSS category contains a description of the rectangular system of surveys used in major parts of 30 states to reference parcels. This category only portrays the PLSS as a reference system. It does not contain information to the parcel level.

- Other Categories - The five other traditional DLG-3 categories will not be part of a DLG-3 Core data set. The Survey Control and Markers category, although an essential part of the framework, is eliminated because the National Geodetic Survey maintains a more complete and detailed database of that information. The Hypsography category is eliminated because digital elevation models are more flexible and better suit the needs of most users. The Vegetative Surface Cover, Nonvegetative Surface Cover, and Manmade Structures categories have been eliminated because the data do not provide a general reference for other data and there is little commonality among specific requirements for the data.

1.1.7 Data Sources

Digital line graph data are currently derived by digitizing map elements as line graph elements from cartographic source materials. The scale of the source materials 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) for each scale.

These data files are derived primarily from USGS topographic maps published as 7.5-minute quadrangles at 1:24,000- or 1:25,000-scale. Where 7.5-minute coverage is not available, the following sources are used, in order of preference:

- Advance manuscripts for 7.5-minute maps.
- Published 15-minute quadrangles at 1:63,360-scale (Alaska).
- Imagery and other ancillary sources.

1.1.8 Data Structure

The structure of the DLG data will be described by considering the following subject areas: topology, topological elements, and graph theory.

1.1.8.1 Topology

Data collection is directed toward producing fully topologically structured DLG-3 Core data. The DLG-3 concept is based on graph theory in which a two-dimensional diagram is expressed as a directed graph composed of a set of nodes (topologically significant points), lines, and areas 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 between map elements that are obvious when the map is examined visually. The spatial relationships include such concepts as adjacency and connectivity between elements 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 and analysis involving areas and lines and their spatial relationships.

1.1.8.2 Topological Elements

A DLG-3 file is composed of three separate, but related, elements: nodes, lines, and areas. Nodes define the location of the endpoints of every line, and a single node can mark the start or end of one or more lines. Thus, nodes occur at intersections of linear elements and at other places on linear elements where the element is subdivided into separate line segments.

A line is an ordered set of points that describe the position and shape of a linear elementon the map. Each line starts at a node, ends at a node, and has an area to the left and to the right of its direction of travel, which is arbitrarily determined at the time of data capture. Lines connect to each other at nodes, and a line does not cross itself or any other line. A line may describe the boundary between two areal map elements, such as counties, or it may define a map element by itself, such as a road.

A degenerate line is used to define elements symbolized as isolated (nonconnecting) point elements on a map. A degenerate line starts and ends at the same node, has two identical coordinate pairs, has zero length, and has the same area to the left and right of the direction of travel; that is, it is totally enclosed inside one map area. Topologically, a degenerate line is considered to be a fully connected line, because the attached node has a node-line list count of two. Topological symmetry would require a 'degenerate area' element; however, the node-area linkage can be determined through the line topology.

An area is a continuous, unbroken region of the map bounded by lines. In older DLG files, each area is identified in a DLG-3 data file by an arbitrary point chosen to represent the characteristics of the area; the point was not required to be inside the area it represents. However, files processed using the PROSIX DLG processing software have unique area points located inside the area they represent. Also, 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. Polygons as unique elements are not defined explicitly in a DLG file. However, polygons can be constructed using line-area linkages built into the DLG data structure.

1.1.9 Data Specifications

Specifications for DLG data will be described by considering the following subject areas: coordinate systems, cell size and extent, error definition, data quality, and distribution format.

1.1.9.1 Coordinate Systems

The positional descriptions for DLG data elements are expressed in one of several coordinate systems, dependent upon the distribution format selected.

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:

- The coordinate system is Cartesian.

- The origin (x = 0, y = 0) is at the center of the cell. Some older files will havetheir origin below and to the left of the lower left corner of the cell.
- The x axis of the coordinate system is parallel to a theoretical straight line connecting the southwest and southeast corners of the cell, and the y axis is perpendicular to that line.
- One unit is equal to 0.001 inch at map scale.
- The coordinate domain is limited to the range -32768 to +32767.

The file header contains the parameters of a transformation that can be used to convert the internal file coordinates to the ground coordinate system in Universal Transverse Mercator (UTM).

The DLG data in the optional distribution format are expressed in the units of the respective ground coordinate systems; that is, meters in the UTM system.

1.1.9.2 Cell Size and File Extent

In general, DLG-3 Core data are stored and distributed in standard cells of 7.5 minutes of latitude by 7.5 minutes of longitude. Nonstandard quadrangles, which have a neatline extended to accommodate overedge information, (for example, along national boundaries or in coastal areas) are collected as multiple 7.5-minute units.

Of the 1:24,000-scale data collected from 15-minute quadrangles, the majority are digitized as four 7.5-minute units and distributed in standard 7.5-minute cells. In Alaska, data digitized from 1:24,000- or 1:25,000-scale source material are stored in cells varying from 10 minutes to 18 minutes of longitude, by 7.5 minutes of latitude, depending on the latitude of the cell. Alaskan data digitized from 1:63,360-scale source material are stored in cells varying from 20 minutes to 36 minutes of longitude, by 15 minutes of latitude, depending on the latitude of the cell.

1.1.9.3 Error Definition

DLG data may contain errors of three types: blunders, which should be removed before entry into the data base; systematic errors, occurring in a system-specific or a procedure-specific pattern; and accidental errors, which are of a purely random nature and are completely unpredictable. Although all three types can be reduced in magnitude by refinements in technique and precision, they never can be completely eliminated.

Blunders

For DLG data, a blunder is an error of major proportions, often exceeding 0.009 inch (3 times the standard error) in the x or y component directions. This is the maximum error permitted for DLG data, and as such is easily identifiable. Moreover, a blunder is an indication that the data collection process has deteriorated beyond the level of simple systematic or random errors. Every effort is made to eliminate identifiable blunders during processing and quality-control operations. However, despite design precautions, some blunders may remain.

Systematic Errors

Systematic errors are those errors that are introduced by procedures or systems and typically are predictable but not easily correctable. These types of errors cause a bias or artifact in the final product, but they are generally not large enough to be classed as blunders. For DLG data, localized systematic errors could include artifacts, which are typical of raster-digitized data. Unidentified and uncorrected systematic errors are included in and contaminate the accuracy statistics used to describe the final DLG.

Random Errors

Random errors are those errors considered to be observational in nature or a result of limitations in measuring precision. They are caused by both system and human limitations. Random errors generally conform to a normal error distribution.

Standard Error

The standard error statistic is used to describe the horizontal accuracy of a DLG, encompassing both random and systematic errors introduced during production of the data. The standard error is computed in both x and y component directions.

Standard error (SE) for the x or y direction is defined as:

$$SE = \sqrt{\frac{\sum (S_i - S_t)^2}{n}}$$

where S_i = DLG x or y coordinate of a test point

S_t = true x or y coordinate of a test point

n = number of test points

The term S_t, "true" coordinate, refers to the "most probable" coordinate value, because values are normally derived from production map sources.

Accuracy is computed by comparison of the DLG coordinate with true coordinates that were derived with a higher order of accuracy. Test points should be well defined and

well distributed and have "true" coordinates with accuracies greater than the DLG accuracy criteria.

1.1.10 Data Quality

Five characteristics relating to digital data quality are included as sections of a quality report. The goal of this type of standard is to allow the user the freedom to evaluate the usefulness of the data for a given application, not to apply a quantitative threshold toward each characteristic. The quality of digital line graph data can be described in terms of the following five characteristics: lineage, positional accuracy, attribute accuracy, logical consistency, and completeness.

1.1.10.1 Lineage

Lineage data generally provide information on the source of the data file, collection procedures, processing steps, reference systems, projection transformation parameters, data resolution, and coordinate domain.

DLG data carry some lineage information in the header record for each file. Format specifications designate specific fields for lineage data elements (see appendixes 1.B and 1.C). Additionally, lineage data are described in related NMD technical instructions, such as procedure manuals and data users guides.

1.1.10.2 Positional Accuracy

DLG positional accuracy is based on the use of standard USGS graphic products as the fundamental source for initial loading of the NDCDB. These source graphics are normally compiled to meet National Map Accuracy Standards (see appendix 1.D), where 90 percent of well-defined test points are within 0.02 inches of true ground position at map scale. The DLG element positional error must be less than or equal to 0.003 inches in both the x and y component directions, relative to the source that was digitized.

Positional consistency of DLG elements that span quadrangle edges can be altered using edge alignment routines that result in "snapping" together corresponding node and line elements that are located within 0.02 inches of each other. The maximum positional adjustment for any node and associated line element would be 0.01 inches.

1.1.10.3 Attribute Accuracy

Data for a given category will contain attribute codes that reflect the information portrayed on the source, because DLG data represent the source graphic. All attribute

codes of DLG data in the NDCDB will agree within 98.5 percent with attribute codes as described in the *Standards for Digital Line Graphs, Part 3, Attribute Coding.*

1.1.10.4 Edge Matching

Edge matching ensures that features are matched in content, position, and attribution along a common edge. Edge matching is conducted interactively at the time of original compilation and during some revisions, using source materials for verification. Edge align software automatically compares position and attribution and aligns features that are within 0.02 inch of each other. Features that are out of tolerance and (or) have different attributes are identified.

Unrevised DLG's collected from source maps are processed through the edge align software for all edges internal to the project area and for all edges external to the project area if adjoining DLG data exist. (For external edges see section 1.1.10.5, REASON FLAG #8, for exceptions.) For both internal and external edges, the level of edge matching achieved on the source graphics is maintained; do not investigate or correct mismatches.

Revised DLG's are edge matched and aligned according to the instructions found in *Miscellaneous Instruction, Technical Criteria for Digital Revision and Product Generation, Part 1, Digital Line Graph Revision*.

1.1.10.5 Edge Align Status and Reason Flags

Information in the header of the DLG-3 Core indicates the status of the file with respect to the edge matching described above. The four status flags contain the status of the west, north, east, and south edges of a DLG as compared to the edges of the four adjoining DLG files. Each of the four flags is followed by a status reason code that explains the status of the four edges respectively.

The possible status values for a DLG-3 entered into the NDCDB are as follows:

(blank) = no reason code set ("unchecked" for some earlier data sets)
0 = passed edge match check
1 = alignment discontinuity
2 = attribute discontinuity
3 = attribute and alignment discontinuity

The possible reason codes are as follows:

(blank) = no reason code set (“unchecked” for some earlier data sets)
4 = adjacent data do not exist
5 = adjacent data unavailable
6 = temporal/source discontinuity

7 = mismatch valid

8 = paneling unauthorized

9 = processing software limitation

The following combinations of status flags and reason flags are currently valid for the processing software:

blank, blank	blank, 4	blank, 5	blank, 8
0, blank			
1,6	1,7	1,9	
2,6	2,7		
3,6	3,7		

The following is a brief explanation of the reason flags:

4 = adjacent data do not exist

This flag is used with a status flag of blank (unchecked). This combination exists primarily for file edges that are adjacent to areas unmapped within the series or scale of products being digitized; for example, coastal and international boundary locations. This flag is also used for PLSS file edges which border areas of the country not having PLSS information.

5 = adjacent data unavailable

This flag is used with a status flag of blank (unchecked). It is appropriate for edges adjacent to areas having similar source material and data categories, but which have not been digitized and archived. A reason code with the value of 5 may be reset as the adjoining data cell becomes available for edge match verification.

6 = temporal/source discontinuity

This flag indicates a discontinuity in classification or alignment between elements on adjacent DLG's that were digitized from map sources showing different information, or that were compiled or revised from sources having different dates. Mismatches can also occur because of changes in the standards and (or) in the processing software.

7 = mismatch valid

This reason flag applies in the case of a linear graph element ending precisely on the neatline or having a reasonable attribute value change as it crosses the neatline (for example, a road classification change).

8 = paneling unauthorized

This flag is used with the edge status flag of blank and indicates that no authorization was in place for edge matching at the time the data were archived. Paneling is not authorized for (1) adjoining DLG's on different horizontal datums, (2) Hydrography, when the adjoining DLG is on a different vertical datum, or (3) adjoining data that have not been processed successfully to a level 3 DLG using software developed after 1986, such as all Unified Cartographic Line Graph Encoding System (UCLGES) data (pre-1987) and TRANCON data.

9 = processing software limitations

This flag indicates that data have been matched and automatically aligned using the processing software. Mismatches occur because one file has been segmented owing to a processing software file size limitation. The edge align software is unable to distinguish between file segments that are intentionally devoid of data and file segments that are missing data in error. This flag is valid in situations where the mismatches are due only to software limitations. (Until this flag is added to PROSYS/PROSIX, use reason flag 7, mismatch valid, to explain mismatches caused by software file size limitations.

In the course of checking and aligning an edge, it is possible to encounter more than one reason for a mismatch status, such as both valid and temporal/source discontinuities. In such cases the reason flag must be set to indicate the "worst case," (that is, the reason indicating the most serious problem with the edge, which in most cases would require some degree of correction in the future). For the above example, the temporal/source discontinuity reason flag would be set in preference to the mismatch valid flag.

1.1.10.6 Logical Consistency

Logical consistency describes topological fidelity internal to a file. Certain node-area-line relationships are collected or generated to satisfy topological requirements. Some of these requirements include the following: lines begin and end at nodes, lines connect to each other at nodes, lines do not extend through nodes, left and right areas are defined for each line element and are consistent throughout the files, and the lines representing the limits of the file (neatline) are free of gaps.

1.1.10.7 Completeness

Completeness refers to the subset of elements or objects represented in the DLG in relation to the domain of core features portrayed on the source graphic.

1.1.11 Data Distribution Format

DLG data are available in optional distribution format, which was designed to facilitate data usage. The topological relationships explicitly encoded include starting node, ending node, area to the left of direction of travel, and area to the right of direction of travel for line elements, bounding lines for area elements, and bounded lines for node elements. These files are typically larger than those in the standard format but, for certain applications, can simplify processing requirements. For example, because topological linkages are explicitly encoded for all line, node, and area elements, a polygon data structure can be easily created. These linkages facilitate geographic information system (GIS) applications of DLG data as well as generation of graphic products.

See appendix 1.B for a summary of the format and record contents for the optional format.

See appendix 1.C for information on the map projection parameter fields included in the optional distribution format.

1.2 TEMPLATE DEVELOPMENT

The following information describes how the DLG-3 Core templates were compiled and how to use them.

Information contained in these templates was extracted from the National Mapping Program technical instructions, *Standards for Digital Line Graphs, Part 3: Attribute Coding; Standards for 1:24,000-Scale Digital Line Graphs and Quadrangle Maps, Part 2, Hydrography; Standards for 1:24,000-Scale Digital Line Graphs and Quadrangle Maps, Part 3, Transportation; Standards for 1:24,000-Scale Digital Line Graphs and Quadrangle Maps, Part 4, Boundaries; and Standards for 1:24,000-Scale Digital Line Graphs and Quadrangle Maps, Part 5, Public Land Survey System* with modifications to reflect the DLG-3 data model (elements linked to DLG-3 attribute codes in a nonelement-based system). The templates were prepared using the element names and attribute codes associated with those DLG-3 elements included in DLG-3 Core data. The elements are listed in alphabetical order.

"N/A" indicates that no applicable information beyond that defined in the rest of the template is needed.

Throughout the template, if something being described meets the definition and capture conditions of an element, the element name is capitalized. Generic descriptions of elements appear in lowercase type to indicate that they may not meet the definition of the element and should not be considered as that element.

The information contained in the feature templates includes all the information required to collect DLG-3 Core data.

1.2.1 Attribute Code Identification

The attribute information connects real world entities to DLG attribute codes and describes the element to be captured.

1.2.2 Delineation

The delineation describes what the edges of an element are and what to include in an element that meets capture conditions. The delineation generally describes real world entities.

1.2.3 Capture Conditions

The capture conditions describe when to capture an element. The capture conditions are the criteria used to determine if a specific instance of an element is captured. They are described in two parts; the first part lists the characteristics that affect the decision to capture the element, and the second part describes the capture conditions. An "If...Then" format is used.

1.2.4 Attribute Information

The attribute information section describes associated descriptive codes, or parameter codes that are required to be used with the primary code.

1.2.5 Representation Conditions

The representation conditions describe the dimensionality of the element in the DLG as a node, degenerate line, line, or area. If multiple representations are valid, the conditions describe when a specific dimensionality is appropriate.

1.2.6 Source Interpretation Guidelines

The source interpretation guidelines provide additional direction for interpreting the capture conditions for specific source materials or methods. They also contain any modifications to the capture conditions specific to source or capture methods.

1.2.6.1 All

The information in this section helps interpret the capture conditions regardless of the source or method used in data capture. Included are such things as when to capture a coincident element, a decision that is based on the capture conditions, and when to capture something as a different element and not as the element in the template.

1.2.6.2 Graphic

The information in this section helps interpret the capture conditions when the source is a map. Included are guidelines for interpreting the symbology for proper classification, delineation, and capture.

For DLG-3 Core, many elements appearing on the graphic are not captured in the data because DLG-3 Core is a subset of the original graphic content. The capture conditions tell when to capture an element from any source, and the source interpretation guidelines refine that for a graphic source.

Some capture conditions cannot be evaluated just by looking at the map. For example, when an element is represented with a point symbol and the capture conditions state a size requirement, it is not possible to evaluate the true size of the entity from the graphic. If compliance with the capture conditions cannot be determined, then the element is collected. Further evaluation as to whether the element meets capture conditions will be made at the time of revision.

In some cases, capture conditions require collection of elements whose symbology has been suppressed on the map. For example, PLSS lines dropped from the map because they are coincident with a boundary are still collected.

1.2.6.3 Revision

The information in this section helps interpret the capture conditions during revision. Modifications to the capture conditions may be made on the basis of the level of detail that has already been shown on the map or in the DLG-3 data.

Included in this section are guidelines for capturing data from an image, any specifically required information sources, and what, if any, instances of the element are not revised.

APPENDIX 1.A

DLG-3 to DLG-3 Core Crosswalk

The following table provides a guide to aid in the translation of DLG-3 codes to DLG-3 Core element codes. This table is intended only to direct the user to the appropriate element template and does not imply that the element indicated is the correct element in all cases. The user must rely on the element template to determine the correct element and its associated DLG-3 Core code.

The DLG-3 attribute codes are listed in numerical order within each of the DLG-3 Core categories. The information pertaining to DLG-3 Core is shown in bold type face on the table. The first column lists the DLG-3 attribute codes. The second column lists the names of the elements associated with the attribute codes. The third column lists the DLG-3 Core attribute code that is applied to a collected element. The word "No" in the third column means that the element associated with the DLG-3 code is not captured in DLG-3 Core. In some cases, an element associated with a DLG-3 code is collected as a different element in DLG-3 Core. When that occurs, the DLG-3 Core code is listed in the third column, and an explanation is mentioned in the fourth column. The fourth column also contains reminders that are intended to assist the user. However, for a complete set of attribute coding instructions, the user must rely on the element templates contained within the other parts of this standard.

DLG-3 Code	Name	DLG-3 Core Code	Remarks
HYDROGRAPHY			
000 0000	**Outside Area**	**000 0000**	
050 0000	**Photorevised Feature**	**050 0000**	**Used with another hydrography code when unrevised collection is done from a graphic only. Do not use in revision.**
050 0001	Upper Origin	No	
050 0002	Upper Origin at Water Body	No	
050 0003	Sink	No	
050 0004	Entering Water Body	No	
050 0005	Exiting Water Body	No	
050 0100	Alkali Flat	No	
050 0101	**Reservoir**	**050 0101**	**Includes aquaculture ponds (fish hatchery ponds, fish farms, fish ponds, minnow ponds, rearing ponds, and so on), industrial water impoundments, salt evaporators, settling basins, sewage disposal ponds, filtration plant basins, soda evaporators, tailings ponds, water storage basins, and other constructed basins. Does not include covered reservoirs.**
050 0102	Covered Reservoir	No	
050 0103	Glacier or Permanent Snow Field	No	
050 0104	Salt Evaporator	**050 0101**	**Collect as Reservoir.**
050 0105	Inundation Area	No	
050 0106	Aquaculture Pond	**050 0101**	**Collect as Reservoir.**
050 0107	Industrial Water Impoundment	**050 0101**	**Collect as Reservoir.**

DLG-3 Code	Name	DLG-3 Core Code	Remarks
050 0108	Area to be Submerged	No	
050 0109	Sewage Disposal Pond	**050 0101**	**Collect as Reservoir.**
050 0110	Tailings Pond	**050 0101**	**Collect as Reservoir.**
050 0111	Marsh, Wetland, Swamp or Bog	No	
050 0112	Mangrove Area	No	
050 0114	Cranberry Bog	No	
050 0115	Flat (Tidal, Sand, Gravel, Mud, etcetera)	No	
050 0116	**Bay, Estuary, Gulf, Ocean, or Sea**	**050 0116**	**Does not include bays in rivers or lakes.**
050 0117	Shoal	No	
050 0118	Soda Evaporator	**050 0101**	**Collect as Reservoir.**
050 0119	Duck Pond	**050 0101**	**Collect as Reservoir.**
050 0120	**Void Area**	**050 0120**	
050 0121	Obstruction Area in Water Area	No	
050 0122	Gut	No	
050 0123	Drydock Chamber	No	
050 0124	Filtration Pond	**050 0101**	**Collect as Reservoir.**
050 0125	Foul Ground	No	
050 0126	Mine Danger Area	No	
050 0200	**Shoreline**	**050 0200**	**Includes apparent shorelines and low-water lines. Does not include indefinite shorelines.**
050 0201	**Manmade Shoreline**	**050 0201**	
050 0202	**Closure Line**	**050 0202**	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
050 0203	**Indefinite Shoreline**	**050 0203**	
050 0205	Outline of a Carolina Bay	No	
050 0206	Limiting Danger Line	No	
050 0207	Apparent Shoreline	**050 0200**	**Collect as Shoreline.**
050 0208	Sounding Datum	No	
050 0209	Low-Water Line	No	
050 0210	Airboat Trail	No	
050 0299	Processing Line	No	
050 0300	Spring	No	
050 0301	Nonflowing Well	No	
050 0302	Flowing Well	No	
050 0303	Riser	No	
050 0304	Geyser	No	
050 0305	Windmill	No	
050 0400	Rapids	No	
050 0401	Falls	No	
050 0403	Gaging Station	No	
050 0404	Pumping Station	No	
050 0405	Water Intake	No	
050 0406	Dam or Weir	No	
050 0407	Lock Chamber	No	
050 0408	Spillway	No	
050 0409	Gate	No	
050 0410	Rock	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
050 0411	Crevasse	No	
050 0412	**Stream**	**050 0412**	**Includes ephemeral drains < 0.025" (50 ft) along shortest axis. Does not included braided streams.**
050 0413	**Braided Stream**	**050 0413**	
050 0414	**Ditch or Canal**	**050 0414**	**Includes aboveground aqueducts. Does not include ditches in cranberry bogs.**
050 0415	Aqueduct or Pipeline	**050 0414**	**Collect aboveground aqueducts as Ditch or Canal. Do not collect pipelines or underground aqueducts.**
050 0416	Flume	No	
050 0417	Penstock	No	
050 0418	Siphon	No	
050 0419	**Channel**	**050 0419**	**Does not include submerged streams in lakes, boat trails, or seaplane landing areas.**
050 0420	**Wash**	**050 0420**	**Includes dry washes, arroyos, dry gulches, and ephemeral drains ≥ 0.025" (50 ft) along the shortest axis. See Stream for ephemeral drains ≤ 0.025" (50 ft) along the shortest axis.**
050 0421	**Lake or Pond**	**050 0421**	**Includes gravel pits and quarries filled with water. Does not include dry lakes or constructed basins. See Reservoir for constructed basins.**
050 0422	Reef	No	
050 0423	Sand in Open Water	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
050 0424	Spoil Area, Dredged Area, or Dump Area	No	
050 0425	Fish Ladders	No	
050 0426	Holiday Area	No	
050 0601	Underground	No	
050 0602	**Overpassing**	**050 0602**	
050 0603	Elevated	No	
050 0604	Tunnel	No	
050 0605	Right Bank	No	
050 0606	Left Bank	No	
050 0607	Under Construction	No	
050 0608	Salt	No	
050 0609	Unsurveyed	No	
050 0610	Intermittent	No	
050 0612	Submerged or Sunken	No	
050 0614	Dry	No	
050 0615	Mineral or Hot	No	
050 0617	**Underpassing**	**050 0617**	
050 0620	Decimal Fractions of 0.0 Feet or Meters	No	
050 0621	Decimal Fractions of 0.1 Feet or Meters	No	
050 0622	Decimal Fractions of 0.2 Feet or Meters	No	
050 0623	Decimal Fractions of 0.3 Feet or Meters	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
050 0624	Decimal Fractions of 0.4 Feet or Meters	No	
050 0625	Decimal Fractions of 0.5 Feet or Meters	No	
050 0626	Decimal Fractions of 0.6 Feet or Meters	No	
050 0627	Decimal Fractions of 0.7 Feet or Meters	No	
050 0628	Decimal Fractions of 0.8 Feet or Meters	No	
050 0629	Decimal Fractions of 0.9 Feet or Meters	No	
050 0630	Boulders	No	
050 0631	Sand	No	
050 0632	Gravel	No	
050 0633	Rock (Flat or Reef)	No	
050 0634	Mud	No	
050 0635	Shell	No	
050 0636	Coral	No	
050 0637	Tide	No	
050 0639	Undredged	No	
051 ----	Water Surface Elevation, Whole Feet, 9999 or Less	No	
052 ----	Water Surface Elevation, Whole Meters	No	
054 ----	Water Surface Elevation, Whole Feet Greater Than 9999	No	
055 ----	River Mile Mark	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
056 ----	Water Surface Elevation, Whole Feet Below Datum	No	
057 ----	Water Surface Elevation, Whole Meters Below Datum	No	
TRANSPORTATION - Roads and Trails			
000 0000	**Outside Area**	**000 0000**	
170 0000	**Photorevised Feature**	**170 0000**	**Used with another road code when unrevised collection is done from a graphic only. Do not use in revision.**
170 0001	Bridge Abutment	No	
170 0002	Tunnel Portal	No	
170 0004	Gate	No	
170 0005	Cul-De-Sac	No	**Collect centerline of road as Road, if cul-de-sac is large enough to have an interior island.**
170 0007	Drawbridge	No	
170 0100	**Void Area**	**170 0100**	
	Road	**170 0200**	**This DLG-3 code is encoded in the first position on all roads, except for trails, road ferry crossings, and ramps in interchanges. It must be followed by one of the road classification descriptive codes (170 0630-170 0642).**
170 0201	Primary Route, Class 1, Symbol Undivided	**170 0200**	**Collect as Road.**
170 0202	Primary Route, Class 1, Symbol Divided by Centerline	**170 0200**	**Collect as Road.**

DLG-3 Code	Name	DLG-3 Core Code	Remarks
170 0203	Primary Route, Class 1, Divided, Lanes Separated	**170 0200**	**Collect as Road.**
170 0204	Primary Route, Class 1, One Way, Other Than Divided Highway	**170 0200**	**Collect as Road.**
170 0205	Secondary Route, Class 2, Symbol Undivided	**170 0200**	**Collect as Road.**
170 0206	Secondary Route, Class 2, Symbol Divided by Centerline	**170 0200**	**Collect as Road.**
170 0207	Secondary Route, Class 2, Symbol Divided, Lanes Separated	**170 0200**	**Collect as Road.**
170 0208	Secondary Route, Class 2, One Way, Other Than Divided Highway	**170 0200**	**Collect as Road.**
170 0209	Road, Class 3, Symbol Undivided	**170 0200**	**Collect as Road.**
170 0210	Road, Class 4	**170 0200**	**Collect as Road.**
170 0211	**Trail**	**170 0211**	**Includes old railroad grades. Does not include 4WD roads.**
170 0212	Road, Class 5, Four-Wheel-Drive Vehicle	**170 0200**	**Collect as Road, along with descriptive code 170 0642 (not classified).**
170 0213	Footbridge	No	
170 0214	**Road Ferry Crossing**	**170 0214**	
170 0217	Road or Street, Class 3, Symbol Divided by Centerline	**170 0200**	**Collect as Road.**
170 0218	Road, Class 3, Symbol Divided, Lanes Separated	**170 0200**	**Collect as Road.**
170 0219	Road, Class 4, One Way	**170 0200**	**Collect as Road.**
170 0221	Road, Class 3, One Way	**170 0200**	**Collect as Road.**

DLG-3 Code	Name	DLG-3 Core Code	Remarks
170 0222	Road in Transition	No	**Collect the centerline that continues through a road in transition as a Road.**
170 0223	Road in Service Facility, Rest Area, or Viewpoint	**170 0200**	**Collect as Road, if service facility, rest area, or viewpoint is large enough to have an interior island.**
170 0299	Processing Line	No	
170 0401	Traffic Circle	**170 0200**	**Collect the centerline as Road, if traffic circle is large enough to have an interior island.**
170 0402	**Ramp in Interchange**	**170 0402**	**Does not carry functional road class.**
170 0403	Tollgate	No	
170 0404	Weigh Station	No	**Collect centerline of road as Road, if weigh station is large enough to have an interior island.**
170 0405	Nonstandard Section of Road	No	**Collect the centerline that continues through a nonstandard section of road as a Road.**
170 0601	**In Tunnel**	**170 0601**	
170 0602	**Overpassing, On Bridge**	**170 0602**	
170 0603	Under Construction	No	
170 0605	Labeled "Old Railroad Grade"	**170 0211**	**Collect as Trail.**
170 0606	Submerged or in Ford	No	
170 0607	**Underpassing**	**170 0607**	
170 0609	Toll	No	
170 0610	Privately Operated or Restricted Use	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
170 0612	Double-Decked	No	
170 0614	Elevated	No	
170 0615	**Bypass**	**170 0615**	
170 0616	**Alternate**	**170 0616**	
170 0617	**Business**	**170 0617**	
170 0618	On Drawbridge	No	
170 0619	**Spur**	**170 0619**	
170 0620	**Loop**	**170 0620**	
170 0621	**Connector**	**170 0621**	
170 0622	**Truck Route**	**170 0622**	
170 0624	Covered Bridge	No	
	Rural Interstate	**170 0630**	**Codes 170 0630 - 170 0642 apply to the National Highway System functional road scheme.**
	Rural Principal Arterial	**170 0631**	**See note above.**
	Rural Minor Arterial	**170 0632**	**See note above.**
	Rural Major Collector	**170 0633**	**See note above.**
	Rural Minor Collector	**170 0634**	**See note above.**
	Rural Local	**170 0635**	**See note above.**
	Urban Interstate	**170 0636**	**See note above.**
	Urban Freeway or Expressway	**170 0637**	**See note above.**
	Urban Principal Arterial	**170 0638**	**See note above.**
	Urban Minor Arterial	**170 0639**	**See note above.**
	Urban Collector	**170 0640**	**See note above.**
	Urban Local	**170 0641**	**See note above.**

DLG-3 Code	Name	DLG-3 Core Code	Remarks
	Not Classified	**170 0642**	**See note above. Includes 4WD roads.**
170 0650	Road Width 0.025 Inch	No	
170 0651	Road Width 0.030 Inch	No	
170 0652	Road Width 0.035 Inch	No	
170 0653	Road Width 0.040 Inch	No	
170 0654	Road Width 0.045 Inch	No	
170 0655	Road Width 0.050 Inch	No	
170 0656	Road Width 0.055 Inch	No	
170 0657	Road Width 0.060 Inch	No	
170 0658	Road Width 0.065 Inch	No	
170 0659	Road Width 0.070 Inch	No	
172 ----	**Interstate Route Number**	**172 ----**	
173 ----	**U.S. Route Number**	**173 ----**	
174 ----	**State Route Number**	**174 ----**	
175 ----	**Reservation, Park, or Military Route Number**	**175 ----**	
176 ----	**County Route Number**	**176 ----**	
177 xxyy	**Alphabetic Portion of Any Route Number**	**177 xxyy**	
TRANSPORTATION - Railroads			
000 0000	**Outside Area**	**000 0000**	
180 0000	**Photorevised Feature**	**180 0000**	**Used with another railroad code when unrevised collection is done from a graphic only. Do not use in revision.**
180 0001	Bridge Abutment	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
180 0002	Tunnel Portal	No	
180 0007	Drawbridge	No	
180 0100	**Void Area**	**180 0100**	
180 0201	**Railroad**	**180 0201**	**Includes main lines, rapid transits, railroads in roads, and sidings or spurs. Does not include carlines, cog railroads, incline railways, logging trams, old railroad grades, aerial tramways, miniature/amusement park railways, or monorails. Rapid transits also carry descriptive code 180 0610.**
180 0202	Railroad in Road	**180 0201**	**Collect as Railroad.**
180 0204	**Carline**	**180 0204**	**Includes trolley and cable car tracks.**
180 0205	**Cog Railroad, Incline Railway, or Logging Tram**	**180 0205**	
180 0207	**Railroad Ferry Crossing**	**180 0207**	
180 0208	Railroad Siding	**180 0201**	**Collect as Railroad.**
180 0209	**Railroad Yard**	**180 0209**	
180 0299	Processing Line	No	
180 0400	Railroad Station	No	
180 0401	Turntable	No	
180 0402	Roundhouse	No	
180 0601	**In Tunnel**	**180 0601**	
180 0602	**Overpassing, On Bridge**	**180 0602**	
180 0605	**Underpassing**	**190 0605**	
180 0606	Narrow Gauge	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
180 0609	Elevated	No	
180 0610	**Rapid Transit**	**180 0610**	**Used with railroad code 180 0201.**
180 0611	On Drawbridge	No	
180 0612	Private	No	
180 0613	U.S. Government	No	
181 ----	Number of Tracks	No	
TRANSPORTATION - Pipelines, Transmission Lines, and Miscellaneous Transportation Features			
000 0000	**Outside Area**	**000 0000**	
190 0000	**Photorevised Feature**	**190 0000**	**Used with another miscellaneous transportation code when unrevised collection is done from a graphic only. Do not use in revision.**
190 0100	**Void Area**	**190 0100**	
190 0201	Pipeline	No	
190 0202	Power Transmission Line	No	
190 0203	Telephone Line	No	
190 0207	Aerial Tramway	No	
190 0208	Monorail	No	
190 0209	Ski Lift	No	
190 0299	Processing Line	No	
190 0400	Power Station or Power Plant	No	
190 0401	Substation	No	
190 0402	Hydroelectric Plant	No	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
190 0403	**Landing Strip, Runway, Apron, Taxiway**	**190 0403**	**Does not include helipads, seaplane landing areas, or seaplane ramps.**
190 0404	**Helipad**	**190 0404**	
190 0405	Launch Complex	No	
190 0406	Pumping Station or Compressor Station	No	
190 0408	Measuring Station or Valve Station	No	
190 0409	Seaplane Ramp	No	
190 0410	Seaplane Landing Area	No	
190 0601	Under Construction	No	
190 0602	Abandoned	No	
190 0603	Aboveground	No	
190 0605	Unpaved	No	
190 0606	Submerged	No	
190 0607	Nuclear	No	
BOUNDARIES			
000 0000	**Outside Area**	**000 0000**	
090 0000	Photorevised Feature	No	
090 0001	**Boundary Monument**	**090 0001**	
090 0100	**Civil Township, District, Precinct, or Barrio**	**090 0100**	
090 0101	**Incorporated City, Village, Town, Borough, or Hamlet**	**090 0101**	
090 0103	**National Park**	**090 0103**	
090 0104	**National Forest**	**090 0104**	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
090 0105	**National Wildlife Area**	**090 0105**	
090 0106	**National Wilderness Area**	**090 0106**	
090 0107	**Indian Reservation**	**090 0107**	
090 0108	**Military Reservation**	**090 0108**	
090 0110	**Federal Prison**	**090 0110**	
090 0111	**Miscellaneous Federal Reservation**	**090 0111**	
090 0129	**Miscellaneous State Reservation**	**090 0129**	
090 0130	**State Park**	**090 0130**	
090 0131	**State Wildlife Area**	**090 0131**	
090 0132	**State Forest**	**090 0132**	
090 0133	**State Prison**	**090 0133**	
090 0134	**Miscellaneous County Reservation**	**090 0134**	
090 0135	Ahupuaa (Hawaii)	No	
090 0136	Hawaiian Homestead	No	
090 0150	**Large Park**	**090 0150**	**Use for city, county, or regional parks ≥ 0.5 square miles in total area. Do not collect private parks.**
090 0151	Small Park (City, County, or Private)	No	
090 0197	**Canada**	**090 0197**	
090 0198	**Mexico**	**090 0198**	
090 0199	**Open Water**	**090 0199**	
090 0201	**Indefinite or Approximate Boundary**	**090 0201**	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
090 0202	**Disputed Boundary**	**090 0202**	
090 0203	**Historical Line**	**090 0203**	
090 0204	**Boundary Closure Line**	**090 0204**	
090 0299	Processing Line	No	
090 0301	**Reference Monument for Boundary Point**	**090 0301**	
091 00--	**State or State Equivalent FIPS Code**	**091 00--**	
092 0---	**County or County Equivalent FIPS Code**	**092 0---**	
093 00--	**Civil Township or Civil Township Equivalent FIPS Code, First Two Digits**	**093 00--**	
094 0---	**Civil Township or Civil Township Equivalent FIPS Code, Last Three Digits**	**094 0---**	
095 ----	**Monument Number**	**095 ----**	
096 xxyy	**Alphabetic Portion of Any Monument Number**	**096 xxyy**	
U.S. PUBLIC LAND SURVEY SYSTEM			
000 0000	**Outside Area**	**000 0000**	
300 0001	**Found PLSS Section Corner**	**300 0001**	
300 0004	**Meander Corner**	**300 0004**	
300 0007	**Witness Corner**	**300 0007**	
300 0008	**Witness Point**	**300 0008**	
300 0009	**Angle Point**	**300 0009**	
300 0010	**Amended Monument**	**300 0010**	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
300 0012	**Found Quarter-Section Corner**	**300 0012**	
300 0014	**Land Grant or Other Special Survey Corner**	**300 0014**	
300 0101	**Homestead Entry Survey**	**300 0101**	
300 0102	**Donation Land Claims**	**300 0102**	
300 0103	**Land Grant**	**300 0103**	
300 0104	**Private Extension of Public Land Survey**	**300 0104**	
300 0105	**Area of Public and Private Survey Overlap**	**300 0105**	
300 0106	**Overlapping Land Grants**	**300 0106**	
300 0108	**Private Survey in Ohio**	**300 0108**	
300 0110	**PLSS Area**	**300 0110**	
300 0111	**Tract**	**300 0111**	
300 0112	**U.S. Survey**	**300 0112**	
300 0113	**Indian Allotment**	**300 0113**	
300 0114	**Area Outside of the Public Domain**	**300 0114**	
300 0198	**Water**	**300 0198**	
300 0201	**Approximate Position**	**300 0201**	
300 0202	**Protracted Position**	**300 0202**	
300 0203	**Closure Line**	**300 0203**	
300 0299	Processing Line	No	
300 0300	**Location or Mineral Monument**	**300 0300**	
300 0301	**Isolated Found Section Corner**	**300 0301**	
300 0600	**Connecticut Western Reserve**	**300 0600**	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
300 0601	Virginia Military District	300 0601	
300 0602	Ohio Company Purchase	300 0602	
300 0603	Symmes Purchase	300 0603	
300 0604	French Grants	300 0604	
300 0605	Donation Tract	300 0605	
300 0606	Old Seven Ranges	300 0606	
300 0607	Congress Lands North of Old Seven Ranges	300 0607	
300 0608	Congress Lands East of Scioto River	300 0608	
300 0609	Between the Miamis, North of Symmes Purchase	300 0609	
300 0610	West of the Great Miami	300 0610	
300 0612	Refugee Lands	300 0612	
300 0625	Fraction One-Half for Land Grant Corner, Monument or Section Number, or Nonsection Identifier	300 0625	
301 xyyy	Section Number	301 xyyy	
302 ----	Township Number North of the Baseline	302 ----	
303 ----	Township Number South of the Baseline	303 ----	
304 ----	Range Number East of Principal Meridian	304 ----	
305 ----	Range Number West of Principal Meridian	305 ----	
306 00xx	Origin of Survey	306 00xx	

DLG-3 Code	Name	DLG-3 Core Code	Remarks
307 xyyy	**Identifier, Nonsection**	**307 xyyy**	
308 xxxx	**Land Grant, Location or Mineral Monument Number**	**308 xxxx**	

APPENDIX 1.B

Optional DLG Distribution Format

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

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

The following are considered header records:

- File identification and description records (variable record formats)
- Accuracy/miscellaneous records (not currently used)
- Control-point identification records
- Data-category identification records

The following are considered data records:

- Node and area identification records
- Node-to-area linkage records*
- Node-to-line linkage records
- Area-to-line linkage records
- Area-to-node linkage records*
- Line identification records
- Coordinate string records (lines)
- Coordinate string records (areas)*
- Attribute code records
- Text records (not currently used)

*Data distributed in optional format from the NDCDB will not contain these data records.

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-area linkage record(s)*
      Node-to-line linkage record(s) }Repeated for each node within a data category.
      Attribute code record(s)
      Text record(s)

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

   Line identification record
      Coordinate string record(s)
      Attribute code record(s) }Repeated for each line within a data category.
      Text record(s)

*Data distributed in optional format from the NDCDB will not contain these records.

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

FILE IDENTIFICATION AND DESCRIPTION RECORDS

Record Number	Data Element	Contents	Type (Fortran Notation)	Starting Format	Ending Byte	Byte*	Comment
1	1	Banner	ALPHA	A72	1	72	" ***DLG-OPTIONAL FORMAT PRODUCED BY USGS PROSYS RELEASE x.x.x *** "
2	1	Name of digital cartographic unit	ALPHA	A40	1	40	The name of the digital data cell followed by the State two-character designators, separated by hyphens.
---	---	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.
2	3	Date qualifier	ALPHA	A1	52	52	Qualifier to discriminate revision date if present. (P=photorevision, I=photo-inspection, L=limited revision, D=digital revision).
2	4	Scale of original source material	INTEGER*4	I8	53	60	Scale denominator of source material; for example, 24000, 100000, or 2000000.

(Record 2, data element 5 and Record 3, data elements 1 through 18 apply to 24K and 100K data files only. These fields contain filler in 2M data files.)

Record Number	Data Element	Contents	Type (Fortran Notation)	Starting Format	Ending Byte	Byte*	Comment
---	---	Filler	---	---	61	63	3 spaces

*The logical record length for the optional distribution format is 80 bytes, with 8 spaces of blank fill-in bytes 73-80 of each record, which may be used for a record sequence number.

FILE IDENTIFICATION AND DESCRIPTION RECORDS-continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
3	4	Smallest primary contour interval	ALPHA	A4	52	55	Smallest or only primary contour interval, followed by the interval unit as described above (selected categories).
3	5	Comma	ALPHA	A1	56	56	Comma separator
3	6	Smallest primary bathymetric contour interval	ALPHA	A4	57	60	Smallest or only primary bathymetric contour interval, followed by the interval unit as described above (selected categories).
3	7-9	Coded Flags	ALPHA	A1	61	63	3 flags for future use
3	10	Coded Flag	ALPHA	A1	64	64	Database coded edge flag for internal NMD use.
3	11	EDGEWS	ALPHA	A1	65	65	Status flag for west edge, values are: b=unchecked, 0=passed, 1=alignment discontinuity, 2=attribute discontinuity, 3=attribute and alignment discontinuity.
3	12	EDGEWR	ALPHA	A1	66	66	Reason for EDGEWS, values are: b=no problem, 4= adjacent data do not exist, 5=adjacent data unavailable, 6=temporal/source discontinuity, 7=mismatch valid, 8=paneling unauthorized, 9=processing software limitations.

FILE IDENTIFICATION AND DESCRIPTION RECORDS-continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
2	5	Sectional indicator (100K files)	ALPHA	---	64	66	Codes S, F, or T for size of section, plus sequence number.
---	---	Filler	---	---	67	72	6 spaces
---	---	Filler	---	---	1	41	41 spaces
3	1	Largest primary contour interval	ALPHA	A4	42	45	Largest primary contour interval, followed by the interval unit (1=feet, 2=meters). Present only if two or more primary intervals exist. (selected categories)
3	2	Comma	ALPHA	A1	46	46	Comma separator
3	3	Largest primary bathymetric contour interval	ALPHA	A4	47	50	Largest primary bathymetric interval, followed by the interval unit (1=feet, 2=meters, 3=fathoms). Present only if two or more primary intervals exist. (selected categories)
---	---	Filler	---	--	51	51	1 space

FILE IDENTIFICATION AND DESCRIPTION RECORDS-continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
3	13	EDGENS	ALPHA	A1	67	67	Status flag for north edge, values are b,0,1,2, or 3 as above.
3	14	EDGENR	ALPHA	A1	68	68	Reason for EDGENS, values are b,4,5,6,7,8 or 9 as above.
3	15	EDGEES	ALPHA	A1	69	69	Status flag for east edge, values are b,0,1,2, or 3 as above.
3	16	EDGEER	ALPHA	A1	70	70	Reason for EDGEES, values are b,4,5,6,7,8 or 9 as above.
3	17	EDGESS	ALPHA	A1	71	71	Status flag for south edge, values are b,0,1,2, or 3 as above.
3	18	EDGESR	ALPHA	A1	72	72	Reason for EDGESS, values are b,4,5,6,7,8 or 9 as above.
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	[1]Code=1 UTM (24K and 100K), Code=3 Albers Conical Equal Area (2M files)
4	3	Code defining zone in ground planimetric reference system	INTEGER*2	I6	13	18	[1]Code for appropriate UTM zone (24K or 100K files), Code=9999 for 2M files

[1]See General Purpose Transformation Package software documentation for additional information.

* Listed values reflect current NMD standard.

FILE IDENTIFICATION AND DESCRIPTION RECORDS-continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	4	Code defining units of measure for ground planimetric coordinates throughout the file	INTEGER*2	I6	19	24	[1]Code=2, meters
4	5	Resolution	REAL*4	D18.11	25	42	The true ground distance corresponding to 0.001 inch at map scale. Scale / Resolutions 1:24,000 0.61 M 1:25,000 0.635 M 1:48,000 1.22 M 1:62,500 1.587 M 1:63,360 1.61 M 1:100,000 2.54 M 1:250,000 6.35 M 1:2,000,000 50.80 M
4	6	Number of file-to-map transformation parameters	INTEGER*2	I6	43	48	number=4
4	7	Number of accuracy/miscellaneous records	INTEGER*2	I6	49	54	Currently=0, none included
4	8	Number (n) of control points	INTEGER*2	I6	55	60	n=4 These points are usually, but not always, a definition of the file coverage.

[1]See General Purpose Transformation Package software documentation for additional information.

* Listed values reflect current NMD standard.

FILE IDENTIFICATION AND DESCRIPTION RECORDS-continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
4	9	Number (q) of categories in the DLG file	INTEGER*2	I6	61	66	* q=1
4	10	Horizontal Datum	INTEGER*2	I3	67	69	Horizontal Datum of DLG 'b' or 0 = NAD 27 1 = NAD 83 2 = Puerto Rico 3 = Old Hawaiian 4 = Local (Astro)
4	11	Vertical Datum	INTEGER*2	I3	70	72	Vertical Datum of DLG 'b' or 0 = NGVD 29 1 = NAVD 88 2 = Local Mean Sea Level
5-9	1	Projection parameters for map transformation	REAL*8	3D24.15	1	72	Three parameters on each of 5 records (see Appendix 1.C).
10	1	Internal file-to-map projection transformation parameters	REAL*4	4D18.11	1	72	X, Y coordinates resulting this transformation will be expressed in the appropriate ground planimetric coordinate system. If the x, y coordinates are already in the ground coordinate system, the projection parameters will be: A1=1.0, A2=0.0, A3=0.0, and A4=0.0.

* Listed values reflect current NMD standard.

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	A6	1	6	"SW," "NW," "NE," or "SE" for four quadrangle corners. Field is padded with trailing blanks.
	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	X coordinate	REAL*4	F12.2	37	48	In units in the appropriate zone of the ground plani-metric coordinate system.
	5	Y coordinate	REAL*4	F12.2	49	60	In units in the appropriate zone of the ground plani-metric coordinate system.
---	---	Filler	---	---	61	72	12 spaces

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 to USGS/NMD data.
	2	Attribute format codes	INTEGER*2	I4	21	24	Blank or zero (0) indicates default (2I6) attribute formatting in major-minor pairs.
	3	Highest node identification number	INTEGER*2	I6	25	30	Number of nodes referenced in the file.
	4	Actual number of nodes in file	INTEGER*2	I6	31	36	Only if the DCF is not packed, and the element ID numbers not compressed, will 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	*0=node-area list not included, 1=node-area list included.
	6	Presence of node-to-line linkage records	INTEGER*2	I1	39	39	0=node-line list not included, *1=node-line list included.
	---	Filler	---	---	40	40	1 zero or space

* Values marked are values from data distributed from the NDCDB.

DATA CATEGORY IDENTIFICATION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	7	Highest area ID number	INTEGER*2	I6	41	46	Number of areas referenced in the file.
	8	Actual number of areas in file	INTEGER*2	I6	47	52	Only if the DCF is not packed, and the element ID numbers not compressed, will this number be different from data element 7.
	---	Filler	---	---	53	53	1 space
	9	Presence of area-to-node linkage records	INTEGER*2	I1	54	54	*0=area-node list not included, 1=area-node list included.
	10	Presence of area-to-line linkage records	INTEGER*2	I1	55	55	0=area-line list not included, *1=area-line list included.
	11	Presence of area-coordinate lists	INTEGER*2	I1	56	56	*0=area coordinates not included, 1=area coordinates included
	12	Highest line identification number	INTEGER*2	I6	57	62	Number of lines referenced in the file.

* Values marked are values for data distributed from the NDCDB.

DATA CATEGORY IDENTIFICATION RECORDS--continued

Record Number	Data Element	Contents	Type (Fortran Notation)	Format	Starting Byte	Ending Byte	Comment
1-q	13	Actual number of lines in file	INTEGER*2	I6	63	68	Only if the DCF is not packed, and the element ID numbers not compressed, will this number be different from data element 12.
	---	Filler	---	---	69	71	3 spaces
	14	Presence of line-coordinate lists	INTEGER*2	I1	72	72	0=line coordinates not included, *1=line coordinate list included.

* Values marked are values for data distributed from the NDCDB.

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	Number is positive and seq- uential from 1-n within each element type, where n is the highest element ID number.
	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 a node list (for areas)	INTEGER*2	I6	31	36	
	5	Number of elements in line list	INTEGER*2	I6	37	42	Number of line segments that intersect at the node or, for areas, line segments plus number of islands.
	6	Number of x,y or lat-long points in area-coordinate list	INTEGER*2	I6	43	48	For area records only, blank for node records.
	7	Number of attribute code pairs listed	INTEGER*2	I6	49	54	
	8	Number of text characters listed	INTEGER*2	I6	55	60	Zero (0). There are no text attributes for DLG data.
	9	Number of islands within area	INTEGER*2	I6	61	66	For area records only, blank for node records.
---	---	Filler	---	---	67	72	6 spaces

NODE-TO-AREA LINKAGE RECORDS

FORTRAN FORMAT (12I6), for each node: The list consists of area internal ID numbers (which appear in bytes 2-6 of the area identification records) of all the areas that are adjacent to that node. There is no logical order to the list.

NODE-TO-LINE LINKAGE RECORDS

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

AREA-TO-NODE LINKAGE RECORDS

FORTRAN FORMAT (12I6), for each area: The list consists of node internal ID numbers (which appear in bytes 2-6 of the node identification records) of all nodes that are adjacent to that area. For those areas with islands, the number zero, used as a delimiter, marks the beginning of each island sublist. The format of this list is the same as the area-line list below.

AREA-TO-LINE LINKAGE RECORDS

FORTRAN format (12I6), for each area: The list consists of line internal ID numbers (which appear in bytes 2-6 of the line identification records) ofall lines that bound that area and lines that are adjacent to an area. For those areas with islands (indicated by bytes 61-66 of the area's first record), the number zero, used as a delimiter, marks the beginning of islands. Lines with this area to the right are included as positive ID numbers. Lines 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). The number zero is inserted in the list before each island sublist. Lines that do not contribute to the effective boundary of the area (those having both their area left and right assigned to the same area) are not considered bounding lines. Therefore, these lines, while still present in the file, will not be referenced in the area-to-line linkage records.

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	Number is positive and sequential from 1-n within each element type, where n is the highest element ID number.
	3	Starting node		I6	7	12	Internal ID number. Refers to data element 2 of the node identification record.
	4	Ending node		I6	13	18	Internal ID number. Refers to data element 2 of the node identification record.
	5	Left area		I6	19	24	Internal ID number. Refers to data element 2 of the area identification record.
	6	Right area		I6	25	30	Internal ID number. Refers to data element 2 of the area identification record.
	---	Filler		---	31	42	12 spaces
	7	Number of x,y coordinate pairs listed		I6	43	48	Number of coordinate pairs listed.
	8	Number of attribute code pairs listed		I6	49	54	
	9	Number of text characters listed		I6	55	60	Zero (0). There are no text attributes for DLG data.

LINE COORDINATE STRING RECORDS

FORTRAN format (3(2F12.2)): The coordinates are in appropriate units in the designated ground planimetric coordinate system (usually meters in UTM) or in internal file units.

CODE RECORDS

As major-minor code attribute 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.

AREA COORDINATE STRING RECORDS

FORTRAN FORMAT (3(2F12.2)): The last data element in the area identification record contains the number of islands within the area. If this number is greater than zero, the following convention applies to the area coordinate list:

> The coordinates of the outside boundary of the area are listed first. The first coordinate of the outside boundary is repeated to signal the closure of this ring. Next, the coordinates of one of the islands are listed. The first coordinate of this boundary is repeated, again signaling the end of this ring. Next, the first coordinate of the outside boundary is listed as a ring delimiter. This process is repeated until the coordinates of the boundaries of all the islands are listed. The coordinates in this list are ordered so that the area being referenced is always to the right of the boundary described by the sequence of coordinates. Therefore, the list is ordered clockwise around the perimeter of the area and counterclockwise around each island, if any. The common coordinates between adjacent ring lines are only listed once, except for the beginning and ending of a ring.

EXAMPLE 1: (A diagram illustrating this example may be found following the text.)

Area line list (for area 41): 10, 11, -12, 0, 14, -15, 0, -18, 0, -82, -84, 21

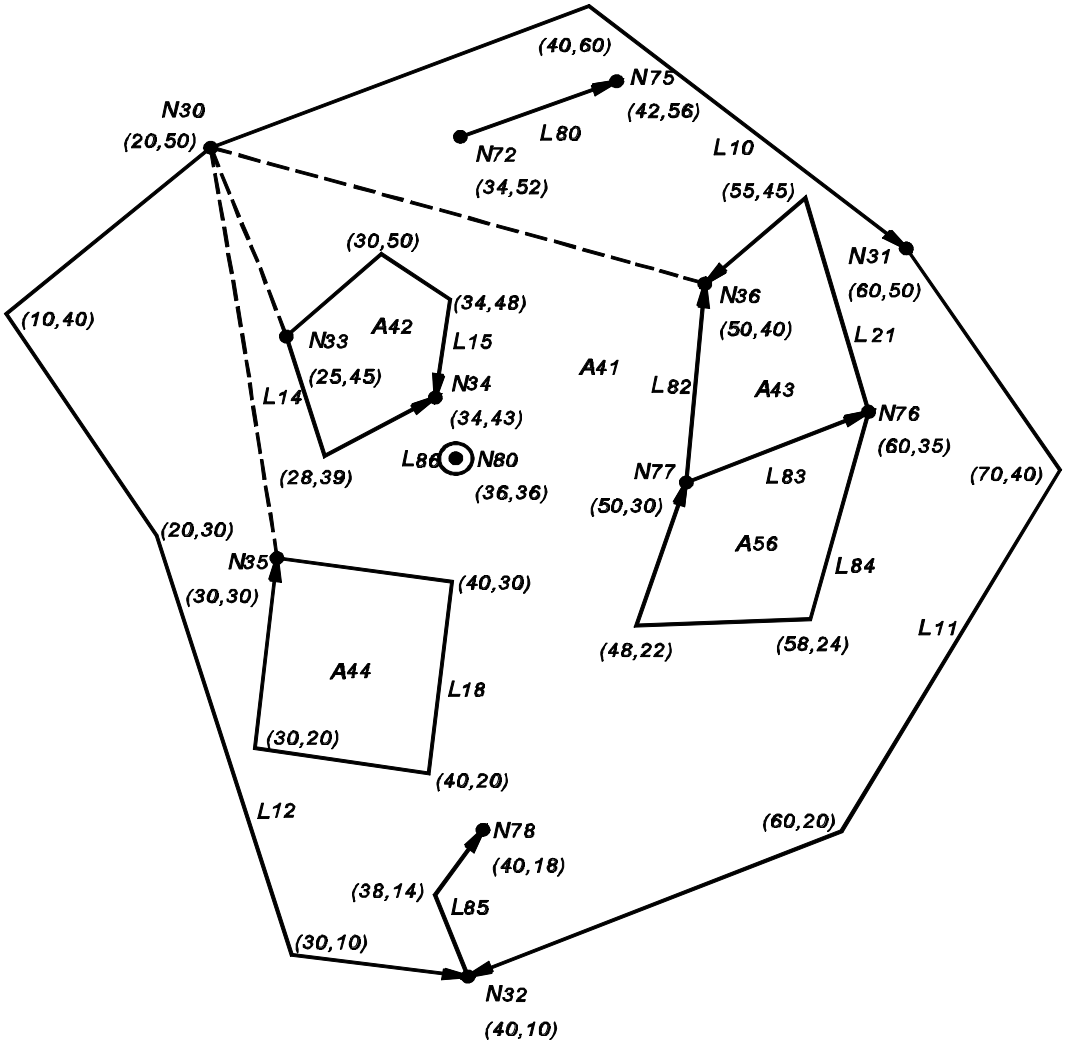
Area node list (for area 41): 30, 31, 32, 0, 33, 34, 0, 35, 0, 36, 77, 76

Area coordinate list explanation:

```
     o  Outside ring coordinates:
        (20, 50), (40, 60), (60, 50), (70, 40), (60, 20), (40, 10), (30, 10), (20, 30), (10, 40), (20, 50)  starting point
        [                   (      ]                      [      )                                    ]  of outside ring

                    L10                          L11                                  L12                 separate rings

     o  1st island ring coordinates:
        (25, 45), (28, 39), (34, 43), (34, 48), (30, 50), (25, 45), (20, 50)          ring closes       first coordinate
        [                   (     ]                                  )                itself            in outside ring
                                                                                                          delimiter
                 L14                          L15

     o  next island ring coordinates:
        (30, 30), (30, 20), (40, 20), (40, 30), (30, 30), (20, 50)      ring delimiter
        [                                              ]

                             L18

     o  last island ring coordinates:
        (50, 40), (50, 30), (48, 22), (58, 24) (60, 35), (55, 45), (50, 40), (20, 50)     ring delimiter must be
        [         (       ]                    [       )                    ]             present at end of list if
                                                                                           islands are present
                L82                 L84                       L21
```

Note: Since lines 80, 85, and 86 have area 41 as both their area left and area right, they are not considered "boundaries" of area 41. Therefore, they are not used to build the area line list, area node list, or area coordinate list for this area.

Complete area coordinate list:
(20, 50), (40, 60), (60, 50), (70, 40), (60, 20), (40, 10), (30, 10), (20, 30), (10, 40), (20, 50),
(25, 45), (28, 39), (34, 43), (34, 48), (30, 50), (25, 45), (20, 50),
(30, 30), (30, 20), (40, 20), (40, 30), (30, 30), (20, 50),
(50, 40), (50, 30), (48, 22), (58, 24), (60, 35), (55, 45), (50, 40), (20, 50)


(40,60)
N75
(42,56)
N30
(20,50)
L80
N72
(34,52)
L10
(55,45)
N31
(60,50)
(30,50)
(34,48)
N36
(50,40)
(10,40)
N33
A42
L15
L21
A41
(25,45)
L82
A43
L14
N34
(34,43)
N76
(60,35)
L86
N80
(36,36)
N77
L83
(70,40)
(28,39)
(50,30)
(20,30)
A56
N35
L84
(40,30)
(30,30)
L11
(48,22)
(58,24)
A44
L18
(30,20)
(40,20)
L12
(60,20)
N78
(40,18)
(38,14)
L85
(30,10)
N32
(40,10)

APPENDIX 1.C

Map Projection Parameters

The optional DLG distribution format includes fifteen fields reserved for map projection parameters. These parameters are typically used as input for a coordinate transformation package such as the USGS General Cartographic Transformation Package (GCTP).

The ground coordinate system for large scale DLG's is the Universal Transverse Mercator (UTM) projection system. The UTM coordinate system uses only the first two of the fifteen parameter fields as follows:

1. Longitude of the center of the DLG cell.
2. Latitude of the center of the DLG cell.
3-15. Not used (=0).

A transformation to or from UTM using GCTP can be controlled by specifying the UTM zone or by supplying the geographic coordinates of any point in the zone (from which the UTM zone is computed by GCTP) in parameters 1 and 2. The DLG header, however, requires both the zone and the coordinates of the center point of the DLG. The codes for UTM coordinate zones are as follows:

West longitude (degrees)	Zone
180 - 174	1
174 - 168	2
168 - 162	3
162 - 156	4
156 - 150	5
150 - 144	6
144 - 138	7
138 - 132	8
132 - 126	9
126 - 120	10
120 - 114	11
114 - 108	12
108 - 102	13
102 - 96	14
96 - 90	15
90 - 84	16
84 - 78	17
78 - 72	18
72 - 66	19
66 - 60	20

In any scale DLG file, the parameters are encoded as packed, degrees-minutes-seconds (DMS) as follows:

degrees * 1000000 + minutes * 1000 + seconds

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 1.D

U.S. National Map Accuracy Standards

With a view to the utmost economy and expedition in producing maps which fulfill not only the broad needs for standard or principal maps, but also the reasonable particular needs of individual agencies, standards of accuracy for published maps are defined as follows:

1. Horizontal accuracy. For maps on publication scales larger than 1:20,000, not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale; for maps on publication scales of 1:20,000 or smaller, 1/50 inch. These limits of accuracy shall apply in all cases to positions of well-defined points only. Well-defined points are those that are easily visible or recoverable on the ground, such as the following: monuments or markers, such as bench marks, property boundary monuments; intersections of roads, railroads, etc.; corners of large buildings or structures (or center points of small buildings); etc. In general what is well defined will also be determined by what is plottable on the scale of the map within 1/100 inch. Thus while the intersection of two road or property lines meeting at right angles would come within a sensible interpretation, identification of the intersection of such lines meeting at an acute angle would obviously not be practicable within 1/100 inch. Similarly, features not identifiable upon the ground within close limits are not to be considered as test points within the limits quoted, even though their positions may be scaled closely upon the map. In this class would come timber lines, soil boundaries, etc.

2. Vertical accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10 percent of the elevations tested shall be in error more than one-half the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

3. The accuracy of any map may be tested by comparing the positions of points whose locations or elevations are shown upon it with corresponding positions as determined by surveys of a higher accuracy. Tests shall be made by the producing agency, which shall also determine which of its maps are to be tested, and the extent of such testing.

4. Published maps meeting these accuracy requirements shall note this fact on their legends, as follows: "This map complies with National Map Accuracy Standards."

5. Published maps whose errors exceed those previously stated shall omit from their legends all mention of standard accuracy.

6. When a published map is a considerable enlargement of a map drawing (manuscript) or of a published map, that fact shall be stated in the legend. For example, "This map is an enlargement of a 1:20,000-scale map drawing," or "This map is an enlargement of a 1:24,000-scale published map."

7. To facilitate ready interchange and use of basic information for map construction among all Federal mapmaking agencies, manuscript maps and published maps, wherever economically feasible and consistent with the uses to which the map is to be put, shall conform to latitude and longitude boundaries, being 15 minutes of latitude and longitude, or 7.5 minutes, or 3-3/4 minutes in size.

U.S. Bureau of the Budget
Issued June 10, 1941
Revised April 26, 1943
Revised June 17, 1947