Forest Service Handbook
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Forest Service Handbook 7109.13a – Geometronics Handbook
Chapter 40 - Automated Cartography

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Approved by: Susan M. Super, Acting Service-wide Directive Manager

Date approved: March 5, 2003

Responsible Staff:

Explanation of changes: Following is an explanation of the changes throughout the directive by section.

7109.13a: This is a technical amendment that converts the format and style of this Forest Service Handbook (FSH) title (previously in "Applixware") to the new FSH template using the agency's current corporate word processing software. Where chapters were previously organized into more than one document, they are now merged into one chapter whenever possible.

Although some minor typographical and technical errors have been corrected, this amendment contains no changes to the substantive direction in this Handbook.

Table of Contents

41 - Digital Mapping Systems

The Forest Service collects data from its Primary Base Series/Single Edition Quadrangle maps to create a digital database for map production. This digital database also supports the National Geographic Information System (GIS) Plan and the National Digital Cartographic Data Base (NDCDB). The planimetric data files, known as Cartographic Feature Files (CFF), provide a standard template or base of known accuracy for registration of resource data layers in GIS. Digital base series layers include: transportation features, drainage courses and surface water locations, political and administrative boundaries, Public Land Survey System (PLSS), Forest Service and other land ownership, and other cultural features. These layers are included in the CFF; however, the contour and elevation data are provided by the Digital Elevation Models (DEM) system (sec. 42.2).

Use this chapter in conjunction with "Cartographic Specifications and Symbols," EM-7140-24, chapter 6, section 18, CFF Digitizing Guide (sec. 06.3).

42 - Standards for Digital Cartographic Data

42.1 - Cartographic Feature File

The Cartographic Feature Files (CFF), provide basic plan metric map features, from a standard source, to which resource data should be registered. Features are represented as line strings and points in ground coordinates with cartographic attribute information attached.

42.11 - Source

Use the Forest Service Primary Base Series/Single Edition Quadrangle, derived from the U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle Map Series, revised to include Forest Service information, at a scale of 1:24,000 (15-minute Topographic Quadrangle Series at a scale of 1:63,360 for Alaska). Use the USGS quadrangle, which is the mandatory source for digital base data, where the Primary Base Series/Single Edition Quadrangle is unavailable. This method ensures that all information conforms to a uniform standard.

42.12 - Accuracy

The original U.S. Geological Survey source maps are constructed to meet National Map Accuracy Standards, which require that 90 percent of all well-defined features be shown on the map within .02 inch (.508 mm) of their true locations, equivalent to 40 feet (12.2 meters) on the ground at the Primary Base Series/Single Edition Quadrangle scale of 1:24,000 (105.6 feet, 32.2 meters at 1:63,360 scale for Alaska). Ensure that all features, whether digitized or scanned, are within .005 inch (.127 mm) of the position shown on original source at that scale. Likewise, ensure that the point density is sufficient to reproduce the features within .005 inch (.127 mm).

42.13 - Format

Collect the digital data (X, Y digits) in local coordinates, state plane coordinates (ground feet or meters), or UTM coordinates. Include on each layer at least three control points. Quad corners

are normally used, with their latitude and longitude values as attributes. The items digitized for each map layer are known as features, and are recorded as either points or lines. Each feature is represented in the data file by a header record and a series of trailer or X, Y records, one for each point digitized. Code and digitize all features in accordance with "Cartographic Specifications and Symbols," EM-7140-24, chapter 6 (sec. 06.3).

Identify each different feature type (for example, trail, bridge, small building) by a three-digit code and a feature class. The feature class (for example, standard symbol -- variable orientation, discrete line -- variable length) tells how a feature should be digitized, although certain codes may require special treatment when digitizing (see "Cartographic Specifications and Symbols," EM-7140-24, chapter 6, sec. 06.3). Each feature class is associated with certain point types, with each digitized point belonging to either an endpoint or straight-line point category.

For roads, digitize the centerline of the double-line road symbol. For double-line streams, digitize each side, as with islands within the streams. When a stream is interrupted by a lake, digitize the lake separately; stop the stream at the inlet and resume at the outlet.

42.13a - Coincidence

Digitize coincident features (two or more features occupying the same position, such as a road and a boundary) only once. The feature header contains the attribute codes corresponding to the features this line represents; this is known as multi-linking. On a Primary Base Series/Single Edition Quadrangle map, if a section of pipeline is coincident with a road, drop the pipeline symbol for that section and resume where the road turns away from the pipeline. In the Cartographic Feature File, however, the coincident section carries both the road and the pipeline attributes, so the file has a complete representation of both features.

Similarly, use symbols only for indicating land status parcel boundaries on the Primary Base Series/Single Edition Quadrangle map if they are not coincident with other boundaries or landnet information. Non-coincident and coincident parcel boundaries receive different attribute codes in the CFF; nevertheless, between the two types of codes and the symbols used on the map, the full parcel boundary is represented in the digital file and on the map graphic.

In other situations, a CFF attribute code may automatically imply additional information. For example, by definition a Forest boundary is also a Ranger District boundary; only the Forest boundary is coded in the CFF. Thus, to get a complete representation of Ranger District boundaries, one would need both the Forest and Ranger District boundaries from the CFF. Software can create separate coincident lines should the user need them to form polygons on separate layers.

42.13b - Structure

The CFF data are not topologically structured, meaning that the file contains no information on the relationships between features. There is nothing to indicate which lines were connected to each other on the source map or which lines start at a particular node. Therefore, where similar features, such as roads, intersect on the map, digitize a node so that topology can be created later with a minimum of trouble. For instance, when two roads cross, digitize four features, with each

feature ending at the intersection of the two roads. Then, the individual pieces of a given road would all be in the file, but the road segments would have no information relating a segment to the other individual segments.

42.14 - Storage

The original base map data shall be maintained at the Geometronics Service Center, which can provide the data subsets when request. Base map data are stored in geographic coordinates.

42.15 - Output

Various automated cartographic systems are programmed to accept data in different formats; therefore, use a standard data structure from which subsets can be easily selected and reformatted.

42.15a - Ordering Data

Choose how data needs to be organized, according the desired layers or levels needed in the data file, to provide the required results. On the Cartographic Feature File order form, select data format, file separations, coordinate system (State Plane or UTM) and zone, and delivery on nine-track tape or floppy disk. When requesting data in MOSS or ARC/INFO format, multi-linked lines (sec. 42.13a) can be separate into individual elements; that is one copy of the line with the one attribute, and one copy with the other attribute. A quad can be supplied in one file, or separated into standard layers (roads, drainage, landnet/status and boundaries, point features and miscellaneous), or separated according to user-defined specifications. See "Cartographic Feature Files: A Synopsis for the User," EM 7140-21 (sec. 06.3), for a sample of the ordering form and additional information on ordering.

42.16 - Integration of Base Data Into a Geographic Information System

The Cartographic Feature File generated by the Geometronics Service Center are not delivered in a format suitable for direct input into a Geographic Information System (GIS). The feature attributing done by the Geometronics Service Center (GSC) describes only the features shown on the map, but additional attributes will need to be identified, coded, and added to the feature by local resource specialists to further define the other characteristics of the features.

In order to maintain data integrity, collect resource information in accordance with the following base data requirements:

1. Register resource information to Base Series features.

2. Represent coincident features on different layers by the same string of X, Y coordinates.

3. Include in the registration of resource information at least three grid ticks, labeled with latitude and longitude coordinates that are common to the Base Series.

Since CFF data files are not topologically structured and each GIS has a different way of describing the relations between features, GSC handles the interface to each GIS on a case-by-case basis, customizing CFF to meet individual Forest GIS needs. Therefore, rather than generating a topologically structured data file, creates files from which a GIS can build topology with little or no interaction required from the user.

42.17 - Maintenance

Coordinate maintenance of Cartographic Feature File with the Primary Base Series/Single Edition Quadrangle revision schedule (sec. 11.4). Regional geometronics staff shall furnish revisions in a digital correction guide format that will facilitate the update of the Primary Base Series/Single Edition Quadrangle (FSM 7142.04c). In order to maintain the integrity of the master CFF database, the Regional geometronics staff must verify CFF revisions developed by field units, before submittal to GSC. Digital corrections shall be incorporated into the database maintained at the Geometronics Service Center.

42.2 - Digital Elevation Model Data

Digital elevation model data are in the form of 7.5-minute digital elevation model (DEM) data. The DEM are an array of Z values representing the terrain of the particular model and are usually generated in the Universal Transverse Mercator (UTM) coordinate system but allow several other options. The detailed description and standards for use of DEM data are found in the USGS publication "Standards for Digital Elevation Models" (sec. 06.3). The DEM are broken into three classification levels.

1. Level 1. Photogrammetrically generated on lower order machines. No point may contain an error over 50 meters in elevation and the maximum permitted root mean square error (RMSE) is 15 meters.

2. Level 2. Generated by contour digitizing from existing topographic maps or photogrammetrically. The data set has been processed and edited to remove identifiable system errors. A root mean square error (RMSE) of one-half contour interval, not to exceed 7 meters in elevation, is the maximum allowable. There are no errors greater than two contour intervals in magnitude.

3. Level 3. Data sets have been vertically integrated to ensure positional and hypsographic consistency with planimetric data categories such as hydrography and transportation. Data in this category are derived from digital line graph (DLG) data using selected elements from both hypsography (contours, spot elevations) and hydrography (lakes, shorelines, drainage). A RMSE of one-third contour interval, not to exceed 7 meters in elevation, is the maximum allowed. There are no errors greater than one contour interval in magnitude.

Alaska DEM data is primarily obtained by digitizing contours from 15-minute maps, and may not meet the vertical accuracy standards of one-half contour interval (approximately 15 meters for 1:63,360 scale maps with 100-foot contours).

42.21 - Collection Methods

42.21a - Photogrammetric Digitizing

Use the U.S. Geological Survey publication "Analysis of Digital Terrain Profile Data" (sec. 06.2), as a guide for setting parameters for digital data collection. Follow these procedures:

1. Classify quad areas to be digitized as flat, moderate, or steep, typically representative of 10-, 20-, or 40-foot contour intervals respectively on 7.5-minute maps.

2. For each digitized quad, determine the X, Y, Z digital point density at ground distance prior to profiling.

3. Collect profile data using stereoscopic instruments of second order or higher.

4. Check each quad for RMSE (sec. 42.2) on the Interactive Digit Edit System (IDES) on the basis of 30 inspection points, evenly distributed, taken from the corresponding quad sheet. Inspect each quad separately and do not average inspection results with those of other quads.

42.21b - Line Following

Another method of collecting X, Y, Z data is by line-following 7.5-minute quadrangle contour plates using GSC's Line Trace Plus system. A 7-meter accuracy DEM should be achieved from data collected by line-following techniques.

1. Use stable base positive or negative source material.

2. Digitize all contour lines. Point thinning may be performed on the raw data prior to converting to the DEM format.

3. Collect additional data to assist in the definition of flat areas and to provide for water body flatness.

42.22 - Data Accuracy

1. Measure digital point accuracy for the Digital Elevation Models (DEM) using root mean square error (RMSE) calculation on 30 selected terrain checkpoints.

The method of determining 7.5-minute DEM accuracy involves computation of the root-mean-square error linear interpolated elevations in the DEM and corresponding "true" elevations from the published maps. Select test points that are well distributed, representative of the terrain, and have "true" elevations well within the DEM accuracy criteria.

Select test points that are located on contour lines, benchmarks, or spot elevations. A minimum of 30 test points per DEM is required. Collection of test point data and comparison of the DEM to the quadrangle hypsography are conducted by Geometronics Service Center (GSC) (FSM 7142.04c).

2. Use existing U.S. Geological Survey control, where available, to bridge photos, establish passpoints, and for quality control points for digital RMSE checks. Well-defined map positions may be used where ground control does not exist. If vertical control points are selected from maps, they will be limited to field-checked elevations.

43.23 - Data Verification

42.23a - Editing

All data produced in-house will be checked and edited on the digital elevation model editing/modification on a personal computer (DEMPC) at the Geometronics Service Center to check and edit the following types of errors:

1. Data omissions and/or spikes.

2. Water body leveling.

3. Incorrect edge matching between data profiles.

4. Root mean square error - maximum allowable error of 7 meters.

5. System errors.

6. Random error.

The Geometronics Service Center (GSC) will transmit verify Digital Elevation Models (DEM) to the U.S. Geological Survey in accordance with the current Interagency Agreement (FSM 1531.4).

42.23b - Photo Differences

Differences occur where photogrammetrically derived Digital Elevation Models (DEM) show disturbed earth (open-pit mines) that is not on the published 7.5 minute U.S. Geological Survey quadrangles. The photos are newer and, therefore, show more current information. If the disturbed areas show approximately the same data on the DEM as on the photo (same size, shape, and so forth) assume that area to be correct. Edit the remainder of the Digital Elevation Models (DEM) in the usual manner. When root mean square error values are taken, collect them in the usual manner except do not read points in the disturbed area.

42.24 - Derived Products

Several varied products may be derived from Digital Elevation Models generated data, including: perspective views, slope zone maps, isoslope maps, aspect zone maps, scene-area maps, and Geographic Information System interface.

42.3 - Global Positioning System Data

The Global Positioning System (GPS) can be used to determine the position of any point on the earth's surface by measuring the distance between an earth-based receiver and a number of

satellites. The GPS can also be used to determine the position of any feature by receiving and decoding orbital data transmitted from the current NAVSTAR satellite system. Position determination is accomplished through a process referred to as pseudo-ranging. Since locating features is essential to mapping, GPS has become an important tool for mapping and geographic information system (GIS) data entry.

Photogrammetry remains a cost effective means for mapping ground features as long as they are identifiable on existing aerial photography having a scale commensurate with the accuracy desired. However, when new photo acquisition is not practical, or for identifying and transferring features that are not easily identifiable on air photos (such as trails), GPS mapping is a simpler and cheaper process. GPS mapping is clearly the best alternative for mapping only a few features, for rapid data captures, or when ground inspection of features to be mapped is required.

When collecting base series map data, conform to National Map Accuracy Standards, which for Primary Base Series/Single Edition Quadrangle (Primary Base Series/Single Edition Quadrangle) maps requires that the horizontal position of 90 percent of well defined features be correct to within 40 feet. To meet this requirement when using GPS data for map updates, the final digitized description of the feature should be the average of all points collected. Edit line data to aesthetically represent the features as long as the final alignment meets NMAS. Ensure that the feature is a suitable item of content for the map in question; then, record the feature characteristics in order to select the proper map symbol. Proper selection of map symbols is particularly applicable to roads, which have 7 different Primary Base Series/Single Edition Quadrangle map symbols (more if multi-lane roads are included), depending on the construction characteristics.

42.31 - Accuracy Issues

The feature alignment accuracy of Global Positioning System-collected data includes both the accuracy of individual data points and the spacing between data points (except for point data). Feature alignment accuracy is needed for data collection with resource grade instruments with a differentially corrected positional accuracy of 2-5 meters circular error probability (CEP). Adaptation of these standards to geodetic grade instruments enables data collection to National Map Accuracy Standards at 1:24,000 scale and is a simple procedures.

If feature to be mapped, such as a section corner, must be surveyed to a higher accuracy for other purposes, use procedures commensurate with the higher accuracy needs.

42.31a - Differential Processing

Differentially process all data using a base station closer than 300 miles to the remote instrument. Use third order or better survey techniques to establish base station instrument location coordinates.

42.31b - Collection Mode

Ensure that sufficient satellites are visible simultaneously at the base and remote instruments to enable continuous three-dimensional (3-D) collection. Limit precision dilution of precision (PDOP) values to no greater than 6. Collect data in a 3-D mode whenever possible. Use two-dimensional (2-D) data collection only when 40 feet or less of relief exist along the feature being surveyed. If 2-D data is used, label it "approximate location" due to the horizontal error that can be introduced through collection.

42.31c - Check Features

At a minimum, at the beginning and end of each Global Positioning System (GPS) data collection session, survey a portion of a linear feature already mapped on a Primary Base Series/Single Edition Quadrangle quad (check feature). Use this check feature to verify through post processing exercises that the GPS system is working correctly. Confirm that check features are accurately mapped; some features are cartographically displaced to accommodate other nearby features. If time allows, survey additional check features periodically throughout each session.

42.32 - Point Spacing

For linear and polygonal features, use continuous data collection. Coordinate the frequency of data collection with the speed of the vehicle to produce a data point spacing that accurately represents the feature being located and meets National Map Accuracy Standards (NMAS).

Some map worthy features have been compiled to less than NMAS on Primary Base Series/Single Edition Quadrangle quads or have not been compiled at all, especially features that are obscured by vegetation (such as trails). Vegetation may also be a impediment to Global Positioning System operation. The point spacing recommendations of this section may be adjusted if the data that can be collected will still result in a significantly improved location of the surveyed feature compared to the existing map location. For example, if a road, trail, or other feature being surveyed is labeled "location approximate" on the map and a improved location can be identified, then the point spacing may be adjusted to capture the improved location for future map updates. As with all features mapped at less than NMAS, these features should be labeled "location approximate" on the map.

42.33 - Point Features

Features shown on Primary Base Series/Single Edition Quadrangle maps as a point symbol (for example, mines, section corners, wells, small buildings) are considered point features. At each point, collect 120 three-dimensional (3-D) records that are capable of being differentially corrected. Since not all 3-D records are capable of being differentially corrected, take 3 or more minutes of data at the 1-second interval recording mode. The average of the positions collected will be the coordinates of the feature. Place the GPS antenna as closely as possible to the center of the feature. If the center cannot be occupied (for example, a building), use an offset point and measure the bearing and distance to the center so that the center location can be calculated

relative to the offset point to within +/- 5 feet. If necessary, make subsequent visits to stations to collect the minimum 120 differentially corrected records for each station. If, after a second station visit, the file does not contain 120 differentially corrected records, process a second Global Positioning System traverse. If the difference is +/- 10 percent, accept the original GPS traverse. If not, conduct a traverse survey.

42.34 - Collection Procedures

Two local problems can arise for each traverse site:

1. Terrain blocking occurs when a hillside blocks the path between the satellite and the receiver. If the traverse is located on a westerly aspect, the satellites in the east must clear the easterly horizon in order to be accessed, especially when the traverse is on steep ground. Masking the eastern sky in the software is known as using curtains. Set these curtains in appropriate pre-mission planning software to match the horizon of the terrain.

2. Canopy blocking occurs when the boles and foliage of trees interferes with the satellite signals. For example, on flat ground, in a dense canopy, the signals are received from directly overhead but as the angle of observation decreases; the boles and foliage appear dense and limit signal reception. Pre-mission planning software can measure this effect by using a higher elevation mask. The elevation mask is specified for the horizon in all directions as opposed to a curtain, which is used for only a portion of the sky. Local experience in varying tree stand types enhances the accuracy and predictability of data collection under canopy.

Plot the data files and inspect to ensure that all turning points are collected. If a point does not have 120 corrected three-dimensional (3-D) fixes, or if a turning point was not collected in the point file, return to the field and collect the needed data at those points.

42.35 - Equipment

Use of multi-channel receivers with a minimum of four dedicated channels, one for each satellite is recommended. In addition to the Global Positioning System equipment, carry a compass, clinometer (degrees), 100-feet of cloth tape and flagging, and marking pen for monumenting stations.

42.36 - Data Evaluation

Do not submit Global Positioning System (GPS) data for addition to Primary Base Series/Single Edition Quadrangle maps until it has been thoroughly evaluated for accuracy and completeness. Field monitors the data collection process to minimize the occurrence of gaps in linear data or inconsistent data caused by satellite blockage or other problems.

Prepare a final point plot of the data to be added to the map after it has been edited or remeasured.

42.37 - Data Presentation

Sketch Global Positioning System (GPS) surveyed features to be added to Primary Base Series/Single Edition Quadrangle maps on correction guides using proper colors as is done with all other features. Place the label "GPS" alongside the correction guide alignment as a source reference. Submit a digital file for each quad containing differentially corrected coordinate data for linear features collected in continuous mode. Present point data as a single coordinate averaged from the differentially corrected data points. Store line and point data in different data files (sec. 42.39).

Submit the final point plots (see sec. 42.36) with the correction guide material. Also submit a sketch of the survey geometry in cases where offset locations are used to survey a feature (see sec. 42.33).

42.38 - Metadata Record

Include information about the collection process in the metadata record (data about data). Collection process information should precede the coordinate data to help determine the data's proper application and reliability. Include standard information in the coordinate data to properly identify the point, line, or polygon.

42.39 - Formats

42.39a - Metadata Record

Position in Metadata Record	Description	Code
1	**Format**	
	a. Point	PNT
	b. Line	LNE
	c. Polygon	PLY
	d. Special Circumstance	SPC
	e. Non-standard	NON
2	**Date of collection**	MMDDYY
	Alternative: Julian Day and Year	
	Example: 012693 (126 day, 1993)	
3	**Forest ID Number**	0000000000
	1. Any other agency use	7777777777
	Example: 000000RO4A	
	R06F06D04A	
4	**Channels receiver is capable of tracking.**	1
	Categories:	
	1. L1 C/A, code	
	2. L1 C/A, code - carrier smoothing	
	3. L1 C/A, carrier	
	4. Dual Frequency	
	5. Other (list)	
5	**PDOP Mask Setting**	00
6	**Elevation Mask Angle Setting**	00
7	**Signal level Mask Setting**	00

Position in Metadata Record	Description	Code
8	**Position fix mode**	
	a. 2D	2D
	b. 3D	3D
9	**Order of base station used**	1
10	**Base station position logging interval.** (In seconds)	00
11	**Distance From Base Station** (In kilometers)	00KM
12	**Total number of corrected position fixes from rover data.**	0000000
13	**Datum of data**	
	a. NAD 27	NAD27
	b. NAD 83	NAD83
	c. Harn/Year	HAR92
14	**Coordinate type**	
	a. Longitude, Latitude	GEO
	b. UTM	UTM
	c. State Plane Coordinate	SPC
15	**Coordinate Zone**	0000
	UTM 0001-0027	
	SPC 0100-5300	
16	**Linear Units**	
	a. U.S. Survey Foot	USFT
	b. System International Foot	SIFT
	c. Meters	METE

42.39b - Coordinate Data

Position in Coordinate Data Record	Description	Space in Statement
1	**Meridian** 2 letter abbreviation	00
2	**Township number**	000
3	**Range number**	000
4	**Section number** In which majority of feature falls in	00
5	**CFF Code**	000
6	**Coordinate data** a. Plane coordinates - X, Y b. Geographic - DDDMMMSS, DDMMSS Longitude, Latitude	X, Y

42.39c - Standard Data

Use an ASCII file with a standard format with key data elements assigned in specific order. If a variation of the standard format is used, provide a description of the format with the metadata record. Note in the standard metadata record the distinction between standard formats for point, line, or polygon and non-standard or special circumstance formats for (sec. 42.39a). Define point data as a single coordinate that can be identified by a Cartographic Feature File (CFF) feature code. Define line and polygon data string as a series of coordinates that can be identified by a CFF feature code. Use a special circumstance format to incorporate extra information for point identification in addition to the CFF feature code.

1. Point Feature Format example.

   METADATA RECORD
   PNT,083092,005M,06,10,NAD27,FS,LATLNG,1,2D,005,Y

   COORDINATE POINT DATA

   SLC, 3S, 1W, 02, 427, 423651.23, 1122236.12

2. Line or Polygon Feature Format example.

   METADATA RECORD

   LNE,083092,005M,06,10,NAD27,FS,LATLNG,1,2D,005,Y

COORDINATE DATA

SLC, 3S, 1W, 02,101
423651.23, 1122236.12
423655.66, 1122232.11
423658.21, 1122228.17

42.39d - Non-Standard Data Format

A non-standard format is a format that is unique to the user. Provide a descriptive statement when a non-standard format is used for proper identification of the format elements.

1. Metadata Record - Non-Standard Format

   NON,083092,RO6F06D04A,1,08,10,6,3D,1,1,20,0000180,NAD27,SPC,1101,USFT
   Include descriptive statement.

2. Coordinate Point Data - Non-Standard Format. Format for data is unique to the user. Use with a common framework of guidelines to ensure that the use and reliability of Global Positioning System data is an integral part of map revision and new mapping. The additional information contained in the metadata record helps the user determine the appropriate application and reliability of the coordinate data. The framework encourages standardization of GPS data to ensure maximum use and identification of questionable data.

42.39e - Special Circumstance Feature Formats

1. Metadate Record

   SPC,083092,RO6F06D04A,1,08,10,6,3D,1,1,20,0000180,NAD27,SPC,1101,USFT

2. Coordinate Point Data

   BO,6S,44E,24,556,**000393C4**,745720.10,441661.60
   (Identifying Mineral claim 393, corner 4)
   Length of field for extra information: 00000000

42.39f - Cartographic Feature File Feature Code Information

Use the spout first CFF code identification number, when possible, to encourage standardization of terms for feature description. These codes are currently in use for the digital collection of the Primary Base Series/Single Edition Quadrangle maps. The current version of the feature code table is filed on the Geometronics Service Center's Data General System: Host: W03A, Staff:DM, Drawer:Distribution, Folder:CFF, File:Feature_Code_Table.

Certain mapping features require additional information to help identify unique characteristics of these features because the CFF feature code is not be specific enough for identification. This information must include the feature's name or identification number along with specific point

information. Mineral surveys, homestead entry surveys, benchmarks, mineral monuments, and corners of the rectangular survey system are examples of such a circumstance.

42.39g - Numbering Systems

Use a unique numbering system to properly identify the specific corner of the survey. Two numbering systems currently in use are the alphanumeric system, which is defined in the publication "Corner Search, Perpetuation, & Recordation: A Training Guide" (sec. 06.3), and the Bureau of Land Management's Public Land Survey System Coordinate Computation System Point (PCCS) identification scheme, which is defined in "GCDB Data Collection Software User Documentation, Users Manual" (sec. 06.3). Information about the PCCS Point Identification scheme is available from any state office of the Bureau of Land Management.

42.39h - Data Submission to GSC

Use the form FS-7100-26 to submit Differential Global Positioning System (DGPS) data if unable to combine the metadata statement, coordinate information, and coordinate data in the recognized standard format (ex. 01).

DIFFERENTIAL GPS COORDINATE DATA
SUBMISSION TO THE
GEOMETRONICS SERVICE CENTER

I. Metadata Record:

GENERAL INFORMATION

1. Submitting Agency and contact:

1. Agency (FOREST SERVICE)
2. Region (1)
3. Forest (FLATHEAD NF)
4. District (HUNGRY HORSE)

2. Date of collection: (8/21/93)

3. Contact: (NAME)

RECEIVER INFORMATION

4. Channels receiver is capable of tracking:# (1)

Categories:

1. L1 C/A, code
2. L1 C/A, code - carrier smoothing
3. L1 C/A, carrier
4. Dual Frequency
5. Other (list)

5. PDOP Mask Setting: (6)

6. Elevation Mask Angle Setting: (16)

7. Signal level mask setting: (6)

8. Position fix mode:# (1)

1. 2D
2. 3D

BASE STATION INFORMATION

9. Order of base stations used: (3rd)

10. Base station position logging interval: (In seconds) (1)

11. Distance From Base Station: (In Kilometers) (28)

DATA INFORMATION

12. Total number of corrected position fixes from rover data: (1396)

13. Coordinate type:# (3)

1. Latitude, Longitude
2. UTM
3. State Plane Coordinate

14. Datum of data:# (1)

1. NAD 27
2. NAD 83
3. Harn/Year

15. Coordinate Zone: (2501)

UTM 0001-0027
SPC 0100-5300

16. Linear Units:# (1)

1. US Survey Foot
2. System International Foot
3. Meters

II. Coordinate/Feature Information:

1. Meridian: (MONTANA P.M.)

2. Township number: (28 NORTH)

3. Range Number: (16 WEST)

4. Section number: (6)

In which majority of feature falls

5. Description of the feature:

CFF Code (107)
Description (TRAIL #152)

III. Coordinate File Name: (FLXPK.DXF Abbreviated Quad Name)

Coordinate Format: Plane Coordinates - X,Y
Geographic - DDDMMSS,DDMMSS (Longitude, Latitude)