Standard on Digital Cadastral Maps and Parcel Identifiers

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INTERNATIONAL ASSOCIATION OF ASSESSING OFFICERS

1. Scope

This standard provides recommendations on the development and maintenance of digital cadastral map layers and parcel identifiers. It describes digital mapping system components, content, design, preparation, maintenance, and contracts. It also discusses deed processing and parcel identification systems. This standard addresses computerized mapping systems; see the Standard on Manual Cadastral Mapping (2003) for information on manual parcel mapping.

2. Introduction

The principal responsibility of the assessor is to locate, inventory, and appraise all property within the jurisdiction. A complete set of maps is necessary to perform this function. Maps help determine the location of property, indicate the size and shape of each parcel, and reveal geographic relationships that affect property value. Maps and map data are important not only for assessors, but also for other governmental agencies, the public at large, and the land information community (such as realtors, title companies, and surveyors). In addition, the assessor must track current ownership of all parcels, so that the proper party can receive assessment notices and tax bills.

Computerization of the map and parcel data provides new, exciting capabilities to manage, analyze, summarize, and display geographically referenced information. Digital cadastral map layers and parcel data are easily shared, allowing various users to manipulate and selectively retrieve layers of parcel and other information and to produce composite maps with only the data needed by each. Such sharing also reduces the duplication of effort inherent in separate, possibly incompatible, map systems.

A digital cadastral mapping system should have the following components: a geodetic control network; a current, accurate, base map layer (ideally, photo-grammetrically derived) that is tied to the geodetic control; a cadastral layer delineating all real property parcels; aerial photographs and/or images; a unique parcel identifier assigned to each

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parcel; a series of parcel data files containing parcel identifier, ownership, and assessment data; and layers of interest to the assessor such as municipal boundaries, zoning, and flood plains.

In creating or revising a digital cadastral mapping system, the assessor should make every effort to cooperate with other public and private sector entities, thus creating a true multipurpose cadastre. Such a system meets the needs of other offices in the jurisdiction, and outside agencies and entities, by allowing the efficient sharing of data. However, should efforts at cooperation fail, it may become necessary for the assessor to develop a single-purpose mapping system. In any case, the assessor must retain the ultimate authority to inventory, create, and define parcels and parcel identifiers.

3. Elements of a Digital Mapping System

A mapping system for assessment purposes includes the maps, accompanying records, and resources to support mapping. It should contain the following elements:

3.1 Geodetic Network

A geodetic control network consists of monumented points whose locations on the surface of the earth are defined with certainty. The points may be described in terms of latitude and longitude, but are more commonly used when projected to state plane coordinates. Spacing of control points should be related to land value, the need for accurate mapping, and desire to avoid re-mapping when more accurate information becomes available. Today, professional land surveyors using global positioning systems (GPS) usually locate such points.

In the future, improvements in surveyors' GPS equipment and techniques may reduce the need for dense on-the-ground control networks. A few control points with continuously operating reference stations (CORS)—especially those that broadcast their signals—may serve this purpose. Assessors should support efforts to create such stations and to mandate their use when preparing plats, surveys, and descriptions.

3.2 Base Map Layers

Base maps locate the major physical features of the landscape such as roads, water features, elevation contours, fence lines, and building footprints. In some jurisdictions, they contain the fundamental information from which the cadastral maps are prepared. Base maps should be tied to the geodetic network. In urban areas, they are prepared using photogrammetric methods and are line maps. In rural areas, they may be US Geological Survey digital topographic maps or orthophotoquads. Contractors using the necessary techniques and equipment typically produce base map layers.

3.3 Cadastral Map Layers

The cadastral map layers should be tied to the base map layer and should show all parcels in the assessing jurisdiction. Parcel polygons should be attributed with the parcel identifier. Parcel record boundary lines should be attributed and/or annotated with bearing, distance, and curve data. Details on map creation and maintenance are in sections 4 through 7.

3.4 Additional Map Layers

A full multipurpose cadastre will have a variety of layers. Polygon map layers that can be of great value to the assessor include municipal and taxing district boundary, appraisal neighborhood, soil type, zoning, subdivision exterior, and flood insurance rate areas. Linear map layers include street centerline, utility, and transit lines. Point map layers include fire and police stations and schools. Some of these layers, when compatibly registered with the cadastral layer, may be obtained from other offices or entities.

3.5 Parcel Identifiers

Each parcel should have assigned to it a unique identification number or code

that links the cadastral layer with files containing data such as ownership, value, use, and zoning. Parcel identifiers provide a common index for all property records and may help track changes in legal descriptions in a uniform and more manageable way. Details on parcel identification systems are in section 8.

3.6 Ownership Information
The current owner, owners, and/or parties of interest should be identified for each parcel. In addition, the basis of ownership (recorded deed, contract, court decree, and so on) should be documented. It is desirable to maintain records of past ownership history. Deeds and other ownership documents should be processed within two weeks of recording (National Research Council 1983, p. 56). Details on ownership database maintenance are in section 6.

3.7 Imagery
Aerial photographs have long been an essential tool for assessment. They are being increasingly supplemented or replaced by digital images from airplanes and satellites. All imagery is of much more value when it has had distortions removed so that it matches the geodetic control, base map, and cadastral layer. Such images are called orthophotos or ortho images. Jurisdictions should acquire new imagery of urban areas at least every five years and at least every ten years for rural areas. Jurisdictions experiencing rapid or slow growth may need to adjust this timetable. Aerial imagery (and photogrammetric work done to create base maps) should meet published specifications for scale, overlap, tilt, time of day, and other requirements (URISA 1999, US Geological Survey 1986, FGDC digital imagery).

3.8 Map Products
The assessor should make cadastral data available in a variety of formats. Providing Internet maps can allow easy public access; an intranet can give similar access to all offices in the jurisdiction. Data may also be distributed on CD-Rom, DVD, magnetic tape, and other formats and should be accompanied by appropriate metadata. No matter how advanced the capabilities of the office, a set of well designed printed maps should be available to the public and staff.

Cadastral maps, whether designed for on-screen or printed viewing, should include

- Boundaries of all parcels
- Parcel identifiers
- Parcel dimensions and areas
- Subdivision or plat boundaries, as well as block and lot numbers
- Boundaries and names of political subdivisions, such as counties, towns, and municipalities
- Boundaries and names of geographic subdivisions, such as sections, townships, government lots, land districts, and land lots
- Locations and names of streets, highways, alleys, railroads, rivers, lakes, and other geographic features
- Other basic map information, including a map number, title block, map scale, map legend, north arrow, key or link to adjoining maps, and disclaimer

3.9 Facilities and Equipment
Cadastral mappers and deed processors should have a minimum of 100 square feet (10 square meters) of workspace per person. Additional adequate space should be provided for large-format scanners, plotters, copiers, printers, and for storage of large-format map documents. The process of converting from manual to digital maps may create a temporary need for additional space. See Standard on Facilities, Computers, Equipment, and Supplies (2003).

3.10 Program Management
Responsibility for mapping program management should be clearly assigned. Managers' duties may include

- Producing new cadastral and associated map layers (see sections 4 and 5)
- Maintaining existing layers and ownership records (see section 6)
- Controlling quality of production and maintenance (see section 7)
- Contracting for mapping services and aerial imagery
- Sharing and selling data
- Meeting with the land information community and the public on parcel descriptions in problem areas
- Purchasing hardware and software
- Creating and maintaining procedure manuals
- Training personnel
- Budgeting

Managers must first ensure that their map products meet appraisal needs and then coordinate their efforts with other agencies and entities. They should also be aware of national standards for cadastral and other digital map data.

3.11 Staff and Training
An effective digital cadastral mapping and deed-processing program requires approximately one staff person per 10,000 parcels. This number may be modified due to:

- Degree of automation achieved in deed processing and mapping work flows
- Economies of scale in larger jurisdictions
- Need to create or recreate digital map layers
- Volume of deed processing work
- Ratio of deeds that simply require changing owner names to deeds and plats that require creating new parcels
- Need to respond to public requests for map and ownership information
- Reliance on contracted mapping services
- Need to create layers for non-assessment purposes, such as zoning, transportation planning, and emergency response

All mapping personnel should receive training in procedures that are appropriate to the jurisdiction. At a minimum, mapping and deed-processing staff should understand the engineering basis of highway and railroad rights of way, the surveying basis of boundary creation and description throughout the history of the jurisdiction, and appropriate legal principles of boundary and title law. Once these basic competencies are achieved, staff should be trained in the appropriate techniques of mapping with coordinate geometry (COGO), computer aided drafting (CAD), and/or geographic information systems (GIS) software.

3.12 Procedures, Standards, and Records
A procedure manual for deed processing, as well as for the production and maintenance of cadastral and other map layers, should be developed to ensure that this work is done in a uniform manner. The manual should include detailed standards for map layers and associated databases. It must be continually maintained to reflect procedural changes. In accordance with applicable statutes and ordinances, records used in preparing and maintaining the maps should be retained.

4. Preparation for a Digital Mapping Program

4.1 Needs Analysis
Adequate preparation is essential before undertaking a new digital mapping pro-

gram or revising an existing one. The jurisdiction must first evaluate the assessor's mapping needs. This analysis should:

- Review applicable statutes, rules, regulations, and standards
- Inventory office functions, practices, and resources
- Determine the type of finished product and the accuracies desired and required
- Evaluate existing and needed personnel, facilities, software, hardware, and operating systems
- Determine the funding available

This process, which may be undertaken with outside assistance, should then be extended to the entire jurisdiction and to potential outside cooperators and end users. At that point, decisions should be made on the:

- Type of mapping program to create
- Appropriate mix of in-house versus contracted work
- Desired work flow
- Technical specifications for the map layers
- Preliminary schedule for the work

4.2 Selection of Type of Digital Map

A critical initial decision must be the desired quality of digital cadastral layer. In general, there are four types, ranging from simple scanned maps to COGO maps created from survey bearings, distances, and curve data. The decision on a type of digital cadastral map need not be final. Rather, a jurisdiction might decide to proceed through all four types over a period of years. However, the fourth type, a COGO-based cadastral layer, is the best and should be the goal of all jurisdictions.

4.2.1. Scanned Maps

Existing manual maps can simply be scanned into a raster image. These can be difficult to maintain in this raster form, and they do not have linked data, but they can be easily accessed and shared by anyone with a computer, and they are relatively inexpensive to produce.

4.2.2. Scanned with Data Point

The scanned maps can have a data point placed in each parcel's approximate center (paracentroid). These are still difficult to maintain, and still easily shared, but the attributes of the data points—such as owner name, parcel address, and assessed value—can be displayed and queried. Such scanned maps should be georeferenced to a geodetic control network, so they can be displayed with other data layers.

4.2.3. Trace-Digitized Polygons

Manual maps (in paper or scanned form) or aerial images can be traced to create digital polygons with associated parcel data. The resulting cadastral layer can be adequate for many appraisal and planning analysis functions; however, parcel boundary lines do not have bearing and distance attributes and are commonly less accurate than lines created with COGO methods. If manual maps with parcel numbers and bearing and distance annotation have been scanned and georeferenced, they can be displayed as a background layer to the traced polygons.

4.2.4. COGO'd Polygons

Metes and bounds on source documents, such as deeds and plats, can be used to create parcels through coordinate geometry methods. Such maps are the most accurate and useful, the most easily maintained over time, and have bearing, distance, and curve attributes for most lines. Parcels without bearing and distance information are created by digitizing base map lines.

4.3 Technical Specifications

Specifications should be prepared that clearly define technical aspects of the aerial imagery or digital mapping project. They should include such items as

- Quality and quantity of products to be produced
- Geographic areas to be mapped
- Tiling scheme for data (typically township, range, and section; state plane coordinate grid cell; or administrative area such as municipality, township, or precinct)
- Preliminary activities to be performed (for example, the establishment of horizontal and vertical control)
- Map layers to be produced
- Data to be captured as attributes or annotation
- Sources of data to be used
- Procedures for quality control
- Accuracy as a function of scale and data sources
- Designs for printed and on-screen map products
- Documentation of processes and data

4.4 Pilot Project

Any major mapping or re-mapping program—whether done in-house or under contract—should begin with a pilot project. It should focus primarily on average areas of the jurisdiction, not on the easiest or most difficult to map. Completing a pilot project should give guidance on technical specifications, training needs, fitness of hardware and software, need for outside assistance, program costs, effectiveness of quality control, and work schedule.

4.5 Contracting for Mapping Services

Consideration should be given to whether the new map layers will be prepared in-house or obtained from an outside source. Many assessors' offices do not have the expertise necessary to plan for and produce digital cadastral maps. Those offices may have some local, regional, state, or provincial agency that provides assistance. If not, the jurisdiction must either acquire needed personnel and equipment or contract with a professional mapping firm for the production of map layers. The jurisdiction or assessor should become familiar with accepted contracting procedures, such as those contained in IAAO's Standard on Contracting for Assessment Services (2002).

5. Cadastral Layer Creation

5.1 Assembling Source Data

The first step in creating a new or revising an existing cadastral map layer should be to assemble all relevant information. This includes the following:

- A list of the parcels in the area to be mapped
- Maps of taxing district and municipal boundaries
- Geodetic control network information
- In areas covered by the US Public Land Survey System (PLSS) of township, range, and sections, all Government Land Office and Bureau of Land Management cadastral survey plats and field notes
- Railroad, highway, and, if needed, utility route surveys
- Subdivision, townsite, and town plats and surveys
- Private land surveys and associated corner records
- Current orthoimagery of the area
- Deed descriptions for unplatted parcels and for parcels that vary from lot and block boundaries
- Court decisions that affect parcels in the area to be mapped
- Relevant base map data, such as edge of pavement, street and railroad centerlines, water features, and fence and field lines

- Information on rights of way, whether dedicated by plat, purchased in fee, vacated, abandoned, or unopened and, if required, held as an easement
- Information on utility easements, if required
- Previous maps on vellum, paper, drafting film, and in digital form
- Other imagery of the area, from non-ortho or older photographic sources
- Highway maps, street name databases, and other sources of information for official names of roads
- US Geological Survey topographic maps and geographic names databases for additional feature names

5.2 Mapping Parcels

COGO-based mapping should follow the sequence of sources in 5.1. The digital cadastral layer is composed of the following:

- The control layer
- If available, the PLSS or other survey framework is delineated
- Well-surveyed features affecting large areas such as highways or railroads
- The largest and best surveyed subdivisions and townsites
- Parcels with good quality metes and bounds descriptions
- Those parcels whose boundaries must be traced from base map elements, such as creeks and fences

If base map data is insufficient for tracing, field checks and discussions with owners to establish agreed-upon boundaries are appropriate.

5.3 Problem Resolution

Every parcel shown on a digital cadastral layer is important to

- The appraiser, who must locate it in the field and calculate its value based on area
- The planning department, which may determine a radius around it, for notifying neighbors of proposed actions
- The owner and his neighbors, who may wish to locate their respective boundaries
- The owner in states where payment of property tax is a requirement for adverse possession, whose very title may depend on these lines

Digital cadastral map layers commonly contain areas in which individual parcels or groups of parcels have gaps, overlaps, or closure errors. Decisions on resolving such problems should be made with great care, based on:

- Knowledge of mapping and boundary law, such as principles of junior and senior rights, water boundaries, and adverse possession
- Knowledge of surveying techniques and technology, such as the need to rotate descriptions to a common basis of bearing
- Knowledge of land division systems affecting the jurisdiction, such as the evolving PLSS and/or Spanish, French, or English colonial practices (Price 1995)
- Understanding of the capabilities and limitations of the software being employed, such as the ability to snap, extend, trim, generalize, adjust closure by compass rule, and use fuzzy tolerances
- Solid common sense

The goal should be to produce a final cadastral map layer with seamless, clean polygons without gaps or overlaps. It may be necessary to work with property owners, attorneys, private surveyors, and/or county surveyors to resolve problems and achieve this goal.

Decisions on problem areas should be well documented. This may be done on

worksheets (which must be filed and preserved) or in text files. The best practice for documentation would be annotations or memo fields attached to points, lines, or areas on the map.

6. Mapping System Maintenance
Digital cadastral map layers and ownership databases should be maintained on a continuous basis by qualified personnel. Map and ownership data represent a substantial capital investment, which can be lost unless all changes and corrections are made on a regular basis.

6.1 Ownership Maintenance
Maintenance of ownership databases involves

- Collecting all relevant deeds, contracts, plats, court cases, owner requests, and other muniments of title
- Identifying the parcels these documents affect
- Determining whether the documents have no effect, are simple ownership changes, or require changing parcel boundaries through splits, combinations, property line adjustments, new subdivisions, or map edits
- If necessary, interacting with property owners, surveyors, attorneys, title insurance staff, and other land information professionals to resolve problems
- Entering the changes in appropriate databases
- Controlling quality of the data

6.2 Cadastral Layer Maintenance
Maintenance of the digital cadastral map layer involves

- Obtaining information about needed changes (through the processes in the section 5)
- Making those changes of parcel lines, parcel identifiers, and associated data
- Performing quality control
- Distributing the data to appropriate parties
- Constantly correcting and improving the cadastral layer as new and more accurate survey data become available
- If needed, remapping areas with greater accuracy

6.3 Backing Up Data
For computerized map and ownership data, a back-up copy should be made at the end of each workday and stored at a remote site.

7. Quality Control
In both map creation and maintenance, quality control is a vital process. Software should be designed with built-in testing for data integrity and validity. Tests should be run and queries performed to ensure that all relevant documents (deeds, plats, ownership change requests) have been properly processed, with correct ownership and map changes made. Near-perfect correlation must be maintained between parcels in tabular databases and parcels in digital map layers. Cadastral map layers should be tested for spatial accuracy using published standards (FGDC, NSSDA 1998), and the results should appear in metadata. A procedure should be established to solicit user requests for map changes.

8. Parcel Identification Systems
A parcel identification system provides a method for referencing land parcels, or data associated with parcels, using a number or code instead of a complete legal description. The correlation of digital maps and individual property records requires that each parcel be assigned a uniform parcel identifier.

The parcel identification system should be legally defined and recognized as the official reference to all documents or data for each parcel. It is desirable for

all jurisdictions in a state or province to use the same primary system of parcel identification. Because agencies have different needs, various secondary identifiers may also be used to index parcel data; however, all of the secondary identifiers must be cross-indexed to the legally recognized, unique parcel identifier, allowing multiple uses of the data (National Research Council 1983, p. 63)

8.1 Kinds of Parcel Identifiers

There are three basic forms of parcel identifiers in common use: location identifiers, name-related identifiers, and alphanumeric identifiers. The primary identifier for assessment purposes should be a location identifier. Name-related and alphanumeric identifiers are frequently used secondary identifiers and should be cross-indexed to the location identifier.

8.1.1 Location Identifiers

A location identifier is one in which the parcel number provides the location of the parcel. Examples include map-based identifier systems, geographic coordinate identifier systems, or identifiers related to the US Rectangular Survey System (National Research Council 1980, p. 60).

- *Assessors' Map-based Systems*—A map-based system is relatively simple and easily used. Under this system, the assessment map itself is incorporated into the parcel identifier. The parcel identifier consists of a map, block (or group), and parcel number such as 32–02–16, where 32 represents the map on which the parcel is found, 02 indicates the block on the map, and 16 identifies the parcel in that block. Rural maps usually do not use the block designation. In some jurisdictions, maps are bound in books.In such instances, parcel identifiers may consist of map book, page, and parcel numbers. Map-based identifiers do, to some extent, reference a geographic area and are convenient in the field. Problems may arise in this system where extensive development is occurring, requiring re-mapping and the assignment of new parcel identifiers; however, in stable areas, this system may be satisfactory.
- *Geographic Coordinate Systems*—The geographic coordinate system is a method of locating a point on the Earth's surface based on its distance from each of two intersecting grid lines known as *x* and *y* axes. A coordinate parcel number is composed of the *x* and *y* coordinates. Parcel identifiers using this system are composed of the coordinates for a single point, usually the approximate center of the parcel. Because the parcel number generally refers to the center of the parcel it describes, the geographic location of the parcel can be determined from the parcel number alone. This system tends to be complex, and an understanding of coordinate systems is needed to fully utilize it. Once understood, however, the system is relatively simple to use and maintain. It also meets the criteria of uniqueness and permanence. This system lends itself to automated systems because computers can be programmed to prepare maps and assign parcel identifiers based on coordinates.
- *Rectangular Survey System*—This system of parcel numbering is based on the US Public Land Survey System. Parcel identifiers based on the rectangular survey system are developed using the township, range, section, quarter-section, and quarter-quarter-section numbers, along with individual parcel identifiers that are assigned to each tract. This kind of identifier readily provides the geographic location of each parcel, is relatively easy to understand and maintain, and meets the criteria of uniqueness and permanence.

8.1.2 Name-related Identifiers
A name-related identifier uses the names of individuals claiming an interest to a parcel as the parcel identifier. A common example of this is the use of name codes in the grantor–grantee index. Use of such identifiers is discouraged because they do not meet the criteria of permanence and reference to geographic location.

8.1.3 Alphanumeric Identifiers
An alphanumeric code is often an arbitrary number associated with the parcel. An example is the sequential numbering system in a tract index.

8.2 Desirable Characteristics
It is desirable for parcel identifiers to incorporate the following attributes: uniqueness, permanence, simplicity, ease of maintenance, flexibility, and reference to geographic location. Of course, uniqueness is most important.

8.2.1 Uniqueness
Uniqueness refers to a one-to-one relationship between a parcel and its identifier. An identifier should be assigned to one and only one parcel and represents the most desirable characteristic.

8.2.2 Permanence
Parcel identifiers should be permanent and change only if the boundaries of the parcel change. Whenever a new parcel is created, it should be assigned a new parcel identifier. It is recommended that changing parcel boundaries be handled through the use of retiring number systems, although suffix systems may be employed. In areas where there is extensive subdivision of land requiring re-mapping, it may become necessary to assign new parcel identifiers, even though some parcel boundaries have not changed.

8.2.3 Simplicity
Parcel identifiers should be easy to understand and use and have as few digits as possible. A parcel identifier that is uncomplicated and easily understood will help to reduce errors in its use.

8.2.4 Ease of Maintenance
The parcel identification system should be easy to maintain and should efficiently accommodate changes, such as subdivision or consolidation of parcels.

8.2.5 Flexibility
The parcel identification system should be reasonably flexible. It should be capable of serving a variety of uses and be convenient for both field and office operations. In the office, access to property records and files should be facilitated through the use of parcel identifiers. To accomplish this, parcel identifiers should be accessible in a logical, sequential order. For field use, parcel identifiers may need to be arranged in geographical order to facilitate systematic valuation procedures.

8.2.6 Reference to Geographic Location
A parcel identification system that is based on geographic location makes it possible to describe and locate a parcel using only the parcel identifier. Such a system simplifies the handling of property records.

8.3 Assigning Parcel Identifiers
Parcel identifiers should be assigned to all parcels, whether taxable or exempt, during the initial phase of a digital cadastral mapping program. These parcel numbers should be considered provisional until the mapping program has been completed and all maps formally approved. Subsequent assignment of parcel identifiers should be done on an ongoing basis by a single agency as new parcels are created.

9. Glossary
Adverse Possession—Possession of land, based on poor or no written title, usually in a manner hostile to deeded owners; may ripen into full ownership; may, in those states in which payment of taxes is a requirement for proving adverse possession, affect assessment mapping practices.

Annotation—Text placed on a map without a tie to a particular graphic element.

Attribute—Data attached to a point, line, or polygon, which can be used to query features or create annotation.

Basis of Bearing—Surveyors in the field typically measure deflection angles between lines. When they return to the office, they assign bearings to those lines. The assigned bearings may be based on assumed north, magnetic north, coordinate grid north, geographic north, or a line in an already established survey. Subdivision plats and recorded surveys typically show their basis of bearing.

Cadastral—Refers to maps and records showing boundaries, ownerships, and attributes of property, usually created for taxation purposes.

Computer Aided Drafting (CAD)—Computer software for drawing points, lines, polygons, and text, with features organized by layers within the drawing; CAD has the ability to trace-digitize lines and often has powerful three-dimensional display ability. Traditionally it has had limited ability to attach attributes to features.

Coordinate Geometry (COGO)—Computer software for drawing surveyed points, lines, and polygons. It calculates intersections and curve data, computes traverse closures and areas, and requires bearing and distance data entry.

Geodetic—Relates to surveying and mapping, which take into account the curvature of the earth. This is in contrast to plane surveying, which focuses on small areas and assumes the earth is flat.

Geographic Information Systems (GIS)—Computer software for mapping and analyzing points, lines, and areas with associated attributes. It permits sophisticated overlay and proximity analysis; displays, integrates, edits, and creates a wide variety of raster and vector data, permitting sophisticated map creation.

Georeference—The process of adding geographic intelligence to a raster image so that it can be displayed under a vector map.

Global Positioning Systems (GPS)—A network of satellites that transmit signals allowing accurate location on the face of the Earth. The better the GPS receiver, the longer the time it occupies a position, and the more intensively data are processed and the more precisely the location is determined.

Junior and Senior Rights—When two deeds conflict—especially when they originated with the same party—the one that was issued first often has a superior (senior) claim to the disputed land.

Metadata—Information that describes a data set; thus, metadata for a cadastral map would describe the map projection, the way the map was made, who is responsible for maintaining the map, whether there are constraints on its use, how accurate the data is, and more.

Multipurpose Cadastre—A cadastre is a set of property maps with associated ownership and parcel information; a multipurpose cadastre is a digital implementation of the concept, designed to provide the basis for tying additional information to the property map.

Muniments—Written documents affecting ownership.

Parcel—A contiguous area of land described in a single description or as one of a number of lots on a plat; separately owned, either publicly or privately, and capable of being separately conveyed and assessed.

Photogrammetric—Photogrammetry is the art and science of making measurements from aerial photographs; using stereo images, photogrammetrists can accurately trace elevation contours, roads,

streams, and building footprints.

Polygon—An area feature, such as a parcel or a county.

Raster—A gridded data source, usually a digital aerial photograph or satellite image. Elevation data may also be in grid form. This contrasts with vector data, which is coordinate-based and describes points, lines, and areas.

Split—The division of a single parcel into multiple parcels. This can involve dividing two parcels into three, and so on. A boundary line adjustment would be a special case where each parcel both gains and loses some area. Also called "segregation," it contrasts with a "combination," in which multiple parcels become one.

Tile, Tiling—Data and maps of large areas typically are broken down into smaller areas. These are tiles and are typically square or rectangular. Tiles are usually based on latitude and longitude, state plane coordinate grids, or Public Land Survey System sections.

Topographic Maps—US Geological Survey topographic quadrangle maps, showing elevations with contours. These are also called "topo maps" or "quad maps."

For a more complete, detailed glossary, accompanied by a list of acronyms, see the Kansas Association of Mappers *GIS Glossary*, available on the Internet at www.kam.to/library/glos.htm.

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