Assessment Mapping and Parceling Standards

Information in this publication is based upon laws and rules in effect at the time this publication was last updated. Should any content in this publication conflict with current laws or rules, the latter shall be controlling. If you have questions, contact the Department Property Tax Unit at (602) 716-6843 or ptcountyservices@azdor.gov.

Effective March 1, 2011

Introduction

As computerized mapping has moved into the mainstream, the sharing of geographic data between all levels of government, and with the public, has enhanced our ability to analyze spatial data. The sharing of this data allows different users to simultaneously and selectively retrieve layers of digital parcel information to produce maps geared to their specific needs. Sharing can also reduce the duplication of costs and effort.

The County Assessor's principal responsibilities include the location, inventorying and appraisal of all locally assessable property within their jurisdictions. The performance of these important functions requires a complete set of maps. Maps aid in determining the location of property, indicate the size and shape of each parcel, and can spatially reveal geographic relationships that contribute either negatively or positively to appraised values. In addition to the Assessors, many other governmental agencies, the general real estate community and the public rely on accurate maps. Computerized or digital mapping provides an accurate and cost effective method to map tax areas, appraisal maintenance areas and appraisal market areas.

In an effort to simplify many mapping concepts, you will find a glossary of the mapping terms that are used in this chapter, beginning on page [23]. The glossary will familiarize readers with a wide range of appraisal mapping terminology.

Parcel Discovery

The Assessors are responsible for discovering; listing and valuing all locally assessable properties within their jurisdictions. The discovery of real property (i.e., parcels of land and any improvements on them) is accomplished through:

1. Field Surveys
2. The processing of Conveying Documents (Affidavits of Value, deeds, etc.).
3. The creation and processing of Plat Maps (a.k.a. cadastral maps).
4. Studying aerial and ground-based Photographs.
5. The processing of Building Permits.

6. The analysis of Ownership Status Maps (obtained from the State Land Department, the Bureau of Land Management, etc.).

Once a parcel is discovered it must be identified, included in the assessment parcel inventory and entered on the appropriate County Assessor's map. (Note: When a parcel is drawn on the appropriate map, the parcel's dimensions will be included.) For the purposes of this manual, a parcel is defined as: "An area of land within legally described boundaries, under a common ownership and capable of being separately conveyed."

Property Identification Systems

Although the use of these maps is helpful in determining the approximate physical location of a property, a well-maintained cadastral mapping system (showing the extent and ownership of land) is essential to provide a standard, accurate *legal description*, which is needed for the accurate location, identification and inventory of property for:

Resale Lease Owner's Use Taxation

Property identification systems were designed and developed to produce a *legal description*, which prevents a specified parcel from being confused with any other parcel.

Five land identification systems are discussed in this chapter:

- Rectangular Survey
- Metes and Bounds
- Geodetic Surveying
- X - Y Coordinates
- Lot and Block

Rectangular Survey System

The U.S. Public Land Survey System (or Rectangular Survey System) of land identification was established in 1785 by the Continental Congress for the purpose of surveying, marking and disposing of land held under the public domain of the United

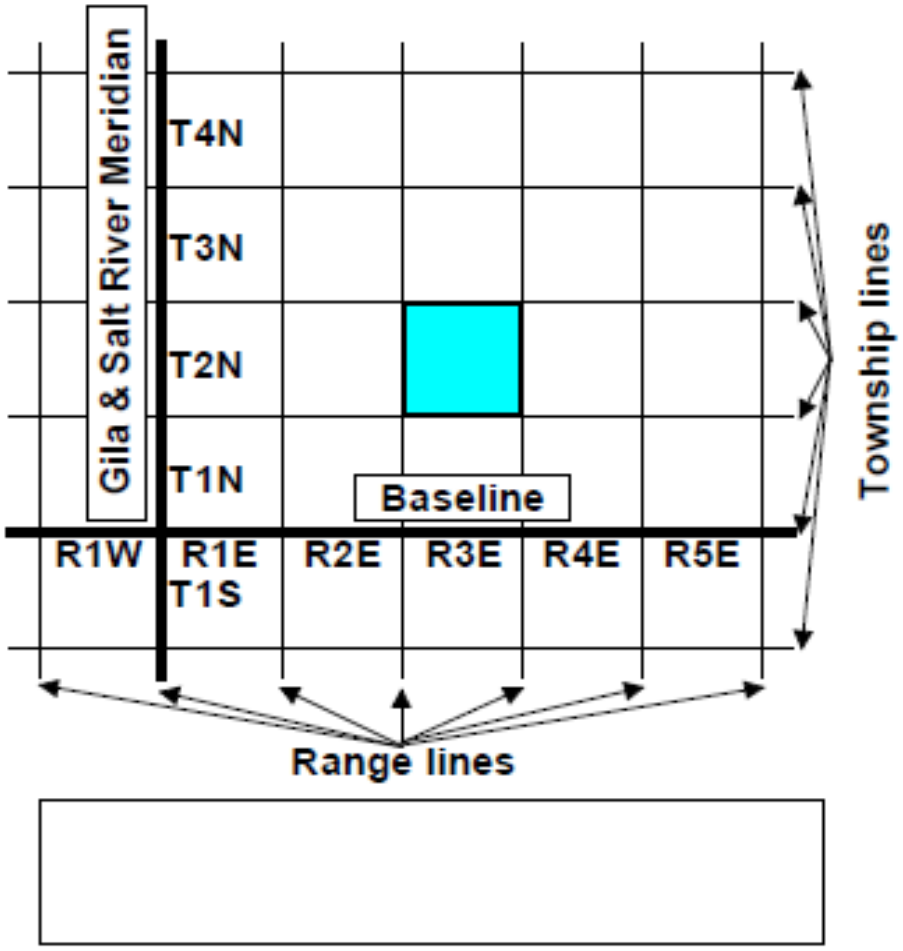
States. A similar system has been established in Canada. This survey encompasses all of the United States except the original thirteen colonies, Kentucky, Tennessee, Texas, West Virginia and parts of Ohio, Alaska and Hawaii. Those states, or parts thereof, were excluded because that property was already held by private owners before the system was established or the territory was acquired by the United States. This system's legal subdivision of the remainder of the country occurred before it was sold or granted (a.k.a., "patented") to private ownership. The system has a number of independent points of origin, through which pass both a true north-south meridian of longitude (called a Principal Meridian) and a true east-west parallel of latitude (called a Baseline).

Baseline Road in Phoenix is so named because it is sited along the baseline of the Gila and Salt River Baseline and Meridian (GSRBM), the Principal Meridian and Baseline from which most of Arizona is measured. Approximately twenty townships in Apache County are measured from the Navajo Baseline and Meridian, which originates in New Mexico, and a small portion of land near Yuma is measured from the San Bernardino Baseline and Meridian, which originates in California.

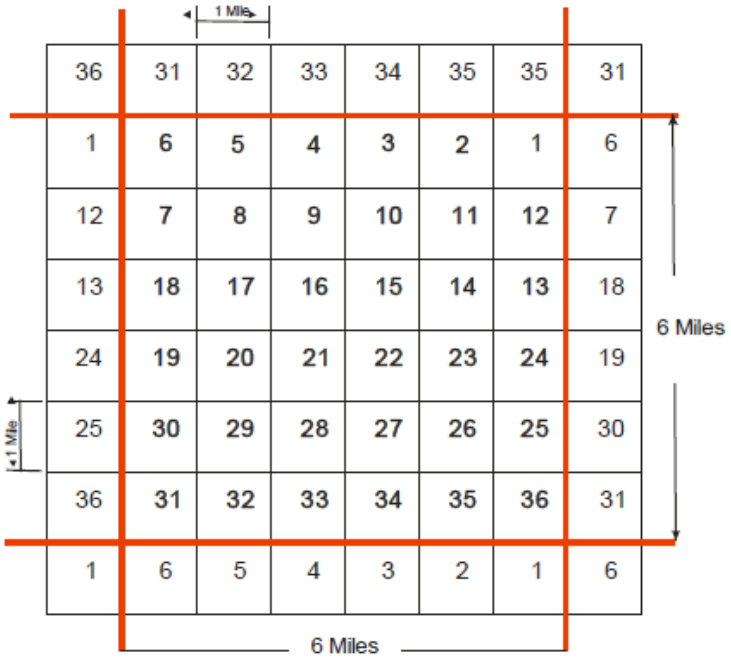
In this system, units of land approximately six miles square are established north and south of the Baseline (called *Tiers of Townships*) as well as east and west of the Principal Meridian (called *Ranges*). Additionally, each six-mile by six-mile square is also called a *Township*. These tiers and ranges are numbered consecutively, beginning at the baseline and principal meridian, respectively.

For example, in the illustration on this page, the strip (or tier) of land located between six and twelve miles north of the Baseline is Township 2 North (abbreviated: T2N), and the strip of land located between twelve and eighteen miles east of the Principal Meridian is Range 3 East (R3E).

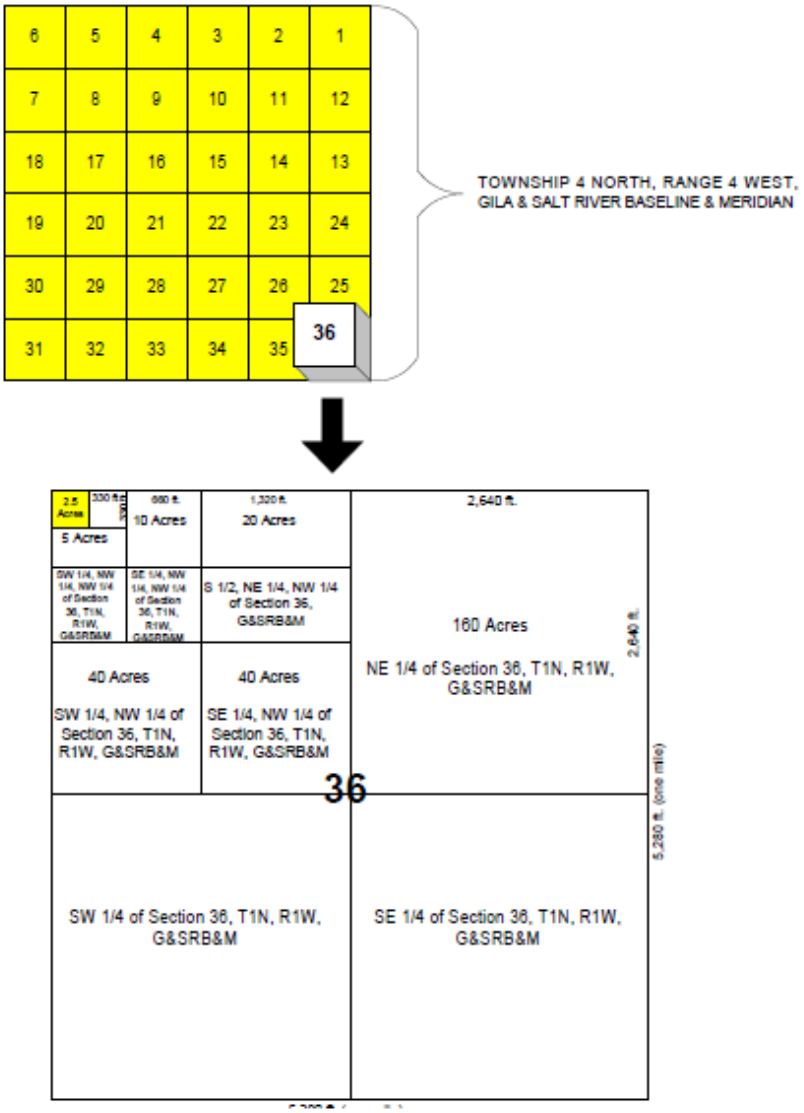
Therefore, the Township that is located at the intersection occurring between six and twelve miles north of the Baseline and between twelve and eighteen miles east of the Principal Meridian is described as Township 2 North, Range 3 East of the Gila and Salt River Baseline and Meridian (abbreviated asT2N, R3E, GSRBM).



As shown in the illustration below, a standard Township contains approximately thirty-six square miles, each of which is divided into thirty-six sections, each one being approximately one-mile square. In the Government Survey System, the sections are numbered beginning at the northeast corner of the Township, continue west six miles to the northwest corner, then move down one strip (tier) and continuing back east six miles, then again dropping down one strip (tier) and again continuing west, and then continuing in this serpentine manner, ending with section number thirty-six in the southeast corner of the Township. The section numbers outside of the dark red lines represent adjoining sections.



Each section is then further divided into four equal parts of 160 acres, each one called a quarter-section. A quarter-section is then divided into four equal parts of forty acres, each called a quarter-quarter section. A quarter-quarter section is again divided into four equal parts, each consisting of ten acres, called a quarter-quarter-quarter section. A final division is of each ten acre quarter-quarter-quarter section into four equal parts, each consisting of two and one-half acres. These are usually the smallest unit of division in this system. In describing land using this system, the smallest unit is given first, and the largest unit last. For example, the shaded 2.5 acre parcel in the upper left (northwest) corner of section 36, as shown below, would be described as “The Northwest quarter of the Northwest quarter of the Northwest quarter of Section 36, Township 4 North, Range 4 West, of the Gila and Salt River Baseline and Meridian (Abbreviated: NW¼, NW¼, NW¼, NW¼, S36, T4N R4W GSRBM).”



Metes and Bounds System

In a Metes and Bounds property identification system, a description of a tract of land always starts at a given point, which is called the “Point of Beginning” (POB). The outside boundaries of the tract are then followed by using certain measurements (*metes*) and reference points (*bounds*) until returning to the POB. It is important to remember that in using a metes and bounds description, you must always start at the Point of Beginning and ‘*close*’ the parcel by returning to the POB.

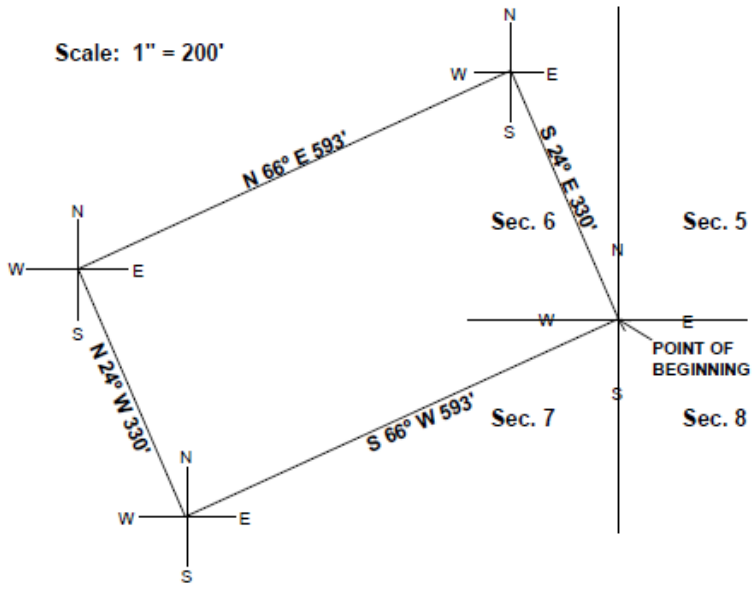
Consider the following legal description: From the Point of Beginning at the section corner common to sections 5, 6, 7 and 8 of T39N, R3E; thence S 66 degrees W 593'; thence N 24 degrees W 330'; thence N 66 degrees E 593'; thence S 24 degrees E 330' to the Point of Beginning, containing 4.49 acres more or less.

Note: The number of degrees should never exceed ninety in a metes and bounds legal description.

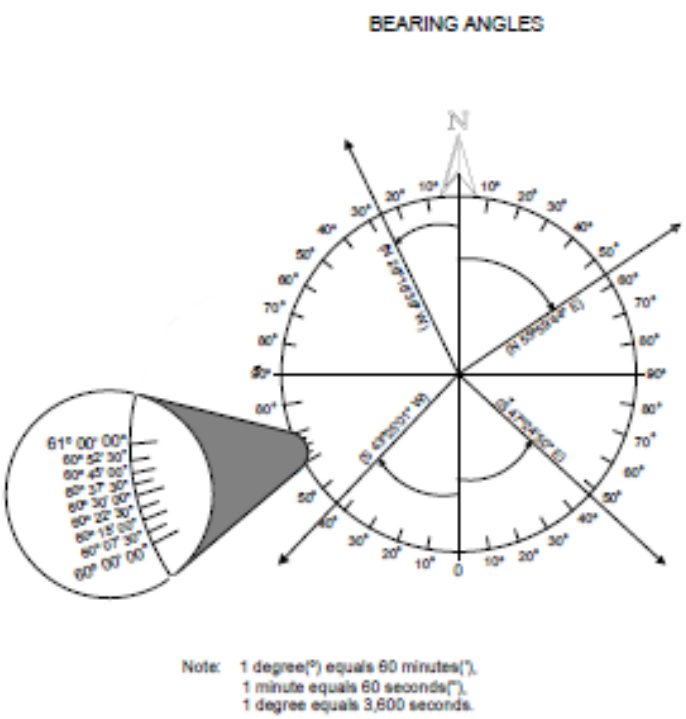
The readings given above can be used to draw the tract, as has been illustrated on the next page. The wording “thence S 66 degrees W 593'...” could be restated as “from there go sixty-six degrees west from the south zero point and measure 59' along that line.” The same procedure would be followed for the next parts of the description, until all boundaries have been plotted. Most properties can be drawn with the use of a protractor or a compass.

For a better understanding of this process, try to recreate the readings provided in the description, or simply follow them on the illustration on page [8]. Starting at the Point of Beginning, measure the stated angle and draw the first line.

Measure the distance given. Measure the next angle and draw the next line from the measured end point. Measure the next given distance. Draw the next line, etc., until the last drawn line reaches the Point of Beginning.



METES and BOUNDS SYSTEM using a COMPASS

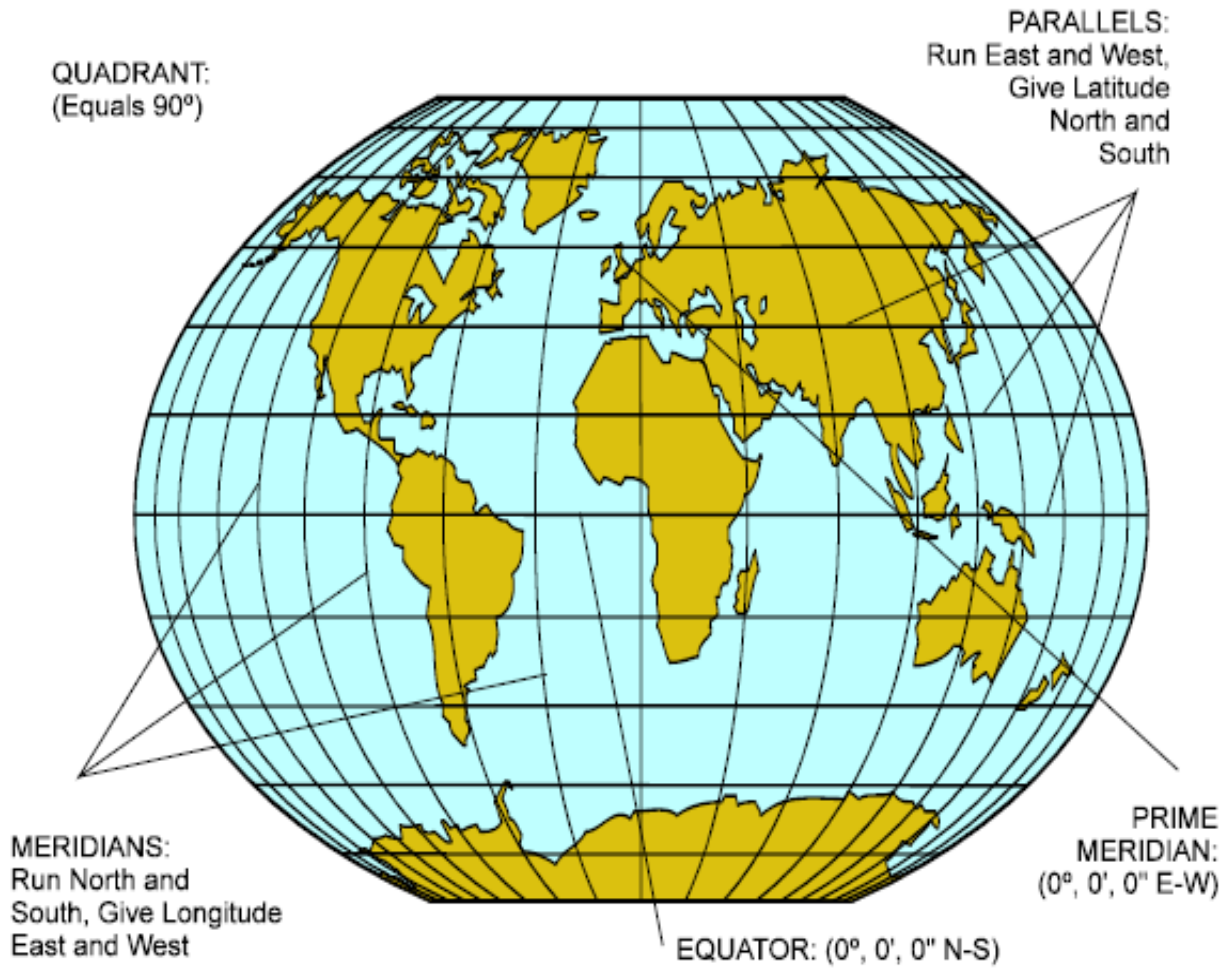


Note: 1 degree(°) equals 60 minutes('),
1 minute equals 60 seconds("),
1 degree equals 3,600 seconds.

Geodetic Surveying (Latitude and Longitude)

In the survey of large areas, it is necessary to take into account the curvature of the earth. Distances are measured in degrees, minutes and seconds of latitude and longitude, from the Prime Meridian, which runs through Greenwich, England at 0°, 0', 0" (zero degrees, zero minutes, zero seconds) east or west Longitude, and from the equator, which is centered between the north and south poles at 0°, 0' 0" north or south Latitude.

PARALLELS and MERIDIANS



PARALLELS run east and west, and are of equal distance from one other.

MERIDIANS run north and south, and converge at the north and south poles due to the earth's curvature.

The **PRIME MERIDIAN** runs through Greenwich, England, at 0°, 0', 0" (i.e., zero degrees [°], zero minutes ['], zero seconds ["] east or west Longitude).

The **EQUATOR** is centered between the north and south poles at 0°, 0', 0" north or south Latitude.

A **QUADRANT** is a ninety degree by ninety degree section of the earth, as measured from one of the poles to the equator, and including ninety degrees of horizontal measure. Each quadrant encompasses one-eighth of the total surface of the sphere of the earth.

All references are made from the intersection of the equator and the Prime Meridian. That point is: 0°, 0', 0" east or west Longitude, 0°, 0', 0" north or south Latitude.

X - Y Coordinates

In the 1930s, the U.S. Coast and Geodetic Survey developed the State Plane Coordinate System, a grid system for each state using an X axis (longitude) and a Y axis (latitude) on the grid. Points describing the boundaries of a parcel were described by their distance east or north of the intersection of the X axis with the Y axis.

Lot and Block System

The Lot and Block system is perhaps the simplest of the three main survey systems to understand. It is the most recently developed of the three main survey systems. It became widely employed in the United States in the 19th century when Americans began to move away from an agrarian society towards an industrialized society and cities began to expand into the surrounding farmland. To sell large tracts of land to buyers, landowners would create a plat map and subdivide the land into a series of smaller lots.

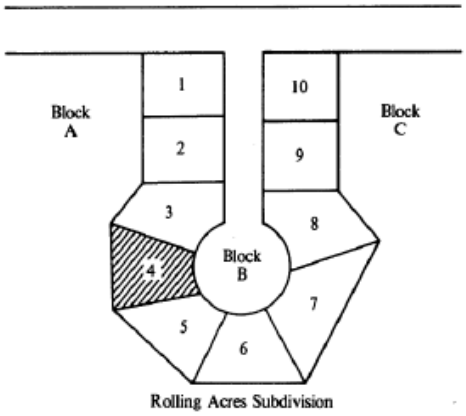
This subdivision survey plan would then be recorded with an official government record keeper. The officially recorded map then became the legal description for all of the lots in the subdivision.

For a parcel’s legal description in the Lot and Block system, the description must identify:

- An individual lot.
- The block in which that lot is located.
- A reference to a platted subdivision (or a ‘phase’ in one).

- A reference to the cited plat map, by a page and / or a volume number.
- A description of the plat map's place of official recording, such as one recorded in the files of the County Engineer or the County Recorder.

Lot and Block Legal Description Example: The shaded property in the Map below is described as "lot 4, block B of Rolling Acres subdivision, plat map on page 23, volume 2, as recorded in the files of the Navajo County Recorder's Office, Arizona."



Arizona's Parcel Identification System for Property Taxation

The system of parcel identification utilized in Arizona will accommodate all legal description systems, including Rectangular Survey, Metes and Bounds, Lot and Block, Geodetic Surveying, X - Y Coordinates and Geocode / Geographic Information System (GIS) / Digital Mapping. In Arizona, the system that identifies parcels for taxation purposes does not legally describe the property. If the 'tracking' of real estate for property taxation purposes was based only on legal descriptions, it could easily become cumbersome and confusing. Parcel identification for property taxation purposes is accomplished through the use of a parcel coding system. This system of parcel identification incorporates an easy to understand method which utilizes a county identifier, a tax book number, a tax map number and a parcel identification number. This system meets the standards of uniqueness, permanency, simplicity and uniformity.

In Arizona, a combination alpha-numeric coding system is used to generate parcel identifiers. A parcel identifier includes:

1. A county identification number. Assigned county identification numbers are:

01 = Apache County	06 = Greenlee County	11 = Pinal County
02 = Cochise County	07 = Maricopa County	12 = Santa Cruz County
03 = Coconino County	08 = Mohave County	13 = Yavapai County
04 = Gila County	09 = Navajo County	14 = Yuma County
05 = Graham County	10 = Pima County	15 = La Paz County

2. A three-digit tax book number. This number identifies a specific area within the county where a subject parcel is located (e.g., 01-100).
3. A two-digit tax map number. This number identifies a specific area within the tax book where a subject parcel is located (e.g., 01-100-40).

   Note: Map numbers 00 and 99 are used to identify Improvements on Possessory Rights (IPRs.)
4. A three-digit parcel number. This number identifies the specific location of a subject parcel of land within the book and maps (e.g., 01-100-40-011).
5. When a numerically identified parcel is split into two or more new parcels, the new parcels will be assigned the numeric identifier of the original parcel. An alpha character will then be added to uniquely identify each new parcel. If two or more numerically identified parcels are combined into one new parcel, the numeric designator of one of the original parcels will be used. An alpha character will then be added to indicate a change to the original parcel. The assigned numbers of the other parcels will then be retired. When a numerically identified parcel is divided into several parcels, the map should be redrawn to establish a new series of numeric parcel designators. When a new map is drawn and new numeric designators have been assigned, the old numeric designators will be retired. This may be achieved by simply retiring the old map number.

PARCEL IDENTIFICATION EXAMPLES *

Original Parcel:

CountyBook	Map	Parcel	
01	100	40	011

Original Parcel Split into Three new Parcels:

CountyBook	Map	Parcel	Split
01	100	40	011 A
01	100	40	011 B
01	100	40	011 C

Parcel 01-100-40-011-b, Split into Two new Smaller Parcels:

CountyBook	Map	Parcel	Split
01	100	40	011 D
01	100	40	011 E

Two Parcels combined:

CountyBook	Map	Parcel	Split
01	100	40	011 A
01	100	40	011 C

The new parcel created will be 01-100-40-011F.

* **To conform to the Arizona mapping convention, original parcel numbers must be retired after each parcel split or combine.**

In some report forms and records an additional number may be utilized. This is a control number, or computer-generated check digit, and is not a component of the parcel identifier.

Characteristics of the Parcel Identifier

Uniqueness. Each Assessor's parcel number is unique in that it is assigned to a single parcel and is never duplicated.

Permanence. Once a parcel number has been assigned to a parcel it will remain with the parcel as long as that parcel's boundaries remain the same. When the legal description of the parcel changes, the old number will be retired and a new number will be assigned to the parcel. In any situation in which the number of splits that has

occurred makes the original scale inappropriate, a new map should be drawn and a new parcel number assigned to represent that change. As discussed above, if the change is a simple split, the parcel number will be changed with the addition of an alphabetic designator. When a parcel is split, the portion of the parcel retained by the original owner will be assigned the lowest available alphabetic designation. If the change constitutes a subdividing of the parcel's land area, new numeric designators will be used.

Uniformity. A uniform parcel identification system must be used in all assessment jurisdictions in Arizona for the following reasons:

1. The parcel number is used in the analysis of sales data. If a parcel's size changes and the parcel number is not changed, serious errors in per unit value indicators (e.g., per square foot, front foot or acre) may result.
2. The entire parcel number and map system provides a means to ascertain that all land in the county is accounted for on the tax roll as being either taxable private land or as public nontaxable land.
3. Parcel numbers are a basic tool used in abstracting data for property tax assessment and statistical reporting purposes.

Ease of Maintenance. The system must be simple in concept, yet flexible enough to facilitate entry and recovery of both individual parcel and aggregate property record data.

The Tax Area Code System

Taxing Authorities are governing bodies authorized by law to impose ad valorem property taxes (or other categories of assessments) within defined geographic areas. Tax authority districts facilitate the application of tax rates and are represented by a five-digit numeric code referred to as a "tax authority code."

Tax areas are regions within each county in which the sum of the tax rates of the applicable Taxing Authorities' are combined. Tax areas are represented by four-digit numeric codes called "Tax Area Codes."

Since each county has a varying number of Taxing Authorities, it is evident that any one Taxing Authorities' boundaries may be identical to or completely distinct from any other, or there may be an overlap of the areas identified by a Tax Area Code.

Tax Area Codes are created by the county in which the Taxing Authorities exist. On or before November 1 of the calendar year preceding the year in which assessments or taxes are to be levied (i.e., the Tax Year), the governing body of the legal entity comprising the Taxing Authority must file with the Department of Revenue, and the appropriate County Assessor, certain information regarding all changes in their boundaries or the establishment of a new taxing district, pursuant to Arizona Revised Statute § 42-17257.

Of the four-digit sequence of numbers in a Tax Area Code, the first two digits represent a school district. This similarity exists throughout the state. Past this point in determining Tax Area Code numbers, each county individually establishes their own procedure. In most counties, the third digit is a code for either a city or town, or for an unincorporated area, while the fourth digit represents an improvement district. The Tax Area Codes are controlled by each County Assessor's mapping section.

Digital Mapping Systems

The International Association of Assessing Officers' (IAAO) "Standard on Digital Cadastral Maps and Unique Parcel Identifiers, July 2003" suggests that a digital mapping system should contain the following elements:

1. A Geodetic Network:
    a. Consists of set points or monuments.
    b. Usually, set points are described in terms of Longitude and Latitude.
    c. Professional land surveyors today can use the Global Positioning System (GPS) to locate set points.

2. Base Map Layers:
    a. Should be tied to the geodetic network.

b. Should consist of physical features, such as roads, elevation contours, water features, fence lines and building footprints.
c. Are, typically, produced by contractors using analytical aerial triangulation control processing, photogrammetric techniques and photogrammetric instruments.

3. Cadastral Map Layers:
   a. Should be ‘tied’ to the base map layers.
   b. Will show all parcels in an assessing jurisdiction.
   c. Will show attributed parcel “polygons” (see the Glossary, page [31]) with recorded parcel boundary lines.

4. Additional Valuable Map Layers include:
   a. Municipal and Special Taxing District boundaries.
   b. Defined neighborhood boundaries.
   c. Soil types.
   d. Zoning codes.
   e. Subdivision boundaries.
   f. Flood plains.

5. Unique Parcel Map Identifiers:
   a. Are expressed as unique parcel numbers, which will provide the location of each parcel.
   b. Will link each unique parcel number to the various cadastral layers, such as an ownership file, a value file, a property use file, and a property zoning file.
   c. Will be generated from an Assessor’s Map-based System, a Geographic Coordinate System or a Rectangular Survey System.
   d. Will offer uniqueness, permanence, simplicity, ease of maintenance, flexibility and a reference to a physical, geographic location.

6. Ownership Information Files:
    a. Are linked to a unique parcel number which allows an Assessor to assign the valuation notice and tax bill to the correct owner.
    b. May include deeds, contracts, plat maps, Tax Court case numbers and records of an owner's information requests.
    c. May include ownership changes, a record of boundary changes through parcel splits and combines, property line adjustments, or various other mapping edits.

7. Cadastral Maps may include:
    a. Parcel Identifiers.
    b. The boundaries of all parcels.
    c. Each parcel's dimensions and total area.
    d. The locations and names of streets, highways, alleys, railroads, rivers, lakes and other geographic features.
    e. Political boundaries, such as those of a county, town or municipality.
    f. Public Land Survey System (PLSS) boundaries, such as townships, range and section numbers, etc.
    g. Government lot boundaries and numbers.
    h. Subdivision names, their boundaries, and their lot and block numbers.
    i. Map numbers, a title, the date of a map's preparation, that map's scale, a map legend, a north arrow, a map key or 'link' to adjoining maps, and any relevant disclaimers (regarding the information used, its accuracy, etc.).

8. Map Products:
    a. Produced by the office of a County Assessor should include a printed set of well designed maps that are available for use by both staff and the public.
    b. Created by the office of a County Assessor should also be able to be distributed digitally, on CD-Rom, DVD or magnetic tape.
    c. Provided on the Internet can allow for easy public access.
    d. Provided on an Assessor's Intranet (i.e., their in-office computer system) can allow easy access to maps from all Assessor's offices in their jurisdiction.

9. The County Assessor should:
    a. Ensure that map products meet their appraiser's needs.
    b. Coordinate mapping efforts with other county agencies.
    c. Be aware of national standards for cadastral map data and digital map data.

10. Mapping Personnel should:
    a. Receive training appropriate to their jurisdictions.
    b. Understand the engineering basis of highway and railroad right of ways.
    c. Understand the survey basis of boundary creation.
    d. Understand and be able to read legal descriptions.
    e. Understand the history of boundary descriptions in their jurisdictions.
    f. Understand the appropriate legal principles of boundary and title law.
    g. Be trained in the techniques used for the manual mapping or digital mapping of parcels that is employed in their jurisdictions.

11. Types of Digital Maps include:
    a. Scanned maps.
    b. Scanned maps with data points.
    c. Trace-digitized polygons.
    d. COGO'd polygons (see the Glossary, page [25]).

In a perfect world, all maps would contain seamless and clean polygons without gaps or overlaps. However, digital cadastral map layers usually contain areas of parcels with gaps or overlaps. These 'closure errors' need correction. Resolution on problem areas should be well documented.

12. Problem Resolutions should be based on:
    a. An understanding of both the capabilities and limitations of mapping software.
    b. A knowledge of the principles of boundary law.
    c. A knowledge of the principles of mapping law.
    d. A knowledge of surveying techniques.
    e. A knowledge of land division systems.

f. Common sense.
g. Consultations with property owners, attorneys and surveyors, when required.

13. Public Perception of Maps:
    a. Maps and computer images help to illustrate to the public the decision making components used by the Assessor
    b. The public often reacts better to visual data rather than to raw data in a tabular or statistical format.
    c. Visual data, in the form of maps and aerial photography, encourages confidence in the assessment process by the public.

Uses of a Digital Mapping System

1. Performing Sales Analyses with GIS:
    a. Provides an interactive combination of tabular and graphic data, which improves the ability to analyze sales data and present sales information.
    b. Allows for diversity in the color coding of different categories of sales data, including improved parcel sales, vacant land sales and land residual sales.
    c. Also allows the use of color coding to indicate the time ranges applicable to different categories of sales data.
    d. Provides a tool to display a number of new subdivisions to compare lot sales and time trends.
    e. Provides a way to add zoning, sales prices and sales dates within the color coded polygons (i.e., parcels).
    f. Allows an analyst to see sales groupings spatially, which may indicate a need for the development of valuation adjustment factors for subdivisions or neighborhoods.
    g. Provides a way to refine what are sometimes arbitrary geographic neighborhood or market area boundaries, such as rivers, lake frontages, and freeways.

h. Includes a way to view sales data in conjunction with the aerial photographs of selected parcel or of neighboring parcels, which may illustrate the need for a neighborhood or market area boundary change.
i. Provides a tool to identify various 'value influencing' attributes, and make comparisons between them (e.g., waterfront versus nonwaterfront property; ranch style homes versus colonial style homes) with a spatial perspective.

2. Performing Sales Ratio Studies using GIS:
   a. May expose a lack of uniformity in values.
   b. Provides a tool to spatially analyze parcels and their assessment ratios within neighborhood or market area boundaries, which may cause changes in the delineation of those boundaries to improve the uniformity of values.
   c. Provides a way to spatially analyze parcels and their assessment ratios within neighborhood or market area boundaries to discover economic influences that will lead to improvement in the uniformity of values.
   d. Can assist an analyst in the development of location adjustments at the parcel or lot level, or at the geoblock level, or at the level of larger geographic areas, such as subdivisions, neighborhoods, market areas, census tracts or zip codes, in order to improve uniformity.

3. Defending Values in Administrative Appeals with GIS Imaging:
   a. Allows for the improved management of more files under appeal.
   b. Allows the Appeal Board members to make better decisions without visiting each property under appeal.
   c. Provides the Appeal Board members a way to study the facts presented by looking at aerial photographs and other imaging documentation of the assessed properties or areas in dispute.
   d. Provides the Appeal Board members with visual documentation that can support the assessed value, and highlight information contained in the subject property's sale affidavit, appraisal record card or the property record card.
   e. May include aerial photographs of local area streets, alleys, structures and other improvements on the land.

f. Will help Appeal Board members make better decisions.
g. Permits the setting of better values and an easier defense of those values.

4. Performing Field Work using GIS Imaging:
   a. Can reduce the number of visits to a property due to the availability of onscreen documentation.
   b. Allows for the viewing of building permits to determine which field inspections are absolutely necessary.
   c. When used in conjunction with recent aerial photographs of a property may assist in locating and identifying new construction or improvements.

5. The Internet allows:
   a. Easy access to Google Maps and other similar commercial products, as well as to some County Assessor's websites.
   b. The public to view parcel maps at anytime.
   c. The public to perform simple analyses.
   d. The public to choose pertinent visual data.

6. Performing Edits on Tax Area Codes with GIS:
   a. Helps to ensure accurate valuations.
   b. Provides a way to verify the assignment of each parcel to the correct Tax Area Code.
   c. Ensures that taxpayers are paying taxes in the correct taxing districts.
   d. Allows the Department's Centrally Valued Property section to allocate tax money to the appropriate taxing authorities.

The following Glossary of mapping terms will aid in the understanding of the mapping concepts found in this chapter. These definitions are from, or are predicated on, those in the texts referenced at the end of this Glossary.

Appendix A: Glossary of Mapping Terms

Acre. A unit of land area measurement equaling ten square chains or 43,560 square feet. 640 acres equal one square mile.

Adjoining. Touching or contiguous [i.e., sharing a common boundary point or line], as distinguished from lying 'near to' or adjacent. To be in contact with; to abut upon.

Aerial Photograph. A photograph of a part of the earth's surface taken by an aircraft supported camera.

Angle. The figure formed by two lines extending from the same point, in degrees. Angles are either "obtuse" (i.e., the number of degrees is greater than 90); "right" (i.e., the number of degrees is exactly 90); or "acute" (i.e., the number of degrees is less than 90).

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 an annotation.

Base Line. A line which is extended east and west on a parallel of Latitude from an initial point and from which are initiated other lines for the Cadastral Survey of the public lands within the area covered by the principal meridian that runs through the same initial point.

Bearing. The horizontal angle which a line makes with the meridian of reference adjacent to the quadrant in which the line lies. Bearings are classified according to the meridian of reference as: astronomic, geodetic, magnetic, grid, etc. When no reference is specified on a plat map or in a document, astronomic meridian is presumed. A bearing is identified by the naming of the meridian from which it is 'reckoned,' either

north or south, and the direction of that reckoning, either east or west. Thus, a line in the northeast quadrant making an angle of 50 degrees from the reference meridian will have a bearing of north 50 degrees east.

Boundary Line. A line along which two areas meet. A boundary line between privately owned parcels of land is usually termed a “property line.” If a boundary is a line of the United States Public Land Surveys, it is given a particular designation, such as section line or township line.

Cadastral. Refers to maps and records showing the boundaries, ownership and attributes of a parcel, usually created for taxation purposes.

Cadastral Map. A map showing the boundaries of subdivisions of land, usually with the bearings and lengths thereof, and the areas of the individual tracts or parcels, for the purposes of describing and recording ownership. A cadastral map may also show culture, rainage and other features relating to the value and use of the land.

Chain. The unit of length prescribed by law for the survey of the public lands of the United States. A chain is equivalent to sixty-six feet, or four “rods” or “poles”. Ten square chains equals one acre.

Compass. A drafting instrument that can be adjusted to different “radii” lengths which is used for the plotting of circles or curves.

Contiguous Land. Two parcels having a common boundary line or point.

Contour. An imaginary line on the ground, all points along which are at the same elevation above or below a specified datum surface.

Contour Map. A topographic map that portrays relief by means of contour lines.

Coordinates. Linear or angular quantities that designate the position of a point in a given reference frame or system. Also used as a general term to designate the particular kind of reference frame or system, such as plane rectangular coordinates or spherical coordinates.

Coordinate Geometry (COGO). Computer software used 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.

Coordinate System. A reference framework consisting of a set of points, lines and / or surfaces, and a set of rules which are used to define the positions of points in space in either two or three dimensions.

Corner. A point on the surface of the earth determined by the surveying process which defines an extremity (i.e., a common point of two lines) on a boundary of the public lands.

Course. In surveying, the direction of a line with reference to a meridian.

Culture. Features of the terrain that have been constructed by man.

Curves. Curved rulers, termed irregular curves, or French curves, used for drawing curved lines. The patterns for these curves are laid out in parts of ellipses and spirals or other mathematical curves in various combinations.

Datum. In ordinary survey usage, a defined reference for survey measurements. Two principal types of datum are horizontal datum and vertical datum.

Degree. A unit of angular measure, represented by the symbol 0 . The earth is divided into 360 degrees of Longitude and 180 degrees of Latitude.

Delineation. The visual selection and distinguishing of map-worthy features on various possible source materials by outlining the features on the source material or on a map manuscript (as when operating a stereo plotting instrument); also, a preliminary step in compilation.

Digital. Information represented in discreet, quantified units rather than continuously. Computers process and store information in digital form.

Drafting. [manually] A method of drawing with pencil or pen and ink, used in cartographic reproduction.

Note: Computer Assisted Drafting [or Drawing] (CAD) is a method of drawing which utilizes a computer software program.

Easement. An interest in land created by grant or agreement, which confers to another (the easement owner) a right to some profit, benefit, dominion, or lawful use of, or over, the estate of the landowner; it is distinct from the ownership of that land.

Elevation. The vertical distance of a point or object above or below a reference surface or datum (generally, mean sea level). Elevation generally refers to the vertical height of land above sea level.

Equator. The parallel of reference that is equidistant from the poles of the earth and which defines the origin of Latitude values.

Feature. A representation of a real-world object on a map.

Geocode. A code (usually numerical) used to locate or identify a point, such as the center of a parcel. Also utilized to assign a street address to a location.

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

Geodetic Coordinates. The quantities of geodetic Latitude and Longitude that define the position of a point on the surface of the earth.

Geographic. Of or relating to the Earth.

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

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

Grid. Any network of parallel and perpendicular lines superimposed on a map which are used for reference.

Initial Point. A point which is established under the Rectangular System of Surveys and from which is initiated from the principal meridian and the baseline that controls the cadastral survey of the public lands within a given area.

Latitude (geodetic use). The angular distance north or south of the equator, expressed in either linear or angular measurements. Also, the north-south component of a traverse course. The horizontal element of the geodetic coordinate system.

Latitude-Longitude. A reference system used to locate positions on the earth's surface.

Legal Description. A written statement, recognized by law, which describes the definite location of a tract of land by reference to a survey, recorded map or adjoining property.

Legend. A description, explanation or table of symbols printed on a map or chart to permit a better understanding or interpretation of it.

Line. On a map, a shape defined by a connected series of unique (X,Y) coordinate pairs. A line may be straight or curved.

Longitude (geodetic use). The angular distance east or west of the prime meridian, usually the meridian of Greenwich (0 degrees Longitude), usually expressed in degrees, minutes and seconds. The vertical element of the geodetic coordinate system.

Lot. A plot (i.e., a parcel) of land, generally in a subdivision of a city, town or village block, or some other distinct tract, represented and identified by a recorded plat. Lots in the shape of a square or rectangle, with only ninety degree angles, are described as

regular in shape Lots with curved boundary lines, or with angles of less or more than ninety degrees, are described as irregular in shape.

Map. A representation, usually on a flat medium (i.e., a map) of all or a portion of the earth or other celestial body, showing relative size and position of features to some given scale or projection. A map may emphasize, generalize or omit the representation of certain features to satisfy specific requirements.

Map Scale (fractional). A fractional scale is the ratio that any small distance on a map bears to the corresponding distance on the earth. It may be written in the form of a fraction (1/100,000) or as a proportion (1:10,000). Fractional scales are representative in any linear units.

Market Area. A broad, geographic area defined for purposes of market analysis.

Meridian. A circle around the earth that passes through the north and south poles, often used as being synonymous with the term “longitude.”

Metes and Bounds. Measures of angles and distances; a description of a parcel of land accomplished by beginning at a known reference point, proceeding to a point on the perimeter of the property being described, and then tracing the boundaries until one returns to the first point on the perimeter, usually a corner. The angles are described by reference to points of the compass, and the distances are described in feet or chains; curves are treated as arcs on a circle.

Metes and Bounds Survey. A survey of an irregularly shaped tract of land, not conforming to the rectangular system of surveys.

Mile. A unit equal to 5,280 feet.

Minute. In the use of a protractor for plotting angles or bearings, a minute is one-sixtieth of one degree. There are sixty seconds in a minute.

Monument. A permanent physical structure marking the location of a survey point or boundary line. Common monuments include inscribed metal tablets or brass caps set in a concrete post and metal rods driven into the ground.

More or Less. When used in connection with quantity or distance in a conveyance of land, this phrase is considered to be a note of safety or precaution that is intended to cover some slight or unimportant inaccuracy. The same applies to the use of the word “about.”

North Arrow. A map symbol that shows the direction of north on the map, thereby showing how the map is oriented.

Origin. A fixed reference point in a coordinate system from which all other points are calculated, usually represented by the coordinates (0,0) in a planar coordinate system, and (0,0,0,) in a three dimensional system. The center of a projection is not always its origin.

Overlap. Where surveys of two different parcels share an area of land in common. The curvature of the earth and surveyor error contribute to the occurrence of Overlap. Modern mapping techniques using GPS reduce an overlap from many feet to only inches.

Overlay. Stacking multiple layers of mapping data, such as parcel and county boundaries, roads and lakes, on a prescribed geographical area.

Parallel. An imaginary east-west line encircling the Earth, parallel to the equator and connecting all points of equal latitude.

Parcel. An area of land described in a legal description. A parcel is separately owned, and can be conveyed and assessed.

Patent. A document by which the United States conveys, to those entitled thereto, legal title to some portion of the Public lands.

Perpendicular. Being at right angles to a given line.

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 “footprints” [of improvements].

Plane Rectangular Coordinates. A system of coordinates in a horizontal plane, used to describe the positions of points with respect to an arbitrary [point of] origin by means of two distances perpendicular to each other.

Planimatric Map. A map that displays only the x-y locations of features and that represents only horizontal distances.

Plat. A diagram drawn to scale showing all essential data pertaining to the boundaries and subdivisions of a tract of land, as determined by survey or protraction.

Point. A geometric element defined by a pair of (X,Y) coordinates.

Pole. Also termed a “rod”; a unit of length in land measurement, equal to twenty-five “links” or 16.5 feet. **Note:** Now considered an outdated term. See “Rod,” below.

Polygon. A closed plane containing three or more angles and straight sides. An area feature, such as a parcel or a county.

Projection. A method by which the curved surface of the Earth is portrayed on a flat surface. Refer also to “Mercator” and / or “Homolosine” projections.

Protraction. The word means extensions; prolongation. An example of its use is the representation on paper of the fractional lots in the north and west tiers of sections within a township. These lines are not monumented on the ground. They are shown on the plat as a protraction (a dashed line) indicating that they were not run [i.e., measured] in the field. The distances given are parenthetical [i.e., qualified, or explanatory only] until they are actually surveyed.

Protractor. An instrument in the form of a semicircle that is used in mapping to measure angles in the drawing or plotting of a metes and bounds survey description. A protractor is calibrated in the degrees contained within a circle.

Public Land Survey System (PLSS). A rectangular survey system established in the United States by the Land Ordinance of 1785. The basic survey unit is the six mile-square township. Townships are located by baselines and meridians parallel to latitude and longitude lines; they are defined by range lines running parallel (north-south) to meridians and township lines running parallel (east-west) to baselines.

Quadrant. Any of the four quarters into which something is divided by two real or imaginary lines that intersect each other at right angles. An arc of 90 degrees is one quarter of a circle.

Quarter Section Corner. A corner at an extremity of a boundary of a quarter-section. Written as "¼ section corner," not as one-fourth section corner.

Radii. Plural for radius.

Radius. The distance from the center to a point on the outer edge of a circle, circular curve or sphere.

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.

Record. A set of related data fields, often a row in a data base connecting all the attribute values for a single feature.

Relief. Variation in the elevation of the ground surface; also, features of height above a plain or reference datum. On topographic maps, relief is depicted by shading, or more accurately by contours or by spot elevations or both.

Right Angle. A figure that is formed by two lines extending from the same point which are perpendicular to, or at 90 degrees from one another.

Right of Way. The legal right to cross the lands of another. Also used to indicate the strip of land for a road, railroad or power line. In regard to Bureau of Land Management (BLM) property, a permit or an easement which authorizes the use of public lands for

certain specified purposes, commonly for pipelines, roads, telephone lines or power lines. Also, the lands covered by such an easement or permit.

Rod. One rod equals 16.5 feet or twenty-five links. Also termed a “perch” or a “pole” in older surveys.

Second. One-sixtieth of one minute of angular measure (i.e. north forty-four degrees 26 minutes 36 seconds west, or abbreviated thus; N440 26' 36"W).

Section. The unit of subdivision of a township with boundaries that conform to the rectangular system of surveys; nominally, a one mile square containing 640 acres.

Section Corner. A corner at the extremity of a section boundary.

Section Half. Any two quarter sections within a section which have a common boundary; usually identified as the north half, south half, east half or west half of a particular section.

Section Quarter. One of the four parts of a section. Normally it is a quadrangle measuring approximately one-half mile on each side and containing approximately 160 acres.

Section Quarter-Quarter. One of the four parts of a section quarter Normally it is a quadrangle measuring approximately ¼ mile on each side and containing approximately 40 acres.

Sixteenth-Section Corner. Also termed “quarter-quarter section corner.” A corner at an extremity of a boundary of a quarter-quarter section, mid-point between or twenty chains from the controlling corners of a section’s or a township’s boundaries. Written as “1 / 16 section corner.”

Split. The division of a single parcel into multiple parcels. This can involve dividing one parcel into two, two parcels into three, and so on. A boundary line adjustment is a special case, in which each of the parcels both gain and lose some area. Also called

“segregation,” it contrasts with a “combination,” in which multiple parcels become one new parcel.

Square. Having four sides lying, crossing or meeting at right angles (90 degrees) with opposite sides parallel and all sides equal in length.

State Plane Coordinate System. A series of grid coordinate systems prepared by the U.S. Coast and Geodetic survey for the entire United States, with a separate system for each state. Each state system consists of one or more zones. Arizona has three zones. The zones are Arizona West, Arizona Central and Arizona East. The grid coordinates for each zone are based on, and [are] mathematically adjusted to, a map projection.

Subdivide. Dividing a township into sections, a section into half sections, etc. Also, dividing an area into lots [i.e., parcels], streets, rights-of-way and easements, usually according to state law and local regulations.

Symbol. Visible signs shown on a map to indicate and distinguish particular features (e.g., roads, rivers, lakes, lot lines, railroads, etc.). Symbols to be used are usually shown in the Legend.

Table. A set of data elements arranged in rows and columns. Each row represents a single record. Each column represents a field of the record. Rows and columns intersect to form cells, each of which contains a specific value for one field in a record.

Thence. In surveying, and in metes and bounds descriptions, the term indicates that the course and distance given thereafter is a continuation from the course and distance given before.

Tie. A survey connection to an existing station or corner of the Public Lands from a point whose position is desired to be referenced.

Topographic Maps. A map which presents the horizontal and vertical positions of the features [of the land] represented; distinguished from a planimetric map by the addition of relief in measurable form. A topographic map generally shows the same features as a

planimetric map, but contour lines or comparable symbols are used to show mountains, valleys and plains; and depth curves are used to show depth in bodies of water. These are also called “topo maps” or “quad maps.”

To Scale. According to the proportions of an established scale of measurement (cadastral maps are ‘drawn to scale’).

Township. In the United States, a quadrangle approximately six miles on a side, bounded by meridians and parallels [i.e., lines], and containing thirty-six sections.

Traverse. A method of surveying in which lengths and directions of lines between points on the earth are obtained by, or from, field measurements across terrain.

Vector. A coordinate-based data model that represents geographic features as points, lines and polygons.

(X,Y,Z) Coordinates. The X and Y coordinates equal horizontal distance on a digital map (north / south and east / west). The Z coordinate equals vertical distance on a digital map. A map is converted from “Planimetric” to “Topographic” with the addition of the Z coordinate to the X and Y coordinates.

References:

1. International Association of Assessing Officers. 2003. *Standard on Digital Cadastral Maps and Parcel Identifiers*.

2. ESRI Press. 2006. *A to Z GIS*. Edited by Tasha Wade and Shelly Sommer.