I. PARCEL MAPS VS. SURVEY MAPS VS. GIS LEGAL STATUS

A. WHAT IS A SURVEY?

1. Land surveying is the science, art, and profession of determining the positions of points on the surface of the earth and measuring the distances, directions, angles, and elevations between them. This data helps accurately create maps and provide evidence to help courts determine plot boundaries.

2. Surveying and mapping has been a known science since at least Ancient Egypt. Surveying fulfills important needs in various fields, such as civil engineering, construction, architecture, and real estate.

3. Land surveyors use various methods to locate property boundaries

4. Once monuments are located, angles established, and measurements made a surveyor will use the information to prepare maps and survey plots of sites.

5. Surveyors are required to provide the measurements necessary to build a map of an area.

6. Land surveyors may work with field equipment such as theodolites, levels, plumb bobs, and total stations, and software such as auto-CAD.

7. The Surveyor is also available to serve as expert witnesses in court cases and provide expertise to attorneys, engineers, architects, and developers.

8. Professional surveys are the only legally binding documents that show where your property begins and ends. Because of this, they can be the deciding factor in property disputes and are crucial when purchasing and developing land.

B. **WHAT IS A MAP**? - A map is a symbolic depiction emphasizing relationships between elements of some space, such as objects, regions, or themes.

1. Many maps are static, fixed to paper but some others are dynamic or interactive.

2. Although most commonly used to depict geography, maps may represent any space, real or fictional, without regard to context or scale, such as in brain mapping, DNA mapping, or computer network topology mapping. The space being mapped may be two dimensional, such as the surface of the earth, three dimensional, such as the interior of the earth, or even more abstract spaces of any dimension, such as arise in modeling phenomena having many independent variables. Today we will deal only with the geographic type maps that look at the earth and items attached or buried in the surface.

3. Geographic maps of territory have a very long tradition and exist from ancient times. The word "map" comes from the medieval Latin Mappa mundi, wherein mappa meant napkin or cloth and mundi the world. Thus, "map" became a shortened term referring to a two-dimensional representation of the surface of the world.

4. There are many arguments of what are the essential elements of a map but most agree that there are at least five: Title, Legend, Grid, Direction, and Scale.

    a. First is your title. The title of your map should tell basic information about the map, such as the area represented. So you could have a map of the Chippewa Falls city area, or you could have a map of Wisconsin, or you could have a map of the United States, or you could have a map of your backyard. The map could be anything, but the title is going to tell you

what or should tell you some basic information about the map and the basic area represented by that map.

b. The next element is the legend, which is also known as the key, and it explains what symbols that are used on that particular map represent, such as symbols for major landmarks. So you may see little peaks to equal mountains, or squiggly lines to equal rivers. Those would be symbols that you could find on the map. They stand for mountains or rivers, so you would know if you saw an area with little peaks, there would be mountains there, or an area with a little squiggle, that would be a river in that area.

c. The third element is the grid. Most commonly represents the geographic grid system, or latitude and longitude marks used to precisely locate specific locations. So on a big map or a map of an actual place, you would often have crisscrossing lines that are going to represent the latitude and longitude of your area in space. You may just have a map of your backyard split up like this, but then you could tell someone in this first square or the second square or the third square where they should find something. And sometimes your grid is set up with letters and numbers. So if I said that there was a tree in this square, you could say in cell C3 on your map, you can find a tree. So that is how the grid would work. But these would be your lines of latitude and your lines of longitude. Latitude is flat, longitude is long, up and down.

d. The fourth element would be directions. A compass rose which looks similar to this, or some other symbol, is usually going to be present on the map to indicate the cardinal directions of north, south, east, and west. Sometimes a map is set up the way you see it, but north is really off to your right instead of being straight ahead, so having the cardinal directions on the map in the form of a compass rose or some other symbol is helpful to make sure that you are reading the map correctly.

e. The Fifth and last essential element of any map is going to be a scale. And a scale shows the relation between a certain distance on the map and the actual distance in real life. For example, one inch might represent one mile. Or ten miles. Or even more depending on the size of the map. So if I drew this little picture, I could say one inch might actually equal ten feet in that backyard. So a scale is just going to tell you what the measurement that you can do on that map, in centimeters or inches, is going to be equal to in terms of real life measurements of feet or yards or miles depending on how large of an area your map is representing. So the five elements that you should see on any map and be able to identify, are the title, legend, grid, directions, and scale.

5. Other elements that are often part of a geographical maps:

   a. Color - Use color to highlight the theme (main point of map). Don't color the entire page - only what you need to emphasize. Such as showing waterway or specific path.

   b. Author and date signed or produced- Write name, the date, and where signed is often useful and a popular addition for a multitude of reasons.

   c. Orientation – This is an expansion on the direction element. This could include showing how the map should be drawn or viewed, i.e. horizontal or portrait. One may also label 4 cardinal directions. North should always ne to the top but not always.

   d. Labels and Symbols – These are words appearing on the map that identify where things are located. Generally they are estimated not exact as to location. These are generally drawn, not written. Drawn representation of a location or something you would find on a map.

C. GIS – WHAT IS IT AND HOW IS IT USED?

1. A geographic information system (GIS) is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations—helping users make smarter decisions.

2. GIS technology applies geographic science with tools for understanding and collaboration. It helps people reach a common goal: to gain actionable intelligence from all types of data.

3. Any digital data that contains location based information is in fact a GIS. This location information in the GIS industry is called “spatial data” and it could be an address, coordinates containing latitude and longitude or complex three dimensional geometry.

4. GIS allows you to visualize data as a map. It allows the user to possess an innate ability to visualize patterns. Patterns that might take hours to identify in a spreadsheet can often be identified in an instant when displayed in a more visually engaging format like a graph, chart, or in this case a map.

5. There are many innovative ways that your data can be displayed on a map. It could be plotting markers, color coding locations based on an a data value or using heat maps to identify clusters and patterns in your data, the possibilities and potential insights are literally endless.

6. Hundreds of thousands of organizations in virtually every field are using GIS to make maps that communicate, perform analysis, share information, and

solve complex problems around the world. This is changing the way the world works.

a. Identify problems – show areas of concentration of auto accidents or where there has been numerous conflicting survey maps.

b. Monitor change - if a picture tells a thousand words, a GIS map tells a thousand pictures. Consider reliction and accretion on the Mississippi.

c. Manage & respond to events - GIS delivers real-time situational awareness. This hurricane and cyclone map shows potential impact to people and businesses, probable track of storms, and storm surge.

d. Perform forecasting - GIS delivers real-time situational awareness. For example hurricane and cyclone map shows potential impact to people and businesses, probable track of storms, and storm surge.

e. Set priorities - GIS helps to set priorities based on spatial analysis. By analyzing crime patterns, public safety officials can identify target areas and assign officers in those areas.

f. Understand trends - GIS helps you gain insight into data that might be missed in a spreadsheet. This map measures job growth or losses in different industries and quantifies local competitive advantage.

7. GIS adds another layer of information to what surveying reveals. These days it is used frequently for natural resource management, developing simulations for things like seismic hazards, water retention, and soil erosion. It assists engineers working to design and build tunnels, sewer systems, and highways. GIS is used by professionals charged with locating potholes that need repair, and land that is available for development, estimating stormwater runoff,

inventorying utility poles, managing utility networks, and creating subsurface 3D utility models.

8. Surveying and GIS are two powerful tools that can be used together to deliver highly accurate information. Applications such as volumetric modeling, 3D visualization, urban planning, and precision farming are relatively new disciplines that combine these technologies. Governments have started to invest in hybrid tech efforts to complete large-scale projects, including the European initiatives SESAR and ERTMS.

9. GIS technology is quickly applying itself to niche surveying techniques, most notably LiDAR. Airborne LIDAR sensors are used by companies in the remote sensing field. They can be used to create a DTM (Digital Terrain Model) or DEM (Digital Elevation Model); this is quite a common practice for larger areas as a plane can acquire 2 - 3 mile wide swaths in a single flyover. Greater vertical accuracy of below 2 inches can be achieved with a lower flyover, even in forests, where it is able to give the height of the canopy as well as the ground elevation. Typically, a GNSS receiver configured over a georeferenced control point is needed to link the data in with the WGS (World Geodetic System). LiDAR are also in use in hydrographic surveying. Depending upon the clarity of the water LiDAR can measure depths from 0.9m to 40m with a vertical accuracy of 15 cm and horizontal accuracy of 2.5m.

10. GIS is the already preferred technology for managing data culled from modern surveying technology – mobile mapping, LiDAR, and laser scanning. As these tools become more precise, surveyors will turn towards GIS technology which has the scale and power to handle the data collected.

11. Surveying involves measuring the location of objects on earth, and more organizations are using Global Navigation Satellite Systems (GNSS) for this

function. This data incorporated into a GIS system can estimate area and prepare digital maps.

a. GNSS (Global Navigation Satellite System) is a satellite system that is used to pinpoint the geographic location of a user's receiver anywhere in the world. Two GNSS systems are currently in operation: the United States' Global Positioning System (GPS) and the Russian Federation's Global Orbiting Navigation Satellite System (GLONASS). A third, Europe's Galileo, is slated to reach full operational capacity in 2008. Each of the GNSS systems employs a constellation of orbiting satellites working in conjunction with a network of ground stations.

b. Satellite-based navigation systems use a version of triangulation to locate the user, through calculations involving information from a number of satellites. Each satellite transmits coded signals at precise intervals. The receiver converts signal information into position, velocity, and time estimates. Using this information, any receiver on or near the earth's surface can calculate the exact position of the transmitting satellite and the distance (from the transmission time delay) between it and the receiver. Coordinating current signal data from four or more satellites enables the receiver to determine its position.

c. Depending on the particular technologies used, GNSS precision varies. For example, the United States Department of Defense originally used an intentional degradation (known as "Selective Availability," or "SA") of GPS signals to prevent potential military adversaries from using the positioning data. Because of SA, GPS accuracy was limited to a 100-meter range for civilian users, although military equipment enabled accuracy to within a single meter. In May 2000, a presidential order mandated that SA be discontinued. Without SA, all GPS receivers are potentially accurate to

within 15 meters. When available, Galileo will provide position accuracy to within one meter.

12. Leaders in the surveying and GIS industries are all beginning to recognize the opportunities that come with cooperation. For those professionals on both sides who are looking to expand their horizons, it is time to embrace the partnership between land surveying and GIS.

D. LEGAL SIGNIFICANCE OF PARCEL MAP VS SURVEY MAP VS GIS MAP

1. They are all valuable pieces of evidence leading to the ultimate goal whatever that may be. They are nothing more than that – pieces of evidence with different weight giving to each of them depending on the ultimate question.

2. Therefore the first question to ask is why am I looking at these items? What is my ultimate goal? Am I helping set the construction of a road, assisting a homeowner, trying to resolve a property dispute, completing a geological study for a mining company, or updating the county real estate tax records? Each has its own goal and the different items have a different value.

3. Legally none of these devices in and of themselves can define ownership. Together they can give a court what it needs to decide.

4. A parcel map is generally a governmental tool. A parcel map, also known as a property map and tax map, are maps typically built to identify property boundaries and is a popular data source for government and other industries such as real-estate. Parcels can often contain many businesses in the same plot.

a. The Wisconsin Parcel Map Initiative is an effort to create a digital parcel map for Wisconsin by aggregating local parcel datasets utilizing geographic information systems (GIS) technology. https://maps.sco.wisc.edu/Parcels

b. Wisconsin Act 20, from the biennial state budget for 2013-2015, created statutory directives for state and local governments to coordinate on the development of a statewide digital parcel map. The Statewide Parcel Map Initiative is an effort to create a digital parcel map for Wisconsin by aggregating local parcel datasets utilizing geographic information systems (GIS) technology. The Parcel Initiative is a multi-faceted, multi-year collaborative effort of the Department of Administration, State Cartographer's Office, and local governments.

c. The site clearly warns users that the site and the information do not represent actual boundaries or property ownership. This is true despite what so many property listers across the state tell users. The statement is

"The information shown on this map was obtained from Wisconsin's counties in 2020 and thus may not be the most current, comprehensive data available. Source data for parcel polygons was collected between January–June of 2020. However, the tax roll year for most records is 2019, as the assessment cycle lags a year behind. To ensure the most current, comprehensive parcel data, consult the local government's land information websites first, or contact the city or county land information office directly. The next release of the statewide parcel layer, V7, is tentatively scheduled for June 30, 2021.

No warranty, expressed or implied, is made regarding accuracy, completeness, or legality of the information herein. The boundaries depicted on this map do not represent the legal ownership boundaries of

any property. The delineation of legal boundaries may only be conducted by a licensed surveyor. This map is not a survey of the actual boundary of any property this map depicts."

d. The primary use may be for tax purposes because in Wisconsin your taxes are determined by assessed valuation and the municipal assessors by statute use the tax parcel data from the tax lister's office as their source of information. Governmental agencies that reimburse farmers a=or grant tax credits will also use this data. School districts are based on tax parcels, voting districts and municipal boundaries all use tax parcel numbers and the GIS tax parcels for definition.

e. Parcels do not define ownership. And they do not define all the extras a survey brings to the table.

5. GIS is just a data gathering and cataloguing system that can be translated into a map depending on the need. The key is that it is a system to collect and store data based on scientific formulas. It still takes a person to translate the data to a map and that person is directed by his or her assignment.

6. The survey provides a "snapshot" of the property at a certain point in time and can tell us a lot about the property because it involves human observation that are not present in CIS Mapping or in electronically created parcel maps.

a. A survey can also shed light on other important factors such as the existence of recorded and non-recorded easements, rights of way, covenants, restrictions, paths, common driveways and other matters.

b. A survey may also show that there exist "unrecorded" easements and rights of way, or that an adjoining neighbor's fence, shed, deck, addition, pool or other improvement encroaches upon the property.

c. A survey can also reveal if additions and other improvements are built within the zoning setback requirements of the town. A survey not only provides the boundary ("metes and bounds") description, but many times it also provides the distances of improvements from various points on the survey to the boundary lines of the property.

7. Whereas parcel maps cannot be used to determine ownership a survey can in combination with other pieces of information form the basis for a Court of Law to determine ownership.

8. A classic example of the difference between a parcel map and a survey is when a parcel map completed by GIS calculations says that a lot has 210 feet of frontage but a land survey based on the deed and the observation of monuments found by a surveyor doing a retracement can certify that the water frontage is only 200 feet. Here an individual will pay taxes on 210 feet of frontage and will own 200 feet and that is a perfectly legal result.

9. There seems to be an unconscious desire among land use professionals to give validity to the lines drawn on parcel map documents. Court records illustrate how often various parties attempt to use these documents for purposes that they were never intended to serve.

    a. Recent court decisions from New York provide several relevant examples. In one case, a surveyor relied on tax maps provided by others in an attempt to locate a parcel of land. There was no apparent effort made to obtain previous descriptions of the disputed tract, or to perform a field survey of the land. The problem arose (in part) as the result of a tax deed generated for the sale of 11 acres that had been foreclosed on by the county government. Since the deed referred only to the tax parcel for a description, it seemed to create a plausible excuse to use the tax map in

order to determine the location of the parcel. In this case, the result was not simply an erroneous location of a boundary line, but rather a complete displacement of the 11-acre tract to a location where it had never existed. In a unanimous decision, the judges dismissed the tax maps as insignificant for determination of title issues. The Court stated:

In describing the disputed parcel's location as being within the plaintiff's property, the defendants' surveyor merely relied upon and replicated the tax map's erroneous estimation of the location of the disputed parcel, which was not sufficient to raise a triable issue of fact as to the parcel's true location…

b. The Missouri courts provide interesting commentary on the general unreliability of tax maps when used to prove the location of a disputed boundary line. In this instance Plaintiff had no other evidence to prove his ownership of the 10-foot strip of land because it was not included within his deed description. The local tax assessor was one of the individuals who testified in the case. While Plaintiff hoped the assessor's statements would strengthen his claim, the testimony ultimately had the opposite effect. The assessor noted that the maps were accurate only down to a 50-foot range and did not clearly demonstrate who owned the disputed 10-foot strip. In addition, some lines were dashed rather than solid, indicating that the employee who drew them was unsure of the ownership of the land in question. Considering the statements made by the assessor, the court expresses puzzlement as to the possible significance of the tax map in these circumstances:

The assessor explained that a tax map is not intended to be used as a survey and should not be relied on as an exact placement of any structure in relation to any lot line. He further testified that there are occasionally

errors on these types of drawings, and in fact, there was previously an error on a lot adjacent in the area in dispute.

c. A recent Tennessee decision found a surveyor charged for negligence when he based a retracement on a tax map and then subdivided the resulting tract. As a result of his work, several of the lots as marked actually overlapped with the adjoining tract. The court emphasized that by ignoring the latest recorded deed for the subject parcel, the work performed violated the Tennessee standards of practice for land surveying. The Court said that the surveyor…in derogation of the rules promulgated by the Tennessee State Board of Examiners for Land Surveyors, failed to create his survey using the latest recorded deed to the property and instead utilized a tax map provided by the Tax Assessor's office.
The court went on to support a claim of negligence against the surveyor. He was ultimately held responsible for any damages that resulted from the negligence or lack of basic surveying skills on his part.

d. In an interesting Vermont case, a surveyor became involved in a development scheme that forced him to decide between following the clients' wishes and performing a proper retracement prior to development of a parcel of land. The developer had initially used a tax map as the basis for a preliminary concept sketch to indicate the rough layout of the proposed division. Unfortunately, an individual acting as an agent for the developers told the surveyor that re-surveying the outside boundaries of the parent tract was unnecessary. More significant to the ultimate outcome was the surveyor's concession to this request. When all work was completed, a strip of land remained that was not intended by the original developer. Total damages awarded by the lower court totaled over $70,000. While the background information included in this case documents numerous problems, the decision includes a warning for any

surveyor considering tax maps as a reliable source of survey information. Among other undisputed findings, the court notes:

…(2) defendant knew that the preliminary sketch was based upon the Ferrisburgh tax map; (3) tax maps are not intended to be used in establishing the boundaries on any survey, and it would not be in accordance with professional surveying standards to do so; … defendant used the tax map to guess at the location of *the southern boundary line of the property (and thus the subdivision).*

As a general rule, any time a court concludes that guesswork has been used as the basis for professional opinions, the outcome will likely be a poor one for the guesser. Additional findings in this case noted that physical features on the land should have alerted the surveyor to a discrepancy. Finally, the court observes that the surveyor made no mention on the face of his survey that the outside boundary lines had not been verified.

e. In another Vermont case the Court stated …*this Court also finds that professional survey standards require that a survey must verify the perimeter boundaries of the parcel to be surveyed. Defendant contends that this finding cannot stand because plaintiffs failed to present expert testimony to support it. In response, plaintiffs point to testimony indicating that defendant was aware that preparing an accurate survey required researching the deeds of adjoining owners to verify the perimeter boundaries of the land to be surveyed*.

f. In an adverse possession case the court stated … *tax maps cannot be used to establish boundary lines or assurance of title. … While it may place one tract of land inside the other, the tax map cannot be used to establish*

boundary lines or color of title. …Tax maps do not "on their face profess to pass title" and, thus, cannot be assurance of title.

10. One can thus conclude that each has its own purpose but if the purpose relates to tile ownership the properly executed certified survey is going to be the best evidence. GIS data may be used to complete the survey. Parcel maps may help get the surveyor started but ultimately the rules governing the proper preparation of a land survey combined with the skills of observation and notation will provide the best evidence.