

Coach PLSS Public Land Survey System 11 30 2024

Coach files are a series of short lessons, each for a Road Scholar topic. Most started out as responses to questions from coaches. Questions and answers are from various events. You will be seeing Mapscans) from various USGS maps and some from AAA Road Maps It's always better to have the whole map, so I will include the name and date of the USGS Topo map that the Mapscans come from. You can get the entire map free online from USGS.gov.

Introduction:

Most maps use a grid system- a series of real or imaginary lines running vertically (or North-South) and horizontally (or East-West). Five different grid systems are used in Road Scholar:

1. Road Map (for example, AAA) Grid
2. USGS Map Sector Reference Grid
3. Latitude and Longitude
4. Public Land Survey System (PLSS)
5. Universal Transverse Mercator (UTM)

Simple grids like Road Map grid references and Map Sector Reference System are very easy and fast to use. More detailed grids like Lat/Long and UTM take more time and involve math but yield much more precise locations.

Land Ownership, Boundaries, and Surveys:

A person who owns land must have a legal deed to their property. The deed is a written legal document that lists the property boundaries of the property. A survey is a plotting, on earth's surface, of the exact property boundaries. The deeds for all properties in an area must agree as to where the exact property lines are so that disputes can be settled. Land survey systems in various parts of the world have been developed for this purpose. This Coach file will explain the two most common survey systems in the United States- the Metes and Bounds System and the Public Land Survey System.

The Public Land Survey System (PLSS) Background:

The United States originally contained 13 states, although state boundaries were hotly contested. One well known dispute over state boundaries between states was a pre-revolutionary fight between Pennsylvania, Maryland, and Delaware over their mutual boundaries. Surveyors Mason and Dixon marked out a mutually agreed on state line; many of its stone boundary markers are still standing. The stone below shows "M" on the Maryland side.



Most of the land in each state was already surveyed, property lines were drawn, and the land was owned by someone. In the treaty ending the Revolution, the US acquired the area now comprising the Midwest states from Britain. The federal government wanted to sell these lands to citizens for settlement. Before land could be sold, a uniform new system was

developed so land boundaries could be established, and people could purchase a clearly defined piece of land.

Thomas Jefferson, who was a trained surveyor, proposed the PLSS grid as this new system. PLSS was not applied back to the original 13 colonies, and some future states had already been divided according to Spanish, French, or Polynesian systems. If you live in a PLSS state, your property description deed and survey use PLSS grid to show boundaries. If you are in one of the original 13 states, you have a "meets and bounds" description using compass bearings and distances from various landmarks- a certain tree, a big rock, a stream, etc.

PLSS is a rectangular grid system and shows on most USGS maps as a red grid of one-mile squares. If you look down from an airplane flying over much of the U.S., you may notice farms and roads set up in large squares-a result of PLSS.

New York Farmlands - boundaries follow landmarks --streams, trees, rocks, etc.	Kansas Farmlands - boundaries follow a pre-set square PLSS grid.
	

To establish PLSS in an area, surveyors drew a Base Line (East-West) and a Principal Meridian (North-South). The intersection of these two lines was their starting point. The land along these lines was divided into Towns of 36 square miles. (These "towns" are not towns with stores and people, just areas of land). Towns were given numbers - Town 1 North was just north of the Base Line, Town 7 South was the seventh town south of the Base Line. East - West variations were named Range. A given 36 square mile area thus might be Town 3N (3 towns north from Base Line), Range 13 East (13 towns east of the Principal Meridian).

PLSS Sections

Each town was divided into 36 one square mile (640 acres) sections, numbered as shown below.

Assume this is Township 3 North, Range 13 East (T3N, R13E)

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27 *	26	25
31	32	33	34	35	36

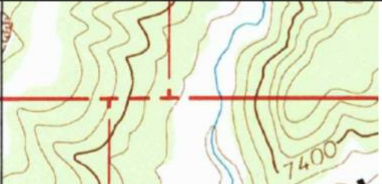
Problem 1. What is the PLSS description of the asterisk?

Section 27, Town 3 North, Range 13 East (written as: Sec 27, T3N, R13E)

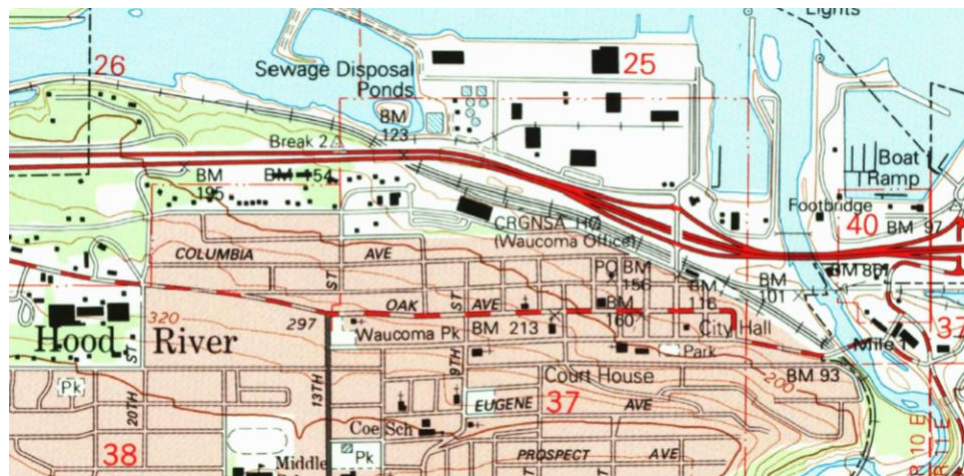
This is careful reading of the grid; no math is involved.

Notice that the number pattern is not like print on a page. This made perfect sense to surveyors walking on the ground, because they had to walk from one section to another to do the surveys. You would not finish a row of sections and then walk back six miles to start again; you just turn around and work the other way. It's like cutting grass. There is even a \$10 word for this: "boustrophedonically", from ancient Greek. It means "I'm doing this survey the same way I would plow a field with my pair of oxen!"

Each PLSS section is shown on topo maps with red boundaries and section numbers. Town and Range numbers are on the neat lines, or map boundaries. The Mapscan below shows the township and range notation. The sections often, but not always, line up perfectly. The red grid lines do not show over large lakes, etc. In flat areas, the red grid lines can be hard to see because roads are often built right on them.

Township Notation show North and South boundaries	Range notation shows East and West boundaries
	

The rule of 36 sections per town is almost always followed. Sometimes, you may encounter a topo map with PLSS Sections above 36, for some reason that made sense to the surveyors on the ground when the map was drawn. See Mapscan below from USGS Hood River, OR 1984. This portion of the map shows the junction of the smaller Hood River with the larger Columbia River. (Hood River is both a River and the name of a city).



Problem 2 Story - The Three Pigs: Pig #3 sits in his office right at the red "25" Section designation. Around him on the map, he can see PLSS Sections 37, 38, and 40. He is perplexed.

What is unusual about PLSS Sections 37, 38, and 40? PLSS sections are normally numbered from 1 to 36.

Locating Places Within a PLSS Section

PLSS sections are usually one square mile, or 640 acres. That's a large area, so each section can be divided into four quarters. Each quarter section is 160 acres. Assuming the soil is good, that is about the amount of land needed for a pretty good, sustainable family farm working on horse power in 1800. These quarter sections are not marked on the USGS maps; you can figure out their boundaries with some measurements and math.

Quarter Sections

Northwest 1/4	Northeast 1/4
Southwest 1/4	Southeast 1/4

To determine the quarter sections on a USGS map, measure the N-S boundary and divide in half; likewise for the E-W boundary. Use your ruler to check the location of a given feature. **Do not ever make marks on a hard copy USGS Map provided in an event! That is a DQ.**

The sample problems and Mapscans below are from USGS Kellogg West, ID 1956. This area has many mines that produced lots of gold, silver, and lead.

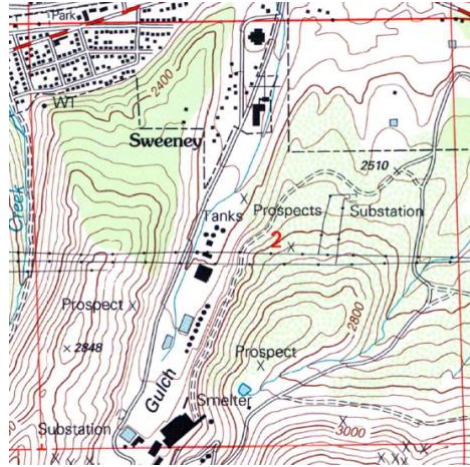
Story-We All Talk About Bruno: Ore from the mines was brought to the biggest smelter in the world, in Government Gulch. Using the Public Land Survey System, can you work out the smelter's location?

I can tell you it is in Town 48 North, Range 2 East. See enlarged Mapscan of smelter:

Government Gulch Smelter enlarged:



PLSS Section with Government Gulch Smelter



Problem 3. How large an area of land (in square miles) is included in this PLSS Section?

1 square mile. This is a knowledge question. All regular sections are one square mile.

Problem 4. What is the 3 -part PLSS description of the smelter's location? Express your answer as Section ____ , Town ____ , Range ____

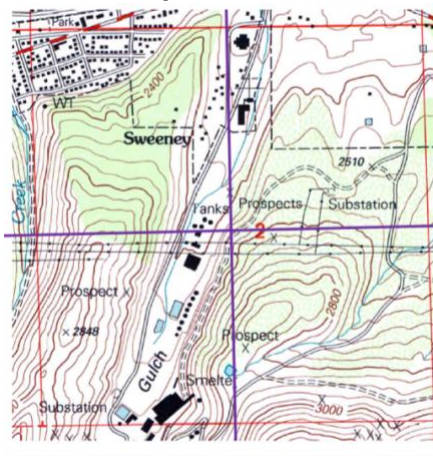
Section 2, Town 48 North, Range 2 East (written as: Sec 2, T48, R2E)

This is careful reading of the grid; no math is involved.

Dividing a Section Into Four Quarter Sections:

Each section is divided into Four quarter sections. These quarter sections are not marked on the USGS map but are shown below in purple.

Section 2, Town 48 North, Range 2 East. Purple lines have been added to show Quarter sections



Problem 5. To the quarter section, what PLSS section is the smelter located?

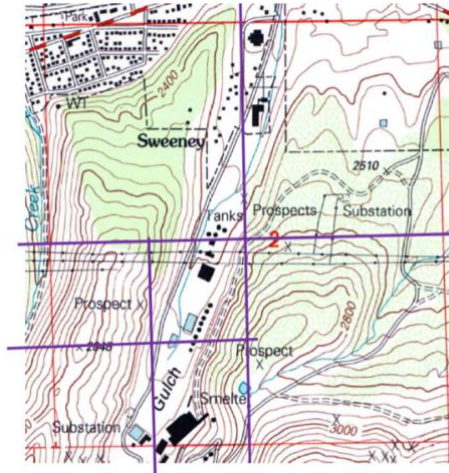
Express your answer as ____ , ____ , Section ____ , Town ____ , Range ____

SW 1/4, Section 2, Town 48 North, Range 2 East. This is careful reading rather than calculation.

Note-The purple lines are not drawn on the USGS map, they are added to show quarter section boundaries.

Dividing Quarter Sections

Section 2, Town 48 North, Range 2 East. Purple lines have been added to show Quarter -Quarter sections; they are not printed on the USGS map.



Problem 6. To the quarter -quarter section, what PLSS section is the smelter located?

Express your answer as _____ , _____ , Section _____ , Town _____ , Range _____

SE 1/4, SW 1/4, Section 2, Town 48 North, Range 2 East. This is careful reading rather than calculation. Note-The purple lines are not drawn on the USGS map, they are added to show quarter section boundaries.

Problem 7. What is the 5- part PLSS Description of the smelter?

Express your answer as _____ , _____ , Section _____ , Town _____ , Range _____

SE 1/4, SW 1/4, Section 2, Town 48 North, Range 2 East Note that this is the same information as the previous question, just phrased differently.

Sections can be broken down further as needed-for example to the N 1/2 of the SE1/4, SW1/4, etc.

Since PLSS sections are defined as one mile on each side, you can save some time by making up an overlay 1 x 1 mile square, drawn at 1:24000 ahead of time, with the quarter sections, etc., marked. Use the scale bar on a hard copy topo. You can also get commercial grids for this - try www.maptools.com.

PLSS sections are almost, but not always, 1 x 1 mile, so your grid may not be an exact fit. Sometimes boundaries are indefinite, cut off, or otherwise unusual. PLSS grids do not show in bodies of water.

PLSS and Map Drawing Problems in Road:

Road Scholar events often contain a map drawing problem. Specs call for you to be given a one square mile grid, and you will be asked to draw in specific features. The "one square mile" makes it likely that event writers will use PLSS to locate the features. Careful map drawing is very time consuming, with color requirements at state and national levels. Many teams have one member start with the map draw while the second starts the other questions.

PLSS and Land Settlement:

The PLSS system let the US Government sell land to settlers and give them accurate deeds. The going price, for about a hundred years, was \$2 per acre- several day's wages at the time. Under the Homestead Act of 1862, some of the land in western states was free for any man or woman. You could claim a Quarter- Section (160 acres) of unsettled land for free. You had to live on the land, secure a water source, build a house and produce a crop within five years; then you owned it. You could still homestead in Alaska until 1986. You never received mineral rights to homestead land; the US government keeps those tight and can sell them. If Exxon finds oil, you do not get paid for the oil.

Metes and Bounds Survey System:

"Metes and Bounds" is a traditional English method of describing land boundaries. These boundaries were originally used to define the limits of a town or church parish, but also apply to individual farms or other land. The usual elements of a metes and bounds description are:

1. Known recognizable landmarks- a certain rock, a particular tree, a stream, etc.
2. The **metes** are the direction (usually compass bearings) and distances between landmarks. They form the boundary lines that surround the land.
3. The **bounds** are the names of the landowners who border the property.

Just as with PLSS, a Metes and Bounds description and survey legally define lands for identification, tax assessment, and sale/purchase.

Metes and Bounds deeds are written in the following fashion:

"Encompassing all that tract of land in the Town of Ancram, County of Columbia, State of New York, bounded as follows: Beginning at the most Southerly located point at a large rock, then proceeding along the lands of Corsini, North 28 ° 13' 50" East 435.2 feet to an iron spike in an old roadway; thence North 23 24' 30" West 243.0 feet to a certain 36" Oak Tree, along the lands of Quinn.....thence to the beginning point... containing 9.997 acres of land. "

In England many centuries ago, it was customary for the men and young boys of a parish or town to assemble each spring and spend several days "beating the bounds". The goal was to teach the younger generation the boundaries when few people could read or write. As a group, they would walk around the town boundaries from one landmark to another, along the metes, until they returned to the starting point. At each stop, the boys would beat the landmark with sticks. That way, they would learn to recognize each of the important points. In some New England states, "Beating the Bounds" is still a requirement for town or state officials. No sticks anymore!

Internet Resources

www.soinc.org national site for Science Olympiad. See menu- events-B events- resources- look for any "Coach" or Coach Notes" files (like this one), see two complete practice events containing questions, answers, methods steps to get answers, and some maps. *Hamilton* and *Zombie Bedtime Rhymes* are former national level events.

<http://dnr.wi.gov> Wisconsin Dept. of Natural Resources. Find search icon at upper right of home page. Enter "PLSS Tutorial". Starting from scratch, this is a great explanation of the Public Land Survey System grid.