Public Land Survey System (PLSS): Elements, Procedure, Authority, and Computations

The PLSS had its start with the passing of the Land Ordinance Act of 1785. The Land Ordinance Act provided for a standardized system of identifying *(surveying)* and disposing of land *(patenting)* to citizens for the purpose of settlement and raising revenue. The Public Domain *(newly acquired territories by the U.S. Government)* was wide open for settlement and expansion of a new nation. The PLSS Point of Beginning or Initial Point was established on the western line of Pennsylvania *(referred to as Ellicott's Line)* in 1785. The surveys continued westward into Ohio where the PLSS went through several iterations before a final scheme was developed to continue throughout the remaining un-surveyed Public Domain. The surveying aspect of the PLSS can be complex, but many of the computations are simple when the original measurement unit is utilized. An example of a slightly complex subject is that the lines of the PLSS are determined as lines of constant bearing taking into account the curvature of the Earth. Whereas an example of one of the simpler computations is determining acreage of a tract of land with the lengths of 2 adjacent sides in chains. The computations will be explained in detail later in the background information.

The design of the PLSS is referred to as being a rectangular survey system, which is what makes it simple. A simple way of describing the system is that it begins with a large rectangle *(Township)* and breaks it down in equal parts *(Sections)*, which then are subdivided further into aliquot parts *(¼ section; ¼ ¼ section)*. The PLSS design facilitates the ability to describe land with a very distinctive description that can only be in one place. The PLSS "grid" is visible throughout the Public Land States as roads, fences, field lines, and other features that developed along the "grid" lines.

Surveyors in general are exposed to many different elements in the remote and urban areas including but not limited to variable weather, poisonous plants, insects, and reptiles, variety of animals such as bears, varying terrain, and an assortment of different people and cultures. Every day in boundary surveying is an unknown adventure!

The following is a more detailed explanation of the parts of the PLSS design and how they may relate to today's boundaries. Also, throughout are fun pictures relating to the adventure of surveying!

- **Basics including Tools of Surveying, Units of Measure, and Computations**

  - The surveys of the PLSS were done in a manner that tried to remain consistent throughout the process. The laws dictated the basic scheme; however, many items were not covered by the law. It was realized that to remain consistent in the general scheme, a Manual of Instructions would need to be prepared and issued to the Surveyor Generals for inclusion in the survey contracts. The inclusion of the Manual in the contracts created a requirement for the Deputy Surveyors to follow it. The first Manual was issued in 1855 by the Commissioner of the General Land Office *(established in 1812)* and it applied to all territories/states. The latest Manual of Survey Instructions was issued in 2009 by the Bureau

of Land Management *(successor to GLO)*. The items not covered by the law included, but were not limited to, the type of monument and how to mark, type of accessories to the monument and how to mark, the necessary items to include in the field returns, allowable closing error, measuring requirements, and many other items.

The monument is the physical item set at a determined survey corner position and originally consisted of wood stakes, chiseled stones, or a natural item such as a tree if the corner position was in it. The modern monument used by BLM surveyors is typically a stainless-steel post, 30 ins. long, 2½ ins. diam., with a brass cap for marking the corner identification. The type of modern monument used can vary depending on the terrain and other determining factors. The field notes of the GLO/BLM surveys describe the monument and the accessories for each corner.

The accessories are items that are noted with a bearing and distance from the monument with marks such as BXO chiseled in a rock outcrop *(bearing X object)*, a tree *(bearing tree)*, mounds of stone, memorials, or pits. The accessories can be any item, within a reasonable distance from a monument, that is considered somewhat permanent and possibly can be distinctively marked. Trees are considered permanent because when they are gone some type of identifiable evidence remains such as a stump hole, decayed wood below the surface, or just a discoloration in the soil. The pits are certain size holes dug out at a certain distance and direction from the monument. These pits eventually fill in with soil but are identifiable years later by the soil discoloration. The pit is visible as an outline because the pits fill in with different soil that has a different color. The mounds of stone are easily identifiable at first and eventually become scattered causing them to be more difficult to definitively identify, but not impossible. The memorial is an item placed below the monument, so if the monument is removed then it is still possible to identify the original location by recovering the memorial. Memorials were originally broken glass, charred wood, or any other identifiable item. A modern memorial used by BLM surveyors is called a Deep-1, which is a plastic case with a magnet in it. The magnet is easily located by modern metal locators.


Outline of East Pit of Original Standard ¼ Sec. 36, T 25 N R 22 W., 6th P.M. Nebr., In Heavy Soil. Corner About 40 Years Old. All Surface Indications Obliterated. Found by U.S. Transitman H.D. Jackson.

The measurement requirements included that the distances were to be reported as horizontal and in chains. The surveyors would either measure holding the chain horizontal or measure on the slope and convert to horizontal using the vertical angle measured. The Act of 1785 required the surveyors to run and note the lines' direction referenced to a true meridian *(true north)*.

- The tools used in the beginning of surveying the PLSS were a compass, axes, chisels, wood scribes, chain or pole, and anything needed at the moment.

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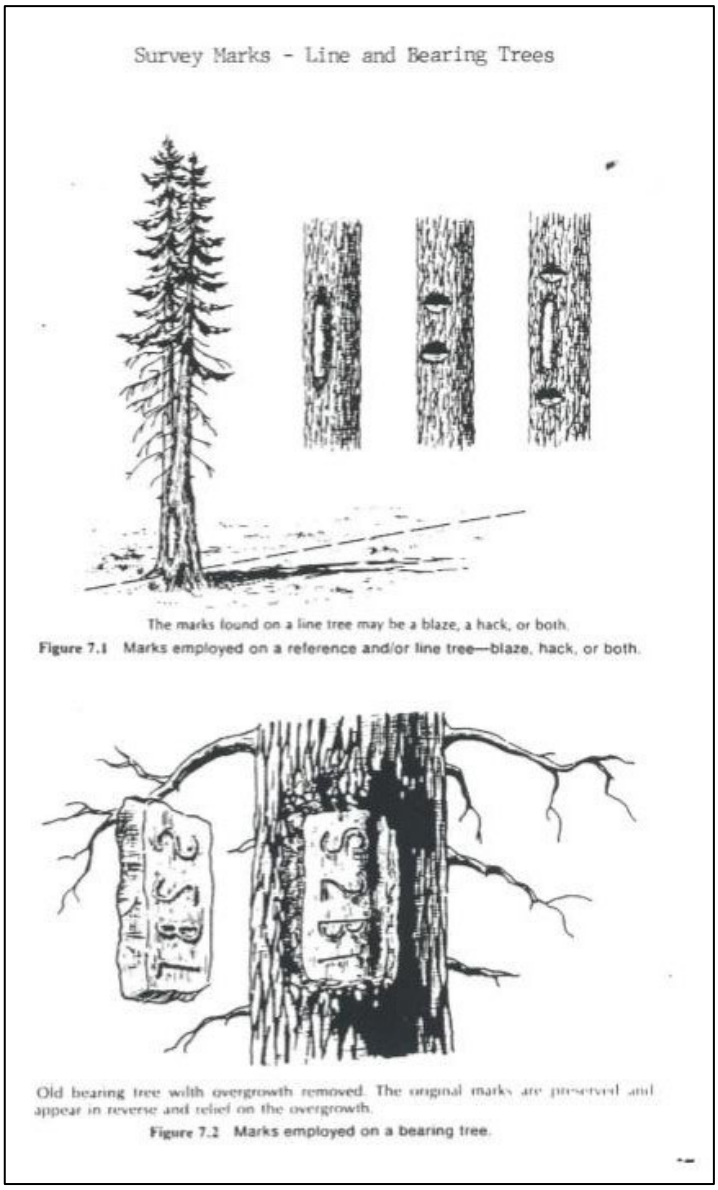

The axes were typically 6-8 ins. in width and were used to cut vegetation and blaze or hack trees. The trees were blazed for the purpose of being accessories and the hacks were used on trees to be indicators of where the surveyed line is located *(line trees if on the actual line)*. Blazing a tree removes the bark and flattens the wood without killing the tree. A hack is a horizontal notch cut well into the wood. In cases where the tree being blazed is going to be marked as a bearing tree, the blaze faces the survey monument and pertinent letters and numbers are carved in the flat wood. The line trees were typically hacked twice on the sides of the tree where line would enter then exit the tree. The blazes and hacks will eventually grow over, but a scar remains indicating the tree was marked as a line tree or bearing tree. The wood scribe is a tool that has a knife edge that can be used to carve letters and numbers into wood. It was used to mark wood posts for monuments and also to mark bearing trees. A chisel was needed to mark stone monuments and/or accessories consisting of hard materials such as rock.

The pictures are of the remains of a 1934 GLO resurvey bearing tree recovered by the BLM in 2008. It is located on the boundary of the Eastern Band of Cherokee Indian Reservation (ECBI) in North Carolina. The tree was cut down at some point prior to recovery. The upper right picture shows the line of the flattened blaze grown over. The lower left picture shows some of the scribing visible when the overgrowth was removed. The lower right picture is the stump with the overgrowth completely removed from the remaining portion of the blaze.

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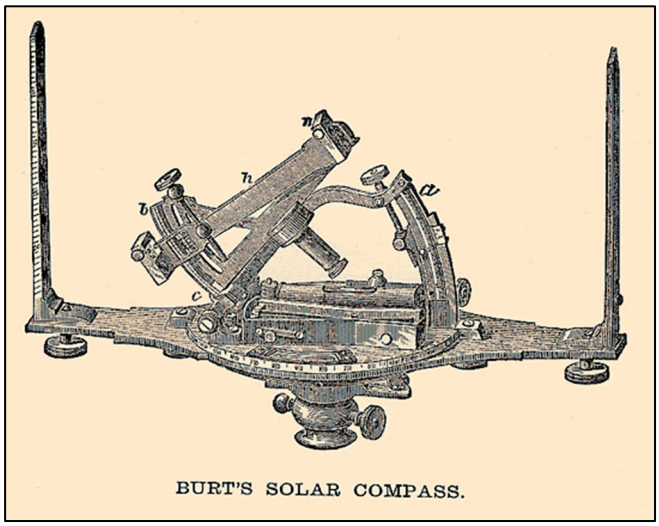
The first compasses were simple and determined magnetic bearing but were unreliable when used around objects that are magnetic in nature *(local attraction)*. The solar compass was invented by William Austin Burt and patented in 1836 and it allowed surveyors to determine direction based on the sun rather than magnetic north. This proved to be superior to the magnetic compass because it is not affected by local attraction.



BURT'S SOLAR COMPASS.

The direction was reported in bearings defined by 4 cardinal directions *(north, south, east, and west)*, and 4 quadrants *(northeast, southeast, southwest, and northwest)*. Each quadrant is ¼ of a circle *(360° / 4 = 90°)*. Direction consists of degrees *(60 minutes)*, minutes *(60 seconds)*, and seconds. An azimuth is another way to report direction and it simply begins at 0° *(north)* and continues clockwise until ending at 360° *(north)*, East = 90°, South = 180°, West = 270°. An example bearing is N. 0°15′45″ E. and the equivalent azimuth would be 0°15′45″. Another example would be S. 54°15′45″ W. with an equivalent azimuth of 234°15′45″ *(180° + 54°15′45″ = 234°15′45″)*. An angle is the difference between two bearings or azimuths. Angles can be reported as either right or left and this is determined by which direction the angle is calculated. Right angle is where you begin at a bearing and rotate to the right *(clockwise)* to the second bearing, whereas left angle is the opposite in that it rotates to the left *(counterclockwise)*. For instance, consider the two example bearings, the angle right from the NE to the SW bearing is 89°44′15″ *(NE quad remainder to east; 90° - 0°15′45″ = 89°44′15″)* + 90° *(entire SE quad)* + 54°15′45″ *(angle right portion of SW quad from south; = 54°15′45″)* = 234°00′00″.

Early Surveyor's 2-Pole (33') Chain

Lobsterville Beach on Martha's Vineyard, MA.

The chain or pole is what was used to measure distances. A pole is a unit of measure that is 16½ feet and typically consisted of a wood rod. Whereas a chain is a unit of measure that is 66 feet long and is made of metal linked together very similar to a modern chain. The lengths of the physical chain used in the original surveys varied from ¼ of a chain to 5 chains all dependent on terrain and the situation at hand. In very steep terrain like the canyons and mountains of Idaho a short ¼ chain was necessary to accurately measure the line, whereas in the plains a 5 chain one could be used for accurate measurements. The link is a sub distance of the chain. It is 0.66 feet long and 100 links makes up 1 chain.

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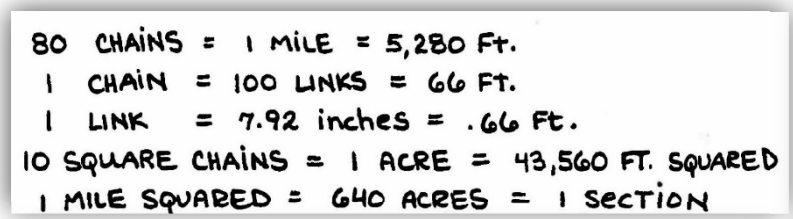
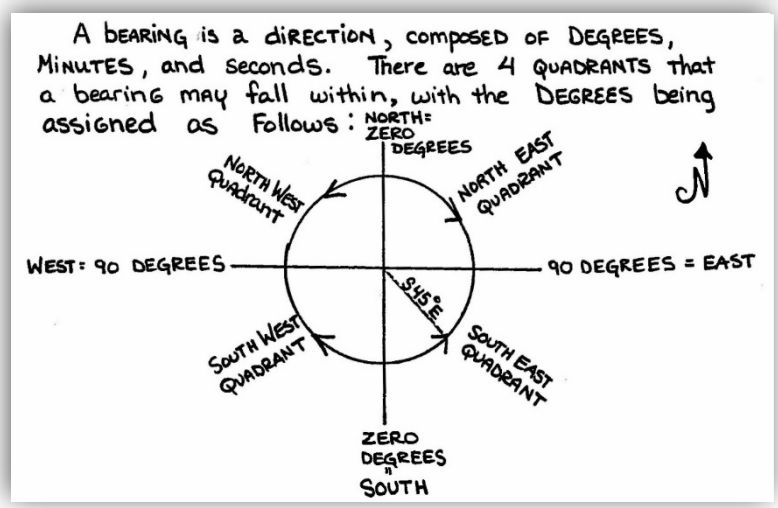
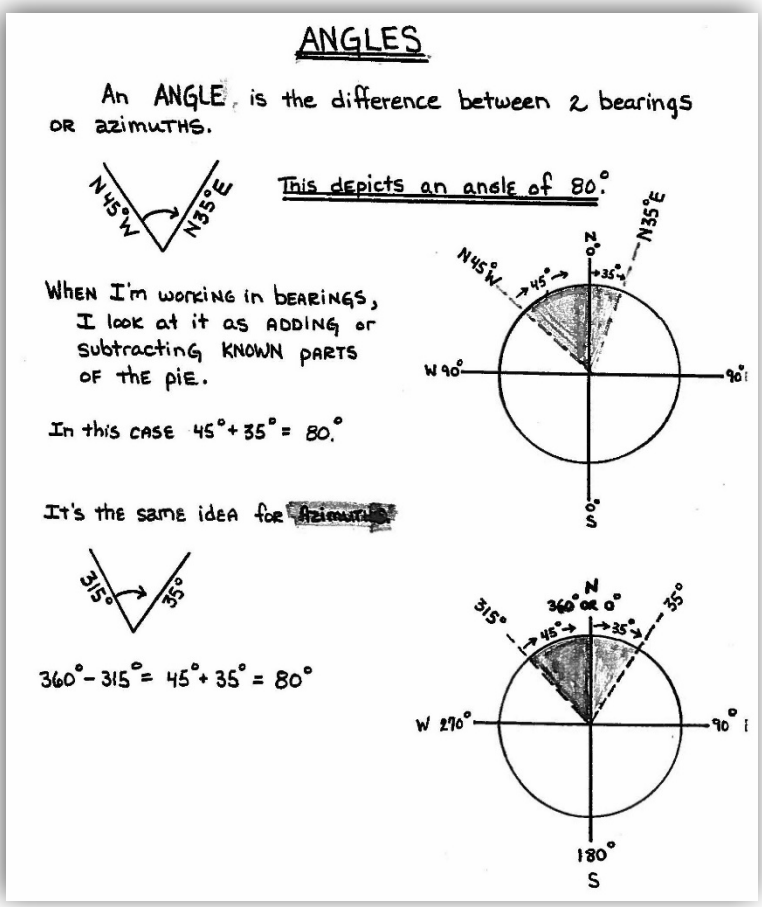






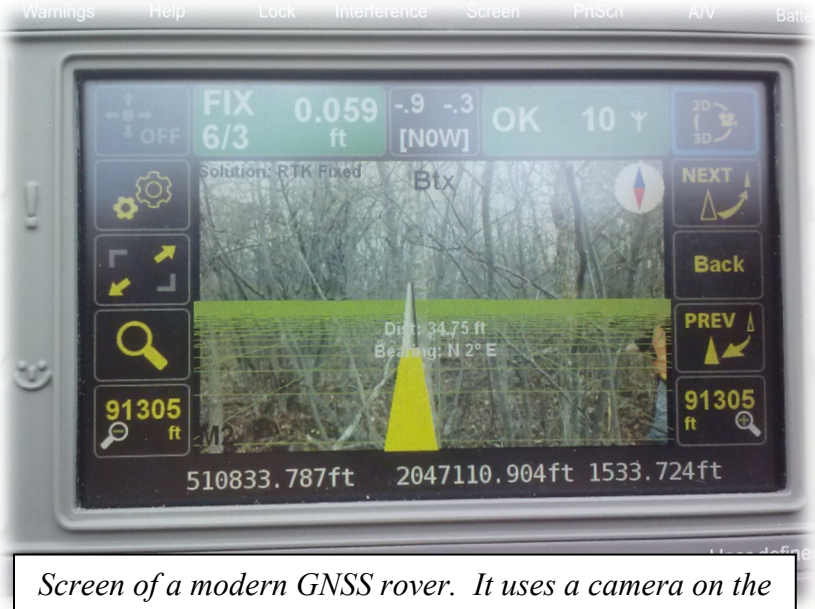
The area of land surveyed was reported in acres. The measurements were reported in chains, so the determination of area is a simple computation. A quarter quarter of a section is 20 chains by 20 chains, therefore 20 x 20 = 400 then 400 / 10 = 40 acres. Another example is a quarter of a section is 40 chains by 40 chains, therefore 40 x 40 = 1600 then 1600 / 10 = 160 acres.

Some of the modern tools used by surveyors have advanced through time, but yet some still remain the same. The compass and distance measuring tools are now Global Navigation Satellite Systems *(GNSS)* and total stations. GNSS instruments use satellite signals to determine a position on the Earth. In optimal conditions GNSS can be extremely accurate and precise, however in conditions that block the signals the system can be quite inaccurate and sometimes completely wrong. In the case of a bad GNSS environment the total station can be used to determine survey positions. This instrument determines angles from known points and uses an electronic distance measurement *(EDM)* for the distances. The EDM uses phase changes, that occur as electromagnetic energy waves, that are reflected back by a target, usually a mirror. In the context of surveying an angle is measured, typically to the right, with the instrument located on the occupied point *(known point)* and pointing at a back site *(known point)* where the instrument is zeroed, ie the angle is set to 0°. The instrument is then turned to the right and pointed at the fore sight *(new point, position to be determined by angle and distance)* where a tripod with a mirror is setup. The mirror is sighted for the EDM to use as a reflecting surface and get a distance reading. The distance is converted to horizontal, by the

instrument, using the vertical angle and the slope distance. The compass is still used for bearings that do not require the accuracy of electronic instrumentation and the distances that are not measured electronically are typically determined with a steel tape. The use of brass caps requires a die kit to mark them, which is a set of steel punches that are letters and numbers instead of just a point. Chisels and wood scribes are still used to this day for marking bearing objects and trees. For recovery of original evidence, a good ole shovel is a very important tool. Digging is a big part of modern BLM surveys as it is necessary for recovery of previous monuments and also for setting new ones. Pictures of original evidence and modern monuments will be included throughout and at the end.

Monte King (Cadastral Surveyor) using a modern GNSS receiver to locate an iron pipe set by the Civilian Conservation Corp (CCC) in 1937 on WEIR.

Doug Uran (Survey Technician) turning angles with a total station in North Carolina.



Screen of a modern GNSS rover. It uses a camera on the front to show the distance and direction to a point as a heads up display.

A large hole dug by hand with a digging bar and a shovel at the intersection of gravel roads on WEIR. The crew was looking for a stone set by a County Surveyor in the early 1900's. Doug Uran in the background and Monte King in the hole probing for the stone.

A view of 6 mile creek in Lewis County Idaho, T. 34 N., R. 2 E., Boise Meridian. A tributary to the Clearwater River.

- **Initial Points, Principal Meridians, and Baselines**

An Initial Point is a point where a Principal Meridian and Baseline was initiated. A Principal Meridian is a line established running north and south and it divides townships between east and west for a particular region. A baseline is a line established running east and west and it divides townships between north and south for a particular region. The Principal Meridians were not only important in the start of the PLSS as a basis for laying out townships, but also as part of the distinctive land description. The Principal Meridians and Baselines were supplemented by Standard Parallels *(baselines)* and Guide Meridians at certain intervals *(typically every 24 miles or 4 townships)* for the purpose of correcting any deficiencies in the lines of the townships. The east and west deficiency is corrected by the standard parallels and is caused by the convergence of the meridians *(all longitudinal lines (lines running north and south) in the Northern Hemisphere converge on the North Pole)*. The lines running east and west are latitudinal lines and they are curved, so the surveys had to take into account the curve for the lines run east and west. The north and south deficiency is corrected by the guide meridians and were most likely caused by errors concerning curvature of the Earth or just human error. See *"Principal Meridians and Base Lines Governing the United States Public Land Surveys"* map for the Principal Meridians and Baselines established in the U.S.

View from New Smyrna Beach looking across inlet at Daytona Beach, Florida.

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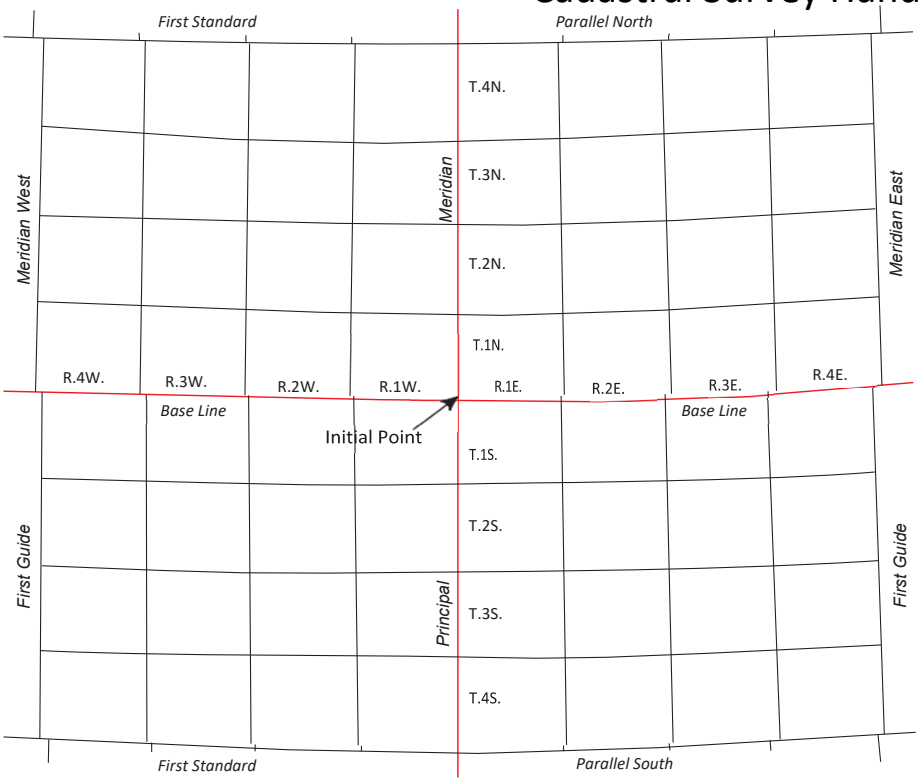

Diagram of a Principal Meridian and Baseline.

Cool tree-Cat Face. Located along exterior of Hanscom AFB in MA.

South boundary of WEIR, 10th Standard Parallel, standard ¼ cor. of secs. 4 and 32, T. 141 N., R. 41 W., 5th P.M., Minnesota. Original survey was 1860 which set wood post and it was resurveyed in 1887 setting stone at the section and ¼ corners. The stone is the 1887 monument and the wood piece (red circle)is most likely the remains of the 1860 monument. Coop recovery in 2009 by Minn. DOT, who provided the backhoe, and BLM, who provided the search area.

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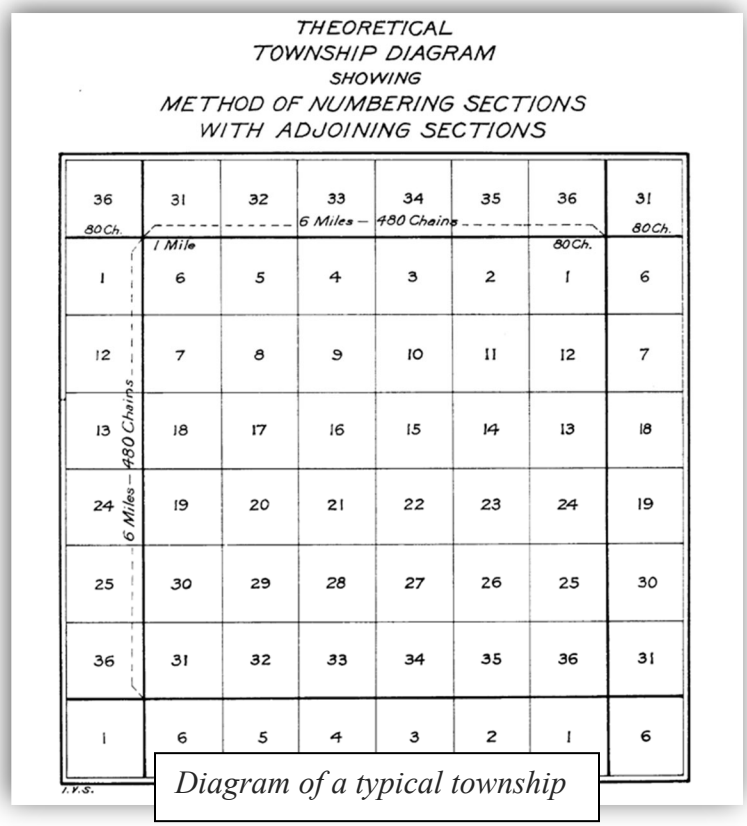
- **Township / Range**


THEORETICAL
TOWNSHIP DIAGRAM
SHOWING
METHOD OF NUMBERING SECTIONS
WITH ADJOINING SECTIONS

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

80 Ch. | 6 Miles – 480 Chains | 80 Ch.
1 Mile
6 Miles – 480 Chains
T.Y.S.

Diagram of a typical township

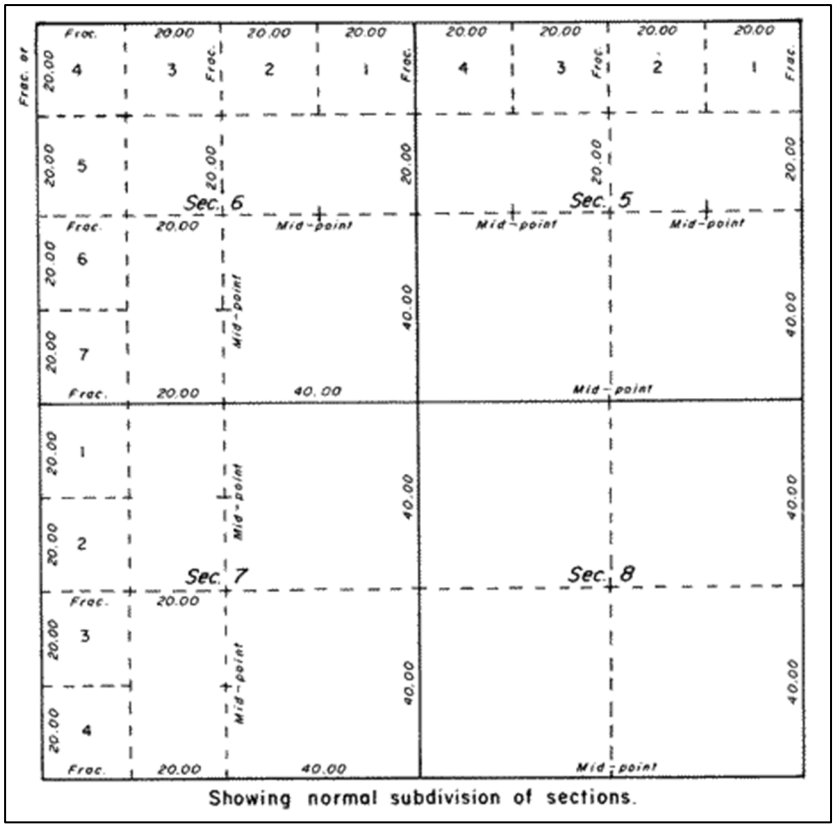
Each township is typically a 6 mile square and is identified with a number that represents how many townships north or south of a Principal Baseline *(Township)*, and a number that represents how many townships east or west of a Principal Meridian *(Range)*, it is located. The township designation also includes a letter *(N. or S.)* representing whether it is north or south of a Principal Baseline. The range is the same except it is a letter *(E. or W.)* representing whether it is east or west of a Principal Meridian. For example, Township 5 North, Range 4 West, Fifth Principal Meridian, Minnesota *(T. 5 N., R. 4 W., 5th P.M., MN)*. The exterior boundaries of townships were surveyed first then the interior section lines were done. The 4 corners of a township, NE, SE, SW, and NW, are simply termed township corners. They are typically the corner of 4 townships, except along standard parallels, guide meridians, and other special circumstances. In a typical township, monuments were set at corner positions, along the exterior boundaries, every ½ mile *(40 chains)*. The corners at whole mile increments are section corners and the ones at the ½ mile increments are quarter corners. In some townships (special cases), the corners at ¼ and ¾ mile increments were also set and these are sixteenth corners.

Wood post, originally set in 1872 and recovered by the BLM in 2009. ¼ cor. of secs. 13 and 18, T. 141 N., Rs. 40 and 41 W., 5th P.M., Minn. Located on the range line between ranges 40 and 41. Found lying down in swamp as pictured on the left. Sharpened point visible on the right.

- **Sections**

The sections are the next unit of size after townships in the PLSS scheme. Townships were subdivided into as many regular sections as possible placing any excess or deficiency in the last half mile running into the north and west boundaries of the township. Each section is typically 1 mile square and is identified by a number, which would be between 1-36, as there are 36 square miles in one township *(6 x 6 = 36)*. A "regular" section contains approximately 640 acres.

The section lines were to be run in a particular manner that led to the least amount of unnecessary travelling. The north and south lines were run once beginning at the south, whereas the east and west lines were run in a fashion that is termed "random and true." The exception to the north and south lines only being run once is the last mile that closes on the north boundary of the township as it was surveyed as random and true. The random lines were surveyed from an existing corner running east, north, or west to another existing corner, which the true location is theorized but truly unknown. The following is a description of how the east and west lines were run, which also applies to the last mile closing on the north boundary. A temporary position for corners to be established along the line were set during the course of running the random line. The random line can end up north, south, or possibly even right at the target corner concerning the latitude. If a difference in the latitude existed, it was noted and then the offset to "true line" was calculated from the random line. The line can also end up being long or short of the theoretical 80 chains, which would then be calculated as an east or west offset from the temporary corners. The survey crew then returned along the random line and moved the temporary corners to the true line using the calculated offsets. Once they arrive at the corner at the beginning of the random line they then ran the line north.



Showing normal subdivision of sections.


Snapping Turtle-Bad River Indian Reservation in Wisconsin.


Horseshoe crab-Lobsterville Beach, Martha's Vineyard, MA.

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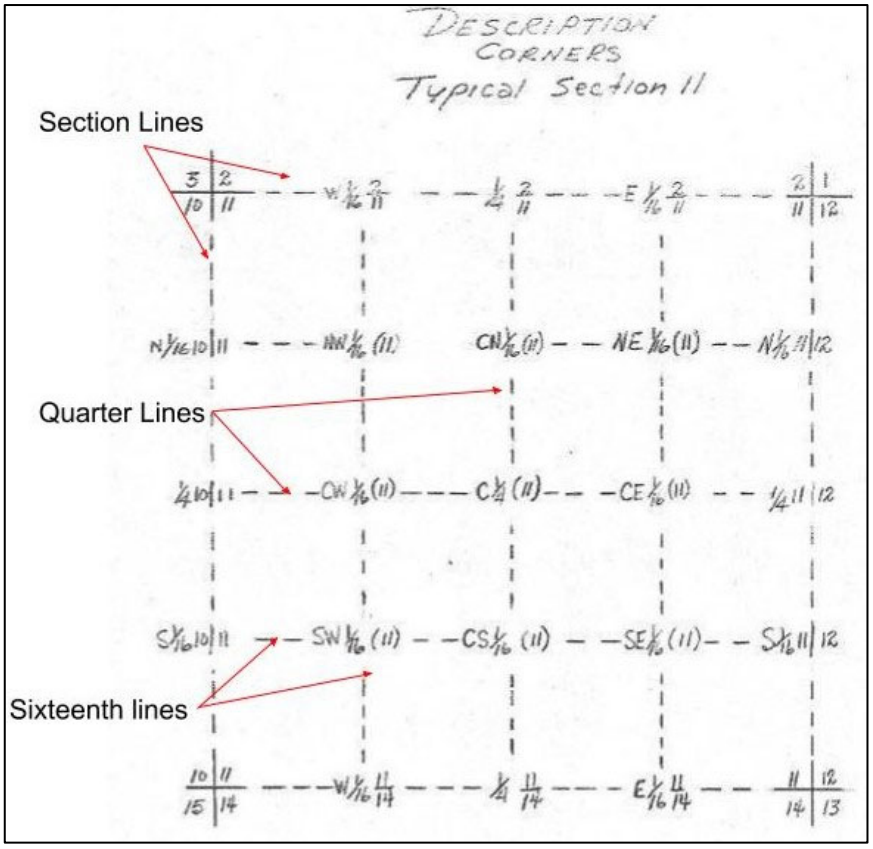
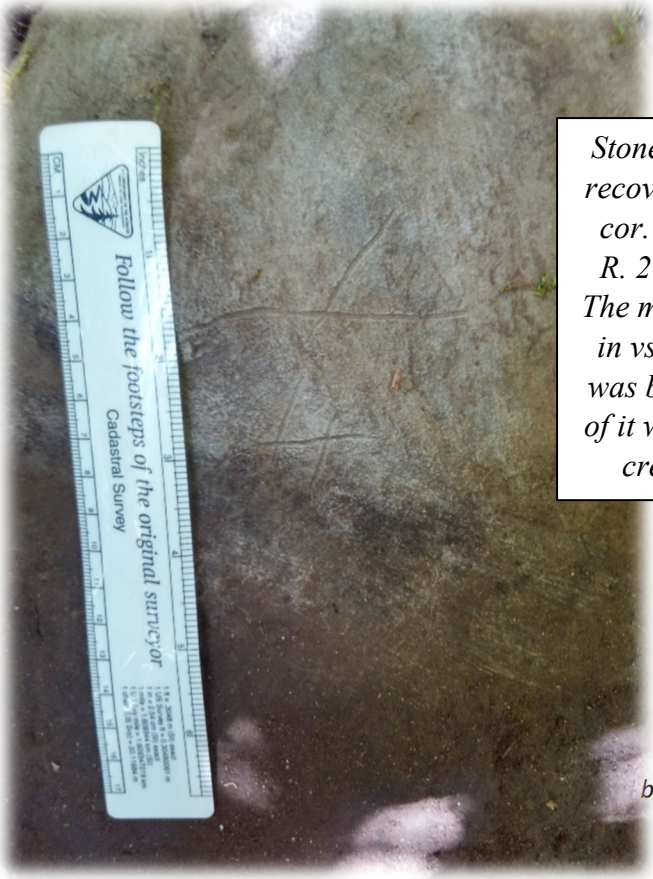
The section exteriors are similar to the township exteriors pertaining to corner position monumentation. The exterior of the section has 4 section corners and 4 quarter corners, and when necessary, the sixteenths are also set. The interior of a section has 9 corners with one being the <u>center quarter corner</u> and the rest being sixteenth corners. The center quarter corner is located at the legal center of the section, which is at the intersection of straight lines *(curve of the Earth is not accounted for in section subdivision except in some situations)* drawn from the 4 exterior quarter corners.

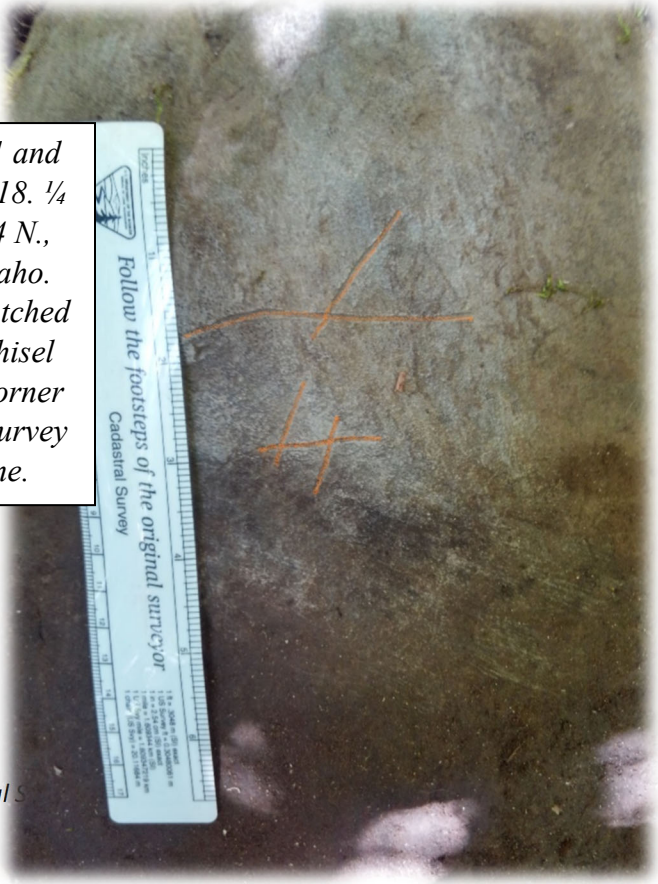


Wood post, originally set in 1870, recovered by county surveyor in 1899 for highway survey, again recovered by BLM in 2012. ¼ cor. of secs 21 and 22 of T. 135 N., R. 41 W., 5th P.M., Minn. The post has a brass tack (red circle) assumed to have been placed by the county surveyor and the other wood posts are most likely witness stakes or flag posts set in the late 1800's. Lower left picture is of the original bearing tree, the blaze is visible as a flat pitched up area (yellow circle).

Stone, originally set in 1891 and found by the BLM in 2019. ¼ cor. of secs. 1 and 12, T. 31 N., R. 3 E. Boise Meridian, Idaho. Can you see the 4 in picture on the left? Picture on the right has it filled in with a paint marker. Marks on stones are difficult to see after being exposed to nature for 100+ years.

Stone, originally set in 1891 and recovered by the BLM in 2018. ¼ cor. of secs. 3 and 10, T. 34 N., R. 2 E., Boise Meridian, Idaho. The marks appear to be scratched in vs chiseled. Maybe the chisel was broken and the sharp corner of it was the only thing the survey crew had to mark the stone.

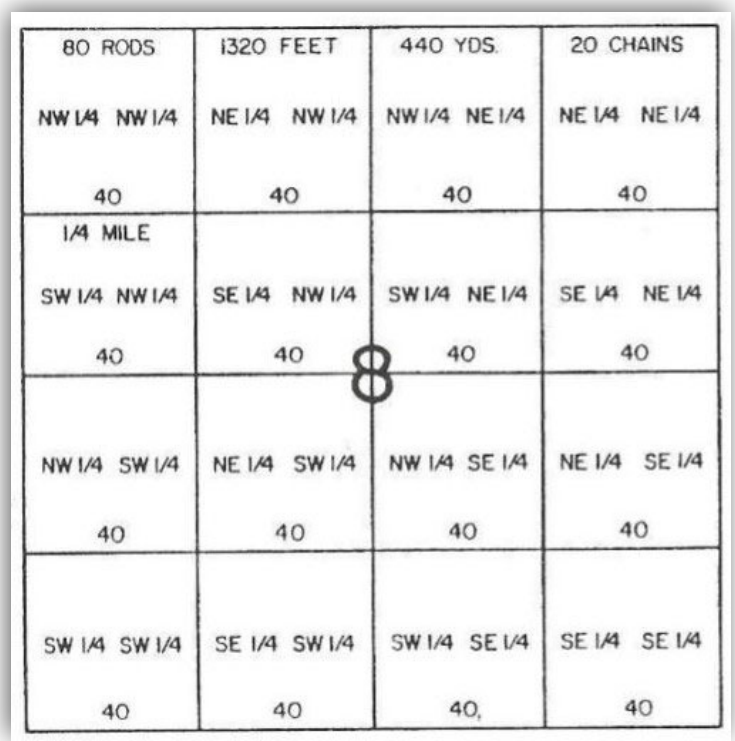




The ¼ cor. of secs. 31 and 36, T. 32 N., Rs. 2 and 3 E., Boise Meridian, Idaho. Stone, originally set in 1891 and recovered by the BLM in 2018. The 3 pictures of the stone demonstrate how vague marks can be emphasized by techniques such as water and paint. Another technique is the shadow method which is demonstrated by the ¼ cor. at the top of the preceding page. The picture to the left is the remains of a pine tree marked as a bearing tree to the stone in 1891. The brass cap is on a stainless-steel post, which was set in place of the stone. The tree with orange paint is a new bearing tree marked X at breast height and BT at the base. The yellow tag helps with visibility at least until it falls off.

- **Government Lots and Aliquot Parts**

Aliquot parts and government lots are created by the subdivision of a section but are not one in the same. The government lots are either more than or less than 40 acres and are the excess or deficiency. They are located on the north and west boundaries of the township and around bodies of water or other items that invade a section or township causing it to be fractional. An aliquot part is created when the section is subdivided into equal parts. This is accomplished in the following manner: (1) divide the section into 4 equal parts referred to as a "quarter" of a section and containing approximately 160 acres (2) divide the quarters into 4 equal parts referred to as a "quarter quarter" of a section containing approximately 40 acres. The 40-acre quarter quarter is the smallest legal subdivision that is defined by law. However, the subdivision can continue down to 0.625 acre tracts of land. The preceding diagram of normal section subdivision shows government lots located against the north and west boundaries of the township *(section 6 and 7)*. The aliquot parts have defined descriptions that can only be one place in a section. For instance, the SW¼ SW¼ of section 8 is the 40 acre tract that is in the far southwest corner of the SW¼ of the section. Using the previous township description, the following is the description of an aliquot part in a particular section. The SW¼ SW¼ of section 8 of Township 5 North, Range 4 West, Fifth Principal Meridian, Minnesota *(SW¼ SW¼ of sec. 8, T. 5 N., R. 4 W., 5th P.M., MN)*.



This diagram represents the aliquot parts of a section 8 with distances in different units but all equal to ¼ mile.

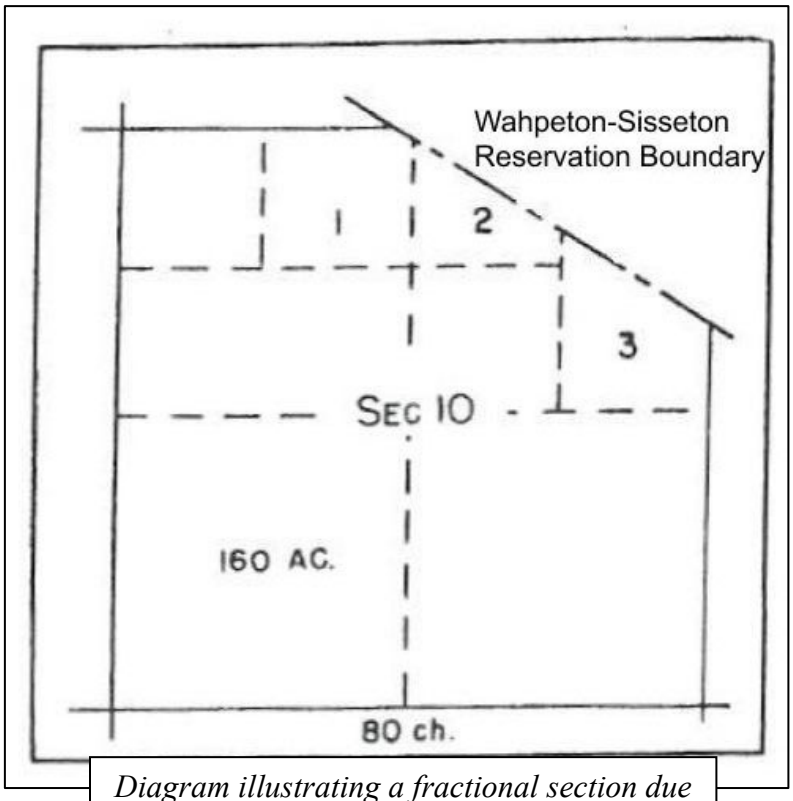
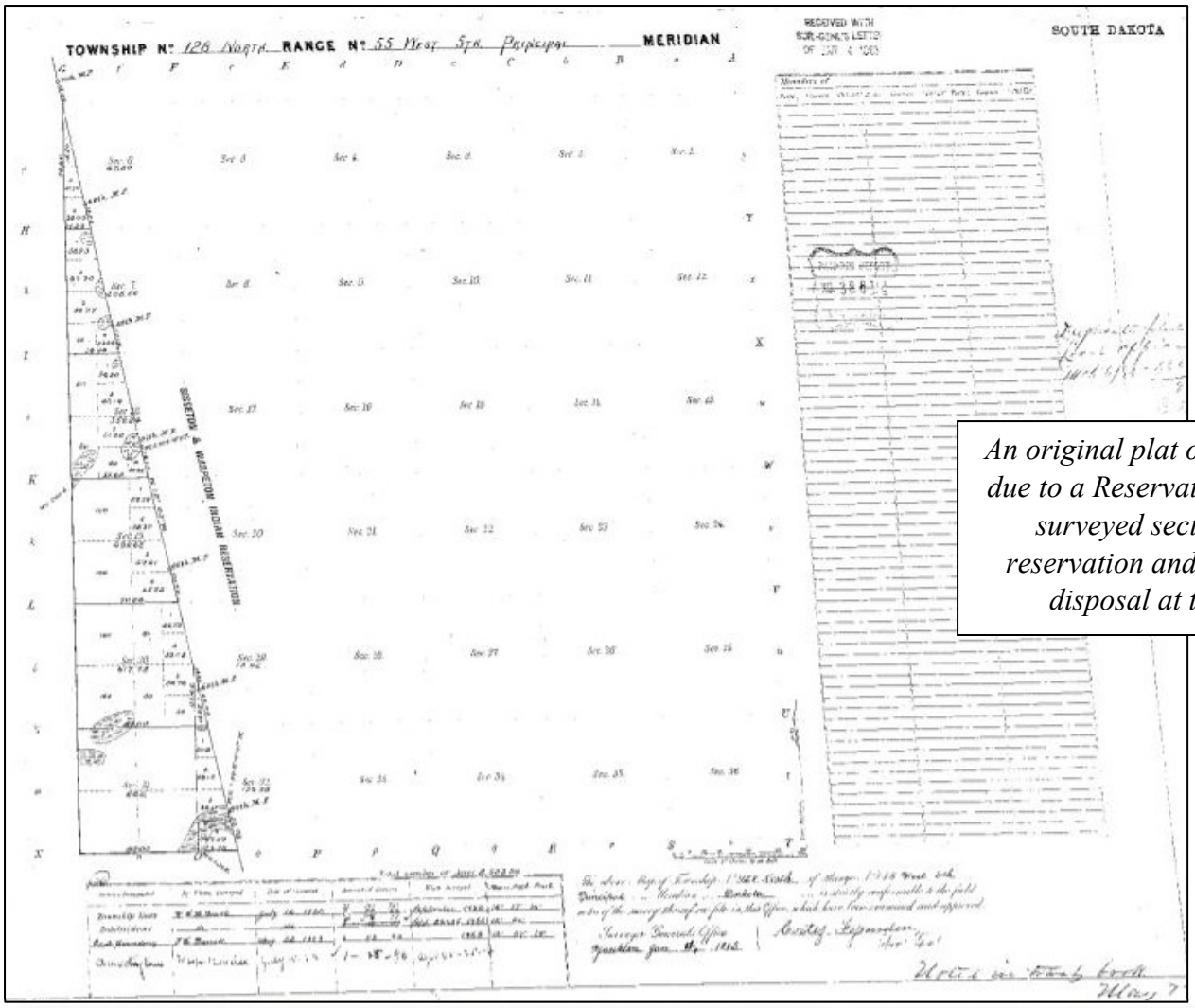
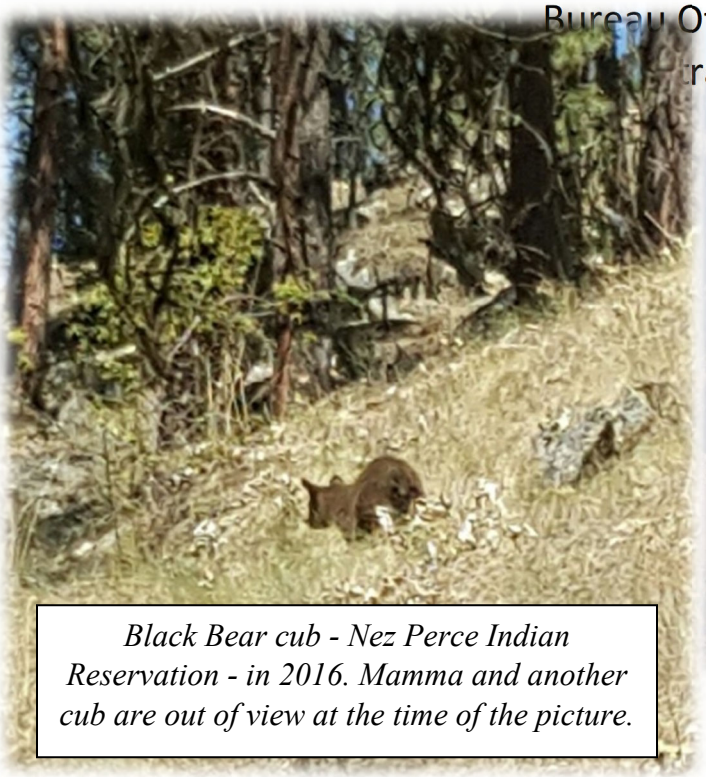


Diagram illustrating a fractional section due to a Reservation Boundary.



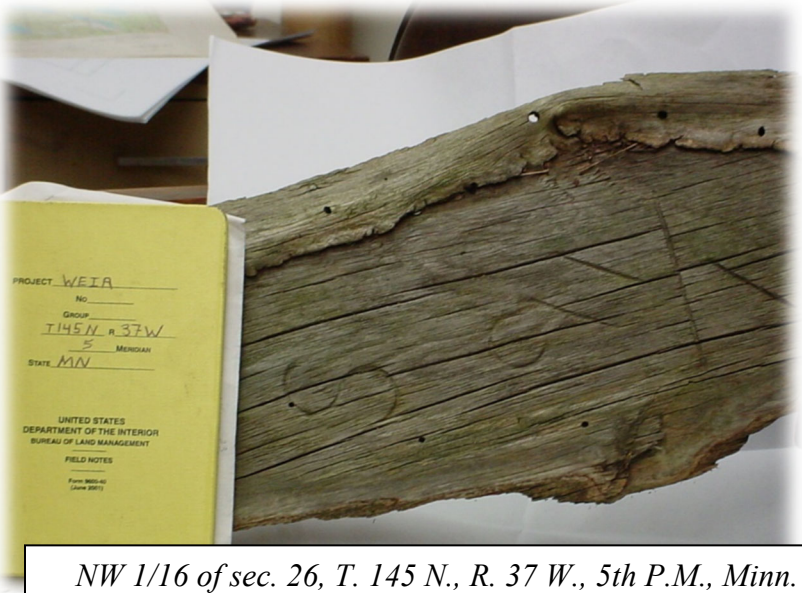
An original plat of a fractional township due to a Reservation Boundary. The un-surveyed sections are within the reservation and are not available for disposal at the time of survey.

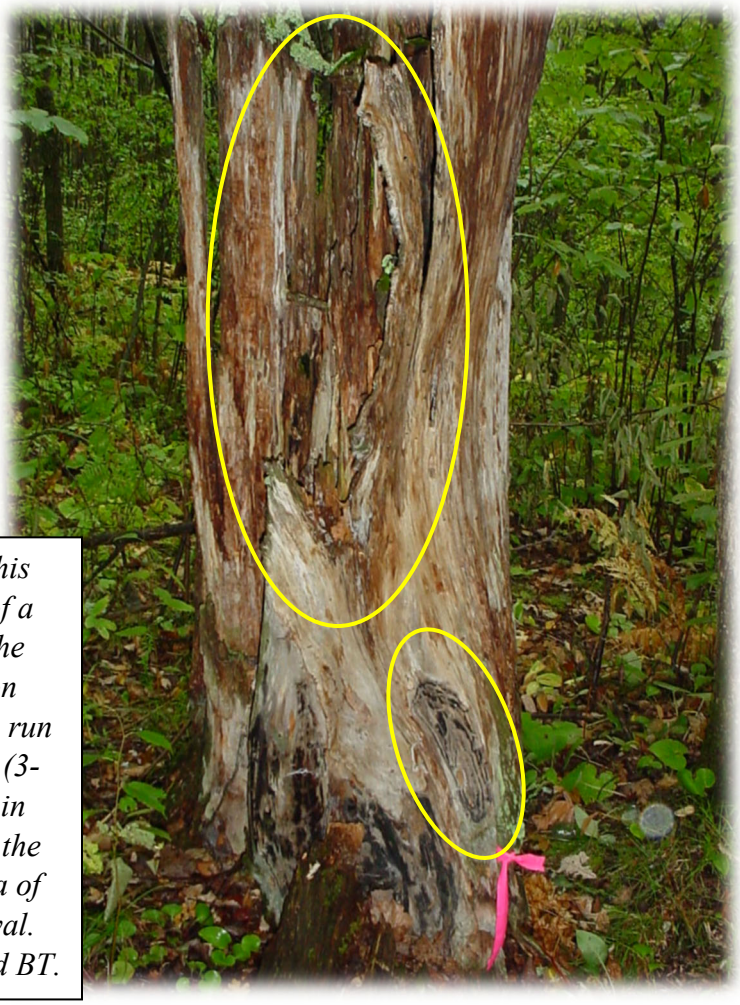
This stone was set in 1892 for a corner (sec. subdivision cor.-1/1024th-every 2½ chains) of Indian Allotment No. 56 on the Nez Perce Indian Reservation (NPIR). It was set by the same GLO contract surveyor that surveyed the township to the extent necessary for surveying the allotments per the Indian Agent's instructions. No record of the allotment surveys has been found to this day, so searching for corner evidence is difficult to say the least. The marks appear to be an attempt at roman numerals for the allotment number. The interpretation is IND (Indian) A (allotment) XLI (actually 41 but should be LVI). Again, it appears the marks were scratched in instead of chiseled. This particular surveyor had crews consisting of inexperienced Tribal members hence the odd marks and mistakes. Recovered by BLM in 2018.



Black Bear cub - Nez Perce Indian Reservation - in 2016. Mamma and another cub are out of view at the time of the picture.

A view of the Clearwater River Canyon near Kamiah, Idaho. Taken from the ¼ cor. of secs. 1 and 36, Tps. 34 and 35 N., R. 2 E., Boise Meridian.

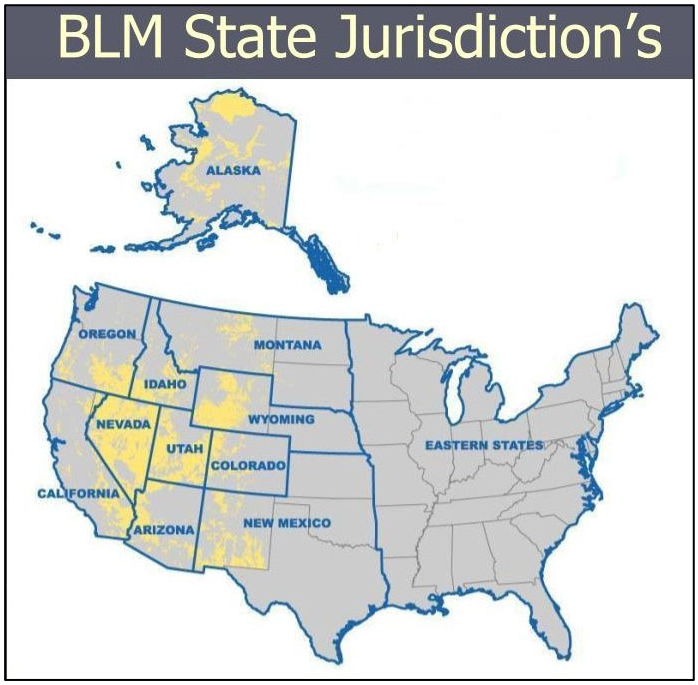




NW 1/16 of sec. 26, T. 145 N., R. 37 W., 5th P.M., Minn. This corner was established and set in 1890 during a resurvey of a township to subdivide the sections into 40 acre tracts for the purpose of issuing Indian Allotments on WEIR. The section subdivision was not done in the normal manner as they were run east and west through the section on random and true lines (3-mile method). The pictures are of the bearing tree marked in 1891 and recovered by the BLM in 2007. The left picture is the actual blaze with scribing visible, which came from the area of the stump in the right picture circled with a large yellow oval. The small yellow oval is a blaze that would have been marked BT.

- **Survey Authority and Types of Surveys**
  - Authority

There are two types of survey authority in the U.S. The first is the federal authority which is through the Secretary of the Interior delegated down through the BLM chain of command to the Cadastral Chief of a respective state or area *(some BLM state offices cover multiple states)*. Federal authority surveys are a decision by the Federal Government and the BLM is the only agency with such authority (25 U.S.C. 176). This authority is only over land with a federal interest, which includes sub-surface minerals and/or surface ownership rights. The BLM surveyors work under this authority, and it covers all 50 states and territories. Therefore, they can practice surveying anywhere the Federal government has an interest. The BLM has the responsibility of maintaining the PLSS because it is the basis of title for much of the U.S. including private land.



State authority is the other one and it is from a specific state, which have their own laws pertaining to surveying. The state issues Professional Licenses to surveyors that meet the requirements of the state and only allows the surveyor to practice in the specific state that provided the license. The authority allows the surveyors to survey private land in the state and they are allowed to retrace federal interest boundaries, but their survey is not binding on the Federal Government, unless it is done under contract and with oversight by the BLM.

  - Types of Surveys

The types of surveys begin with the original survey, which is the first-time land is surveyed and described for transfer of ownership. Subsequent surveys begin with a retracement of the original survey. The retracement survey is where the evidence of the original survey is searched for and verified if questionable. The original evidence is positioned using the appropriate measuring tool and other indirect evidence recovered is evaluated for acceptance as the best available evidence of the original monumented position. This indirect evidence can be improvements such as roads, fences, and field lines, or a survey monument with no record of who or how it was established. The state authority surveyors use the retracement data to establish corners of non-federal land and produce a record of the survey to be filed in the pertinent county records office.

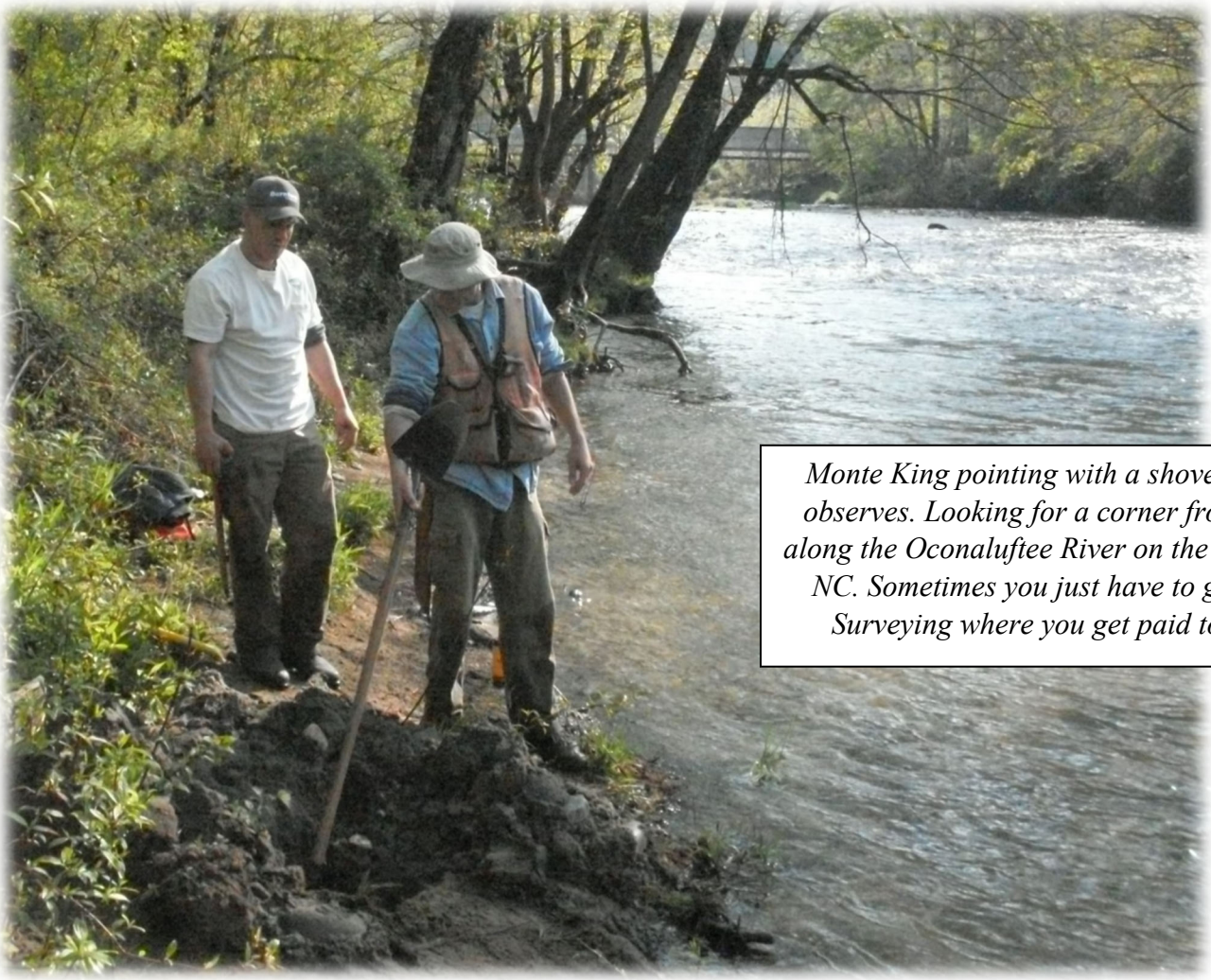
BLM surveys use the retracement data and perform either a dependent resurvey *(most common)* or an independent resurvey *(rare)*. The dependent resurvey relies on the original survey's evidence and record for reestablishing corners of federal interest. The original evidence utilized in the resurvey is remonumented and described in the field notes if it is a

federal interest corner and also if non-federal landowners give permission. If permission is not granted for remonumentation then the original evidence is left as it was found and described in the field notes of the resurvey. The independent resurvey does not rely on previous surveys for evidence or record. It establishes new boundaries and is only executed when the original survey is found to be fraudulent or containing serious gross error. There are several other types of surveys including but not limited to mineral surveys, Indian Allotment surveys, reclamation and farm unit surveys, townsite surveys, and Metes and Bounds surveys *(colonial style-not squares and uses bearings and distances (metes) or adjoining boundary references (bounds) including natural features such as waterways or other distinctive topography).*

The location of the original corner positions is very important due to the fact that the law is clear that the original position holds whether it is mathematically correct or not. If a survey is executed and later a retracing surveyor finds an original corner that was missed by the previous surveyor, then typically the prior survey would need to be corrected in a manner that creates stability in property lines. The correction can be quite complex as many variables need to be considered including land ownership, historical chain of title, and other factors too numerous and complex to list. Typically, if the boundary coincides with a federal interest boundary the original corner position is rigidly held due to the tract's title being based on the original survey. There is no adverse possession against the Federal Government, however some agencies have some latitude for the mitigation of unintentional trespass cases. The importance of having a boundary survey executed to prevent future issues cannot be stressed enough! This is why surveyors should do everything possible to recover original evidence!

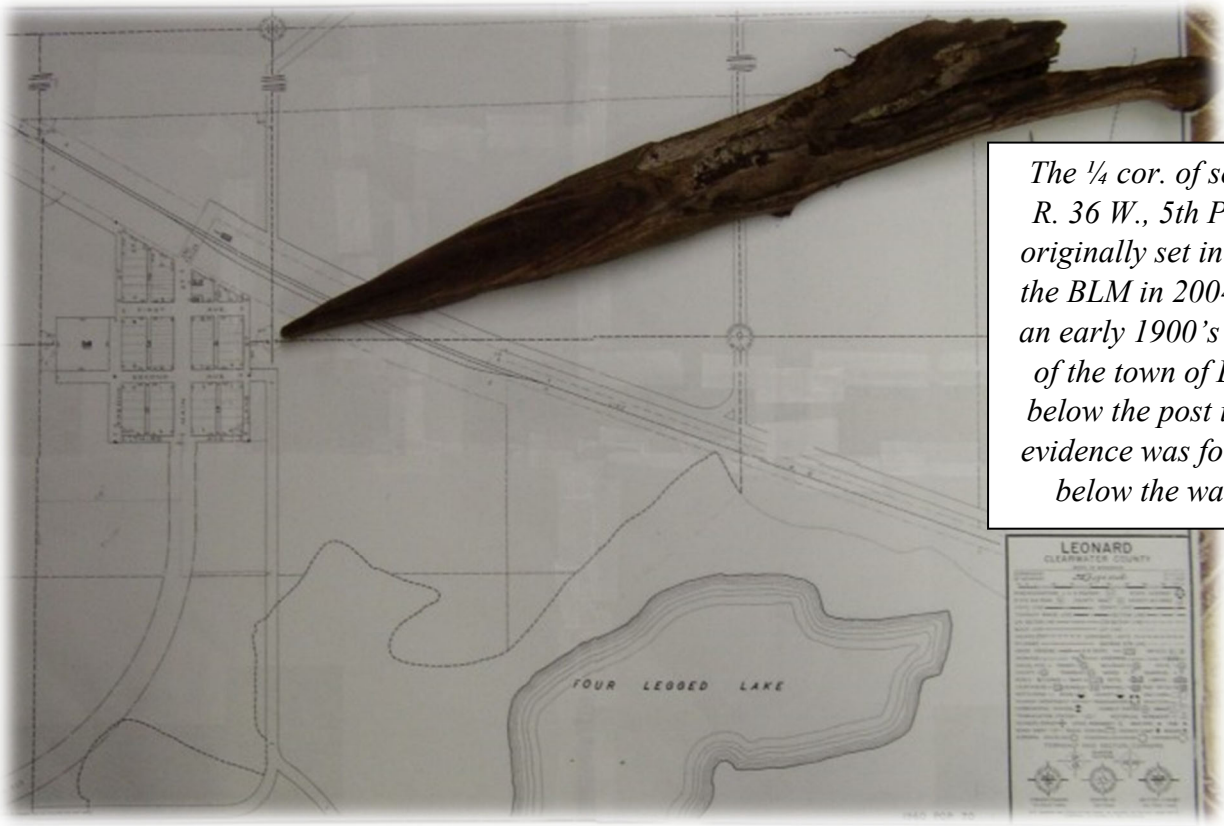
Misc. Pictures and Information

Remember digging is a big part of recovering evidence of prior surveys. This hole was dug searching for an iron pipe set by a county surveyor prior to 1910 on WEIR. According to the county record it was set in place of an original post. Located about 4½ feet below the surface of the highway, which had about 1 foot of pavement and about 2 feet of gravel before natural ground. Brett Tibbetts (Survey Tech.) is on his tippy toes touching the pipe. Traffic control was in place for the excavation.

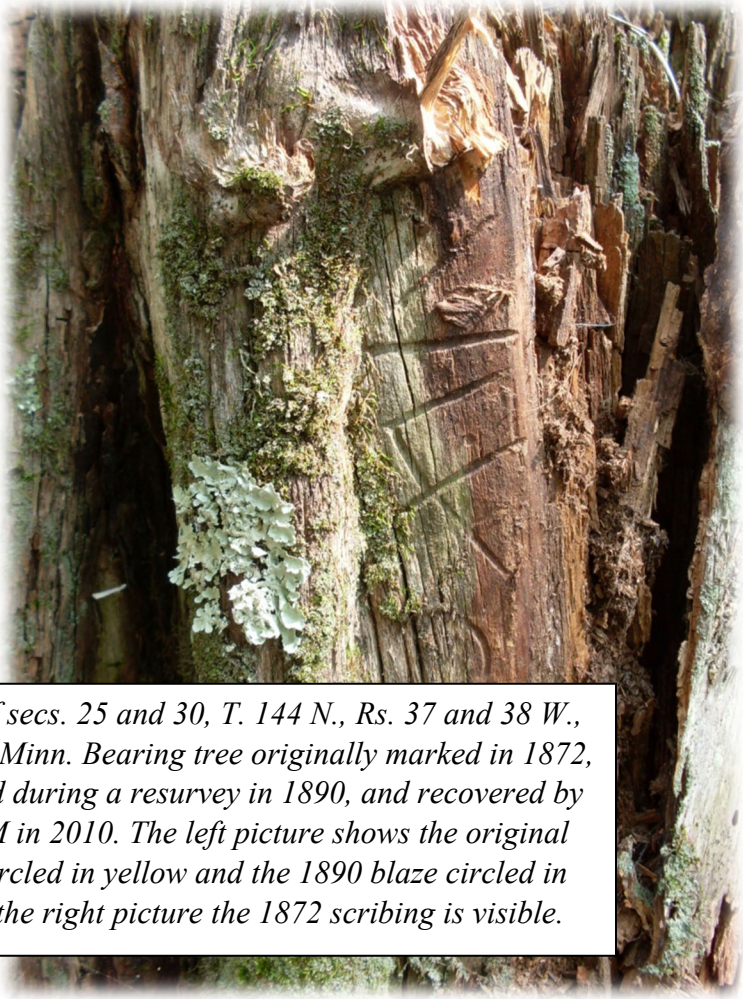


Monte King pointing with a shovel while Doug Uran observes. Looking for a corner from the early 1900's along the Oconaluftee River on the EBCI Reservation in NC. Sometimes you just have to get down and dirty. Surveying where you get paid to play in the dirt!

Misc. Pictures and Information

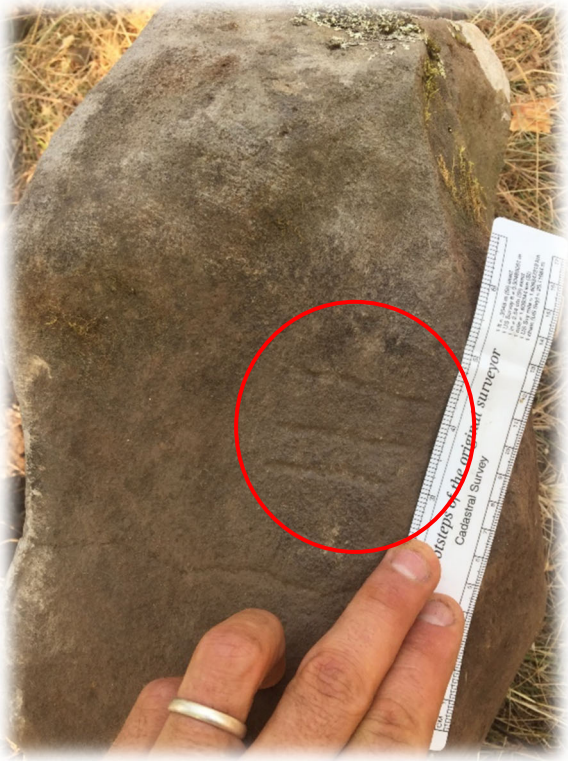


The ¼ cor. of secs. 8 and 9, T. 148 N., R. 36 W., 5th P.M., Minn. Wood post, originally set in 1891 and recovered by the BLM in 2004. It was found by using an early 1900's county surveyor record of the town of Leonard. The record is below the post in the picture. No other evidence was found, only the post point below the water level of a swamp.

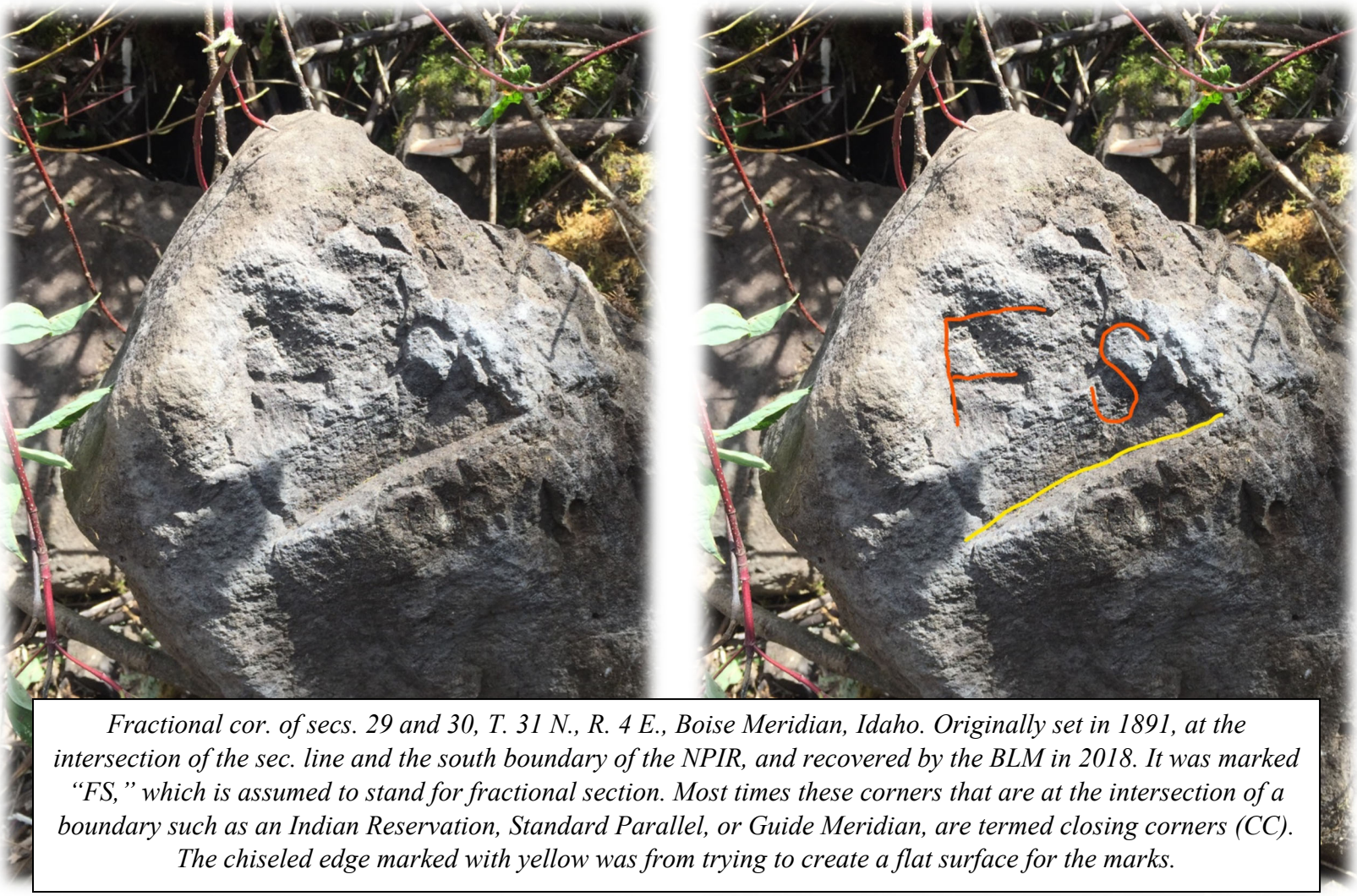


¼ cor. of secs. 25 and 30, T. 144 N., Rs. 37 and 38 W., 5th P.M., Minn. Bearing tree originally marked in 1872, remarked during a resurvey in 1890, and recovered by the BLM in 2010. The left picture shows the original blaze circled in yellow and the 1890 blaze circled in red. In the right picture the 1872 scribing is visible.

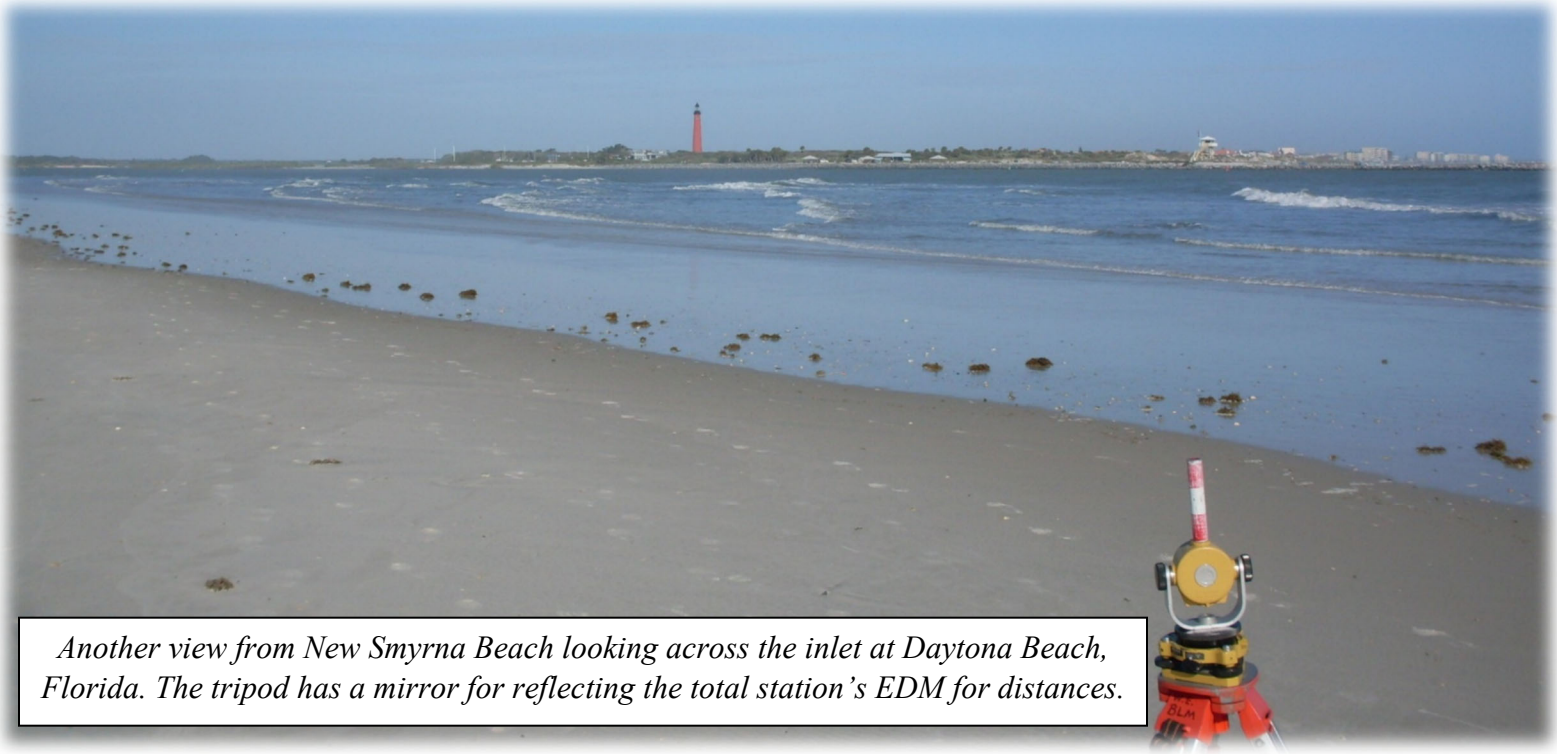
Misc. Pictures and Information



Cor. of secs. 13, 18, 19, and 24, T. 32 N., Rs. 3 and 4 E., Boise Meridian, Idaho. Stone originally set in 1892 and recovered by BLM in 2018. Section corners were marked with a number of grooves or notches on the south and east edges/faces, except on township and range lines where they are marked on the opposite edges, be it north and south or east and west depending on direction of the line. For interior section corners the number of grooves or notches depends on how many miles it is from the south and east boundaries. For township lines it is how many miles from the east and west boundaries, whereas on range lines it is from the north and south boundaries. The upper left picture is of the south face and has 3 grooves. The lower right picture is of north face and has 3 grooves. The upper right picture is of the east face and has R4E chiseled on it, which is not typical and could have been added by a county surveyor.



Fractional cor. of secs. 29 and 30, T. 31 N., R. 4 E., Boise Meridian, Idaho. Originally set in 1891, at the intersection of the sec. line and the south boundary of the NPIR, and recovered by the BLM in 2018. It was marked "FS," which is assumed to stand for fractional section. Most times these corners that are at the intersection of a boundary such as an Indian Reservation, Standard Parallel, or Guide Meridian, are termed closing corners (CC). The chiseled edge marked with yellow was from trying to create a flat surface for the marks.



Another view from New Smyrna Beach looking across the inlet at Daytona Beach, Florida. The tripod has a mirror for reflecting the total station's EDM for distances.

Misc. Pictures and Information

Fractional cor. of secs. 21 and 28, T. 31 N., R. 4 E., Boise Meridian, Idaho. At the intersection of the east boundary of the NPIR and the aforementioned section line. Mound of stone with a void (red circle) in the middle where a wood post was originally set. Recovered by BLM in 2018. Upper left picture is prior to removing debris from the mound. Upper right is after debris removed. Lower right is from a side angle.

Sometimes you find yourself in places you never imagined. Centerline of a live runway on Hanscom Air Force base (surveyed by BLM in 2015-16). In communication with air traffic control. A portion of the boundary was controlled by the centerline of the runway, so it was necessary to locate said centerline. Pictured is Monte King.

Misc. Pictures and Information

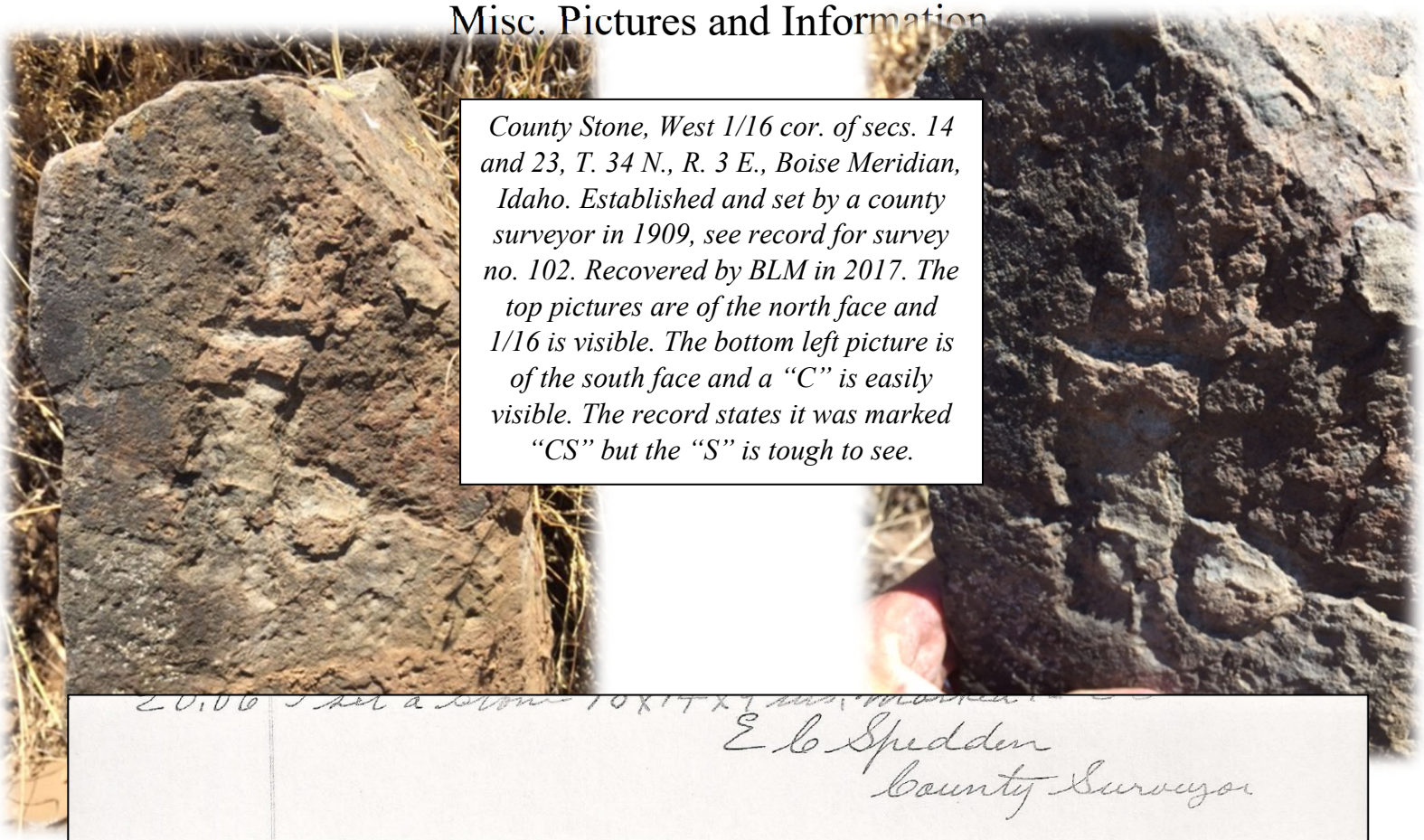
Tom Uran (Survey Tech.) in process of chiseling "BXO" on a rock face on the EBCI Reservation in NC. Monte King is keeping notes and "supervising."

A new bearing tree on WEIR at the beginning of winter.

A completed "BXO" on the ECBI Reservation in NC.

Monument set with a mound of stone around it on the ECBI Reservation in NC.

Wood post, set in early 1900's by a surveyor working for the International Harvester Company. Recovered by BLM in 2008. Located in an old Tamarac swamp on WEIR. Upper left picture has some of the scribing visible. Upper right picture is of entire post. Lower picture is of the post stood up and the crew consisting of Tom Uran (left front), Doug Uran (left back), and Brett Tibbetts (right).



County Stone, West 1/16 cor. of secs. 14 and 23, T. 34 N., R. 3 E., Boise Meridian, Idaho. Established and set by a county surveyor in 1909, see record for survey no. 102. Recovered by BLM in 2017. The top pictures are of the north face and 1/16 is visible. The bottom left picture is of the south face and a "C" is easily visible. The record states it was marked "CS" but the "S" is tough to see.

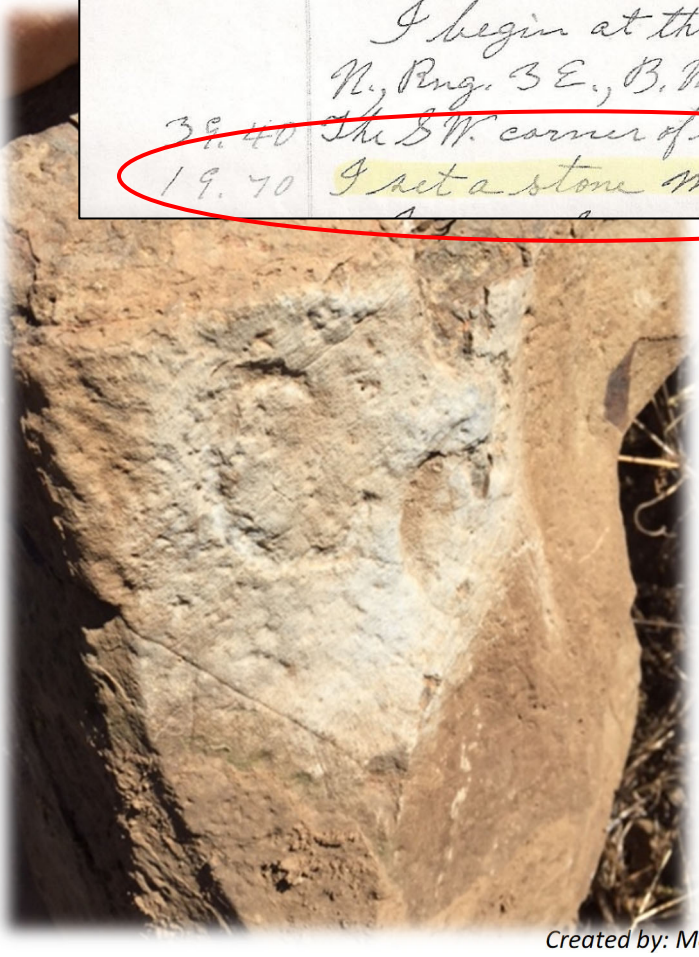
E. L. Spedden
County Surveyor

Survey No. 102 June 14, 1909

For Akridge, Scofield et al

I begin at the S. 1/4 sec. corner of Section 14, Twp 3 N., Rng. 3 E., B. M. and run west

39.40 The S.W. corner of Sec. 14. Thence I run E. on true sec. li
19.70 I set a stone marked to C S
-W1/16 14/23



Curious horses on WEIR.

Stone set by county surveyor in 1893 on the east boundary of NPIR within section 10, T. 31 N., R. 4 E., Boise Meridian, Idaho. The record below is filed in the Idaho County Courthouse and circled in red is the description of this stone being set. The "A" was not visible, however the "+" is circled in red on the pictures. Notice the shadow method being used to emphasize the "+."

96

T Sense

Survey No 2 5

Var 19° 30E

Done Oct 23d and 24th 1893

Begun at ¼ cor for sec 11 and 15 10. th 31 N R 4 E B M.

and run W 18.09 ch

to stone set on N.P.R. Line

Begun at said stone and run N 20° E along

Res. line 20.27 Ch and set stone 12 x 8 x 6 marked + A

Begun at ston on Res. line (first mentioned) and

run S 20° W 15.14 Ch along Res. line to intersection

of sec line between sec 16 and 21. Corrected and

Misc. Pictures and Information

A WEIR Biology Dept. employee, Curt Uran, with a young crow. The crow was too young to fly and was knocked out a nest by a wind storm. It was rescued and cared for until it was able to be released.

Massachusetts-Rock wall marking the boundary of 2 parcels of land. A modern GNSS rover on a pole in the foreground.

Massachusetts-The road where Paul Revere was captured. Managed by National Park Service and is a parcel of land adjoining Hanscom AFB.

New Smyrna Beach, Florida. Brett Tibbetts relocating a "friend" out of the way for its' safety.

Honey Bee swarm-Northern Minn.

Resources:

- GLO Records:
  https://glorecords.blm.gov
- Cadastral Survey:
  https://www.blm.gov/programs/lands-and-realty/cadastral-survey
- The Federal Land Policy and Management Act of 1976, as amended:
  https://www.blm.gov/sites/default/files/AboutUs_LawsandRegs_FLPMA.pdf
- Manual of Surveying Instructions:
  https://www.blm.gov/sites/blm.gov/files/Manual_Of_Surveying_Instructions_2009.pdf
- Specifications for Descriptions of Land:
  For Use in Land Orders, Executive Orders, Proclamations, Federal Register Documents, and Land Description Data Bases:
  https://www.ntc.blm.gov/krc/uploads/940/2017_SpecificationsForDescriptionsOfLand.pdf
- Surveying our Public Lands:
  https://www.ntc.blm.gov/krc/uploads/538/SurveyingOurPublicLands2002.pdf
- Bureau of Land Management Classroom Investigation:
  https://www.blm.gov/classroominvestigations