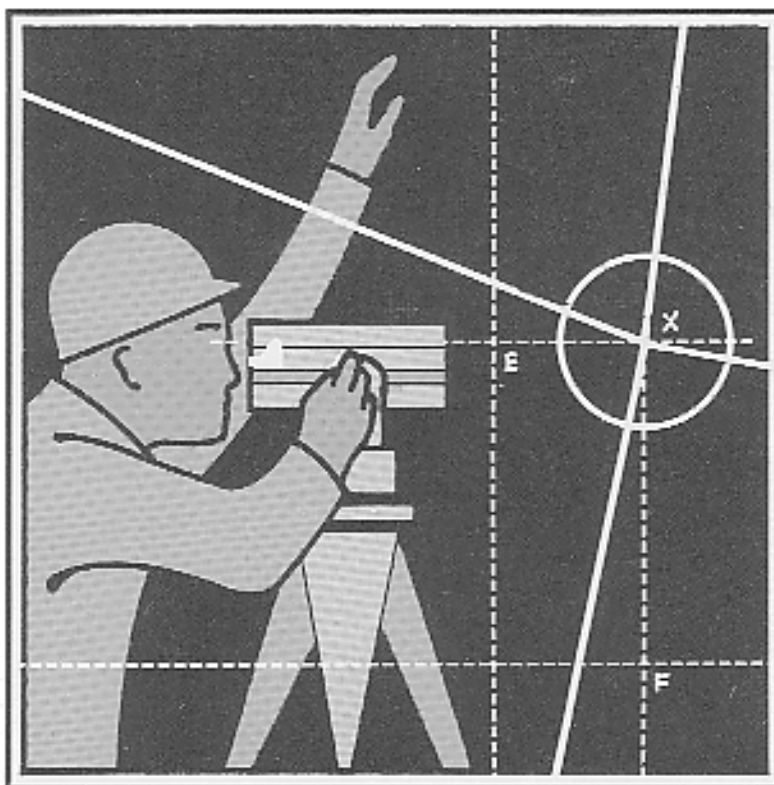


DISCLAIMER

The following is a retyped electronic version of "RESTORATION OF LOST OR OBLITERATED CORNERS AND SUBDIVISION SECTIONS", a supplement to the Manual of Surveying Instructions, designed to be word searchable for ease in finding selected passages. There is no intent, expressed or implied, that this is an exact facsimile of the publication itself.

References are contained herein to certain publications available for sale by the Superintendent of Documents, which are now, in fact, out of print and may no longer be maintained as stock items by the U.S. Government Printing Office. Also, certain addresses are no longer current.

RESTORATION OF LOST OR
OBLITERATED CORNERS &
SUBDIVISION OF SECTIONS
a guide for surveyors



UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management
1974 Edition

PENALTY FOR THE DESTRUCTION OF MONUMENTS

A penalty for the unauthorized alteration or removal of any Government survey monument or marked tree is provided in Title 18, U.S.C., SEC. 1858 (62 Stat. 789). It reads as follows:

Whoever willfully destroys, defaces, changes, or removes to another place any section corner, quarter-section corner, or meander post, on Government line of survey, or willfully cuts down any witness tree or any tree blazed to mark the line of a Government survey, or willfully defaces, changes, or removes any monument or bench mark of any Government survey, shall be fined not more than \$250, or imprisoned not more than six months, or both.

The Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, has for sale to the public the following publications of the Bureau of Land Management:

The Manual of Instructions for the Survey of the Public Lands of the United States, 1973.

Standard Field Tables, 1956 (a Supplement to the Manual of Surveying Instructions), containing traverse tables; stadia coefficients; five-place natural and six-place logarithmic sines, cosines, tangents, and cotangents; six-place logarithms of numbers; and other tables and data of particular application in land surveying practice.

The Ephemeris of the Sun, Polaris, and Other Selected Stars, published annually in advance (a supplement to the Manual of Surveying Instructions).

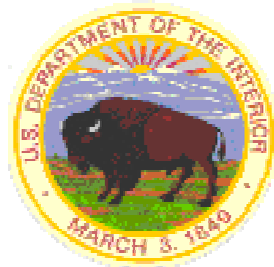
Copies of the approved field notes and plats of the public land surveys, excepting those in Illinois, Indiana, Iowa, Kansas, Missouri, and Ohio, may be procured from the Director, Eastern States Office, Bureau of Land Management, 7981 Eastern Avenue, Silver Spring, Maryland, 20910, and from State Offices of the Bureau. A charge is made for making copies of records furnished the public. The Bureau's copy of public survey records of the excepted States has been transferred to the National Archives and Records Service, General Services Administration, Washington, D.C. 20408.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RESTORATION OF LOST
OR OBLITERATED CORNERS
AND
SUBDIVISION OF SECTIONS

A supplement to the Manual of Surveying Instructions, containing a discussion of practices followed by the Bureau of Land Management, prepared especially for the information and guidance of county and local surveyor.

Prepared in the Division
of Cadastral Survey



UNITED STATES GOVERNMENT PRINTING OFFICE
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**UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Land Management**

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other concerns of America's "Department of Natural Resources".

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

OUTLINE OF SUBJECTS

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Key to Citation of Authorities by Volume and Page or Section

Stat.: United States Statutes at Large.

R.S.: Revised Statutes of the United States; citation will include section number.

U.S.: United States Reports; decisions of the Supreme Court of the United States.

Fed.: Decisions of Circuit Courts of Appeals and District Courts of the United States.

U.S.C.: United States Code (The Code of Laws of the United States).

L.D.: Decisions of the Department of the Interior relating to the public lands.

I.D.: Decisions of the Department of the Interior after 1930.

**UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Washington, D.C. 20240**

This supplement to the Manual of Instructions for the Survey of the Public Lands of the United States has been in print since 1883. The purpose of the supplement is to provide an introduction to the rectangular system of public land surveying and resurveying and a compendium of basic laws relating to the system.

The information is of interest to county and local surveyors in retracing the lines of the public land surveys. Attorneys, title insurance company personnel and others who have professional interests in former or present public lands find this explanation of survey procedures valuable.

The pamphlet deals mainly with general practices and rules for the restoration of lost corners and the subdivision of sections. These procedures are used by the Bureau of Land Management in its surveys and resurveys of public lands. There has been little change in these procedures since their first publication in 1883. The presentation has been designed to answer many of the common questions arising in practical work. The pamphlet does not cover controversial questions or exceptional situations.

Included also is an explanation of methods generally successful in the retracement of lines and the recovery of corner evidence and other marks of the original public land surveys. Meander lines and riparian rights are discussed briefly at the close of the pamphlet.

Suggestions for the revision or improvement of later editions of this volume are welcomed.

Director



RESTORATION OF LOST OR OBLITERATED CORNERS

JURISDICTION

The Director, Bureau of Land Management, under the Supervision of the Secretary of the Interior, has complete jurisdiction over the survey and resurvey of the public lands of the United States.

After title to a piece of land is granted by the United States, jurisdiction over the property passes to the State; the Federal Government retains its authority only with respect to the public lands in Federal ownership. Where the lands are in private ownership, it is a function of the county or local surveyor to restore lost corners and to subdivide the sections. Disputes concerning these questions must come before the local courts, unless settled by joint survey or agreement. It should be understood, however, that no adjoining owner can make a valid encroachment upon the public lands.

The various states were surveyed under somewhat different practices according to the date of survey. The earliest rules were in manuscript and printed circulars; regulations more in detail, improving the rectangular system, were issued in Manuals of 1855, 1881, 1890, 1894, 1902, 1930, 1947, and 1973.¹

RESURVEYS

Both the public and the privately owned lands may be resurveyed by the Bureau of Land Management in certain cases, under the following authority:

The act of Congress approved March 3, 1909, as amended by joint resolution approved June 25, 1910, provides:

That the Secretary of the Interior may, in his discretion, cause to be made, as he may deem wise under the rectangular system now provided by law, such resurveys or retracements of the surveys of public lands as, after full investigation, he may deem essential to properly mark the boundaries of the public lands remaining undisposed of (35 Stat. 845; 36 Stat. 884; 43 U. S. C. sec. 772).

The 1909 act is generally invoked where the lands are largely in Federal ownership, and where there may be extensive obligation or other equally unsatisfactory conditions.

¹ Manual of Instruction for the Survey of the Public Lands of the United States, 1973; Superintendent of Documents, Washington, D. C. 20402.

The act of Congress approved September 21, 1918, provides authority for the resurvey by the Government of townships, therefore held to be ineligible for resurvey by reason of the disposals being in excess of 50 percentum of the total area thereof (40 Stat. 965; 43 U. S. C. sec. 773).

The 1918 act may be invoked where the major portion of the township is in private ownership, where it is shown that the need for retracement and remonumentation is extensive, and especially if the work proposed is beyond the scope of ordinary local practice. The act requires that the proportionate costs be borne by the landowners.

PROTECTION OF BONA FIDE RIGHTS

Under the above laws, and in principle as well, it is required that no resurvey or retracement shall be so executed as to impair the bona fide rights or claims of any claimant, entryman, or owner of land so affected.

Likewise in general practice, the local surveyor should be careful not to exercise unwarranted jurisdiction, nor to apply an arbitrary rule; he should note the distinction between the rules for original surveys and those that relate to retracements. The disregard of these principals, or for acquired property rights, may lead to unfortunate results and prompts the suggestions herein that are intended to help avoid such troubles.

In unusual cases where the evidence of the survey cannot be identified with ample certainty to enable the application of the regular practices, the surveyor may submit his questions to the proper State Office of the Bureau of Land Management, or to the Director.

ORIGINAL SURVEY RECORDS

The township plat furnishes the basic data relating to the survey and the description of all areas in the particular township. All title records within the area of the former public domain are based upon a Government grant or patent, with description referred to an official plat. The lands are identified on the ground through the retracement, restoration, and maintenance of the official lines and corners.

The plats are developed from the field notes; both are permanently filed for reference purposes and are accessible to the public for examination or making of copies in the offices listed on page 4.

Many supplemental plats have been prepared by protraction to show new or revised lottings within one or more sections; these supersede the lottings shown on the original township plat. There are also many plats of the survey of islands or other fragmentary areas of public land which were surveyed after the original survey of the township.

These plats should be referred to as governing the position and description of the subdivisions shown on them.

RESURVEY RECORDS

The plats and field notes or resurveys which become a part of the official record fall into two principal classes according to the type of resurvey, as follows:

The *dependent resurvey* is a restoration of the original survey according to the record of that survey, based upon the identified corners of the original survey and other acceptable points of control, and the restoration of lost corners in accordance with proportional measurement as described herein. Normally, the subdivisions shown on the plat of the original survey are retained on the plat of the dependent resurvey, although new designations and areas for subdivisions still in public ownership at time of the resurvey may be shown to reflect true areas.

The *independent resurvey* is designed to supersede the original survey and creates new subdivisions and lottings of the vacant public lands. Provision is made for the segregation of individual tracts of privately-owned lands, entries, or claims that may be based upon the original plat, when necessary for their protection, or for their conformation, if feasible, to the regular subdivisions of the resurvey.

IMPORTANCE OF PLAT AND FIELD NOTES

The importance, or legal significance, of the plats and field notes is well stated in an opinion by the Department of the Interior (45 L. D. 330, 336) as follows:

It has been repeatedly held by both State and Federal courts that plats and field notes referred to in patents may be resorted to for the purpose of determining the limits of the area that passed under such patents. In the case of *Cragin v. Powell* (128 U.S. 691, 696), the Supreme Court said:

"It is a well settled principal that when lands are granted according to an official plat of the survey of such lands, the plat itself, with all its notes, lines, descriptions, and landmarks, becomes as much a part of the grant or deed by which they are conveyed, and controls so far as limits are concerned, as if such descriptive features were written out upon the face of the deed or the grant itself."

RECORDS TRANSFERRED TO STATES

In those states where the public land surveys are considered as having been completed, the field notes, plats, maps, and other papers relating to those surveys have been transferred to an appropriate State Office for safekeeping as public records. No provision has been made for the transfer of the survey records to the State of Oklahoma, but in the other States the records are filed in the following offices where they may be examined and copies made or requested:

Alabama: Secretary of State, Montgomery, Alabama 36104
Arkansas: Department of State Lands, State Capital, Little Rock, Arkansas 72201.
Florida: Board of Trustees of the Internal Improvement Trust Fund, Elliott Building, Tallahassee, Florida 32304.
Illinois: Illinois State Archives, Secretary of State, Springfield, Illinois 62706.
Indiana: Archivist, Indiana State Library, 140 North Senate Avenue, Indianapolis, Indiana 46204.
Iowa: Secretary of State, Des Moines, Iowa 50319.
Kansas: Auditor of State and register of State Lands, Topeka, Kansas 66612.
Louisiana: Register, State Land Office, Baton Rouge, Louisiana 70804.
Michigan: Department of Treasury, Bureau of Local Government Services, Treasury Building, Lansing, Michigan 48922.
Minnesota: Department of Conservation, Division of Lands and Forestry, Centennial Office Building, Saint Paul, Minnesota 55101.
Mississippi: State Land Commissioner, P.O. Box 39, Jackson, Mississippi 39205.
Missouri: State Land Survey Authority, P.O. Box 1158, Rolla, Missouri 65401
Nebraska: State Surveyor, State Capitol Building, P.O. Box 4663, Lincoln, Nebraska 68509.
North Dakota: State Water Conservation Commission, State Office Building, Bismarck, North Dakota 58501.
Ohio: Auditor of State, Columbus, Ohio 43215.
South Dakota: Commissioner of School and Public Lands, State Capitol, Pierre, South Dakota 57501.
Wisconsin: Department of Natural Resources, Box 450, Madison, Wisconsin 53701.

LOCAL OFFICES OF BUREAU OF LAND MANAGEMENT

The surveys are in progress in the other public-land states, where the records may be examined in, or copies procured from, the State Offices of the Bureau of Land Management, as follows:

Arizona: Phoenix.
California: Sacramento.
Colorado: Denver.
Idaho: Boise.
Montana: Billings.
Nevada: Reno.
New Mexico: Santa Fe.
Oregon: Portland.
Utah: Salt Lake City.
Washington: Portland, Oregon.
Wyoming: Cheyenne.
Alaska: Anchorage.

GENERAL PRACTICES

The basic Federal laws from which the rules for the original surveys and for necessary resurveys or retracements have been derived are set out in Revised Statutes, secs. 2395-2397; the acts of Congress approved March 3, 1909 (35 Stat. 845); September 21, 1918 (40 Stat. 965); and April 29, 1950 (64 Stat. 93), the provisions of which are amplified in the 1973 Manual.

The rules for the restoration of lost corners have remained substantially the same since 1883, when first published as such.¹ These rules are in harmony with the leading judicial opinions and the most approved surveying practice. They are applicable to the public land rectangular surveys, within the states listed above and to the retracement of those surveys, as distinguished from the running of property lines that may have legal authority only under State law, court decree, or agreement.

In the New England and Atlantic Coast States, except Florida, and in Pennsylvania, West Virginia, Kentucky, Tennessee, and Texas, jurisdiction over the vacant lands remained in the States. The public land surveys were not extended in these States and it follows that the practices outlined herein are not applicable there, except as they reflect sound surveying methods.

The practices outlined herein are in accord with the related provisions of the Manual; they have been segregated for the convenience of the reader in order to separate them from the instructions pertaining only to the making of original surveys.

For clarity, the practices, as such, are set in bold print. The remainder of the text is to be regarded as explanatory and advisory only, the purpose being to exemplify the best general practice.

In some states, the substance of practices for restoration of lost or obliterated corners and subdivision of sections, as outlined herein, has been enacted into law. It is incumbent on the surveyor engaged in practice of land surveying to become familiar with the provisions of the laws of the State, both legislative and judicial, as affecting his work.

¹ Restoration of Lost or Obliterated Corners, and Subdivision of Sections, March 13, 1883, 1 L.D., 339; 2d edition 1 L.D. 671; revised October 16, 1896, 23 L.D. 361; revised June 1, 1909, 38 L.D. 1; reprinted in 1916 and 1936; revised April 5, 1939; reissued May 8, 1952; reprinted with corrections July 11, 1955; reprinted in 1960; revised June 3, 1963; reprinted 1965 and 1968.

GENERAL RULES

The general rules followed by the Bureau of Land Management, which are controlling upon the location of all public lands, are summarized in the following paragraphs:

First: That the boundaries of the public lands, when approved and accepted, are unchangeable.

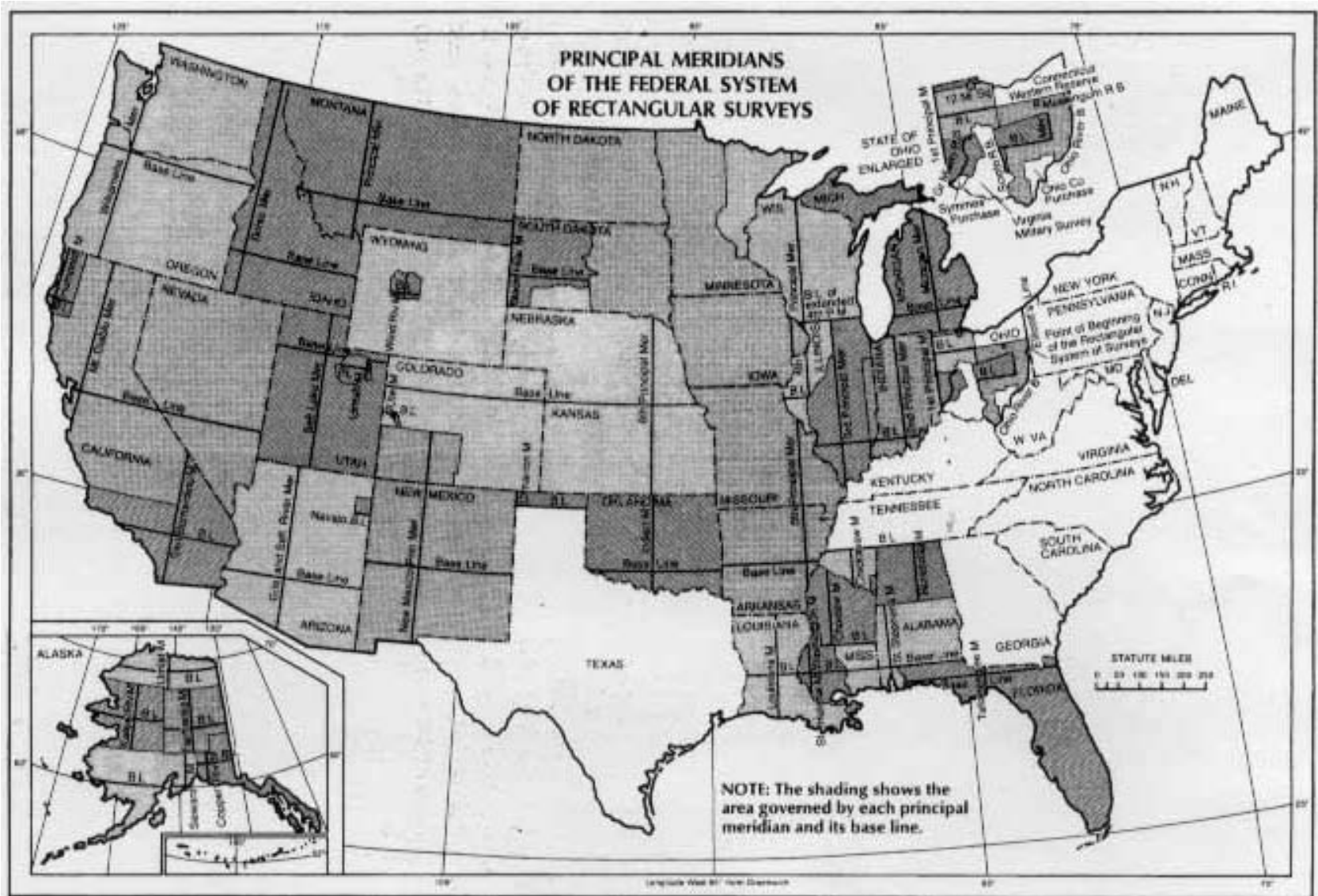
Second: That the original township, section, and quarter-section corners must stand as the true corners which they were intended to represent, whether in the place shown by the field notes or not.

Third: That quarter-quarter-section corners not established in the original survey shall be placed on the line connecting the section and quarter-section corners, and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on the lines between fractional or irregular sections.

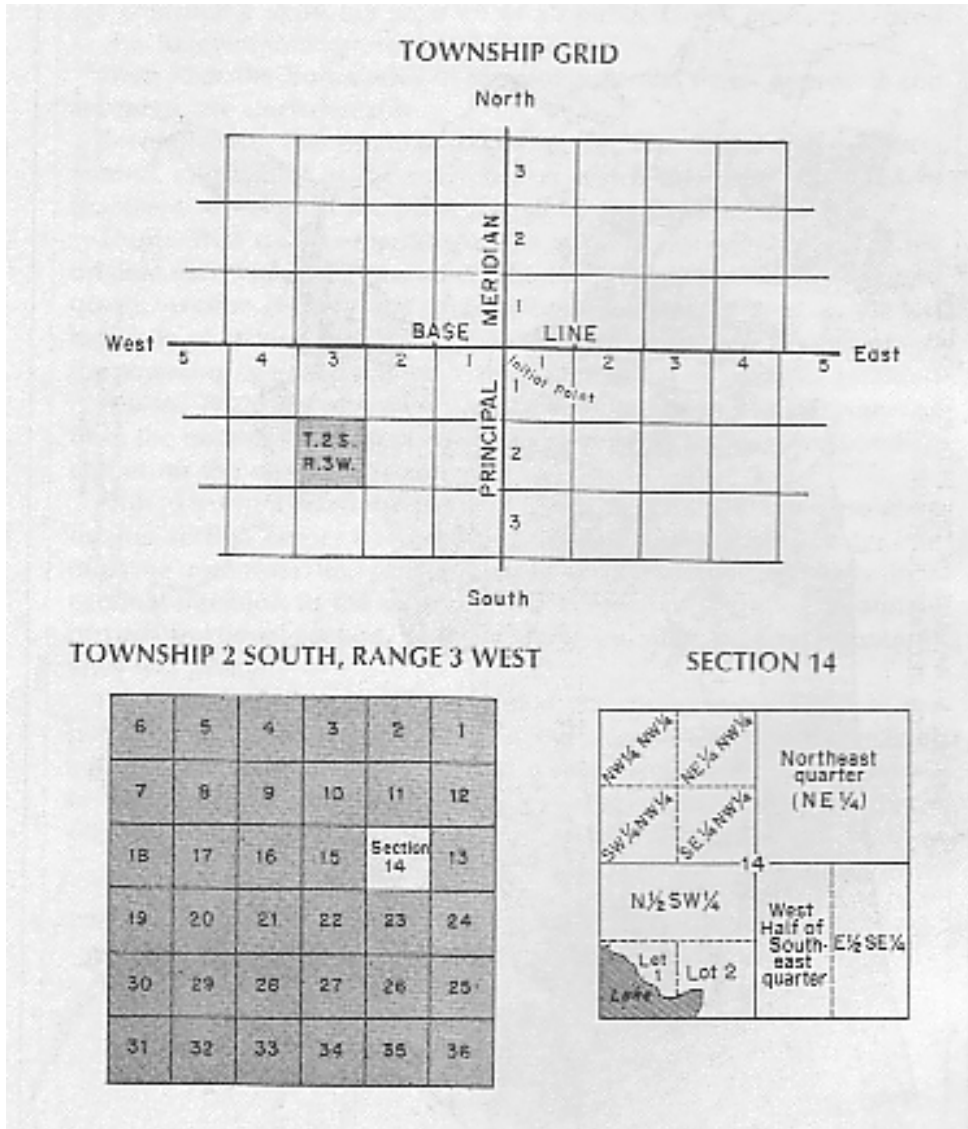
Fourth: That the center lines of a section are to be straight, running from the quarter-section corner on one boundary to the corresponding corner on the opposite boundary.

Fifth: That in a fractional section where no opposite corresponding quarter-section corner has been or can be established, the center line must be run from the proper quarter-section corner as nearly in a cardinal direction to the meander line, reservation, or other boundary of such fractional section, as due parallelism with the section boundaries will permit.

From the foregoing it will be evident that corners established in the public land surveys remain fixed in position and are unchangeable; and that lost or obliterated corners of those surveys must be restored to their original locations from the best available evidence of the official survey in which such corners were established.



GENERALIZED DIAGRAM OF THE RECTANGULAR SYSTEM OF SURVEYS

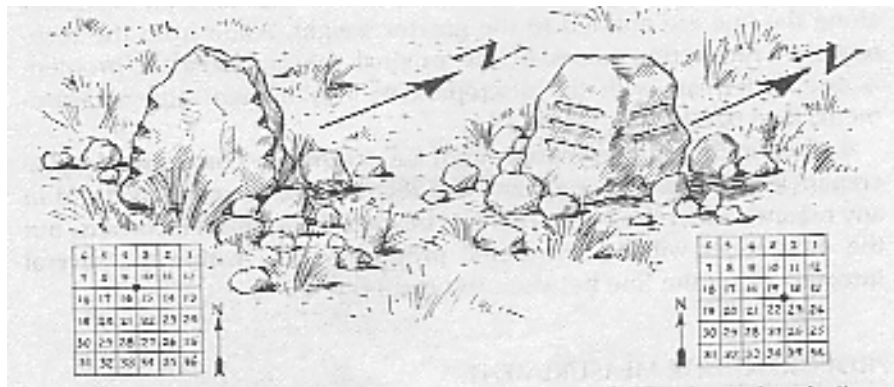


RESTORATION OF LOST OR OBLITERATED CORNERS

The restoration of lost corners should not be undertaken until after all control has been developed; such control includes both original and acceptable collateral evidence. However, the methods of proportionate measurement will be of material aid in the recovery of evidence.

1. An existent corner is one whose position can be identified by verifying the evidence of the monument, or its accessories, by reference to the description that is contained in the field notes, or where the point can be located by an acceptable supplemental survey record, some physical evidence, or testimony.

Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered through the testimony of one or more witnesses who have a dependable knowledge of the original location.



Marks on old stone section corners. The notches or grooves indicate the number of miles from the south and east boundaries of the township, respectively.

2. An obliterated corner is one at whose point there are no remaining traces of the monument, or its accessories, but whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt, by the acts and testimony of the interested landowners, competent surveyors, or other qualified local authorities, or witnesses, or by some acceptable record evidence.

A position based upon collateral evidence should be duly supported, generally through proper relation to known corners, and agreement with the field notes regarding distances to natural objects, stream crossings, line trees, and off-line tree blazes, etc., or unquestionable testimony.

3. A lost corner is a point of a survey whose position cannot be determined, beyond reasonable doubt, either from traces of the original marks or from acceptable evidence or testimony that bears upon the original position, and whose location can be restored only by reference to one or more interdependent corners.

If there is some acceptable evidence of the original location of the corner, that position will be employed.

Decision that a corner is lost should not be made until every means has been exercised that might aid in identifying its true original position. The retracements, which are usually begun at known corners, and run according to the record of the original survey, will indicate the probable position for the corner, and show what discrepancies may be expected. Any supplemental survey record or testimony should then be considered in the light of the facts thus developed. A line will not be regarded as doubtful if the retracement affords recovery or acceptable evidence.

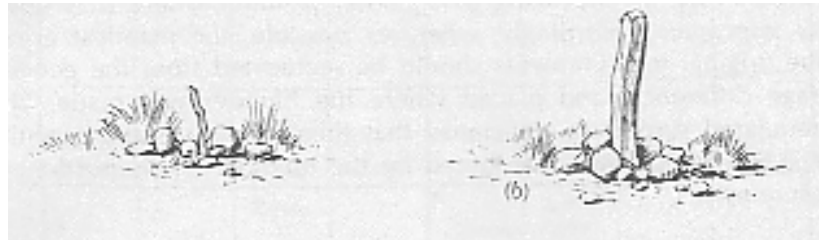
In cases where the probable position for a corner cannot be made to harmonize with some of the calls of the field notes, due to errors in description or to discrepancies in measurement developed in the retracement, it must be ascertained which of the calls for distances along the line are entitled to the greater weight. Aside from the technique of recovering traces of the original marks, the main problem is one that treats with the discrepancies in alinement and measurement. (See p. 33.)

4. Existing original corners cannot be disturbed; consequently, discrepancies between the new and the record measurements will not in any manner affect the measurements beyond the identified corners, but the differences will be distributed proportionately within the several intervals along the line between the corners.

PROPORTIONATE MEASUREMENT

The ordinary field problem consists of distributing the excess or deficiency in measurement between existent corners in such a manner that the amount given to each interval shall bear the same proportion to the whole difference as the record length of the interval bears to the whole record distance. After having applied the proportionate difference to the record length of each interval the sum of the several parts will equal the new measurements of the whole distance.

5. A proportionate measurement is one that gives concordant relation between all parts of the line, i.e.—the new values given to the several parts, as determined by the remeasurement, shall bear the same relation to the record lengths as the new measurement of the whole line bears to that record. Lengths of proportioned lines are comparable only when reduced to their cardinal equivalents.



Corner monuments of the public land surveys. Reading from top of page: (a) Modern iron post with brass cap, and mound of stone; (b) wooden posts, the one on left not much more than a twig; (c) wooden post, showing decay at ground line; (d) corner monument obliterated, remnants of stone mounds identify corner position; (e) corner monument obliterated, evidence of old pits fixes corner position.

Discrepancies in measurement between those recorded in the original survey and those developed in the retracements should be carefully verified with the object to placing each such difference properly where it belongs. This is quite important at times, because, if disregarded, the result may be fixing of a corner position where it is obviously improper. Accordingly, wherever possible, the manifest errors in the original measurements should be segregated from the general average difference, and placed where the blunder was made. The accumulated surplus or deficiency that then remains is the quantity that is to be uniformly distributed by the methods of proportionate measurement.

SINGLE PROPORTION

6. The term “single proportionate measurement” is applied to a new measurement made on a line to determine one or more positions on that line.

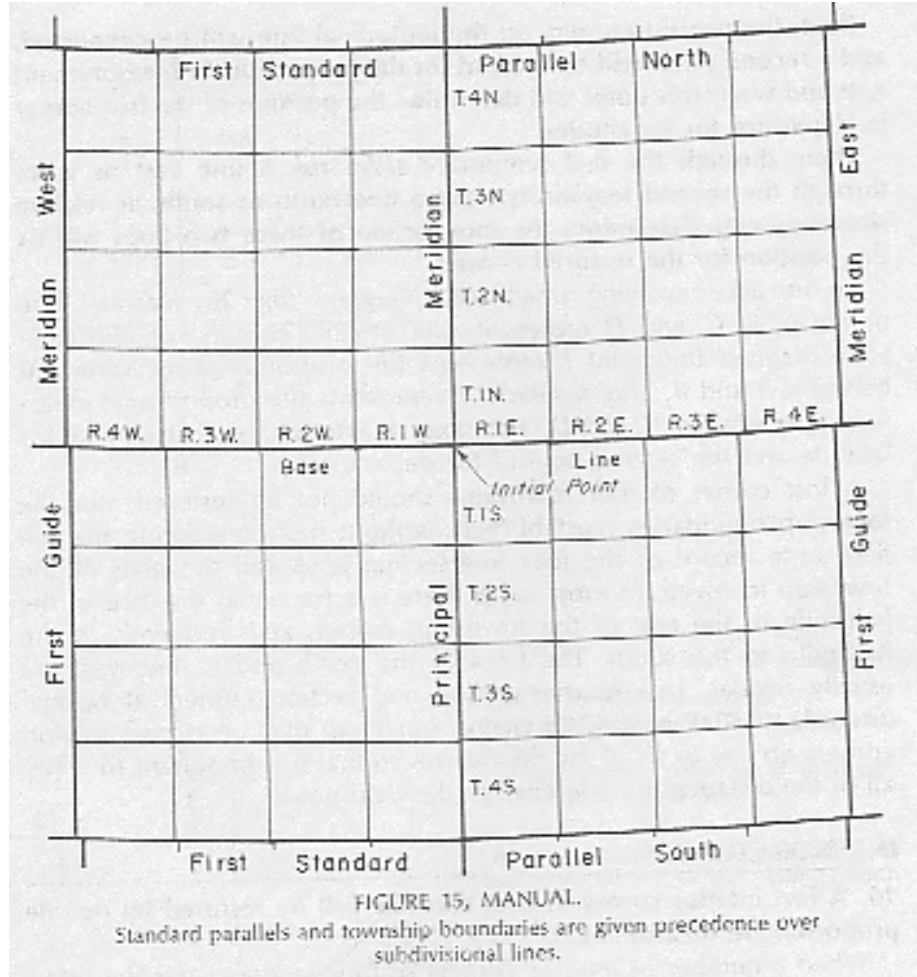
In single proportionate measurement, the position of two identified corners controls the direction of the line between those corners, and intermediate positions on that line are determined by proportionate measurement between those controlling corners. The method is sometimes referred to as a “two-way” proportion. Examples: a quarter-section corner on the line between two section corners; all corners on standard parallels; and all intermediate positions on any township boundary line.

DOUBLE PROPORTION

7. The term “double proportionate measurement” is applied to a new measurement made between four known corners, two each on intersecting meridional and latitudinal lines, for the purpose of relating the intersection to both.

By double proportionate measurement, the lost corner is reestablished on the basis of measurement only, disregarding the record directions. An exception will be found in those cases where there is some acceptable survey record, some physical evidence, or testimony, that may be brought into the control. The method may be referred to as a “four-way” proportion. Examples: a corner common to four townships, or one common to four sections within a township.

The double proportionate measurement is the best example of the principal that existent or known corners to the north and to the south should control any intermediate latitudinal position, and that corners east and west should control any intermediate latitudinal position, and that corners east and west should control the position in longitude.



As between single or double proportionate measurement, the principle of precedence of one line over another of less original importance is recognized, in order to harmonize the restoring process with the method followed in the original survey, thus limiting the control.

STANDARD PARALLELS AND TOWNSHIP BOUNDARIES

8. Standard parallels will be given precedence over other township exteriors, and ordinarily the latter will be given precedence over subdivisional lines; section corners will be relocated before the position of lost quarter-section corners can be determined.

9. In order to restore a lost corner of four townships, a retracement will first be made between the nearest known corners on the meridional line, north and south of the missing corners, and upon that line a temporary stake will be placed at the proper proportionate distance; this will determine the latitude of the lost corner.

Next, the nearest corners on the latitudinal line will be connected, and a second point will be marked for the proportionate measurement east and west; this point will determine the position of the lost corner in departure (or longitude).

Then, through the first temporary stake run a line east or west, through the second temporary stake a line north or south, as relative situations may determine; the intersection of these two lines will fix the position for the restored corner.

In the accompanying small scale diagram (fig. 70, Manual), the points A, B, C, and D represent four original corners; on the large scale diagram the point E represents the proportional measurement between A and B; and, similarly, F represents the proportional measurement between C and D. The point X satisfies the first control for latitude and the second control for departure.

A lost corner of four townships should not be restored, nor the township boundaries reestablished, without first considering the full field note record of the four intersecting lines and the plats of the township involved. In most cases there is a fractional distance in the half-mile to the east of the township, corner, and frequently in the half-mile to the south. The lines to the north and to the west are usually regular, i.e. --quarter-section and section corners at normal intervals of 40.00 and 80.00 chains, but there may be closing-section corners on any or all of the boundaries so that it is important to verify all of the distances by reference to the field notes.

INTERIOR CORNERS

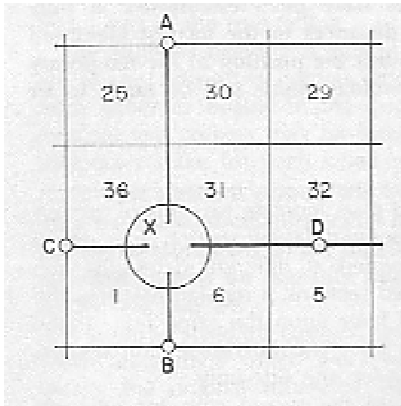
10. A lost interior corner of four sections will be restored by double proportionate measurement.

When a number of interior corners of four sections, and the intermediate quarter-section corners, are missing on all sides of the one sought to be established, the entire distance between the nearest identified corners both north and south, and east and west, must be measured. Lost section corners on the township exteriors, if required for control, should be relocated.

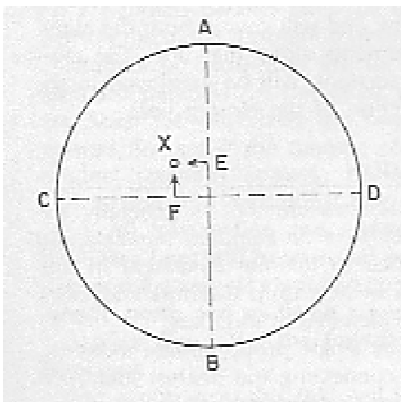
RECORD MEASUREMENT

11. Where the line has not been established in one direction from the missing township or section corner, the record distance will be used to the nearest identified corner in the opposite direction.

Thus, in the same diagram, if the latitudinal line in the direction of the point D has not been established, the position of the point F in departure would have been determined by reference to the record distance from the point C; the point X would then be fixed by cardinal offsets from the points E and F as already explained.

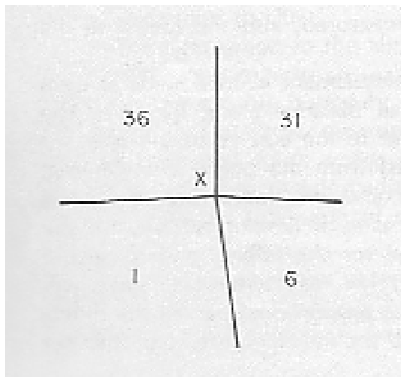


Lost township corner in vicinity of X



A, B, C, D,—Control corners
 E—Proportionate point for X in latitude between A and B
 F—Proportionate point for X in departure between C and D

Correct position of X is at intersection of lines extended East or West from E, North or South from F.



Restored corner showing true direction of township lines

FIGURE 70, MANUAL

12. Where the intersecting lines have been established in only two of the directions, the record distances to the nearest identified corners on these two lines will control the position of the temporary points; then from the latter the cardinal offsets will be made to fix the desired point of intersection.

TWO SETS OF CORNERS

In many surveys the field notes and plats indicate two sets of corners along township boundaries, and frequently along section lines where parts of the township were subdivided at different dates. In such cases there are usually corners of two sections at regular intervals, and closing section corners established later upon the same line, at the points of intersection of a closing line. The quarter-section corners on such lines usually are controlling for one side only.

In the more recent surveys, where the record calls for two sets of corners, those that are the corners of the two sections first established, and the quarter-section corners relating to the same sections, will be employed for the retracement, and will govern both the alinement and the proportional measurements along that line. The closing section corners, set at the intersections, will be employed in the usual way, i.e.--to govern the direction of the closing lines.

RESTORATION BY SINGLE PROPORTION

The method of single proportionate measurement is generally applicable to the restoration of lost corners on standard parallels and other lines established with reference to definite alinement in one direction only. Intermediate corners on township exteriors and other controlling boundary lines are to be included in this class.

In order to restore a lost corner by single proportionate measurement, a retracement will be made connecting the nearest identified regular corners on the line in question; a temporary stake (or stakes) will be set on the trial line at the original record distance, (or distances); the total distance will be measured, also the falling at the objective corner.

On meridional township lines an adjustment will be made at each temporary stake for the proportional distance along the line. The temporary stake then will be set over to the east or to the west for falling, counting its proportional part from the point of beginning.

On east-and-west township lines and on standard parallels the proper adjustment should be made at each temporary stake for the proportional distance along the line, for the falling, and to secure the latitudinal curve (see Manual¹); i.e.—the temporary stake will be either advanced or set back for the proportional part of the difference between the record distance and the new measurement, then set over the curvature of the line, and last corrected for the proportional part of the true falling.

¹Secs. 2-75 to 2-78, inclusive; the true latitudinal curve. Secs. 3-17 to 3-30, inclusive; the running of township exteriors. The term latitudinal curve as there employed denotes an easterly westerly line properly adjusted to the same mean bearing from each monument to the next one in regular order, as distinguished from the long chord or great circle that would connect the initial and terminal points.

The adjusted position is thus placed on the true line that connects the nearest identified corners, and at the same proportional interval from either as existed in the original survey. Any number of intermediate lost corners may be located on the same plan, by setting a temporary stake for each when making the retracement.

13. Lost standard corners will be restored to their original positions on a base line, standard parallel or correction line, by single proportionate measurement on the true line connecting the nearest identified standard corners on opposite sides of the missing corner or corners, as the case may be.

The term “standard corners”, as used above, will be understood to mean all corners which were established on the standard parallel during the original survey of that line, including, but not limited to, standard township, section, quarter-section, meander, and closing corners. Closing corners, or other corners purported to be established on a standard parallel after the original survey of that line, will not control the initial restoration of lost standard corners.

Corners on base lines are to be regarded the same as those on standard parallels. In the older practice the term “correction line” was used for what later has been called the standard parallel. The corners first set in the running of a correction line will be treated as original standard corners; those that were set afterwards at the intersection of a meridional line will be regarded as closing corners.

14. All lost section and quarter-section corners on the township boundary lines will be restored by single proportionate measurement between the nearest identified corners on opposite sides of the missing corner, north and south on a meridional line, or east and west on a latitudinal line, after the township corners have been identified or relocated.

An exception to this rule will be found in the case of any exterior the record of which shows deflections in alinement between the township corners (p. 20).

A second exception to the above rule is found in those occasional cases where there may be persuasive proof of a deflection in the alinement of the township boundary, though the record shows the line to be straight. For example, measurements east and west across a range line, or north and south across a latitudinal township line, counting from a straight-line exterior adjustment, may show distances to the nearest identified subdivisional corners to be materially long in one direction and correspondingly short in the opposite direction as compared to the record measurements. This condition, when supported by corroborative collateral evidence as might generally be expected, would warrant an exception to the straight-line or two-way adjustment under the rules for the acceptance of evidence, i.e.—the evidence outweighs the record. See Retracements. The rules for a four-way or double proportionate measurement would then apply, provided there is conclusive proof.

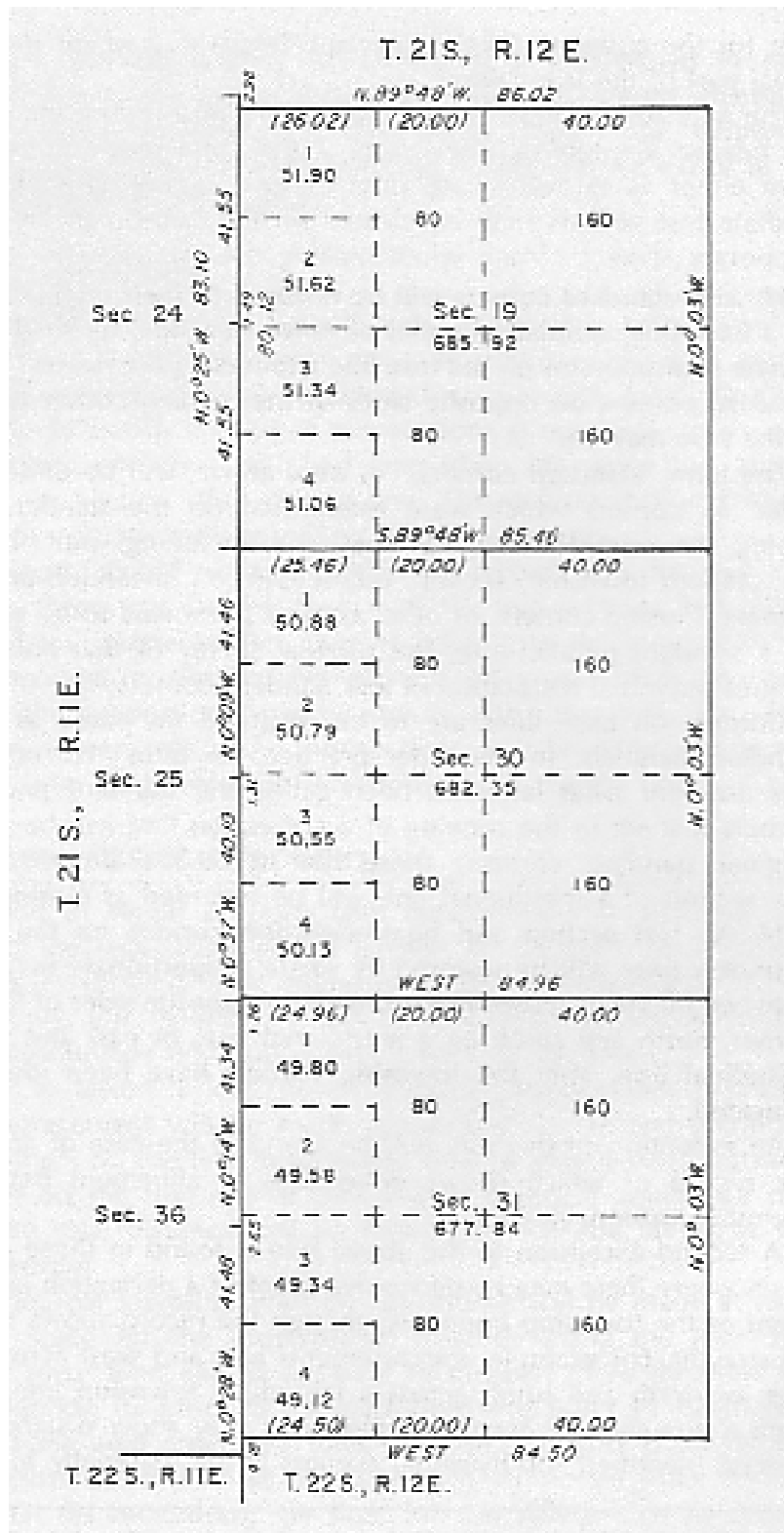


FIGURE 81,

Two sets of corners on an irregular township boundary.

15. All lost quarter-section corners on the section boundaries within the township will be restored by single proportionate measurement between the adjoining section corners, after the section corners have been identified or relocated.

This practice is applicable in the majority of the cases. However, in those instances where other corners such as meander corners, sixteenth-section corners, etc., were originally established between the quarter-section and the section corners, such minor corners, when identified, will exercise control in the restoration of lost quarter-section corners.

16. Lost meander corners, originally established on a line projected across the meanderable body of water and marked upon both sides will be relocated by single proportionate measurement, after the section or quarter-section corners upon the opposite sides of the missing meander corner have been duly identified or relocated.

Under ordinary conditions, the actual shore line of a body of water is considered the boundary of lands included in an entry and patent, rather than the meander line returned in the field notes. It follows that the restoration of a lost meander corner would be required only infrequently. Under favorable conditions a lost meander corner may be restored by treating the shoreline as an identified natural feature which controls the measurement to the point for the corner; this is particularly applicable where it is evident that there has been no change in the shore line.

17. A lost closing corner will be reestablished on the true line that was closed upon, and at the proper proportional interval between the nearest regular corners to the right and left.

In order to reestablish a lost closing corner on a standard parallel or other controlling boundary, the line that was closed upon will be retraced, beginning at the corner from which the connecting measurement was originally made, itself properly identified or relocated; a temporary stake will be set at the record connecting distance, and the total distance and falling will be noted at the next regular corner on that line on the opposite side of the missing closing corner; the temporary stake will then be adjusted as in single proportionate measure (p. 33).

A closing corner not actually located on the line that was closed upon will determine the direction of the closing line, but not its legal terminus; the correct position is at the true point of intersection of the two lines.

IRREGULAR EXTERIORS

Some township boundaries, not established as straight lines, are termed “irregular” exteriors. Parts were surveyed from opposite directions, and the intermediate portion was completed later by random and true line, leaving a fractional distance. Such irregularity follows some material departure from the basic rules for the establishment of original surveys. A modified form of single proportionate measurement is used in restoring lost corners on such boundaries. This is also applicable to a section line or a township line which has been shown to be irregular by a previous retracement. Figure 71.

In order to restore one or more lost corners or angle points on such irregular exteriors, a retracement between the nearest known corners is made on the record courses and distances to ascertain the direction and length of the closing distance. A temporary stake is set for each missing corner or angle point. The closing distance is then reduced to its equivalent latitude and departure.

On a meridional line the latitude of the closing distance is distributed among the courses in proportion to the latitude of each course. The departure of the closing distance is distributed among the courses in proportion to the length of each course. That is, after the excess or deficiency of latitude is distributed, each temporary stake is moved east or west an amount proportional to the total distance from the starting point.

On a latitudinal line the temporary stakes should be placed to suit the usual adjustments for the curvature. The departure of the closing distance is distributed among the courses in proportion to the departure of each course. Then each temporary stake is moved north or south an amount proportional to the total distance from the starting point.

Angle points and intermediate corners will be treated alike.

ONE-POINT CONTROL

18. Where a line has been terminated with measurement in one direction only, a lost corner will be restored by record bearing and distance, counting from the nearest regular corner, the latter having been duly identified or restored.

Examples will be found where lines have been discontinued at the intersection with large meanderable bodies of water, or at the border of what was classified as impassable ground.

INDEX ERRORS FOR ALINEMENT AND MEASUREMENT

Where the original surveys were faithfully executed, it is to be anticipated that retracement of many miles of the lines in a given township will develop a definite and consistent difference in measurement and in a bearing between original corners, such as to establish a characteristic of the original survey. Under such conditions it is proper that allowance be made for the average differences in the restoration of a lost corner where control is lacking on one direction. The adjustment will be taken care of automatically where there is a suitable basis for proportional measurement.

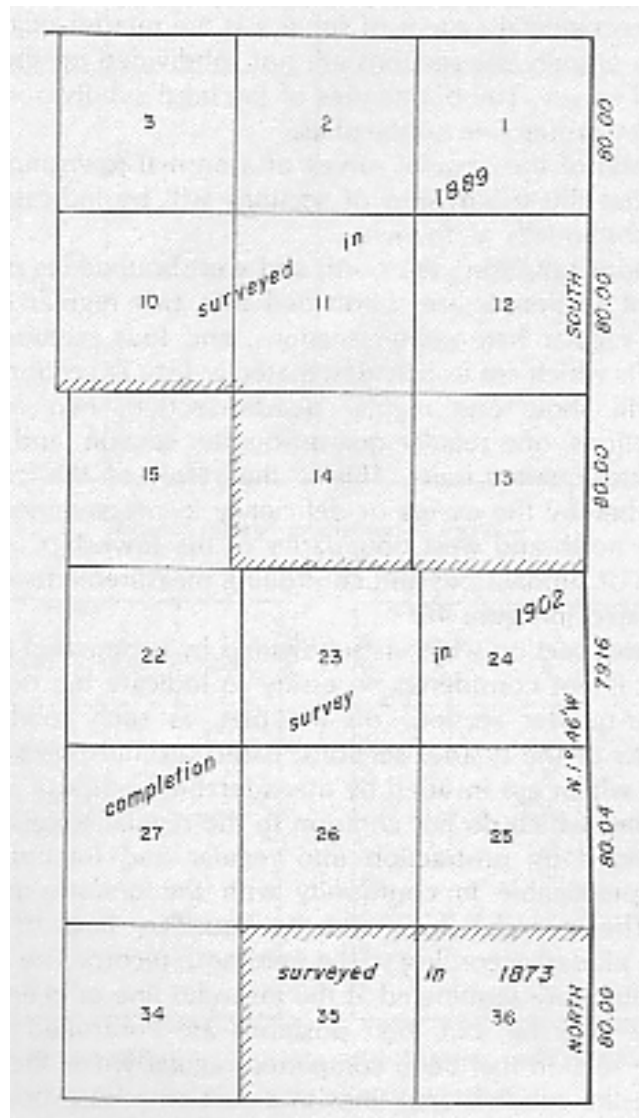


FIGURE 71, MANUAL
Irregular exterior resulting from the piecemeal survey of a township line.

SUBDIVISION OF SECTIONS

The fundamental principles for the subdivision of sections are derived from secs. 2396 and 2397, Revised Statutes (43. U. S. C., secs 752, 753). The ordinary unit of administration of the public lands under the rectangular system of surveys is the quarter-quarter section of 40 acres. Usually the sections are not subdivided on the ground in the original survey. The boundaries of the legal subdivisions generally are shown by protraction on the plats.

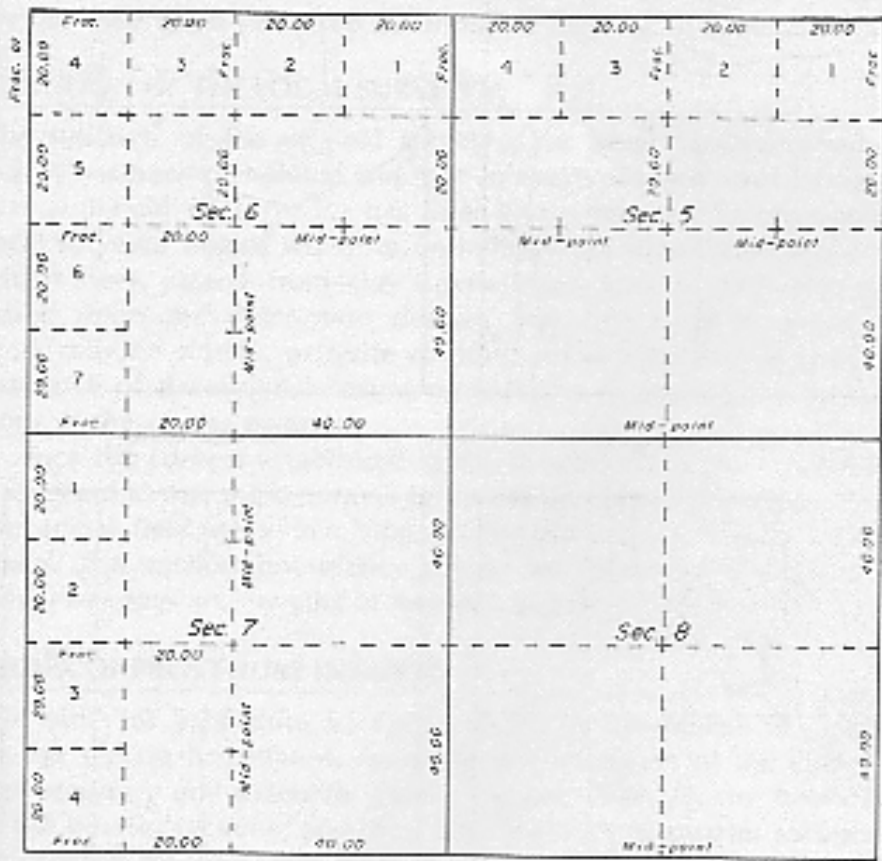
On the plat of the original survey of a normal township, it is to be expected that the subdivision of sections will be indicated, by protraction, substantially as follows:

The sections bordering the north and west boundaries of the township, except section 6, are subdivided into two regular quarter-sections, two regular half-quarter sections, and four fractional quarter-quarter units which are usually designated as lots. In section 6, the subdivision will show one regular quarter-section, two regular half-quarter sections, one regular quarter-quarter section, and seven fractional quarter-quarter units. This is a result of the plan of subdivision, whereby the excess or deficiency in measurement is placed against the north and west boundaries of the township.

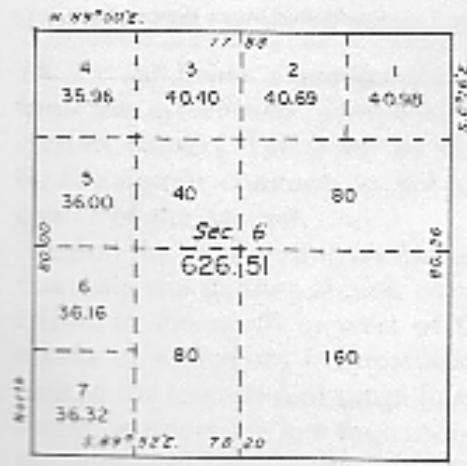
The plan of subdivisions and controlling measurements employed is well illustrated in figure 46.

In a normal section which is subdivided by protraction into quarter sections, it is not considered necessary to indicate the boundaries of the quarter-quarter sections on the plat, as such subdivisions are aliquot parts of the quarter sections, based on mid-point protraction.

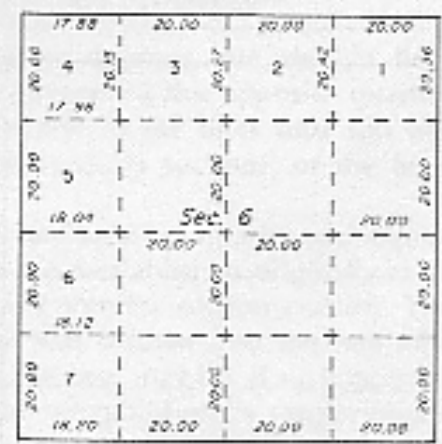
Sections which are invaded by meanderable bodies of water, or by private claims which do not conform to the regular legal subdivisions, are subdivided by protraction into regular and fractional parts as nearly as practicable in conformity with the uniform plan already outlined. The meander lines, and boundary lines of the private claims, are platted according to the field note record. The subdivision-of-section lines are terminated at the meander line or claim boundary, as the case may be, but their positions are controlled precisely as though the section had been completed regularly. For the purpose of protracting the subdivisional lines in a section whose boundary lines are partly within the limits of a meanderable body of water, or private claim, the fractional section boundaries are completed in theory; the protracted position of the subdivision-of-section lines is controlled by the theoretical points so determined. (See fig. 47.)



Showing normal subdivision of sections.

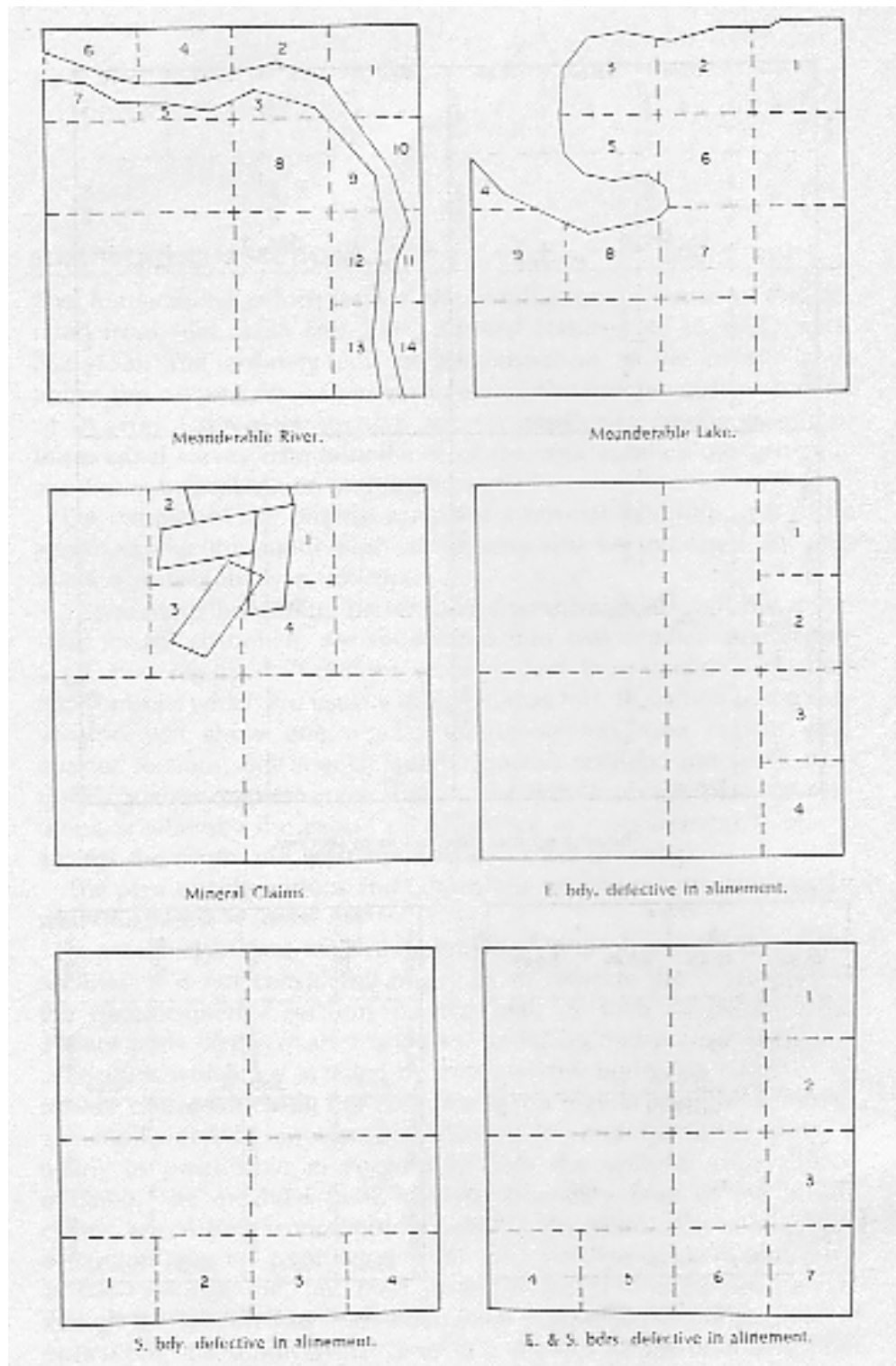


Showing areas.



Showing calculated distances.

FIGURE 46, MANUAL
Examples of subdivision by protraction



FIGURE

MANUAL
Examples of subdivision of fractional sections

FUNCTION OF THE LOCAL SURVEYOR

The function of the original surveyor has been fulfilled when the survey has been completed and monumented properly, and the official plat and field note record has been prepared. The function of the local surveyor begins when he undertakes the identification of lands which have passed from the Government into private ownership, based upon the description derived from the original survey. His work may be simple, or quite complex, depending largely upon the existence of the original corner monuments or acceptable perpetuations of the corner positions.

Since the corners established in the original survey are controlling, it is essential that these corners be found, or properly restored, before the actual field work involving the subdivision-of-section is undertaken. The section boundaries should be retraced to develop the actual bearings and lengths of the lines between the corners.

ORDER OF PROCEDURE IN SURVEY

The order of procedure is: First, identify or reestablish the corners on the section boundaries, including determination of the points for the necessary one-sixteenth section corners. Next, fix the boundaries of the quarter sections; and then form the quarter-quarter sections or small tracts by equitable and proportionate division. The following methods should be employed:

SUBDIVISION OF SECTIONS INTO QUARTER SECTIONS

19. To subdivide a section into quarter sections, run straight lines from the established quarter-section corners to the opposite quarter-section corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or the legal center of the section.

Upon the lines closing on the north and west boundaries of a regular township the quarter-section corners were established originally at 40 chains to the north or west of the last interior section corners. The excess or deficiency in measurement was thrown into the half-mile next to the township or range line, as the case may be. If such quarter-section corners are lost, they should be reestablished by proportionate measurement based upon the original record.

Where there are double sets of section corners on the township and range lines, the quarter-section corners for the sections south of the township line and east of the range line usually were not established in the original surveys. In subdividing such sections, new quarter-section corners are required, so placed as to suit the calculations of the areas that adjoin the township boundary, as indicated upon the official plat, adopting proportional measurements where the new measurements of the north or west boundaries of the section differ from the record distances (pp. 16 and 30).

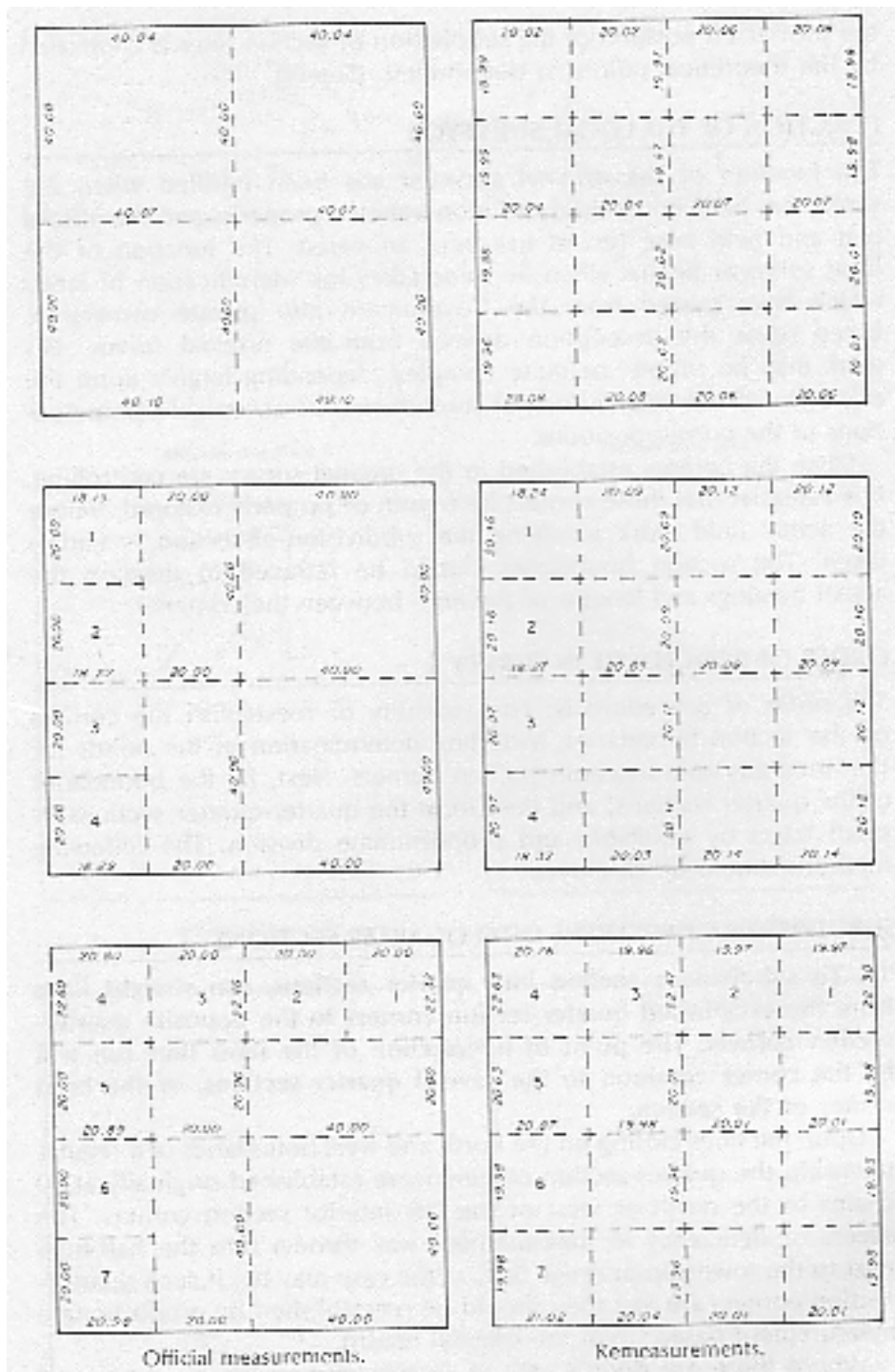


FIGURE 50, MANUAL
 Examples of subdivision by survey showing relation of official measurements and calculated distances to remeasurements, and indicating proportional distribution of differences.

SUBDIVISION OF FRACTIONAL SECTIONS

20. The law provides that where opposite corresponding quarter-section corners have not been or cannot be fixed, the subdivision-of-section lines shall be ascertained by running from the established corners north, south, east, or west, as the case may be, to the water course, reservation line, or other boundary of such fractional sections represented upon the official plat.

In this, the law presumes that the section lines are due north and south, or east and west lines, but usually this is not the case. Hence, in order to carry out the spirit of the law, it will be necessary in running the center lines through fractional sections to adopt mean courses, where the section lines are not on due cardinal, or to run parallel to the east, south, west, or north boundary of the section, as conditions may require, where there is no opposite section line.

SUBDIVISION OF QUARTER SECTIONS

21. Preliminary to the subdivision of quarter sections, the quarter-quarter, or sixteenth-section corners will be established at points midway between the section and quarter-section corners, and the center of the section, except on the last half mile of the lines closing on township boundaries, where they should be placed at 20 chains, proportionate measurement, counting from the regular quarter-section corner.

The quarter-quarter, or sixteenth-section corners having been established as directed above, the center lines of the quarter section will be run straight between opposite corresponding quarter-quarter, sixteenth section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the legal center of a quarter section. (See fig. 50.)

SUBDIVISION OF FRACTIONAL QUARTER SECTIONS

22. The subdivisional lines of fractional quarter sections will be run from properly established quarter-quarter, or sixteenth-section corners, with courses governed by the conditions represented upon the official plat, to the lake, water-course, reservation, or other irregular boundary which renders such sections fractional.

What has been written on the subject of subdivision of sections relates to the procedure contemplated by law, and refers to the methods to be followed in the initial subdivision of the areas, prior to development and improvement. It must be borne in mind that care should be exercised to avoid disturbing, satisfactory conditions as to roads, fences, or other improvements marking subdivision-of-section lines and which may define the extent of property rights.

RETRACEMENTS

Where the surveyor is called upon to retrace the lines of the rectangular public land surveys, the problem requires a careful study of the record data. The first step is to assemble copies of the field notes and plats, and determine the names of the owners who will be concerned in the retracement and survey. A thorough search and inquiry with regard to the record of any additional surveys that have been made since the approval of the original survey should be made. The county surveyor, county clerk, register of deeds, practicing engineers and surveyors, landowners, and others who may furnish useful information should be consulted as to such features.

The matter of boundary disputes should be carefully reviewed, particularly as to whether claimants have based their locations upon evidence of the original survey and a proper application of surveying rules. If there has been a boundary suit, the record testimony and the court's opinion and decree should be carefully examined insofar as these may have a bearing upon the problem in hand.

The law requires that the position of original corners shall not be changed. There is a penalty for defacing corner marks, and for changing or removing a corner. (See inside front cover.) The corner monuments afford the principal means for identification of the survey, and accordingly, the courts attach the greatest weight to the evidence of their location. Discrepancies that may be developed in the directions and length of lines, as compared with the original record, do not warrant any alteration of a corner position (p. 10).

Obviously, on account of roadways or other improvements, it is necessary frequently to reconstruct a monument in some manner in order to preserve its position. Alterations of that kind are not regarded as changes in willful violation of the law, but rather as being in complete accord with the legal intent to safeguard the evidence (p. 37).

Therefore, whatever the purpose of the retracement may be—if it calls for the recovery of the true lines of the original survey, or for the running of the subdivisional lines of a section, the practices outlined require some or all of certain definite steps, as follows:

- a. Secure a copy of the original plat and field notes;
- b. Secure all available data regarding subsequent surveys;
- c. Secure the names and contact the owners of the property adjacent to the lines that are involved in the retracement
- d. Find the corners that may be required:
 - First: By the remaining physical evidence;
 - Second: By collateral evidence, supplemental survey records, or testimony, if the original monument is regarded as obliterated, but not lost, or;
 - Third: By application of the rules for proportionate measurement, if lost;
- e. Reconstruct the monuments as required, including the placing of reference markers where improvements of any kind might interfere, or if the site is such as to suggest the need for supplemental monumentation;
- f. Note the procedure for the subdivision of sections where these lines are to be run and

g. Prepare and file¹ a suitable record of what was found, the supplemental data that was employed, a description of the methods used, the direction and length of lines, the new markers, and any other facts regarded as important.

A knowledge of the practices and instructions in effect at the time of the original survey will be helpful. These should indicate what was required and how it was intended that the original survey should be made.

The data used in connection with the retracements should not be limited to the section or sections under immediate consideration. It should also embrace the areas adjacent to those sections. The plats should be studied carefully; fractional parts of sections should be located on the ground as indicated on the plats.

DOUBLE SETS OF CORNERS

The technique of making field astronomical observations for determinations of the true meridian, and methods for establishment of the true latitudinal curve, were not developed so as to be generally applied for many years after the inception of the rectangular survey system. Without these refinements, and lacking accuracy in the measurement of lines, accumulated discrepancies were bound to develop.

As a result, in order to maintain rectangularity in some of the older surveys, two sets of corners were established on the township boundaries. The section and quarter-section corners established in the survey of the boundary itself are the corners to be adopted in retracement and for control of proportionate measurements. These corners control the subdivisions on one side only of the township boundary. The second set of corners on these boundaries are the closing section corners for the subdivisional surveys on the opposite side of the boundary. The descriptions of these closing corners, and the connecting distances to the regular township boundary corners, will be found in the field notes of the subdivisional survey in which they were established. These closing section corners should be considered and evaluated as evidence in the solution of the whole problem.

¹ In many of the states there is a well established practice for the filing of field notes and plats of surveys, usually in one of the county offices. Otherwise, the record ordinarily would be filed as an exhibit with a deed, or agreement, or court decree, etc.

Where the section corners on the township boundaries are of minimum control, the quarter-section corners have the same status for the same side of the boundary. In the older surveys, quarter-section corners usually were not established for the opposite side of the boundary. Subsequent to 1919 it has been the practice to establish the second set of quarter-section corners. These are at midpoint for distances between the closing section corners, except where the plan of subdivision dictates otherwise, in which event the quarter-section corner is placed at 40.00 chains from the controlling closing corner.

These conditions merit careful study of the plats to the end that the subdivisions shown on the plats be given proper protection. The plats will indicate whether these quarter-section corners should be at mid-point between the closing corners, or if they should be located with regard to a fractional distance. The surveyor should make sure that the position is determined for all corners necessary for control in his work.

There is nothing especially different or complicated in the matter of one or two sets of corners on the township boundary lines. It is merely a question of assembling the complete data and of making a proper interpretation of the status of each monument.

The same principles should be applied in the consideration of the data of the subdivisional surveys, where for any of several causes there may be two sets of interior corners.

THE NEEDLE COMPASS AND SOLAR COMPASS

It should be noted that very simple needle-compass equipment in the hands of men skilled as surveyors, coupled with natural woodcraft and faithfulness in doing their work, satisfied the requirements of the colonial and early public-land surveys.

From the start of the public-land surveys, it was intended that the directions of lines be referred to the true meridian. In the early days, there was a general lack of familiarity with exact methods necessary to attain that purpose. The solar compass was designed by William A. Burt, United States Surveyor of Michigan and Iowa, and introduced in 1836. The instrument was an outstanding improvement over the needle compass, and gave accurate determinations of the meridian in the hands of Burt and others closely associated with him. The solar compass did not come into general use for nearly 50 years. Beginning with the Manual of 1890, the use of the magnetic needle was prohibited except for subdividing and meandering, and then only in localities that were supposed to be free from local attraction. Beginning with the Manual of 1894, the needle compass was entirely discontinued on all public land surveys. Most surveys are now being made with the improved solar transit. Where it is practicable, even more modern instruments such as one-second theodolites, gyroscopic compasses, and electronic distance measuring devices are employed, often in combination with photogrammetry.

It is not the purpose here to supply instructions for the use of the needle compass, but rather to point out what may be expected regarding the directions of the

lines of the early needle-compass surveys when compared with the more dependable modern methods. A large proportion of surveys made prior to 1890 are of the needle compass type. It should be noted that retracements may be made, i.e.,—the evidence of the marks can be developed by needle-compass methods if properly employed. Some surveyors maintain that you can “follow the steps” of the original surveyor more closely by use of the needle compass than by more precise methods.

In addition to the uncertainties of local attraction and temporary magnetic disturbances, the use of the needle compass is exceedingly unreliable in the vicinity of power lines, pipelines, steel rails, steel framed structures of all kinds, and wire fences, etc. Its use is now much more restricted on account of these improvements. The needle compass is rapidly becoming obsolete as it fails to satisfy the present need for more exact retracements.

EXCESSIVE DISTORTION

The needle-compass surveys, before being discontinued, had extended into the region of magnetic ore deposits of the Lake Superior watershed in northern Michigan, Wisconsin, and Minnesota. Here many townships were surveyed, and the lands patented, in which the section boundaries are now found to be grossly distorted. There is no way in which to correct these lines, nor to make an estimate (except by retracement), of the extent of the irregularities, which involve excessive discrepancies both in the directions and lengths of lines.

Considerable experience is required in retracing and successfully developing the evidence of the lines and corners in these areas of excessive distortion. However, the procedure for restoration of lost corners and for the subdivision of sections is the same as in areas of more regularity.

Another feature to be considered in connection with the retracements is that the record may show that one surveyor ran the south boundary, a second the east boundary, and others the remaining exteriors and subdivisional lines. All of these lines may be reported on cardinal, but may not be exactly comparable, i. e. -- the east boundary may not be truly normal to the south boundary, etc. It was customary to retrace one or more miles of the east boundary of the township to determine the “variation” of the needle. This value was then adopted in the subdivision of the township. It follows that the meridional section lines should be found to be reasonably parallel with the east boundary. Under that plan of operation, it should be anticipated that the latitudinal section lines will be reasonably parallel with the south boundary; however, discrepancies in measurement on the meridional lines frequently affect such parallelism. For these reasons, the index corrections for bearings may not be the same for the east and west as for the north and south lines. The two classes should be considered separately in this respect.

Until after 1900, most of the lines were measured with the Gunter’s link chain. The present surveyor must realize the difficulties of keeping that chain at standard length, and the inaccuracy of measuring steep slopes by this method. It is to be expected that the retracements will show various degrees of accuracy in the recorded

measurements which were intended to reflect true horizontal distances.

It is well to call attention, at this time, to the need for segregation of the manifest errors or blunders in the original measurements in order to minimize the effect of such errors in the restoration of lost corners. (See p. 10.) If the original field note record contains sufficient references to natural topographic items encountered along the line(s) being retraced such data frequently will be adequate for localizing the error.

INDEX ERRORS

Where the original surveys were faithfully made, generally there will be considerable uniformity in the directions and lengths of the lines. Frequently this uniformity is so definite as to indicate "index errors" which, if applied, to the record bearings and distances, will place the trial lines in close proximity to the true positions and aid materially in the search for evidence. With experience, the present surveyor will become familiar with the work of the original surveyor and know about what to expect in the way of such differences.

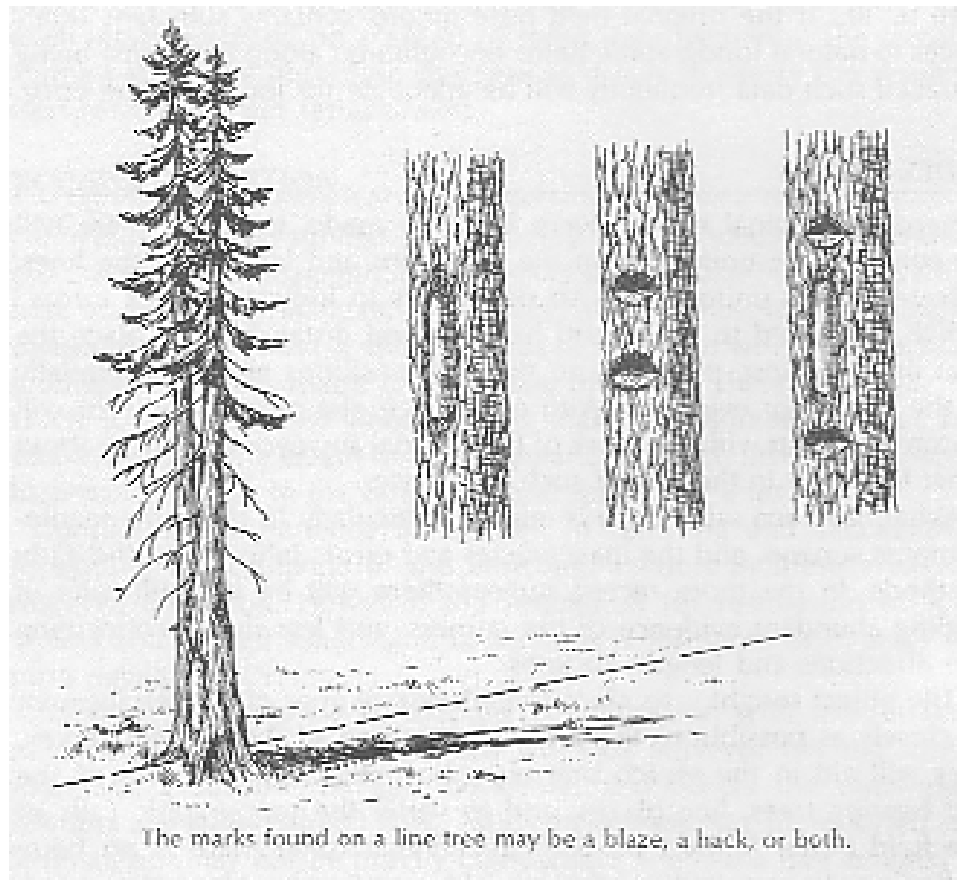
What has been said above is related particularly to the early needle-compass surveys, and the inaccuracies and errors inherent to the early methods. In the more recent surveys there will be less difficulty in finding abundant evidence of the corners, and less doubt concerning the directions and lengths of lines.

The object sought is to place the temporary lines of the retracement as closely as possible to the probable position of the original survey. This will aid in the search that must be made for the marks of the old bearing trees, line blazes, and to verify the topographic calls of the field notes. It must be emphasized that often there is no hope of finding obscure marks of the very old surveys except by experienced, intelligent search in the immediate vicinity of the lines.

COLLATERAL EVIDENCE

The identified corners of the original survey constitute the main control for the surveys to follow. After those corners have been located, and before resorting to proportionate measurement for restoration of lost corners, the other calls of the field notes should be considered. The recorded distances to stream crossings or to other natural objects which can now be identified often lead to the position for a missing corner. At this stage, the question of acceptance of later survey marks and records, the location of roads and property fences, and the reliability of testimony are to be considered.

A line tree, or a connection to some natural object, or to an improvement recorded in the original field notes, any of which can be identified, may fix a point of the original survey. The calls of the field notes for the various items of topography may assist materially in the recovery of the lines. The mean position of a blazed line, when identified as the original line, will place a meridional line for departure, or a latitudinal line for latitude. These are matters which require the exercise of considerable judgment.



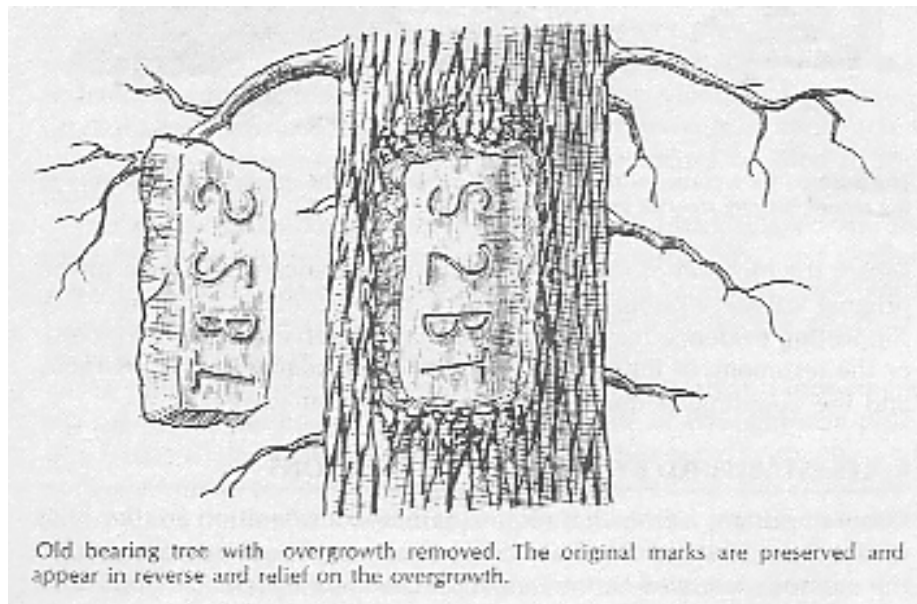
ORIGINAL MARKS

Original line-tree marks, off-line tree blazes, and scribe marks on bearing trees and tree corner-monuments whose age exceeds 100 years, are found occasionally. Such marks of later surveys are recovered in much greater number. Different surveyors used distinctive marks.

Some surveyors used hacks instead of blazes, and some used hacks over and under the blazes; some employed distinctive forms of letters and figures. All these will be recognized while retracing the lines of the same survey and will serve to verify the identification of the work of a particular surveyor.

The field notes give the species and the diameter of the bearing trees and line trees. Some of the smooth-barked trees were marked on the surface, but most of the marks were made on a flat smoothed surface of the live wood tissue. The marks remain as long as the tree is sound. The blaze and marks will be covered by a gradual overgrowth, showing a scar for many years. The overgrowth will have a lamination similar to the annual rings of the tree, which may be counted in order to verify the date of making, and to distinguish the original marks from later marks and blazes. On the more recent surveys, it is to be expected that the complete quota of marks should be found, clear cut and plainly legible. This cannot be expected in the older surveys.

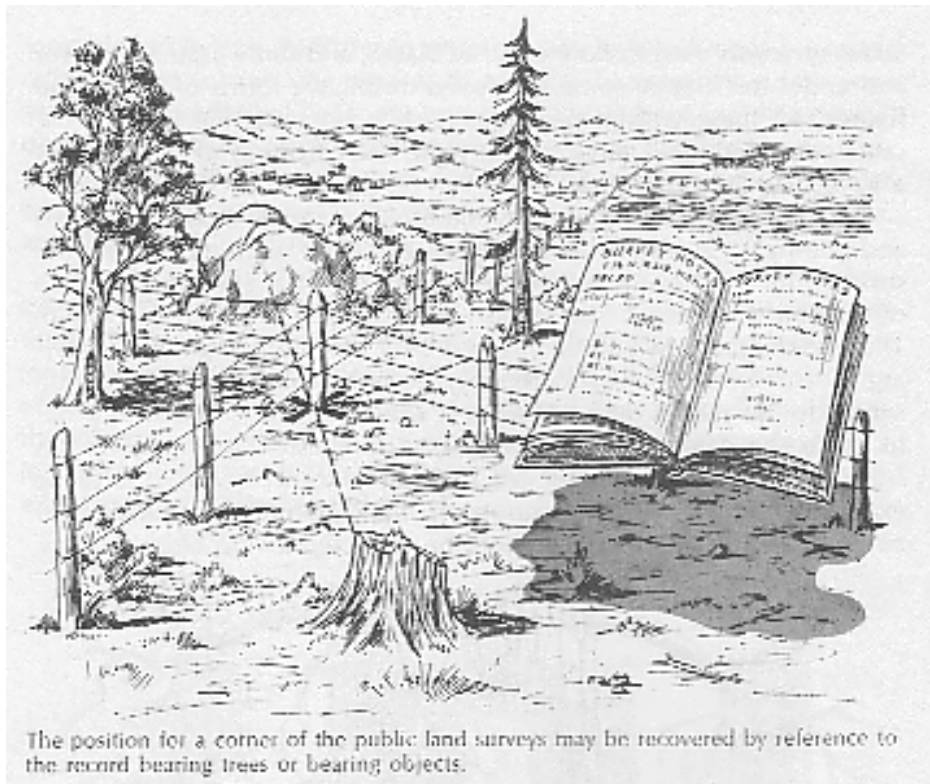
expected that the complete quota of marks should be found, clear cut and plainly legible. This cannot be expected in the older surveys.



It is advisable not to cut into a marked tree excepting as necessary to secure proof. The evidence is frequently so abundant, especially in the later surveys, that the proof is conclusive without inflicting an additional injury that would hasten the destruction of the tree.

The finding of the original scribe marks, line-tree hacks, and off-line tree blazes, furnishes the most convincing identification that can be desired.

It is not intended to disturb satisfactory local conditions with respect to roads and fences. The surveyor has no authority to change a property right that has been acquired legally. On the other hand, he should not accept the location of roads and fences as evidence prima facie of the original survey without something to support these locations. This supporting evidence may be found in some intervening survey record, or the testimony of individuals who may be acquainted with the facts, and the coupling of these things to the original survey.



The position for a corner of the public land surveys may be recovered by reference to the record bearing trees or bearing objects.

RULES ESTABLISHED BY STATE LAW OR DECISIONS

Other important factors that require careful consideration are the rules of the State law and State court decisions, as distinguished from the methods followed by the Bureau of Land Management. Under State law, property boundaries may be fixed by agreement between owners, acquiescence, or adverse possession. Such boundaries may be defined by roads, fences, or survey marks, disregarding exact conformation with the original section lines. The rights of adjoining owners may be limited to such boundaries.

In many cases, due care has been exercised to place the property fences on the lines of legal subdivision. It has been the general practice in the prairie states to locate the public roads on the section lines. These are matters of particular interest to the adjoining owners. It is reasonable to presume that care and good faith were exercised in placing such improvements with regard to the evidence of the original survey in existence at the time. Obviously, the burden of proof to the contrary must be borne by the party claiming differently. In many cases, at the time of construction of a road, the positions for the corners were preserved by subsurface deposits of marked stones or other durable material. These are to be considered as exceptionally important evidence of the position of the corner, when duly recovered and verified.

The replacement of those corners that are regarded as obliterated, but not lost, should be based on such collateral evidence as has been found acceptable. All lost corners can be restored only by reference to one or more interdependent corners.

ADEQUATE MONUMENTATION ESSENTIAL

The surveyor will appreciate the great extent to which his successful retracements has depended upon an available record of the previous surveys, and upon the markers that were established by those who preceded him. The same will apply in subsequent retracements. It is essential to the protection of the integrity and accuracy of the work in hand, the reputation of the surveyor, and the security of the interested property owners, that durable new corner markers be constructed in all places where required, and that a good record be filed of the survey as executed.

The preferred markers are of stone, concrete block, glazed sewer-tile filled with concrete, cast-iron or galvanized-iron pipe, and similar durable material. Many engineers and surveyors, counties, and landowners employ specially designed markers with distinctive lettering, including various cast-iron plates or bronze tablets.

The Bureau of Land Management has adopted a standard monument for use on the public-land surveys. This is made of wrought iron pipe, zinc coated, 2 ½ inches diameter and 28 inches long, with one end split and spread to form flanges or foot plates. A brass cap is securely attached to the top, on which appropriate markings for the particular corner are inscribed by use of steel dies.

Frequently, on account of roadway or other improvements, it is advisable to set a subsurface marker and in addition to place a reference monument where it may be found readily, selecting a site that is not likely to be disturbed.

MEANDER LINES AND RIPARIAN RIGHTS

The traverse run by a survey along the bank of a stream or lake is termed a meander line. The meander line is not generally a boundary in the usual sense, as ordinarily the bank itself marks the limits of the survey.¹ All navigable bodies of water are meandered in the public-land surveying practice, as well as many other important streams and lakes that have not been regarded as navigable in the broader sense. All navigable rivers, within the territory occupied by the public lands, remain, and are deemed to be public highways. Unless otherwise reserved for Federal purposes, the beds of these waters vested in the States at time of statehood.² Under Federal law, in all cases where the opposite banks of any stream not navigable belong to different persons, the stream and the bed thereof become common to both (R.S. 2476; 43 U.S.C. sec. 931).

Grants by the United States of its public lands, including lands bounded by streams or other waters, are construed as to their effect according to Federal law. This includes lands added to the grants by accretion.³

The Government conveyance of title to a fractional subdivision fronting upon a nonnavigable stream, unless specific reservations are indicated in the patent from the Federal Government, carries ownership to the middle to the stream.⁴

Where surveys purport to meander a body of water where no such body exists or the meanders may be considered grossly erroneous, the United States may have a continuing public land interest in the lands within the segregated areas.⁵ Where partition

lines are to be run across accretions, the ordinary Federal rule is to apportion the new frontage along the water boundary in the same ratio as the frontage along the line of the record meander courses. This principle is derived from the opinion of the Supreme Court of the United States in the case of *Johnston v. Jones* (66 U.S. 117, 121). There are many variations to this rule where local conditions prevail and the added lands are not of great width or extent. The application of any rule, when surveying private lands, should, of course, be brought into harmony with the State law.

Where there is occasion to define the partition lines within the beds of nonnavigable streams, the usual rule is to begin at the property line at its intersection with the bank. From that point, run a normal to the medial line of that stream that is located midway between the banks. Where the normals to the medial lines are deflecting rapidly, owing to abrupt changes in the course of the stream, suitable locations are selected above and below the doubtful positions, where acceptable normals may be placed. The several intervals along the medial line are then apportioned in the same ratio as the frontage along the bank.

The partition of the bed of nonnavigable lakes, whether water-covered or relicted, presents a more difficult problem because of the wide range of shapes of lake beds. In the simplest case of a circular bed, the partition lines can be run to the centroid thus creating pie-shaped tracts fronting the individual holdings at the edge of the lake bed. Where odd shaped beds are concerned, ingenuity will be required to divide the lake bed in such a manner that each shore proprietor will receive an equitable share of land in front of his holding. Any consideration of riparian rights inuring to private lands should be brought into line with appropriate State laws or decisions.

¹ *Hardin v. Jordan* (140 U.S. 371). Meander lines, as shown by Government surveys of land bounded by a lake or river, are merely for the purpose of ascertaining the quantity of land to be conveyed, and do not constitute its boundary. The water is the real boundary.

² *United States v. Stotts, et al.* (49 Fed. (2d.) 619). United States, while holding land before admission of State, could grant, for appropriate purposes, titles or rights in land below high-water mark or tidewater.

³ *Hughes v. State of Washington* (389 U.S. 290). Held that the ownership of accretion gradually deposited by the ocean on adjoining upland property conveyed by the United States is governed by federal, not state, law, and under federal law the plaintiff is the owner of the accretions.

⁴ *Hardin v. Jordan*, *supra*.

⁵ *Lee Wilson & Company v. United States* (245 U.S. 24). If, in the making of a survey of public lands, an area is through fraud or mistake, meandered as a body of water or lake where no such body of water exists, riparian rights do not accrue to the surrounding lands, and the Land Department, upon discovering the error, has power to deal with the meandered area, to cause it to be surveyed and lawfully dispose of it.

CONCLUSION

It is not to be inferred that this discussion does more than bring out the fundamentals of the subject, and with reference only to the United States rectangular surveys. These practices and explanations are broadly applicable where the United States is the owner of the lands, in whole or in part. They also have been made applicable in many States by State law to privately owned lands within the area of the former public domain, except where specifically in conflict with the State law.

Many additional factors enter into the treatment of exceptional or controversial situations, such as where the conditions on the ground are found to be seriously at variance with the record field notes and plats, or if there is extensive obliteration. Such factors are altogether too numerous to be brought within the scope of this pamphlet. The explanations need to be suited to the specific problem, and in some cases the treatment may come within the practices herein outlined. Letters of inquiry, if addressed to the Bureau of Land Management, should include a description of the lines in question and the facts as developed by the retracement.

In all cases where no public lands are involved, the surveying procedure must necessarily be brought into harmony with the State law and court opinion. In such cases, the methods and explanations of the Bureau of Land Management must be regarded as advisory only, as that Bureau is without jurisdiction unless Federal lands are involved.