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Practical Boundary Surveying

Legal and Technical Principles

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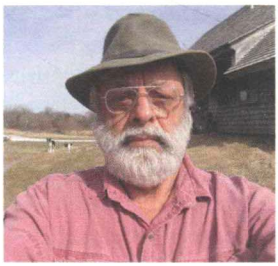
This book is intended to present the reader with an overview of general principles of land surveying and the general legal principles underlying boundary establishment and easements. Because statutes and common law vary from jurisdiction to jurisdiction the information presented herein may not be applicable in the reader's jurisdiction or to any particular circumstances in any jurisdiction. Because the conclusions and observations presented in this book rely on the author's opinion, the information presented herein is subject to interpretation by other professionals in the field who may be more familiar with laws, precedent and practices in their own jurisdiction, and they may have their own opinion on the subjects presented in this book. Prior to relying on the materials presented herein, the reader is encouraged to research laws, methods and requirements of land surveying existing in the reader's jurisdiction and survey system and to seek land surveying advice from a land surveyor licensed in the jurisdiction and legal advice from an attorney licensed to practice in that jurisdiction. This book is not, under any circumstances, to be construed as providing legal advice or surveying advice and the author shall not, under any circumstances, be liable for losses by readers who rely on any information presented herein.

To my wife Viola, a tireless researcher and a surveyor in her own right, and to my mother Elinor who encouraged me to become a surveyor.

About the Author



Paul Gay is an attorney and a professional land surveyor. He has been a land surveyor in private practice for more than 35 years and has been primarily involved in boundary surveying with a special interest in boundary dispute resolution. Mr. Gay has served as an expert witness in many trials involving land and boundary issues from Massachusetts and Rhode Island to Alaska. He wrote the book *Fundamentals of Boundary Surveying*, Professional Surveyor Publishing Co., Inc. in 2002, *Survey*, a computer program for surveying calculations, *Metrology*, a Windows units conversion program, and *Tide*, a program for calculating tides for any date at many U.S. coastal locations. Other publications include articles in surveying publications, *A History of Gray's Mill, Basic Principles of 19th Century Water Power* and *Sediment Transport around Gooseberry Neck.* Mr. Gay holds a B.S. degree in Sociology from the University of Massachusetts, an ScM degree in Geological Sciences from Brown University and a J.D. degree from New England Law.

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Chapter 1
Introduction

This is a book about boundary surveying. It is written for people who own land and for people who work in any profession or job which involves land. It is also written for land surveyors and students of land surveying. All parcels of land have boundaries. For many parcels of land, the location of the boundaries is uncertain, unknown or disputed. This book will provide the reader with a background on boundary surveying techniques and some of the common legal issues which govern boundary establishment.

Boundary surveying is sometimes thought to be primarily an engineering discipline. In reality, there is much more to boundary surveying than engineering. For most boundary surveyors, that is what makes the profession so challenging and interesting. You can't learn to be a competent surveyor by taking a course, acquiring a degree or reading a book—although all of these things help to provide the necessary foundation. Boundary surveying combines science, engineering, mathematics and law. Correctly performing boundary surveys also requires years of experience. Some boundaries are relatively easy to establish. More often than not they are difficult to establish. Surveyors routinely measure miles within fractions of an inch. Yet even with this ability, they are sometimes unable to determine the actual extent of ownership within several feet. In some surveys, the uncertainty is even greater. How can this be? This book will help the reader to understand why such uncertainties exist and what remedies may be available.

One purpose of this book is to acquaint people who are not land surveyors with the principles used by land surveyors to establish property lines. Home owners, real estate agents, attorneys, engineers, city planners, building officials, students, bankers, title researchers, GIS practitioners and many others will find the information in this book indispensable when they have questions relating to boundaries, easements and land surveying in general.

This book will also be useful to land surveyors who want or need to review the legal principles of boundary establishment and easements. It will serve as an

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important learning resource for students who are studying land surveying at the college level and who hope to become licensed. Because this book focuses on boundaries, it is not intended to replace a general textbook covering all types of surveying, such as construction and topographic surveying. However, because it integrates legal, technical and operational aspects of boundary surveying it will help a student develop an overall view of how surveys are performed.

The technical methods and equipment used in boundary surveying have changed as a result of the widespread adoption of computers and other electronics. Total stations (electronic theodolites) and global positioning systems (GPS) have replaced transits and steel tapes. Data collectors have replaced field books. Computers have replaced calculators for most surveying calculations. Large format plotters have replaced drawing plans by hand. However, these changes have no effect on old boundary surveys which have endured for generations. Stone boundary markers and piles of stones set in the 1800s are still routinely found in fields and in the woods. Plans and deeds created and recorded in the same period are still found in recorder's offices throughout the country. Boundary surveying is inextricably tied to history. Surveyors and others, who need to understand how a boundary originated and how it should be reestablished today, must be familiar the methods and equipment that were used when the boundary was first created. With some modern texts on land surveying, the emphasis is on the new, the latest equipment and techniques that are being used today. Although there is nothing wrong with this approach, indeed surveyors must understand and be adept at using the latest technology, in this book we will not ignore the past. We will learn about transits, theodolites, steel tapes, rods, chains, links, magnetic compasses and other equipment and methods that were used by past surveyors. It has been said that when a surveyor needs to reestablish boundaries that were created a hundred or more years ago, the new surveyor must "follow in the footsteps of the original surveyor". We cannot hope to follow in these footsteps unless we understand the methods and equipment used by the original surveyor.

Even if the reader never needs to interpret a deed written or a plan drafted in the 1800s, having an appreciation of the history will help place modern practices in context. Surveying technology was much simpler when transits rather than GPS receivers were used for making measurements. Surveyors using chains and steel tapes actually made measurements using their own hands. Today, using electronics, measurements are much more abstract because the surveyor is not actually doing the measuring—electromagnetic waves and microprocessors now do the work. For readers unfamiliar with surveying measurements, the relative simplicity of early measurement techniques will provide a solid foundation from which current techniques may be more readily understood.

In some ways, the technical aspects of boundary surveying have gotten easier with the advent of electronic instruments. When compared to the skill required to use a steel tape and theodolite or transit, which took years of experience to perfect, modern instruments and global positioning have made accurate measurements available to nearly anyone who understands the technology. These new capabilities threaten to oversimplify the real challenges faced by today's professional

boundary surveyors. Technology has not reduced the required level of knowledge and experience necessary to correctly establish boundaries. Today, a total station or GPS receiver makes it much easier to perform measurements with accuracies far exceeding what was possible using older technologies. But technology does not make it any more likely that a surveyor will locate a boundary at its true location. This is because the legal issues inherent in boundary establishment continue to be the real challenges facing today's boundary surveyors and technology is no substitute for knowledge and experience.

Global positioning has fundamentally changed how boundary surveyors approach their work and many surveyors who formerly relied on total stations for measurements must now be proficient in combining GPS with traditional measurement techniques. This is particularly important when it becomes necessary or desirable to connect a survey to a state plane coordinate system (a way of describing property corners at a precise location in a particular state). However, when the two methods are used together, measured distances are likely to disagree. Surveyors must understand why this happens and how to deal with the differences. Low distortion projections (LDP) are becoming a commonly used way to circumvent some of the limitations and difficulties inherent in state plane coordinate systems, particularly in mountainous areas with high elevations where there can be substantial differences between distances measured on the state plane system and distances measured on the ground.

Some of the chapters in this book contain mathematics, but the concepts are explained in simple terms so that anyone, with a background in high school math, should have no trouble following the logic. The math requirement was intentionally kept to a minimum so that the book would be readable, and hopefully enjoyable, by the widest possible audience. For those who desire a more in-depth treatment of the mathematical aspects of boundary surveying, the Appendix includes the underlying theory and many examples of typical calculations performed by boundary surveyors. The concerns many of us are likely to have about boundary establishment do not require an in-depth understanding of the mathematics underlying boundary surveying. Much of what we need to know will be readily understood if we have a working knowledge of some of the basic technical aspects of surveying and the legal principles of boundary establishment.

Many people need a boundary survey because their boundary locations are unknown or disputed. Even if a property owner believes that he or she knows where their boundaries are located, there are factors such as adverse possession that can change their property lines from the locations stated in their deed. The location and rights associated with easements, such as an old right of way, may be in question. Access easements can have a substantial effect on the value of land. Land isn't worth much if you can't get to it.

Here are some typical questions asked about boundary surveying:

While I was at work, my neighbor had their property surveyed and the surveyor set stakes on my side of the fence. The fence has been there 25 years. My neighbor called me and said they are going to remove my fence. What should I do? Does the neighbor have a right to remove my fence?

My neighbor is having her property surveyed and the surveyor told me that he needed to come on to my property to make some measurements. It's my property and I don't want the surveyor on it. Can the surveyor come onto my property even though I expressly told him to stay off my land?

I found some old stone posts near my lot corners. How do I know if these posts actually fix the location of my property boundaries?

My property does not have any corner markers. I called a surveyor to ask what it would cost to set my lot corners. I think the quoted price is very high. Why does it cost so much just to have a few wooden stakes put in the ground?

A new subdivision has been approved abutting my property, and the bearings and distances shown on the subdivision plan do not agree with those on my deed. Why is the information different? Will recording the subdivision plan affect the location of my boundaries?

There is an old cart path running over my property and my abutter wants to use it for access so he can subdivide his property into 10 house lots. He can't do that, can he?

My lot has concrete markers on each of the corners set by a surveyor when we purchased the property ten years ago. My neighbor just had her property surveyed, and her surveyor put markers two feet from my markers on to the neighbor's property. Now there is a two foot strip of land between my property and my neighbor's property. Who owns this land, my neighbor or me?

Most of these questions do not have simple answers. Some of the answers may be affected by laws in the state where the property is located. The author hopes the following chapters will help the reader to understand some of the underlying issues and how these questions might be answered.

Chapter 2
Getting Started

2.1 Land Surveying Types

A broad definition of land surveying is that surveyors make measurements on or near the surface of the earth. These measurements have traditionally consisted of angles and distances made using optical surveying instruments. Global Navigation Satellite Systems (GNSS or GPS), which use signals emitted by satellites to fix locations on the earth, are supplementing, or in some cases even replacing, traditional techniques and equipment.

Land Surveying can be grouped into several general classifications, such as boundary surveying, topographic surveying, construction surveying, and control surveying. Topographic surveys deal with physical features found at a site and the elevation of the earth's surface. A topographic plan will commonly show buildings, fences, shorelines, sewers and utilities. Topographic plans show contour lines which depict the ground elevations at the site (Fig. 2.1). These plans are often used by developers, engineers and architects for the design and siting of roads, buildings and other structures.

Construction surveys establish control and layout for road and highway layouts, bridges, buildings, sewers and other man-made improvements. Hydrographic surveys are made to acquire data on water depths, locations of rocks, sandbars, coastline erosion and other features associated with oceans, bays, harbors, lakes or rivers.

Control surveying is used to establish precise networks of control points for fixing horizontal and vertical positions. After the control points are established, they can be used for other types of survey projects such as topographic, boundary, route layout and mapping surveys. Control surveys were originally performed using

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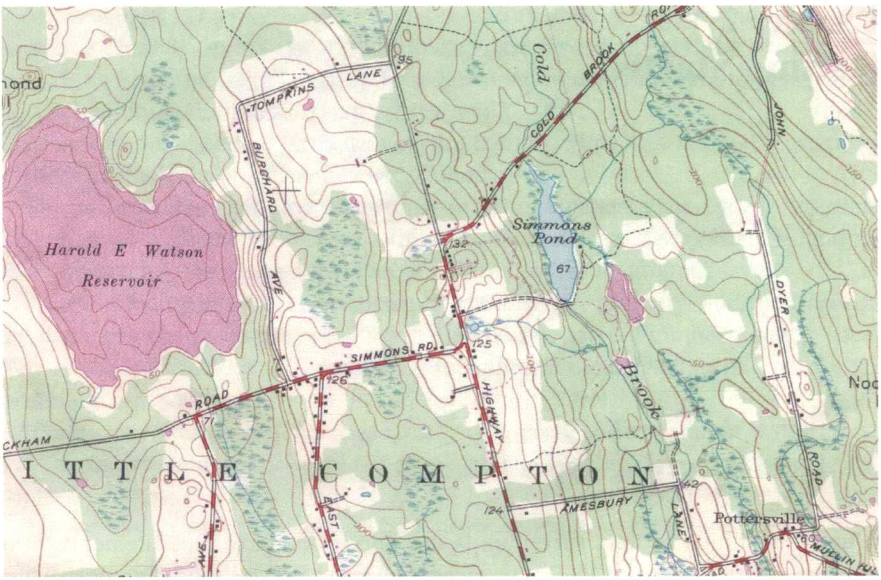

Fig. 2.1 Topographic map

conventional surveying techniques and instruments but modern techniques rely heavily on global positioning because of its high accuracy over long distances.

Cadastral surveying is the determination of the legal boundaries of a parcel of land. It is sometimes called Boundary Surveying or even simply Land Surveying. It encompasses original and retracement surveys of both private and public lands. It is the branch of surveying which will be discussed in this book.

> Cadastral surveying is the determination of the legal boundaries of a parcel of land.

Boundary surveys often include a plan, prepared by the surveyor, showing the results of the survey. A properly prepared plan will show the boundaries of the parcel, and the evidence used to locate those boundaries. The plan will also show the type and location of monuments that were set to fix the boundaries on the ground, and the location of buildings, natural features and improvements on or adjacent to the property. The plan should also show any encroachments and evidence of occupation. The plan is essentially a record of the survey.

Boundary surveys have the potential to affect the legal rights of the property owner and the abutters. Because of this, land surveyors have an obligation not only to their client, but to the public to insure that their survey work is performed with adequate precision and accuracy and that the legal rules governing boundary location have been carefully considered and properly applied.