

Cadastral Survey, Bureau of Land Management Report on Recent Activities

Donald A. Buhler

Introduction

The Department of the Interior manages about one-fifth of the land in the U.S. The Bureau of Land Management (BLM) manages over half of the land within Interior's jurisdiction—256 million acres—more than any other federal agency. This land is primarily located in 12 Western states including Alaska. The BLM also administers 700 million acres of subsurface mineral estate in all 50 states. The BLM's mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The BLM manages public lands used for outdoor recreation, livestock grazing, and energy production; and conserves the natural historical cultural riches on public lands. The agency is the nation's surveyor and maintains extensive current and historical information about land ownership and its use in the U.S. Most title to land, public or private, begins with a land description established by an original cadastral survey, possibly dating back to 1785. Security of legal title to land is the fundamental object of the cadastral surveyor's work. The BLM's Cadastral Survey program has continually provided professional survey services to all federal land managers. These services provide prudent land managers with tools to methodically and rationally make everyday business decisions while managing risk.

In 1776, the U.S. declared its national independence and, shortly thereafter, began facing the many dilemmas, situations, and issues reserved for fledgling nations. The concept of public lands was one such issue. More specifically, the focus was on the appropriate development and disposition of public lands—lands held in trust

for the people of the U.S. By 1785, the new body of Congress passed the Land Ordinance of 1785, establishing a system for surveying and thereby initializing the demarcation of the public lands for their orderly disposition into new states and Indian reserves, as well as conveyance from federal to state and private ownership or retention for federal administration. Further, a new land tenure system based upon a “rectangular system of survey” was created specifically for the orderly identification and disposal of these “new” unorganized lands (Figure 1). This method of land definition and disposal, however, did not extend to what would become the 50 states we enjoy today. In fact, only 30 of those states utilize the



Figure 1. The Public Land Survey System actually set monuments to real property rights, carved lines into the landscape and otherwise chiseled linearity into the very face of America.

Donald A. Buhler, Chief Cadastral Surveyor, Bureau of Land Management, Department of the Interior, Washington, DC. E-mail: <don_buhler@blm.gov>. Contributors: **Bob Ader**, **Bob Dahl**, **Doug Haywood**, **Dan Ontiveros**, and **Mark Wahlfeld** of the Cadastral Survey Program.

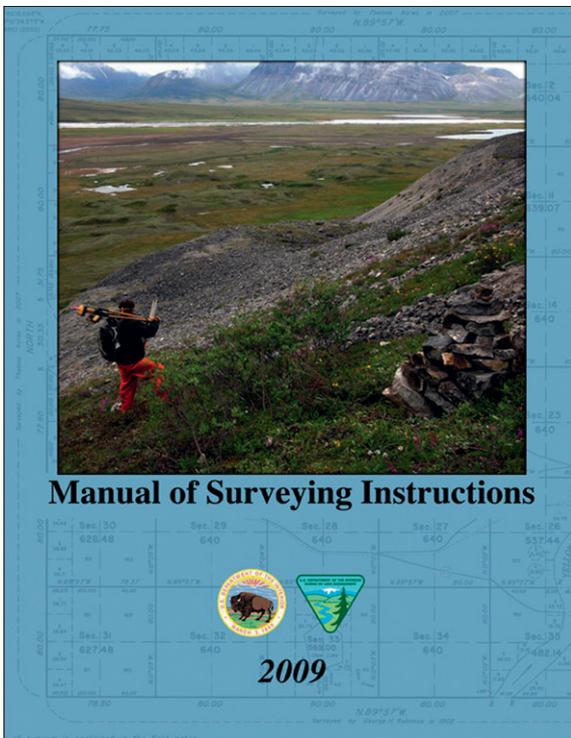


Figure 2. The Manual of Surveying Instructions, known as the Manual (<http://www.blmsurveymanual.org>).

“rectangular system,” or what is now known as the Public Lands Survey System (PLSS). The original 13 colonies, along with Hawaii, Kentucky, Maine, Tennessee, Texas, Vermont, and West Virginia, were established by other means and surveyed according to different systems and standards. The BLM Cadastral Survey Program is organized into the 12 different State Offices and headquartered at Washington, DC. The primary mission of the Cadastral Survey is the preservation of the PLSS and boundary determination of Federal interest lands.

This article provides an overview of projects which have enhanced the PLSS and the profession of surveying. The focus is on the *Manual of Surveying Instructions*, (hereafter referred to as the *Manual*, see Figure 2), indigenous peoples (Native Americans/Alaska Natives), newly available services and products (Standards for Boundary Evidence), and the National Cadastre (activities of the Cadastral Subcommittee of the Federal Geographic Data Committee).

Manual of Surveying Instructions

The *Manual of Surveying Instructions* (*Manual*) is an official government publication describing

the provision of cadastral surveys in conformance with statutory law and judicial interpretation. Various laws have been enacted governing cadastral surveys—often referred to as official surveys or Federal Authority Surveys—and the general plan of surveying is derived from them. The first set of surveying instructions were the original federal survey statutes. Initially, advice and general instructions were given to the Surveyors General by the Secretary of the Treasury, who was then in charge of land sales. Beginning in 1812, instructions were issued by the Commissioner of the General Land Office (GLO), an agency within the Treasury Department. Subsequent instructions were given to surveyors in manuscript or in printed circulars.

In 1831, the Commissioner of the GLO issued detailed instructions to the Surveyors General concerning surveys and plats. The applicable parts were incorporated by individual Surveyors General in bound volumes of instructions and used in the field by deputy surveyors under contract to the GLO. From these directions the *Manual* evolved. The immediate forerunner of the *Manual* series was printed in 1851 as *Instructions to the Surveyor General of Oregon; Being a Manual for Field Operations*. Its use was soon extended to California, Minnesota, Kansas, Nebraska, and New Mexico. In a slightly revised version, these instructions were issued as the *Manual of 1855*. Previous editions of the *Manual* were issued in 1855, reprinted in 1871, 1881, 1890, 1894, 1902, 1930, 1947, and 1973. Instructions modifying specified surveying operations were prescribed in 1864 and 1871. Advance sheets of the first six chapters of what would become the *Manual of 1930* were promulgated in 1919, and a 1928 manuscript edition of the chapter on plats superseded the related portions of the *Manual of 1902*. Throughout, and to this day, the primary focus of the *Manual* has been, and remains, the backbone for the integrity of the PLSS and the system of federal and non-federal survey and land records.

The 2009 edition of the *Manual* governs the conduct of all surveys and resurveys of the official boundaries of all federal interest lands, which have been authorized or approved by the BLM in the Department of the Interior. Every effort has been made in the 2009 edition of the *Manual* to preserve the longstanding principles of cadastral survey formulated in the 1973 edition of the *Manual* while accommodating updated technology and making clarifications as deemed necessary. Advances in technology may make the



Surveying the public lands.

surveyor's job more efficient and various relatively minor changes in survey policy and techniques may occur over time, but the job itself and the basic principles have not changed since 1785. Security of legal title to land, one of the bulwarks of American citizens' basic freedoms, is the fundamental object of the cadastral surveyor's work and of the *Manual*.

Cadastral Survey and the American Congress of Surveying and Mapping have established a PLSS Foundation to provide for education and scholarship in the field of cadastral surveying. The Foundation will provide outreach to land tenure professionals which will be focused on the new *Manual of Surveying Instructions*, creating a national cadastre, and other issues associated with the PLSS.

Indigenous Peoples

Since its founding, the U.S. has strived to develop a unique relationship with the Indian Nations. This "Independent Nation/Dependent Nation" relationship has evolved to the point where it has become the responsibility of the Independent Nation to provide for the support of the various Dependent Nations. The special support or "benefit" from the U.S. Government to the Indian people and nations is referred to as Trust Services. One such "benefit" is the special handling of certain Indian lands known as trust lands or restricted lands. In the case of trust lands, the title is owned by the United States Government in trust for an individual American

Indian or an Indian Nation. For restricted land, although owned by an American Indian, Indian Nation, or Native Alaskans, the alienation of the title by the owner is restricted by the U.S. Government. A unique feature of trust and restricted lands is that they are not subject to adverse possession and are inalienable. The boundaries of Indian lands are maintained by the BLM/U.S. Government.

The BLM, by federal law, is responsible for the survey and maintenance of Indian reservation and other trust boundaries throughout the U.S. Reservation lands alone account for approximately 21,500 miles (34,600 km) of external boundaries delineating 83 million acres (33.6 million hectares) of trust and restricted lands.

Recently, the Secretary of the Interior, in an effort to create a more efficient and effective method of delivering trust services, developed and implemented the Fiduciary Trust Model. This model created four initiatives pertaining to Cadastral Survey, which are directly associated with the boundary management of Indian lands and boundaries. These four initiatives include (1) the creation of the BLM Indian Lands Survey Program, (2) the creation of a cadastral-based geographic information system, (3) the creation of the Certified Federal Surveyor Program, and (4) improvement and modernization of the PLSS within Indian Country.¹

An additional program derived from these new initiatives is the BLM Cadastral Indian Program. The goal of this program, as funded by the Bureau of Indian Affairs, is to prioritize boundary determination needs throughout Indian Country and

¹ A term denoting lands set aside or reserved by the Congress of the U.S. Congress is the only entity allowed to permit this designation.

guide limited funding to projects with the highest priority.

Products and Services—Standards for Boundary Evidence

Since 1785, the Cadastral Survey has delivered top-quality products and services uniquely created to address the specific needs of each of its clients. The Cadastral Survey's flagship product, the Federal Authority Survey,² demonstrates the BLM's commitment to a high, national standard of quality and satisfaction. Recently, a secondary method of utilizing portions of boundary evidence was developed by Cadastral Survey, Bureau of Indian Affairs Realty Program, Office of Special Trustee for American Indians, and representatives of tribes and Alaska Native Corporations to efficiently address or resolve realty transactions or issues without incurring the large outlay of time and funding required by a Federal Authority Survey. This new method has become known as the Standards for Boundary Evidence. These standards include a Legal Description Review (LDR), Chain of Surveys (COS), Certificate of Inspection and Possession (CIP), and the Boundary Assurance Certificate (BAC).

The purpose of LDR is to ensure that a written land description is free of error, conflict, or ambiguity and that it can withstand legal challenge. The COS is a collection of successive land surveys or other forms of boundary and corner identification, location, or opinion affecting a particular parcel of land, arranged consecutively, from the government or original land survey down to the present. This is analogous to a chain of title with a focus on location and geospatial data. The CIP renders a standardized and formalized opinion on the sufficiency of the physical boundary evidence for the purpose(s) for which the land is being acquired; most often requiring a physical inspection of the parcel's boundary. The BAC is an opinion as to the risk of loss or damage in using the current existing boundary in relation to the intended use of the land based upon current LDR certificates, COS certificates, and CIP. A BAC is a compendium of evidence, founded upon all known location defects, conflicts, ambiguities, gaps, overlaps, unwritten rights, and

failure of legal descriptions, surveys, use and occupancy, and other boundary evidence for a tract of land.

Demographics and Recruitment Efforts

There are approximately 250 Cadastral Surveyors throughout the U. S., with 45 percent reaching retirement eligibility by 2013. This loss will be offset to some degree through recruitment of candidates for entry and mid-level positions who are good communicators, highly motivated, energetic, talented, and qualified Cadastral Surveyors.

Recently, a job fair was conducted at the American Congress on Surveying and Mapping national conference in Salt Lake City, Utah, which proved to be a great opportunity to reach out to the private sector land surveying community by providing employment information. Interested parties were alerted to current opportunities for each of the 12 BLM State Offices. Those demonstrating the most interest were given the opportunity to submit their resume and contact information. More information on land surveying opportunities with the BLM can be found at <http://www.blm.gov/wo/st/en/prog/more/cadastralsurvey/Careers.html>.

In addition to the above recruitment effort, the Cadastral Survey also supports newly recruited surveyors through partial payments of federal student loans. Senior land surveyors with critical skill are also offered retention bonuses in order to maintain their expertise on important projects and geographic areas.

Cadastral Data and the U.S. Mortgage Crisis of 2008-2009: A Case for a National Land Parcel System

The symptoms of the 2008 mortgage crisis can be seen in distressed mortgages, foreclosures, and decreasing real estate values across the U.S. A 2007 National Research Council (NRC)

² A survey for the Secretary which represents a Record of Decision (which may be appealed) of the U.S. Government. It must contain a request for survey, assignment instructions, special instructions, fieldwork (including monumentation), field notes, plats, a critical review, an approval of the plat, field notes for the Director of the BLM, and an official filing.

report entitled “National Land Parcel Data: A Vision for the Future” provided a blueprint for harnessing technology at the federal level to collect, monitor, analyze, report, and map critical data for 150,000,000 parcels across the U.S. (NRC 2007). The Federal Geographic Data Committee (FGDC), a group of federal agencies with a mandate to coordinate geospatial activities, charged the Cadastral Subcommittee, which is chaired by the BLM’s Chief Cadastral Surveyor, with organizing a meeting with key stakeholders in the financial and mortgage arena to document requirements for an effective national approach to the utilization of parcel data. This meeting was held in Washington, DC, in May 2009 and it was attended by representatives from the Federal Reserve Board, Housing and Urban Development, The Policy Institute, Federal National Mortgage Association (known as Fannie Mae), the Federal Home Loan Mortgage Corp. (known as Freddie Mac), the Census Bureau, and the private sector.

Cadastral information refers to property interests. Cadastral data represent the geographic extent of the past, current, and future rights and interests in real property. Cadastral features include parcels, boundaries, cadastral reference information such as the PLSS, and land parcel description. Boundaries that have been surveyed and marked on-the-ground are preferred. The description of the parcel in a data set should include additional information about the parcel, including a unique identifier (which can be constructed from existing identifiers assigned by parcel stewards), the value, ownership, real estate tax use classification, zoning classifications, site address, and legal description of the real property. A clear map representation of land parcels is expected to provide useful information about their location, boundaries, extent, and relationships to other geographic features. In the U.S. there are over 4000 jurisdictions with cadastral information responsibilities but only a few with comprehensive and clear cadastral representation.

In the course of investigating the mortgage crisis and the need for parcel data it became apparent that a distressed housing market, like a contagious disease, tends to infect some communities while leaving others relatively untouched. The chairman of the Federal Reserve Ben Bernanke had this to say about the mortgage crisis we are experiencing: “Foreclosures create substantial social costs. Communities suffer when foreclosures are clustered, adding further to the down-

ward pressure on property values. Lower property values in turn translate to lower tax revenues for local governments, and increases in the number of vacant homes can foster vandalism and crime” (Bernanke 2008).

According to Harding et al.(2008), parcel level information is the essential unit to monitor, track, and analyze mortgage information and the potential contagious affects of mortgages. Parcels provide the appropriate level of granularity to track contagion. When combined with information about the value and use from local assessors, parcel data provide the information necessary to make informed decisions on mortgage issues, on a community by community basis. The parcel information is centered on the value of land and its improvements and on the location of the parcel (see Table 1).

The attributes shown in Table 1 and parcel geometry make it possible to conduct spatial analysis and mapping of mortgage-related concerns. Approximately 82 percent of parcels in the U.S. are mapped in a digital format with the attributes shown in Table 1 and can be used for spatial analysis.

The strategy for using parcel data to support the timely identification of mortgage crisis symptoms is to create an early warning system which would first be used to identify “hot spots.” Within neighboring hot spots, additional and more detailed and granular information could be collected for further analysis. If warranted, a third level of detail would follow with the collection of even more detailed information about individual properties. *The New York Times* developed an interactive web-based prototype of such a system for the New York Metropolitan area (Mapping Foreclosures

Attribute	Description
Parcel ID	Local parcel identifier
National parcel ID	Local parcel identifier with jurisdiction code prefixes to make it nationally unique
Site address	The location address, one parcel may have none or many site addresses
Improved value	The total value of improvements on the parcel
Land value	The total value of the land
Assessor use code	The use code assigned by the local assessor
Geometric representation	The representation of the location of the parcel as either a polygon or a point

Table 1. Parcel attributes and identifiers.

2009). In this system, trends in foreclosure rates are monitored at the Census tract level on a regular basis and can be dynamically mapped through time. By zooming into a specific neighborhood, one can see a point-level pattern of specific foreclosed properties. Several local governments and commercial providers have similar functionality or components of a system which enable the user to interactively obtain detailed information about foreclosed properties.

There are over 4000 primary authoritative producers of land parcel information in the U.S., and all of them generate or maintain essential data components related to land parcels. Local government assessors collect parcel value information for the purposes of fair and equitable property taxation. The local government source is termed the authoritative source or “an entity that is authorized by a legal authority to develop or manage data for a specific business purpose” (FGDC Cadastral Subcommittee 2008). Typically the assessor is the authoritative source of information on the parcel’s value and often is also the creator of the tax parcel maps that reflect property ownership on a tax roll. Assembling this information in a standardized form from local producers has been one of the impediments to the creation of a robust national parcel data system.

There is an opportunity to coordinate GIS activities on a statewide basis to eliminate waste and improve efficiency in government. Agencies at all levels of government could coordinate with other stakeholders to prevent the duplication of geographic data and systems at taxpayers’ expense. Those stakeholders include nonprofit organizations, academia, businesses, and utilities. The “right” solutions will vary state-by-state, and they will be created through the development of effective strategic and business plans. For parcel data, statewide initiatives offers a solution to coordination where parcel data from authoritative local producers can be assembled into trusted data sets hosted and published by a state. Most notably the State of Montana has completed this process, as have Tennessee and Florida, providing parcel data for the entire state along with essential attributes to support an early warning system and a parcel by parcel resolution to future mortgage crisis type events.

The FGDC Cadastral Subcommittee has developed data standards and implementation guidance for cadastral data, including identifying the levels of stewardship for states, parcel core data, and PLSS data publication standards. The

Cadastral Subcommittee completed an inventory of all 50 states, the District of Columbia, and the U.S. Territories, determining the level of stewardship for each entity and identifying the next steps in advancing the availability of standardized cadastral data.

Beyond communication and collaboration there is a need for funding to complete the data collection and standardization and to support states in delivering the published data and building sustainable relationships with cadastral data producers. In early 2008, the amount of funding required to complete the PLSS and parcel data collection, standardize the existing data, and provide support for establishing sustainable systems for access to the data was \$350 million over three years. The 2009 survey will provide an update to that funding estimate which is expected to be quite a bit smaller as states and local governments make opportunities for coordination and complete projects initiated in the past few years.

The National Research Council recommended the creation of both a federal land parcel coordinator and a national land parcel coordinator (NRC 2007). The first would be responsible for federal lands and property; the second would coordinate parcel data from all sources, both public and private lands. A truly national land parcel cadastre would likely require strong partnerships between the Federal Government and state and local governments (Folger 2009).

Conclusion

Land parcels are an important part of the legal, economic, financial, and real estate system of all nations. The BLM is the lead agency coordinating the collection and maintenance of land parcel data for federal lands, and as such it is responsible for performing cadastral surveys and maintaining past and current land status on all federal and Indian lands. Legislation addressing some of the issues for creating a national cadastre has been introduced in the Congress, and similar bills were introduced in previous Congresses. Coordinating all land parcel data, the bulk of which is produced for local and regional needs on non-federal lands, remains even more of a challenge. In addition to emergency response to disasters, other perceived needs for a national land parcel database include responding to home mortgage foreclosures, dealing with wildfires, managing energy resources on federal lands,

dealing with the effects of climate change, and possibly more.

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