

# **The Energy Community and Cadastral Data FGDC Cadastral Subcommittee – Energy Workgroup**

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## **Introduction**

This paper discusses the need for accurate survey boundaries and land ownership information required by the energy community (exploration, production and reclamation), regulatory agencies and private individuals to provide decision support tools necessary to manage the life cycle of energy development from prospect to production. From the early stages of prospect identification through leasing, permitting, drilling, completion, production and marketing, land ownership rights and interests contribute to each step in this life cycle. Knowing who owns mineral rights, which local, tribal, state and federal regulations apply in an area and how to gain access to the drilling locations and development sites often hinges on surface and subsurface rights and interests.

The Office of Management and Budget (OMB) Circular a19<sup>1</sup> defines the National Spatial Data Infrastructure (NSDI) as the technologies, policies and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors and the academic community. It also established the Bureau of Land Management (BLM) as the chair of the FGDC Cadastral Subcommittee and the agency charged with the coordination and development of the standards for Cadastral Information.

## **Cadastral Information**

Cadastral data is the information about rights and interest in land. Cadastral data may also be known as real estate data or parcel information or tax parcel information. There are many legal and historical nuances and subtleties surrounding the management of cadastral information. The Cadastral NSDI attempts to simplify some of this in two ways, first by providing the cadastral information in two components, cadastral reference and parcels, and second by providing a limited set of parcel level information to support identified business process needs. The source of the cadastral NSDI data is derived from the databases of the data stewards.

## **The Cadastral NSDI**

The Cadastral National Spatial Data Infrastructure (Cadastral NSDI) has been defined by the FGDC Cadastral Subcommittee as a minimum set of attributes about land parcels that is used for publication and distribution of cadastral information by cadastral data producers. The Cadastral NSDI is intended to provide sufficient information to support integrating basic land parcel information

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<sup>1</sup> OMB Circular A-19 revised [http://www.whitehouse.gov/omb/circulars/a016/a016\\_rev.html](http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html)

across jurisdictional boundaries providing a regional view of property ownership and rights. This regional view is designed to answer fundamental questions regarding land ownership and property characteristics (structures, land use, and parcel geometry) in support of end user business land ownership information.

The Cadastral NSDI is extracted (published) from data producers at all levels of government, but primarily from local governments, federal land management agencies, state land management agencies or state departments of revenue. There are other data producers that contribute to the Cadastral NSDI including county land survey programs, private surveyors and state GIS programs.

The Cadastral NSDI is standardized so it can be integrated across jurisdictional boundaries, from county-to-county and from state-to-state forming a seamless, non-overlapping representation of the Cadastral NSDI elements.

The Cadastral NSDI has two components: Cadastral Reference and Parcels. Supplemental information such as orthophotography and geodetic control are essential to building and integration parcel geometry. The supplemental information also provides context for the cadastral information and databases such as hydrography, transportation and even elevation contours in some cases may be essential for vertical integration of parcel mapping. The standards for supplemental information are defined by non-cadastral groups but are essential for establishing an accurate geographic reference for the Cadastral NSDI so that published data can be integrated with other information. The standards for the cadastral reference and parcel components are defined by the Cadastral Subcommittee and are in the Cadastral Data Content Standard<sup>2</sup>.

In the western states the PLSS is the primary Cadastral Framework. It is supported by the federal government through the Bureau of Land Management's (BLM) Cadastral Survey Program and a standard, digital representation of the PLSS referred to as the Geographic Coordinate Database (GCDB). The Cadastral Framework includes cadastral survey point and polygon areas that include standard identifiers used to link to additional information. The parcels include federal land transactions, such as mineral surveys and use authorizations, and privately held lands represented most frequently by county or state managed land ownership and tax parcels. The parcels also include a unique identifier that is assigned by the parcel custodian or steward that can be connected to additional information.

One of the most important characteristics of the PLSS component of the Cadastral NSDI for the energy industry is that it represents a single continuous presentation of the PLSS cadastral framework and parcels, based on the most accurate and current information available. This PLSS framework can be relied upon to produce seamless data, i.e., edge matched federal, state and private

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<sup>2</sup> Cadastral Subcommittee, *FGDC Cadastral Data Content Standard version 1.3*, May 2003, <http://www.nationalcad.org/data/documents/CADSTAND.v.1.3.pdf>

land, lease parcels, well spots, and survey's along state boundaries will be correctly located. It will be maintained by the appropriate data steward and published for use by the energy industry. Perhaps the most important facet of this PLSS data is that it is based upon survey measurements, reflecting the most complete cadastral framework that can be tied to land records from any data steward. This is a key element to support energy development in the western U.S. geologic provinces.

In the past energy exploration and production companies have relied heavily on PLSS products that were digitized from paper maps published by the USGS and the BLM. In the late 1970's, Phillips Petroleum, Petroleum Information and the Tobin Companies created proprietary PLSS products. These early data sets proved to be useful even though the PLSS coordinates may not have been within national map accuracy standards and were difficult to update. The biggest problem with these digitized products is that the PLSS was represented at the section level and did not contain proportional subdivisions, lots, tracts, riparian or mineral surveys and were not based on survey information. Data of unknown accuracy that may be incomplete creates a degree of risk for the energy industry. For example, If well locations, leases or subsurface ownership is not located with certainty (both in the field or on map products) or is not tied to a common framework based on surveys, the rights and interests in producing wells could be challenged.

The goals of the Cadastral NSDI for the energy industry are:

- to facilitate the implementation of standard sets of information,
- to educate the user community regarding availability of reliable cadastral framework data and parcels, and
- to establish a collaborative foundation for industry and government for decision support.

These activities will increase the efficiency for permit review and approval processes and improve the quality of information used to make decisions through the entire lifecycle of an energy development project. Improved information quality and more timely delivery of reviews, licenses and permits reduces the risk of errors and incomplete information for both the regulators and the energy industry.

These goals will be achieved by using and maintaining a standardized Cadastral Framework with common agreed upon control and a core set of information about federal transactions (leases, use restrictions, etc) privately held parcels that can support records research and the identification of surface and subsurface landowners.

This paper will

- (1) describe how the standardized survey based cadastral framework, which has been defined by efforts with other industries, is an advantage to energy industry and
- (2) propose a list of attributes for cadastral parcel data for the energy industry that will be validated in partnership with energy industry representatives and the FGDC Cadastral Subcommittee.

## **PLSS Cadastral Framework – Application and Advantages to Energy Industry**

In reviewing energy regulatory processes and energy industry permit and reporting requirements, four essential benefits of the use of the survey based PLSS Framework have been identified. These are 1.) completeness, 2.) accuracy and maintainability, 3,) related to land records and 4.) known positional reliability.

### ***Completeness***

*Completeness means that legal corners are inventoried and all areas are properly identified.*

The BLM's Geographic Coordinate Database product provides a complete inventory of all PLSS corners established by the original government surveys. This means a standardized point identifier can be generated for each original corner. With a complete inventory there is no question as to whether a corner is missing. Closing corners and standard corners are all identified. More accurate coordinate values and modern monuments can update original corners and be referenced to the correct corner. The correct corners can all be updated as needed.

Completeness means that the legal areas identified in the original government surveys are completely and correctly identified. This is particularly important for government lots and other divisions of sections. Land patents and government transactions are tied to these divisions and having them correctly and completely identified will assist in the rapid and correct identification of land areas.

Completeness is particularly important in a changing environment. Consider the following example (Figure 1) in Campbell County Wyoming. This figure shows an the original government survey plat for township 52 North, Range 72 West approved on August 14, 1883 on the left.

Original Survey 1883

Resurvey 1980

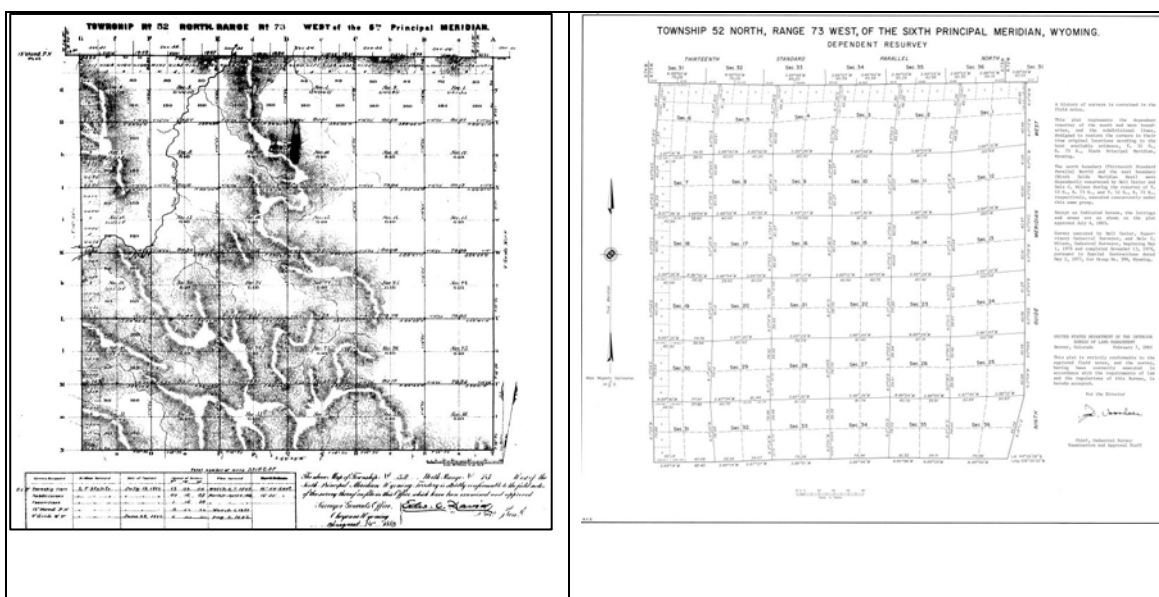


Figure 1 – BLM Original Survey and Resurvey Comparison

Over time this land has been homesteaded and mineral rights severed creating spit estate mineral ownership. Through mineral development it became necessary for the Bureau Of Land Management to perform a “Dependant Resurvey” (shown on the right in Figure 1) and locate the original monuments on the ground and issue updates to the survey plats and notes. Figure 2 is an enlargement of section 36 as shown on the 1:24,000 USGS quadrangle map. Notice the distance of the section line on the quadrangle map vs. the position of the section as computed in the GCDB. The USGS map shows section geometry that closely resembles the original 1883 survey and does not reflect the newer, more accurate 1980 survey.

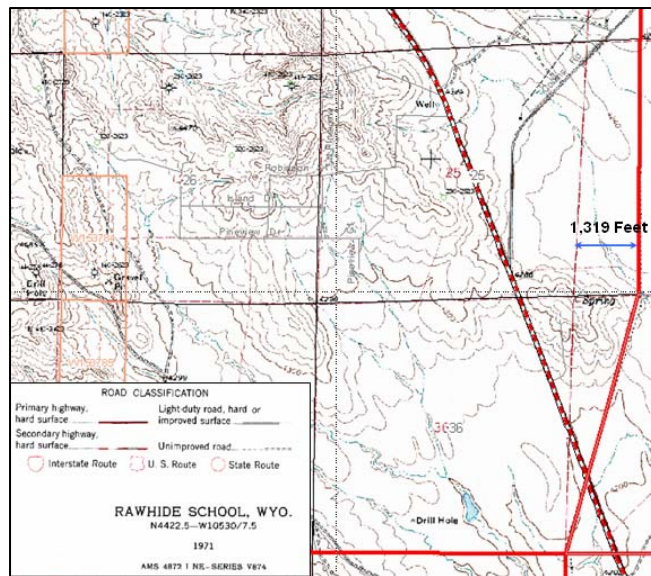


Figure 2 – Original Plat and USGS Comparison

### Accuracy and Maintainability

*Accuracy means that the corner locations and area shapes and relative locations to each other represent the surveyed areas. Maintainable means that new measurements and control can be integrated with survey measurements to produce an improved PLSS representation over time and provide a clear lineage as to what contributed to the changes.*

The corner locations and areas shown on generalized map presentations of the Cadastral Framework often rely on visible possession evidence rather than the surveyed locations. As anyone who has worked around and with land records will soon realize, surveyed lines often do not follow the photo visible evidence such as roads, fences and other features.

The surveyed PLSS may be based on original and older surveys. These records are more accurate than relying on the possession and visible features. The survey based data can be more easily and correctly updated because the information about the monuments, the date and condition of the monuments and observed measurements between the monuments are used to construct the plat. By re-observing a monument and obtaining high accuracy coordinates, all of the other associated measurements can be re-evaluated and a more accurate representation of the actual conditions can be presented.

In terms of applications for the energy industry, the survey based PLSS framework has an accurate and maintainable representation of the division of sections. This means that aliquot parts (quarters, sixteenth and further divisions) are based on the rules of section division and measurements not just geometry divisions. This is critical for the energy industry because leases, use restrictions



The light purple lines on the plat are updated positions generated from the BLM's GCDB. Notice how the survey based data has the lot numbers and the lot acreages while the USGS quadrangle representation has only section level lines. Without the survey information it would be impossible to correctly subdivide this section into its correct components. The smaller blue lettering is information regarding measurements used to compute the section divisions. If the USGS quadrangle maps do have found corners on known monumented locations, these positions are incorporated into the survey control analysis.

Figure 4 is an analysis of area computations using the USGS Quadrangle sheet and the surveyed PLSS. The increased accuracy from the survey based framework (GCDB) also shows that additional analysis can be done to compare record acreage to GIS computed acreage.

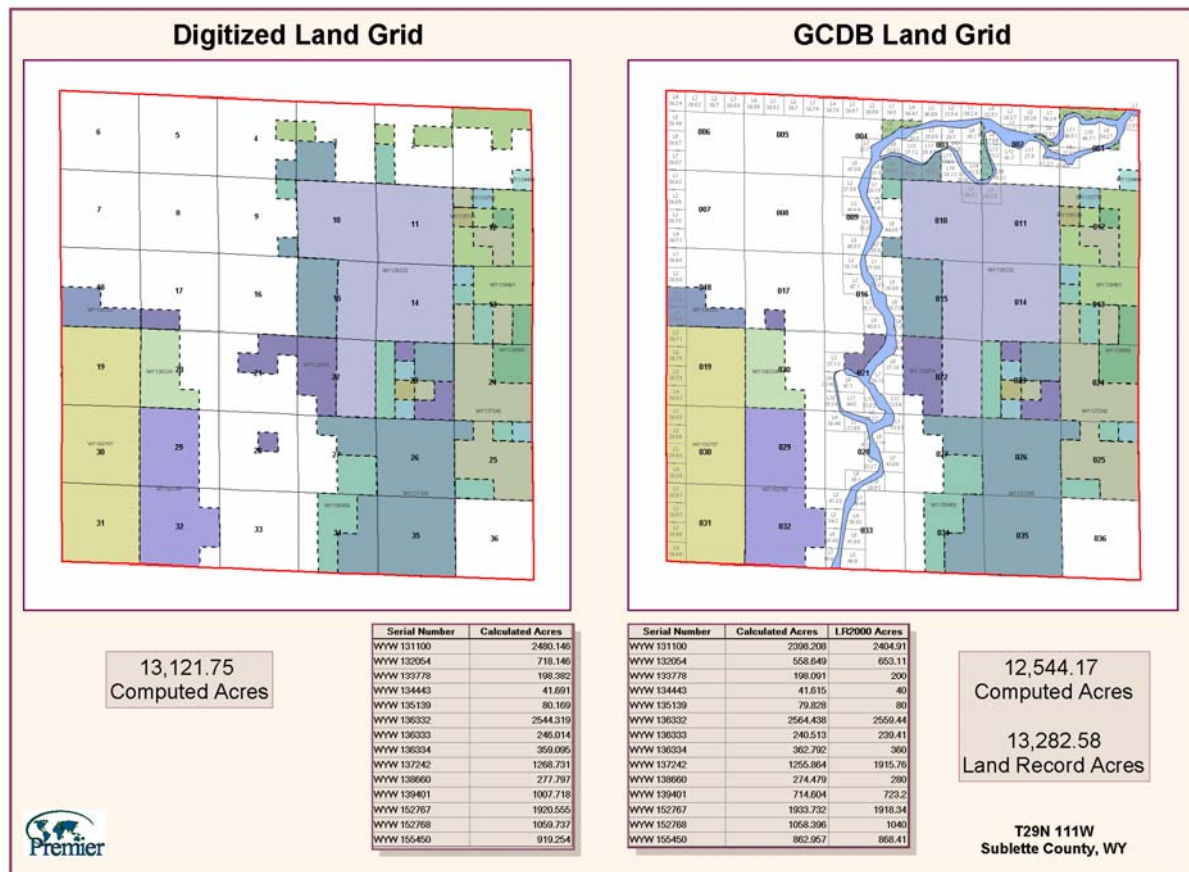


Figure 4 – Computation Comparisons

Maintainability is further expanded when partnerships are formed with all data producers. Montana is an excellent example of this partnership. The BLM Cadastral Survey office in Montana, the State of Montana and participating counties have agreed to and signed a maintenance agreement. In this agreement all participants share in the development of control points and agree to use the resulting common PLSS Framework. This agreement reduces the costs to everyone and expands the quality of the PLSS Framework.

### ***Related to Land Records***

*The PLSS Framework in the western states is essential to referencing and defining rights and interests in land. Ultimately the energy regulators and the energy industry need the specific details of individual parcels. An agreed to,*



*standardized Cadastral Framework means that parcels, both surface and subsurface, can be seamlessly tied together.*

Land records data goes beyond the basic framework to individual parcels, both surface and subsurface. On federally managed lands, parcels are defined by decisions and transactions such as use authorizations, leases or mineral surveys. These areas represent specific agency actions or decisions and are tied to federal records stored in the BLM maintained Legacy Rehost 2000 database (LR2000) which contains information about the dates of the actions, they type of action and who is affected by the action. In areas where the surface ownership is non-federal (state, tribal, county or private) the ownership is often represented by real estate tax system parcels. In areas of separated estates, the surface may be privately owned and the minerals federally managed. In all of these cases it is essential to build a seamless presentation of surface and subsurface ownership to correctly manage and exploit energy resources.

Figure 5 is a depiction of an area in Fallon County Montana that represents where federal subsurface management (shown in red) meets the private surface ownership seamlessly. Because the Federal agencies, counties and State use the same Cadastral Reference the parcel and ownership information they each maintain as a part of their workflow match seamlessly.

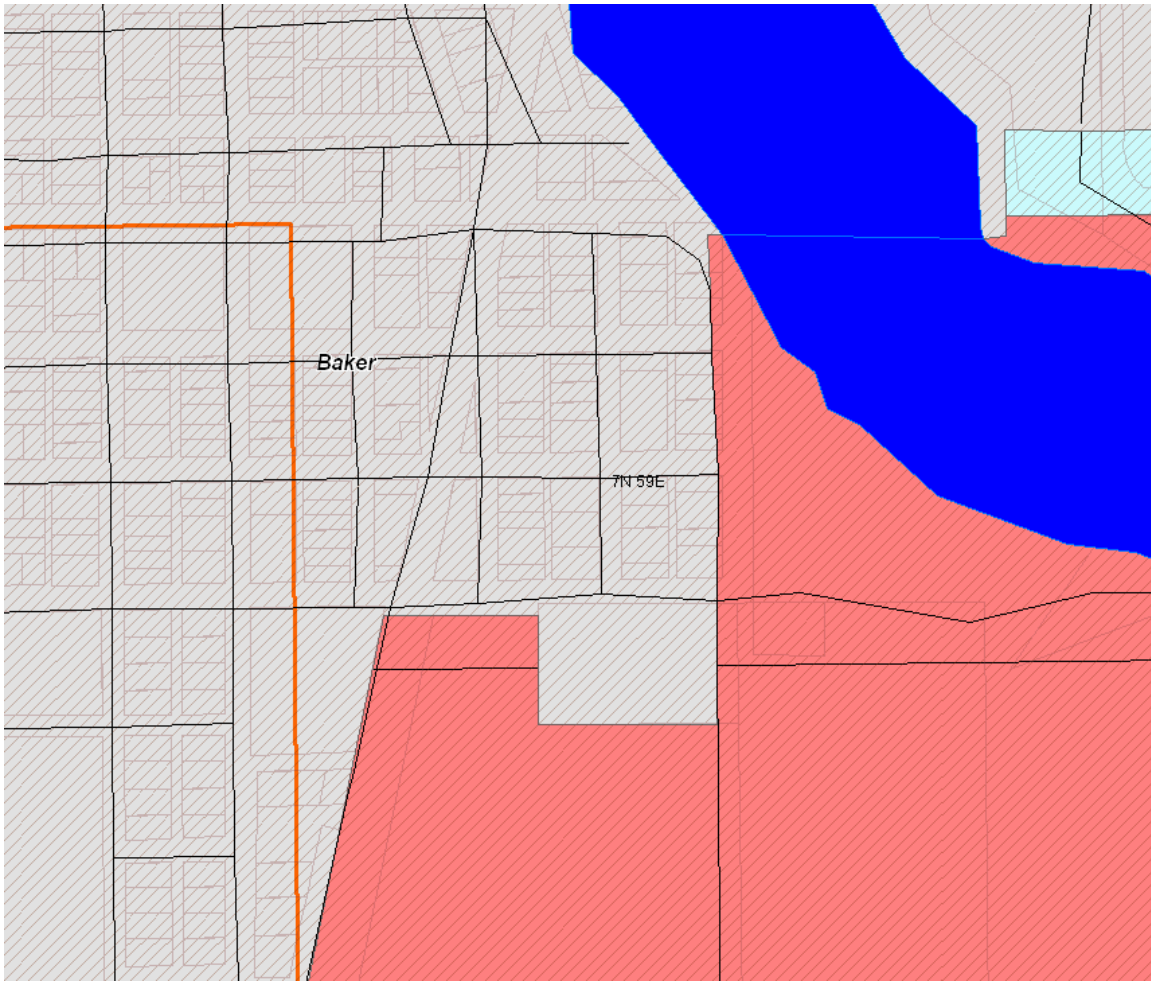


Figure 5 – Federal Records and County Records Combined

On privately owned surface the parcels and division of the framework into aliquot parts and government lots. There is no other data set that divides the section information correctly into the division. This is a critical element of the GCDB.

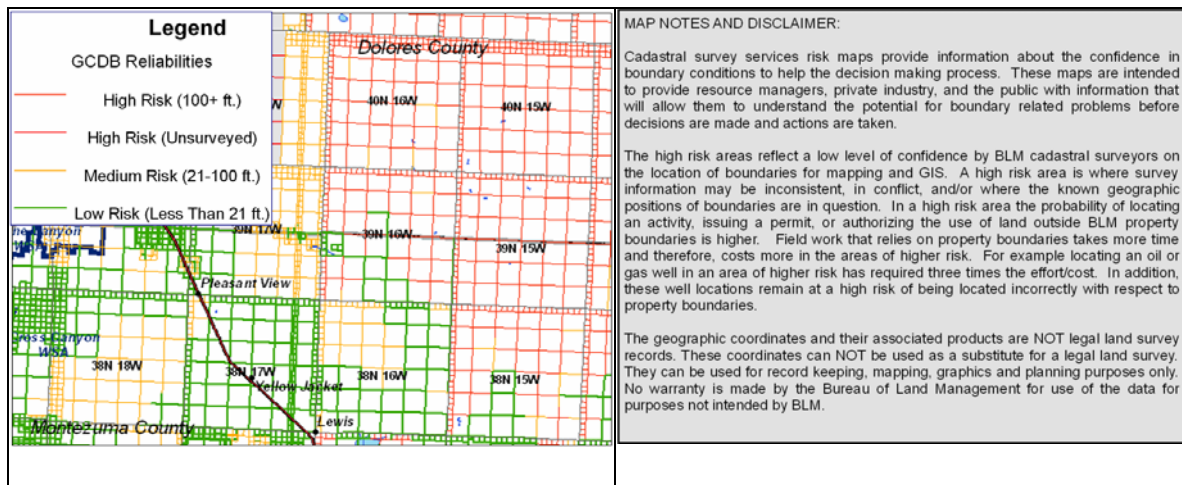
This also means that the rich attribute set in the county tax systems can be linked by legal descriptions and ownership detail can be reviewed for preliminary evaluations and analysis of the mineral estate.

### ***Known Reliability***



*Known reliability means that the accuracy of individual corners, lines and areas is captured in the data and can be used to support decision making.*

This also allows for an effective investment in resources. By knowing where to invest to improve the reliability of data themes we can make the most effective investment in enhancements.



**Park County**  
**Township 2 S, Range 8 E**  
 April 26, 2006

Monument Accuracy in Feet  
 (Average Error of Monument)

- 30 - 40
- 41 - 50
- 51 - 74
- 75 - 96
- 97 - 114

Township  
 Sections  
 Parcel Boundary

Scale in Miles  
 0 1 2

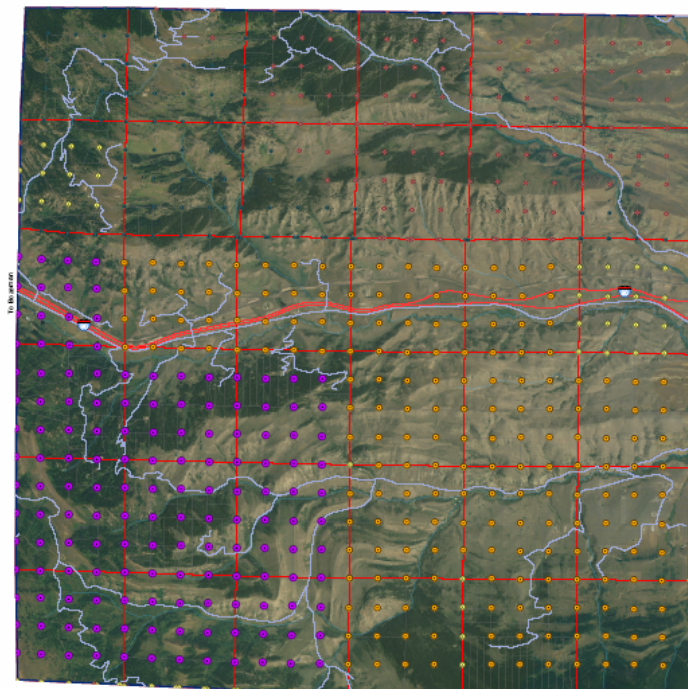


Figure 6 – Examples of a Cadastral Framework Reliability Diagram

Known reliability also reduces risk. Knowing the accuracy of corners means that information will be used as appropriate and a poorly known position will not be used as if it were highly accurate.

## Policy Support

The Western Governors' Association (WGA) has developed adopted a policy resolution about the development and use of the Cadastral Framework in 2003 (WGA Resolution 2003-5)<sup>3</sup>. The recommendations in the resolution address their recognition of the importance of the Cadastral Framework, specifically the support of the Public Land Survey System

1. To address multiple land related issues, Western Governors recognize the importance of the collection, integration, maintenance and distribution of digital geographic data representing the legal land subdivision from the PLSS, land ownership, appraisal and other related information. To this end, WGA encourages member states, local governments and tribal entities and the private sector to engage in a coordinated effort that will lead to standardized best practices and land record modernization as well as a solid digital cadastral infrastructure.

2. Western Governors support the general recommendations of the Western Cadastral Data and Policy Forum including:

a. Partnerships: Develop Partnerships that maximize state, tribal, federal and local participation and collaboration in important programs for cadastral data collection, maintenance and integration.

b. Access: Promote sharing of cadastral information among jurisdictions to support critical state functions and regional activities.

c. Funding: Support increased funding and resources for the collection and maintenance of cadastral data through federal, state and local collaborative efforts.

d. Standards: Support the development and implementation of consistent cadastral procedures and data standards across jurisdictions including boundary, ownership and appraisal data.

e. Education: Inform and educate policy makers, other stakeholders, and private sector users about the benefits and use of cadastral information.

3. Western Governors recommend the BLM, in conjunction with the Western Governors Geographic Information Council, develop a comprehensive, unified plan for GCDB implementation and maintenance across the West. These plans need to address critical management priorities for the west (wildland fire, energy) as well as technical issues (e.g. data content), policy issues (e.g. data sources), maintenance and improvement issues, and resource issues (e.g. funding).

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<sup>3</sup> <http://www.westgov.org/wga/policy/03/plss3-5.pdf> last accessed 5-20-2006

4. Western Governors urge BLM to complete, enhance, and maintain the GCDB in coordination and partnership with states. Western Governors call on Congress to provide the necessary funding for BLM to undertake and sustain this important effort. Western Governors call on Congress to provide necessary funding to allow expenditure of already appropriated funding (i.e. Homeland Security) to support local, state and tribal implementation of NSDI framework cadastral databases.

### **Cadastral NSDI – Cadastral Framework**

The Cadastral Framework has been defined and standardized through efforts with the wildland fire and emergency response communities. Additional elements can be added to this framework, if needed, for the energy industry. The attributes of the Cadastral NSDI Framework are as follows.

#### **Cadastral Points**

- Standardized Point ID
- XCoord
- YCoord
- ZCoord
- XAcc
- YAcc
- ZAcc
- Producer Name
- Coordinate Date
- Coordinate System (EPIC)
- Producer Point Identifier

#### **PLSS Township**

- PLSS Township ID
- Principal Meridian
- Township Number
- Township Fraction
- Township Direction
- Range Number
- Range Fraction
- Range Direction
- PLSS Township Label (cartographic label)

#### **PLSS First Division**

- First Division ID
- PLSS Township ID
- First Division Type (Section, tract etc)
- First Division Name (section number, tract number)
- First Division Label (cartographic label)

#### **PLSS Second Division**

- First Division Identifier
- Second Division Type (quarter, quarter-quarter, government lot, etc)
- Second Division Name (NE, NE of SW, Government Lot 2)
- Second Division Label (cartographic label)

### **Cadastral NSDI – Parcels Energy Profile - Proposed**

The parcel information sits on top of and is referenced to the Cadastral NSDI Framework. For the energy community the FGDC Cadastral Subcommittee has

tentatively identified the following elements as essential to an “energy core” set of information that would be provided by all parcel data producers in energy resource areas.

- Parcel Outline (Polygon) If the polygon is not available than the centroid is provided.
- Parcel Centroid (Point)
- Parcel ID
- Source Reference
- Survey Type (Federal Parcels)
- Source Reference Date
- Surface Owner Type
- Improved
- Owner Name (Surface Management Agency)
- Assessment / Value for Land Information
- Assessment / Value for Improvements Information
- Assessment / Value Total
- Primary Assessment / Value Classification
- Secondary Assessment / Value Classification
- Tax Bill Mailing Address
- Parcel Street Address
- Parcel Area
- Parcel Zoning
- Public Parcel Name
- Subsurface Owner Type
- Subsurface Management Agency or Owner Name
- Commodity Type

## **Conclusion**

The Cadastral NSDI information is essential to the energy community. The Cadastral Framework consists primarily of the Public Land Survey System (PLSS) in the west and is essential for providing the common reference for the rights and interests information as well as point locations that are used to reference wells and other assets. The parcel information provides the rights and interests that describe who owns the energy resource.

From a regulatory perspective anecdotal studies in Wyoming have established that a common survey based Cadastral NSDI can save as much as 50% in application, permit, monitoring and reclamation activities. In the cases examined, the state regulatory agency time to process an application for a permit to drill (APD) was cut in half because all required information could be easily cross-referenced and validated. The added benefit of increased accuracy of information and more complete understanding of the data and special circumstances is immeasurable.

The FGDC Cadastral Subcommittee would like to work with representatives of the energy community to further enhance the definition of the parcel data needs and to validate these findings in site specific projects. The Subcommittee would also like the energy community to embrace and apply the Cadastral NSDI framework standards. By working together we can define and build a cadastral



system that improves decision making for the energy community and improves the nation's NSDI.