

# THE IMPOSSIBLE CADASTRAL SURVEY

## Part 1

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**M**y firm, Johnson-Frank and Associates is based in southern California. Most of the developed portions of California were originally Mexican and Spanish *ranchos*. As such, that land was already in private hands when it came into the possession of the United States. Since it was never “public land,” it was never sectionalized relative to the Public Land Survey System (PLSS) that is so familiar to surveyors in much of the United States. Therefore, most of the surveying “action” in our local area is based on metes and bounds or retracement of older subdivisions.

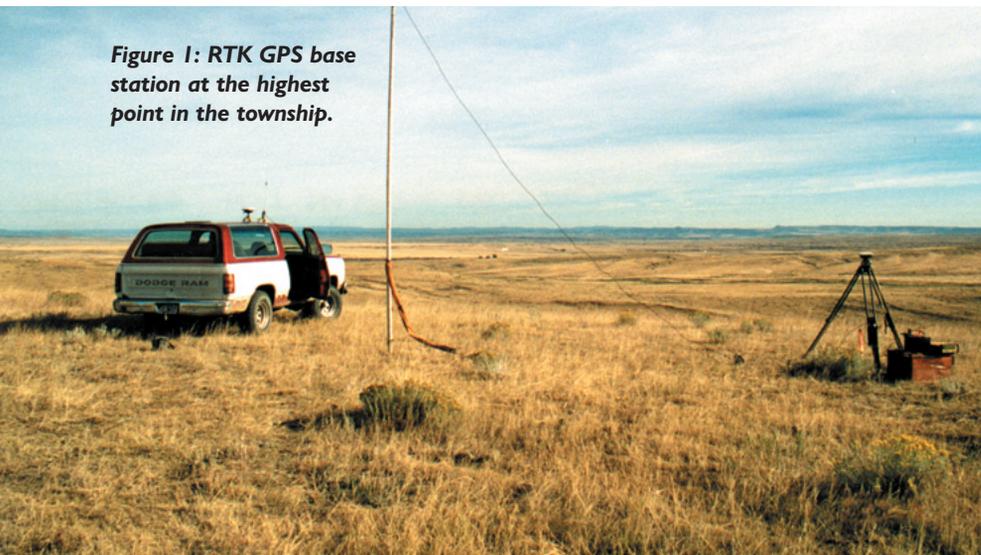
During the last few years, our firm has had the good fortune to have a number of challenging Public Land System Surveys. I have written about several of them in previous issues of *Professional Surveyor*:

1) In late 1995, I assisted a local surveyor to locate the boundaries of portions of seven sections in southwestern South Dakota. During the course of that project, I developed a system using least squares and particularly StarPlus StarNet software, to develop initial State Plane search coordinates based on the original survey data and USGS quad sheet topography, and then continually refine those coordinates on a daily basis, based on both the record information available and the physical evidence found in the field. This method of developing increasingly better search coordinates, teamed with the newly developed capabilities of RTK GPS, allowed us to complete this project rapidly and effectively. (**Figure 1**) (See “Cadastral Retracement by Least Squares and RTK GPS, Parts 1 & 2, *PS*, Oct/Nov 2001.)

2) In 1996 our firm was contracted to monument the boundary of Marine Corps Logistics Base in Barstow, California. In this survey, I continued to develop the “least squares-RTK” search system devised on the Dakota survey by including not only the data from the original PLSS survey notes, but also all of the other record information in the area. On this project we combined the original record information from the 1850s, as well as more modern information from the 1940s through the 1990s. All of the record information was weighted in accordance with the normal errors and accuracy to be expected from the equipment and procedures of the time period in which the survey was made. Additionally, StarNet has an entry mode in which bearing data from record maps can be entered, and the software converts the bearing data to angles. Using the resulting angles and distances, the adjustment file is not hindered by basis of bearings differences. This results in the ability to easily attach all of the record data to the State Plane coordinate system to produce coordinates in that system for ease of search using GPS. Using RTK GPS attached to a small helicopter, in four days of search operation we were able to locate 20 original PLSS corners which had not been seen since 1857. (See “Surveyor Droppings,” *PS*, Jul-Aug 1999)

3) In 1999, we were contracted to locate and monument the boundary of Marine Corps Air Station Miramar near San Diego, California. This survey consisted of 34 miles of boundary with about 700 corners to search, find, or set. Like the Barstow survey, we had records from 1850 to the present. Again, we input all of the record data into a StarNet file to develop search coordinates. It was my goal and belief that using my least squares

**Figure 1: RTK GPS base station at the highest point in the township.**



“...WE HAD ACCOMPLISHED IN THOSE FOUR DAYS OF LEAST SQUARES/RTK GPS OPERATION WHAT IT WOULD HAVE TAKEN ABOUT THREE MONTHS WITH THE CONVENTIONAL CADASTRAL RETRACEMENT PROCEDURES...WE DEVELOPED A NEW SYSTEM [AND] WE PROVED IT IN THE FIELD.”



## FEATURE

method, we could produce search coordinates for almost all of the corners that would be within “half a shovel width” of the monument. In most cases that goal was realized. We found about 400 out of the 700 searched for, and most of them were within the “half-shovel” goal. About nine miles of this boundary consisted of sectionalized land, much of which had been originally surveyed by S.W. Brunt, one of the infamous Benson Syndicate surveyors who were found to have falsified many of their original surveys, including this one. Those corners, which were probably never set, were definitely a bit more difficult to find! This project allowed us to again gain efficiency in retracement using our least squares/RTK system, and at the same time continue to refine that system.

### The 1902 Survey

Now back to the case at hand. In 1997, one of the local southern California community college districts had asked me for a proposal to locate and monument their “Environmental Studies Area” in the mountains just north of Los Angeles. This area consists of very steep mountains covered with dense intertwined 10-foot high manzanita and scrub oak brush. The original survey in this area was performed in 1902, with stone and stake monuments. We found no records of any surveys within three miles of our subject property since the 1902 original. I took my best guess at the cost, and set my bid high enough that if we should be chosen, we wouldn’t get hurt too much! I figured that they would think it was way too much to pay to find their lines. If we didn’t get the project, it wouldn’t hurt my feelings due to

the difficulty and the unknowns of the survey. As expected, we did not hear back. I didn’t feel bad, and I didn’t follow up. Some jobs you are just better off without!

### The 1993 Survey

Three years later, in June of 2000, I received a call from the Dean of the college. He told me they were now under a court order to find their easterly boundary due to a conflict with their neighbor. He requested that I again look at their property, specifically the southwest quarter of the southwest quarter of Section 24, Township 3 North, Range 14 West, San Bernardino Meridian. (Figure 2) This 40-acre parcel is the northeasterly extremity of the college district’s property lying farthest up Gold Canyon off Little Tujunga Canyon. The east line of this property was the line in contention. The north and south lines of Section 24 are generally on ridges at about the 4000-foot elevation. Between these ridges is a 2000-foot deep canyon that runs from just south of the northeast corner to just north of the southwest corner. As I “waffled” on the phone, really not wanting to gamble my efforts on the possibility of successfully performing this obviously difficult survey, he volunteered that another surveyor had done some work for them on the area in question. “Would his report on the survey be of assistance to you in estimating the effort at hand?” I told him all information is good information, and he faxed me the “report.”

The “report” was from one of the better-known surveyors in California, Nevada, and Arizona. Here are some excerpts from his report dated August 31, 1993:

Figure 2: Steve Backes views part of the challenging terrain of Section 24.

“ . . . THIS IS EXTREMELY TREACHEROUS COUNTRY AND ACCESS TO THE SEARCH AREAS IS LIMITED TO HIKING AND CLIMBING.”

—Excerpt from 1993 Survey



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*“The purpose of this letter is to serve as a report on our efforts to conduct a field survey of the said Section 24. The original survey was performed by the General Land Office in 1902. There have been no subsequent surveys by anyone since then. According to the record, the monuments set by the original surveyor were mounds of stones.*

*“We have obtained copies of the original field notes and the Official Plat from the Bureau of Land Management in Sacramento. The Bureau of Land Management is the successor to the General Land Office. We have also obtained copies of the same records from BLM Headquarters in Washington, D.C.*

*“We have obtained aerial photographs of the property and topographic maps on which we have plotted the approximate positions of the Section corners and quarter corners of said Section 24 as described in the field notes and making use of the topographic calls contained in the field notes.*

*“To date we have only recovered the S.W. Corner of the section. We have sent field crews and search parties to the remaining seven corners and have not found any evidence of the original survey monuments. We observe that this is extremely treacherous country and access to the search areas is limited to hiking and climbing. Some locations requiring over four hours to reach the search area . . .*

*“We have searched an area at each possible corner location with a radius of 300 feet. We also observe that the area, for the most part contains decomposed granite. Given wind, rain and snow for the excess of 90 years, it is doubtful that a rock mound would survive.*

*“We have discussed the situation with the Chief Surveyor for the Bureau of Land Management in Sacramento and the Supervising Land Surveyor for the Angeles National Forest. Neither one of them could offer any suggestions nor did*

*they have any information that we had not already considered. They both did confirm that other retracement efforts in the same township as recent as last year turned up nothing also.*

*“Private surveyors have no authority to set original monuments of Sectionalized Land. That authority is reserved to the U.S. Secretary of the Interior. He has chosen to delegate that to the Bureau of Land Management. A private surveyor can only retrace and or perpetuate the original survey evidence as set by the federal government.*

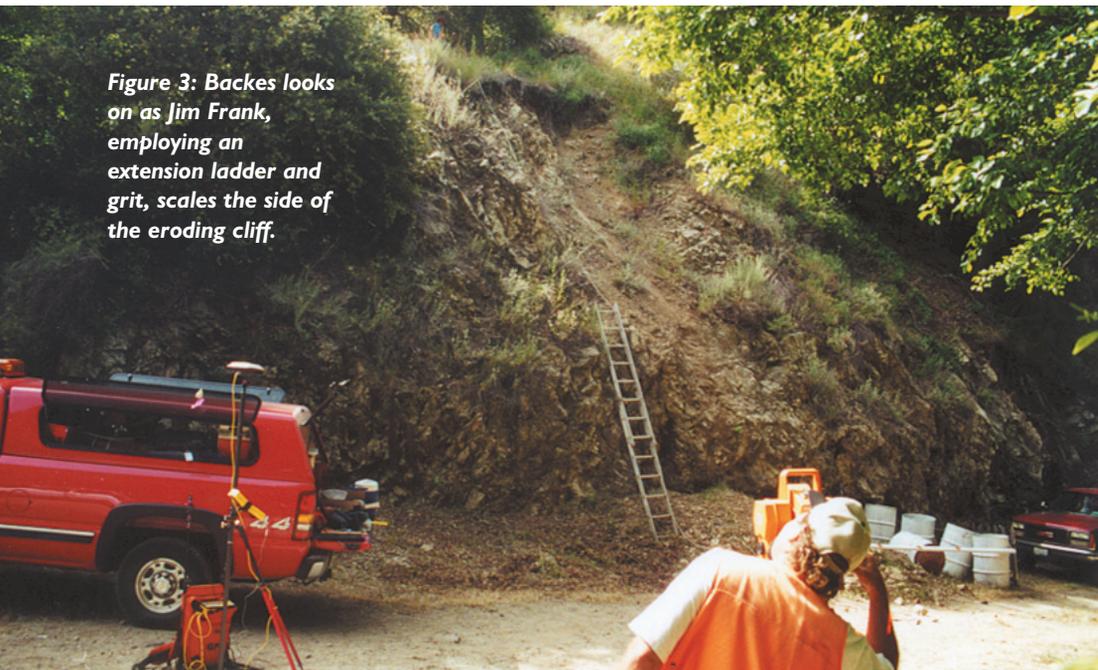
*“We are further advised by the federal surveyors that in country and soil conditions that exist at Section 24 will cause the rock mounds to somewhat be absorbed over the years. That is the mound and the soil they set on tends to erode or dissolve and the evidence disappears.*

*“This brings us to conclude that there is nothing further that we can do to retrace the original boundaries of Section 24. We believe that we have put forth every effort possible. In the most simple of terms, there is nothing there.”*

Wow!!! An impossible survey? Or was that just a challenge? The old U.S. military adage came to mind: *The difficult we do immediately, the impossible takes a little longer.*

I entered all of the original data from the 1902 survey for entire east half of the township into StarNet to compute rough State Plane coordinates for the corner monuments. I obtained a digital copy of the USGS quad sheet from SurfMaps in San Diego. Using AutoCAD, I overlaid the original survey, including the topo calls, over the USGS topography, and it appeared to fit within reason. This led me to believe that our original surveyor had been in the field and surveyed the lines generally as he described in his notes. I felt that the survey was possible, but what the effort might be to perform it was still in question. It would certainly not be easy.

**Figure 3: Backes looks on as Jim Frank, employing an extension ladder and grit, scales the side of the eroding cliff.**



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I called the Dean and explained to him what the “report” meant, which he apparently had not understood previously. I told him that, contrary to the report, I thought that the survey was possible, but I didn’t know how difficult it could become. I also explained to him that if I gave him a firm quote, I would in effect, take his boundary problems and make them mine, and that I was not prepared to do that. Luckily, he understood the problem. I then gave him a proposal to perform all of the research, all of the computations that I could to narrow down search locations, and spend three days on site using our best systems, including the helicopter supported RTK GPS to ascertain if we could find sufficient monumentation from the 1902 survey to allow us to reasonably estimate the remainder of the project. He agreed, and we began.

### The Search to Compile Records

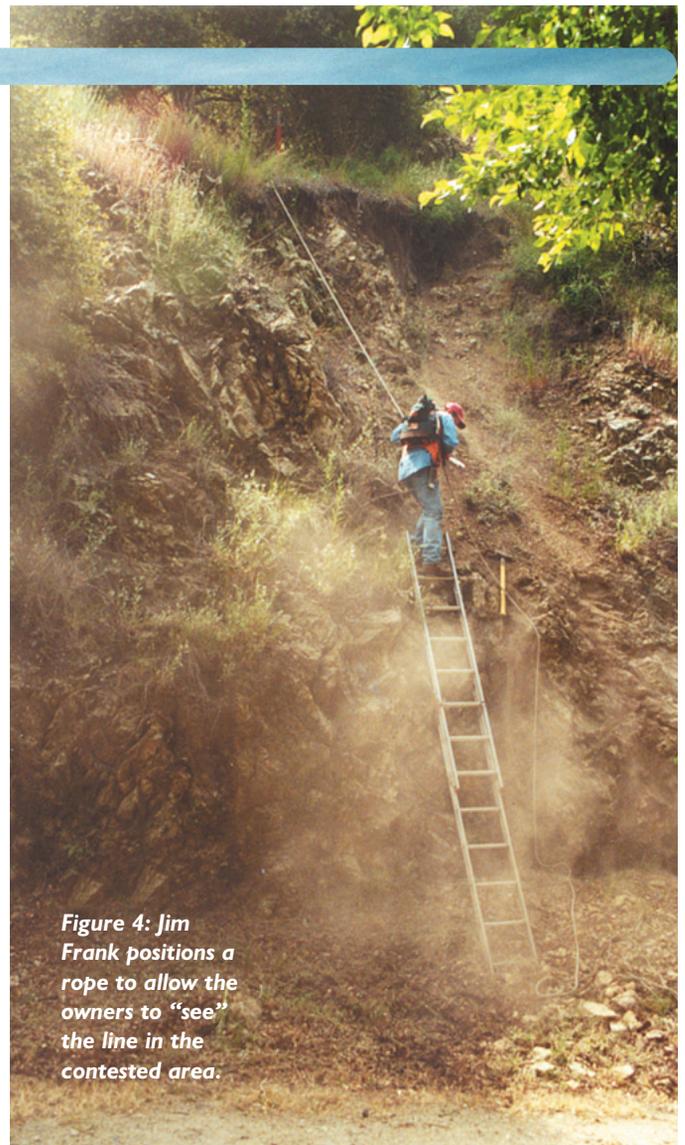
Our previous research at the County of Los Angeles and had only turned up the original 1902 notes and plat and the fact that there were no “modern” surveys of record in our area. In an attempt to garner any and all possible record information in the area, I requested all of the record maps and survey notes in the entire township from the county. Again, the only data I received from the county was about three miles to the west.

I called the BLM in Sacramento and ordered all of the notes and plats for the entire township and the adjoining township to the east. They had good news and bad. The good news was that in addition to the original 1902 survey, they had located a mine claim survey from 1940 in Section 26, to the southwest of our property. The bad news was that the township to the east had never been surveyed, I presume due to the rough country and its early inclusion in the U.S. Forest Reserve. The 1940 survey did find the southwest corner of our Section 24. This was very good news, because it gave me not only a place to look, but also the assurance that the original surveyor had set his corners.

I also called the Angeles National Forest Supervising Surveyor to see if they had any information in the area, since they had adjoining land to the subject survey. He informed me that they had a contract surveyor working on a Record of Survey of some of the forest property to the west of our area. I called the contract surveyor and received a digital copy of his yet to be recorded Record of Survey map. His survey came to within a mile of ours and supposedly was based on State Plane coordinates. More good news, something I could use!

By combining the current Forest Service survey, and the mine claim survey of 1940, I could produce a pretty good coordinate (1940 accuracy) for my southwest corner. Through the 1902 mathematical and topographic data, I could also produce coordinates for the rest of my search corners. My newly minted coordinates seemed to fit the topo from the quad sheet pretty well. I thought I was ready to go out and get ‘em.

The Dean wanted to meet me out on the property to show me his problem. I took a couple of our Trimble GPS receivers with me. Prior to our meeting time, I found two of the corner monuments shown on the Forest Service preliminary Record of Survey and collected enough data on them to tie them to Continuously Operating Reference Stations (CORS) in the area. Being earthquake study country, we have about 250 of them to choose from. I guess that is one of the good parts of living on “shaky ground. (Figures 3 and 4) After our meeting, I went up



**Figure 4: Jim Frank positions a rope to allow the owners to “see” the line in the contested area.**

a forest road to the southeast corner of the section. The notes indicated that, due to the southeast corner falling on a steep cliff, the original surveyor had set a witness corner on a ridge, two chains (132 feet) north of the actual corner. I could see from the USGS quad sheet that I could drive to within about a hundred feet of the witness corner location. I felt that if the original surveyor had stated that he had set a witness corner on a ridge and the ridge existed in that location, I should have a good chance of finding that corner. Bad news—the ridge had been bulldozed for a firebreak. There was no possibility of any mound of rocks surviving at the apex of the ridge where I expected it to be. I did, however, find a mound of rocks right at the edge of the firebreak and at the break point from the ridge top to the steep cliff to the south. Could this be it, with no markings, and not in the middle of the ridge? I doubted it.

After again massaging all of the record data, along with my own positions on two of the forest service points, and again evaluating that data against the quad sheet topography, I felt we were ready to make an attempt to locate some corners. ▼

*(To be continued)*

**ROGER FRANK** is cofounder, current owner, and president of Johnson-Frank & Associates (JFA), located in Anaheim, California. This is his fifth article for Professional Surveyor.