

The Surveyor

A Good Life

Our farm home in Western Missouri was a good place for my three brothers and me to grow up. Being thirteen miles from the nearest town we learned to entertain ourselves. That was easy with the tall maple trees upon which to hang swings, trapezes and tight ropes to practice exercises on. There was timber in the pasture where we could hunt rabbits and squirrels, and a large creek where we could swim and fish. Good training for the work that lay ahead! We learned reading, writing and arithmetic at the one-room school a mile and one-half south. In those days we did not travel far. The extent of my travels, until I was sixteen years of age, were the slow, all day trips we made by wagon to Nevada, the county seat. There mother traded butter, eggs, and a few old hens for groceries and clothes for us. On such trips we enjoyed the smell of coal smoke, and watched the trains whiz by; the puffing engines hissing steam to scare our horses. The long drive home in the late evening, usually after dark, was an adventure for us boys. Passing along pitch-black, tunnel-like roads through the dense timber in creek bottoms, we watched lightning bugs glow, and also heard katydids chirp, with maybe a hoot from a wise old owl, which gave us a creepy feeling. Never to be forgotten was the welcoming home by old Rover, who hearing the team and wagon, met us a half-mile from home, jumping at the horses' heads in play.

But time marched on. By the time I was in my middle teens my brother Elmer had graduated from college and was teaching a country school in Routt County, Colorado. His exciting letters, telling of deer hunts, mountain trips, and other adventures, caused me to long for the day when I too could go "West". But my father's passing away when I was seventeen

forced a change of plans. I would be needed at home to help mother run the farm. I did manage to attend college and obtain a diploma in book-keeping and banking by the time I was nineteen years old. As I waited, my longing to go to Colorado or Wyoming grew greater and greater. In my mind's eye I could see greater opportunities in the West. I was not interested in an office job or work on a farm in Missouri if I could find something better. Fortunately, in the early spring of 1905, Elmer, then working on a Government survey project in Wyoming, secured a position for me with the same outfit he was with, to start the first of June. I then did my best to get the home crops planted by the last of May so I could leave the farm work to my younger brothers, Ray and Willis, and go to Wyoming.

It was a joyful day for me that first day of June 1905 when I left home on the jerk-water train for Kansas City, with train fare to take me to Garland, Wyoming, with a basket of sandwiches and apple pies mother had prepared for me to eat along the way. Leaving Kansas City on the Burlington train I enjoyed hearing the car wheels begin their rhythmic click-e-ty click click-e-ty click over the rail joints with increasing tempo as we pulled out of the yards midst clanking bells and hissing steam. I then realized I was on my way to the promised land.

We passed through Kansas, Nebraska, Wyoming and on to Toiyabe, Montana; thence through Pryor Gap to Garland, Wyoming, where I found the Brunt Survey Camp, my destination. Standing in front of the cook tent was Rhoda Huber, the camp cook, who welcomed me. Five or six other tents were grouped along Alkali Creek where the men slept. Miss Huber was a Mormon girl from Lovell, Wyoming, a good cook.

The men furnished their own camp mess and slept on the ground. Candles furnished such lights as were needed. Three wagons were available for moving camps. The camps were usually moved every week or ten days.

Upon my arrival in camp I was assigned to Wilford Utterbach's line crew as cornerman. My duties included supplying corner stones as I could find them along the line; mark them with a chisel, and set them in the ground. At times I would carry a suitable stone on my shoulder for a half mile. If no stones were available, we were permitted to set a wooden stake for a corner. If the terrain was passable for wagons we sometimes drove one along to haul the tools and corner stones. I, being used to doing farm work and driving horses, was sometimes detailed to take a wagon ten miles south of camp to the river to pick up dry cottonwood limbs and logs for stove wood. I enjoyed the wood detail because I was then my own boss and could take my rifle along and look for coyotes. On one occasion a badger ran after me. I ran for the wagon and jumped in. The badger continued under the wagon to its den. I had gotten between him and his hole! But a badger is not above attacking a person. They are fearless. I had one attack my saddle horse which had overtaken it along a trail. It would run and blow at the horse. Rattlesnakes and scorpions were plentiful and coyotes serenaded us every night. Garland's most interesting attractions for me were long freight teams of horses pulling two or three wagons loaded with sacks of wool. Ten or more horses hitched two abreast in a long string were driven by one man riding one of the wheel horses (the team next to the wagon). It was marvelous how one driver could turn the outfit around in the street, and maneuver the heavy wagon into position for loading freight cars. They did it by using a jerkline to guide the lead team. The swing team hitched to the front end of the

wagon tongue plays a most important role when going up hill on sharp curves. Often, they would have to step over the draw chain and pull at right angles to prevent the wagon from being led off the roadway.

Completing surveys around Garland June 30, 1905, the surveyors moved to Cody, Wyoming, where they were split up into three groups. I was assigned to a crew going 85 miles southeast ~~of~~^{to} Worland, Wyoming, to survey a correction line called the 11th Standard Parallel, which we were to survey for 60 miles straight west of a base line from which we would later start section lines running north. The base line we were to survey started at a corner which had been set the previous year on Fifteenmile Creek northeast of Worland. I was promoted to chainman and worked with Arthur Brunt as my chaining partner. Two sets of chainmen were employed on the base line. It ran up Fifteenmile Creek, over Tapman Mountains and crossed the Greybull River below Meeteetse. It ran through desolate badland country where many wild horses were seen. The wild horses were not afraid of us on foot, but would run from any rider at sight. Water was scarce and Col. Brunt on his horse, Tamarack, often went ahead scouting for new campsites where water was available and guided us into them at quitting time. Camps were moved every other day so we never knew where to find the next camp. It was often a weary crew that tramped through the badlands on hot afternoons, with empty canteens and with tongues sticking to the roofs of their mouths. After reaching the Greybull River in August the water situation was much improved.

It was my good fortune to have Mr. Arthur Brunt take an interest in explaining the technical side of surveying to me. During spare time on evenings and Sundays he taught me how to read the verniers on the transit

and solar compass, and to make simple calculations, such as computing declinations of the sun; the azimuth of Polaris, triangulations, and to close sections.

The Standard Parallel project was completed early in September 1905, when we set the last corner, a standard township corner, near the top of Carter Mountain. My party was then transferred 6 miles east to the valley along Meteteetse Creek where the remainder of the season was spent subdividing a township on the north side of the Standard Parallel we had just established. The parties were disbanded the last of October and I returned to my home in Missouri.

Purchasing a set of books on surveying and civil engineering from the International Correspondence School of Scranton, Pennsylvania, I studied surveying during the winter of 1905-1906.

Returning to Wyoming in April 1906, I was put in charge of a survey party of my own. Thus beginning a new chapter in my career as a surveyor. My party consisted of two experienced chainmen, former colleagues, Sam Hutton and Luther Glasgow. My camp tender was a former cowboy, Ed Myers. His wife, Edith, was cook. My cousin, Troy Troutman, from Missouri was my cornerman; and Tommy Jones and Dave Shaffer were my flagman and axeman.

In 1906 a frightening experience occurred while I was surveying a meander line along the south bank of Shoshone River through the 2000 foot deep canyon separating Rattlesnake Mountain on the north from Cedar Mountain. I was carrying my transit southward along a narrow 1 foot wide ledge on the north face of a cliff some 900 feet above the canyon floor. A 4 foot high rotten stump blocked my way. To pass it I quickly swung my body cut and around the obstruction. Grasping the stump with my left hand

for support as I swung outward, the stump gave way leaving me teetering on the brink. I could not move my feet on the narrow ledge to balance myself. Looking down I could see Lilliputian-like wagons on the road 900 feet below! For what seemed like eons I stood there balancing on the face of that awful chasm. Quickly thrusting my left arm to the left (south) I shifted my center of gravity while springing forward to safe footing and a long breath. The Lord had his hand on my shoulder. An unusual aftermath unbeknown to me, axemen Tommy Jones and Dave Sheffer happened to be watching me from a short distance ahead. Two years ago Tommy Jones, then 92 years of age, whom I had not heard from for 61 years, saw my name in a paper and wrote to me from Pacatello, Idaho, and among other things recounted this story. He said Dave and he stood agast as they saw my dilemma. Their hearts were in their throats, he said.

On July 1, 1906, I was appointed a U.S. Deputy Surveyor for the State of Wyoming, by Mr. A. P. Hanson, U. S. Surveyor General for Wyoming. That appointment gave me authority to make official surveys and resurveys of public land, and to sign the official field notes.

At the close of the first season in 1906, I took the team and wagon to George Mueller's ranch at Burlington, and put the horses on winter pasture, then started out looking for a winter job. At the Eaglesnest Camp of the Bureau of Reclamation, Mr. E. F. Tabor, Project Engineer offered me a job as teamster to drive the engineer crew to and from work on construction of the Shoshone Canal. Although it was quite a reduction in status from the transitman job to teamster I accepted it. I saw an opportunity to learn something about irrigation engineering. It turned out to be a lucky break for me.

In addition to taking care of the surveyor's team, and driving the surveyors out to work six days a week, my duties also included feeding, currying, harnessing, and hitching to a buggy Mr. Tabor's buggy team. Tabor's team was nervous and spirited. They were always rearing to go when the last trace was hooked. The right-hand horse watched me, and when it saw me hook the last trace, it would start to prance. If not permitted to go at once he would back up, rear, and throw his head. I would hold the lines taut as Mr. Tabor eased himself into the buggy seat. I hastily hooked the last trace, handed the lines to Tabor and away he would go in a cloud of dust. I suppose Mr. Tabor was satisfied with my work. He said if I would like to learn more about irrigation engineering and surveying he would be glad to teach me nights. That was good news. With my Correspondence School books I soon learned the principles of how to run curves, cross-sectioning; and computing areas; and how to compute the grade and capacity of canals. On February 1st, 1907, I was named "Surveyman"; relieved of my teamster's duties; given a crew, plane table and transit and told to make a contour map of Falston Reservoir. That job was completed to the satisfaction of the engineers. In April, I again left the Reclamation Service and resumed work on my survey contract with the U.S. General Land Office in Dry Creek Basin. Field work on that contract was completed June 30th and I again joined the U.S. Reclamation Service, this time at Camp Cculter on the Garland Flat where I located and cross-sectioned portions of the Franny Canal, and lateral "F" and staked out the concrete 'drops' along the Garland Canal. On September 15th of the same year the survey work closed down and I was sent up to the Eaglesnest Camp to work as a carpenter's helper on the Eaglesnest Flume.

To reminisce a moment: In later years it gives me a feeling of pride to drive through Powell Wyoming country and see the beautiful homes and bountiful crops on land I remember as the 'Garland Flat,' the home of the jackrabbit, prairie-dog, and badger. Well remembered are the problems confronting me when I staked out for the carpenters the forms for the concrete 'drops' along the Garland Canal. Each design a little different from the others.

On October 1, 1907, Mr. George W. Zorn, Chief Engineer for the Big Horn Basin Development Company at Wiley, Wyoming, called me by telephone and employed me as Field Engineer for that company in charge of surveys on construction of three irrigation tunnels and the main canal from the South Fork of the Shoshone River to Oregon Basin south of Cody. There were about 6,400 feet of tunnels and ten miles of canal along the north slope of Carter Mountain. The tunnels were excavated 13 feet in diameter, with a grade of 0.25 foot drop per 100 feet, and the canal had a bottom width of 100 feet, and a slope of 1.00 foot per mile. They were all designed to carry 2000 cubic feet of water per second. No. 2 tunnel, 2600 feet in length, had curves under the ground at each end, and was worked from each end. My job included keeping the miners on line around the curves, and on the proper grade so the two headings would meet, and water would flow through the tunnel. I also set grade stakes for a steam shovel digging the canal a few miles above the tunnels. I lived and had my office in a tarpaper covered cabin the company furnished me at No. 2 Tunnel Camp, and I took my meals at the company mess halls. Three tunnel crews of 12 to 14 men each worked 8 hour shifts at each tunnel heading. Tunneling was carried forward at four different headings during 1907 and 1908. Alignment

was furnished the miners by means of plumb lines I hung from the center of the ceilings of the tunnels. Blasting was with dynamite and powder fuses. There was a fuse for each charge of dynamite, usually twenty or more charges were fired at the close of each shift. I sometimes helped the shift-boss 'split' the fuses just for something to do. With twenty or more lighted fuses spewing at my feet made a novice like me have some second thought as I continued to light other fuses. I stayed up all night the night they were expected to break through No. 2 tunnel. When the graveyard shift shot at 7 a.m. and broke through I was the first to stick my nose in the small opening to get a breath of fresh air, and call through to the opposite crew. Later I found the line brought in from each end checked within $\frac{3}{8}$ th of an inch.

Our next problem was to prepare to line the tunnels with concrete. Gravel chutes and bins were erected to carry the material to the tunnel portals where concrete mixers were placed. Lining the tunnels was proceeding satisfactorily, when in December 1908, the Big Horn Basin Development Company encountered financial difficulty in raising funds to carry on the work. Everything came to a sudden standstill. On January 9, 1909, I severed my relations with the Company and returned to my home in Missouri.

I vacationed around home on the farm in Missouri until August 1909, when I started for the West to look for an engineering job. I bought a round trip railroad ticket to the World's Fair at Seattle, Washington, good for six months with the privilege of stopping off any place. I stopped off in Idaho to look for jobs at American Falls, Minnadoka, Twin Falls and Nampa without success. At Boise I met a Mr. Crocker, who was on his way to take

the train for Chicago. Mr. Crocker employed me on the spot to take a party over on the Snake River and spend a month or six weeks making preliminary surveys for a proposed pumping plant irrigation project, across the river from Grand View, Idaho. He would be back in time to pay us off, he said. I completed that job and went on to see the World's Fair. Returning I stopped off at Spokane and surveyed summer home-sites along the shore of Hayden Lake for the Northern Pacific Railroad until the snow forced us out in November 1909. I then returned home.

In April 1910, I again went to Idaho as Field Engineer for the Snake River Irrigation Company where I had made the preliminary surveys for Mr. Crocker the year before. I was in charge of location and construction of irrigation canals along the Snake River across from Grand View. Mr. Charles Franklin of Boise was Chief Engineer. The job closed down for the winter in November 1910, and I again returned to Missouri.

I was married to Inez Estes, a Missouri girl, on February 12, 1911, and we went to Denver on our honeymoon, where we rented a one-room and kitchenette apartment and spent the rest of the winter. I was looking for a job to go to work on in the spring. While in Denver I renewed acquaintance with employees of the Bureau of Reclamation offices, and in the General Land Office, with whom I had worked or corresponded with, when I was in Wyoming. I also visited Mr. A. Lincoln Fellows, a well known consulting engineer I had met in the field in Idaho on irrigation projects he was examining. I looked upon him for help and advice. In April I was offered two engineering jobs. One was as location and construction engineer for the Snake River Irrigation Company at Grandview, Idaho; the other

was as cadastral engineer in charge of a field party, under the civil appointment with the U.S. General Land Office. We accepted the Government job, with headquarters in Wyoming. I had done similar work for the General Land Office under the contract system in Wyoming back in 1907. I entered on duty in Cheyenne on April 10, 1911, and was assigned to survey six townships north of Cody. The Surveyor General outfitted me with a new Young and Sons solar transit and the necessary surveying equipment. I was authorized to proceed to the field, employ a crew, purchase tents and mess equipment, tools and supplies for running a camp, and hire horses and wagons for transportation. The land to be surveyed had been surveyed thirty years before, but the original survey was defective in alignment and measurement, and in many instances cottonwood stakes were used for corner monuments, which no longer could be found by the settlers. This was a free resurvey by the Government, using iron posts for corner monuments, to aid the settlers and promote the development of the country.

When my wife Inez saw me preparing to spend the summer in a survey camp she wanted to go along. I explained that only employees could live in a Government maintained camp. She jumped at the chance to go along as camp cook, so she would have a camping trip and share in the fun. My warning of pack-rats, dust storms, rattle snakes, and sleeping on the ground never fazed her. She thought she might be able to ride horses now and then, too. She was used to outdoors. On summer evenings down on the farm in Missouri she and her sister Mabel would walk down in the timbered creek bottoms after the milk cows and each ride a cow back to the milk lot. She bought a brand new Whitehouse Cook Book and she was in business. Our first camp was part of Cody on Sage Creek among tall sage brush. It was

not long until she had a pet magpie and a bum lamb with a long tail that the boys had found lost on the side of Heart Mountain. Her hearty laugh proved a morale builder in camp. We continued to work in the Heart Mountain, Rattlesnake Mountain, and Cradle Creek areas in 1912, and late in that year made some homestead surveys in the Big Horn Mountains on the head of the Little Big Horn River. In 1913, considerable time was spent investigating old 1830 surveys in the Big Horn Basin to determine if there was a need for resurveys. In September an unusual event occurred. While we were camped on the Pitchfork Ranch on the Greybull River, Buffalo Bill and the Prince of Monaco on a hunting expedition stopped at our camp. Mr. Cody inquired of my wife, who was alone in camp during the day, about a report that I had recently killed a bear. Mr. Cody explained that they were hunters and were interested in learning where other bear might be found. She gladly gave him full particulars of our encounter with the bear and they proceeded on their way. Incidentally, we enjoyed the bear steaks, and Inez found the lard excellent for making biscuits.

Colonel Cody had an elaborate outfit, with two four-horse wagons, a carriage, and attended by several riders and loose horses. He was impressively dressed with fringed buckskin jacket; with his characteristic gaiter, and glowing silver hair reaching his shoulders.

A few days later we left that camp on an extended trip by wagon, crossing the Continental divide and on to the head of Green River, to survey some land along the shore of Lower Green River Lake. That route took us through Thermopolis and Lander, Wyoming, and through famous Scull Pass, southeast of Lander, where we could still plainly see old wagon ruts left on the prairie by the emigrants traveling the Oregon Trail sixty

years before. We crossed the Green River at Daniel, Wyoming, and turned up the river north along a dim trail for some thirty miles to the lower end of the lake. While camped on the lake shore one of the boys killed a bull elk which supplied us with choice fresh meat while we were there.

November 16, 1913, we disbanded camp at Daniel; shipped the outfit by horse stage to Opal, Wyoming, on the Union Pacific Railroad, thence by express to Cheyenne; we started the wagons back to Cody; I and the men took the stage to Opal, thence on the railroad to our homes.

After spending the winter in the Surveyor General's Office in Cheyenne, I was transferred in April 1914, to the Montana District with headquarters at Helena. I continued to work in the Montana District under J. Scott Harrison and other supervisors until 1945, with the exception of special details to other duties as here-in-after described. Supervisor J. Scott Harrison retired in 1937 and Montana was put under the Boise, Idaho, District Office.

In 1914, the need for resurveys in the prairie sections of the eastern part of the State of Montana was being felt, as new settlers reported that they were unable to find section corners. Many of the corners which had been set in the 1880's were wooden posts which had become lost or obliterated. I was assigned to resurvey these townships in 1914 to 1916.

In the spring of 1917, Glenn Sawyer and I were assigned the difficult task of setting section corners in the Missouri River Badland Breaks south of the Bear Paw Mountains, starting at Eagle Creek across from the mouth of the Judith River and going east on the north side of the river. The area included Black Coules and Bullwhacker Creek, where are found some of the roughest badlands in the nation. Some of the multicolored jagged

slopes being more than 700 feet high, rimmed with stunted, scrubby, twisted, and gnarled pine and juniper trees and brush hard to penetrate. Water within reach of camping spots being scarce, we were forced to haul water with four-horse teams from Bear Paw Springs and Cow Creek to our camp, in water wagons we made from 2-inch tongue and grooved planks. During the three years we spent along the river we continued on east across Cow Creek to Hide-a-way Coules to the mouth of the Musselshell River, Seven Blackfoot, Hell and Snow Creeks, and the Larb Hills where one's feet sank in 3 or 4 inches as he walked on the decomposed shale slopes. We also covered the country to Huxby and Hole-in-the-Eck on the head of Great Forcupine Creek.

While camped at the Long X Ranch during the war we drank water out of a shallow pond with the horses. The horses had the advantage, they could wade out in the water belly deep and drink where the water was not as thick as along the bank where we dipped it up. At that camp we ate horse meat with the cowboys on account of meat rationing.

Our next big job, in addition to the routine surveys, was setting allotment corners on the Blackfeet, Crow, and Cheyenne Indian reservations in Montana.

By 1924, most of the public land in Montana remaining unsurveyed lay within National Forests. There was a continuing effort by the Cadastral Engineers to make the township plats more useful by showing more accurately the topography in the interior of the sections. To better accomplish that goal the Montana surveyors started in 1924 to close all sections vertically as well as horizontally. Sea level elevations along the section lines were obtained by measuring vertical angles to bench

marks on mountain peaks. Through cooperative efforts with Forest Service personnel, the topography and contours inside the sections were filled in making a much more useful map.

In 1924, the Government surveyors in Montana adopted the use of the "Trailer Tape" for measuring section lines, which greatly simplifies the procedure. By that method of measurement, true horizontal distances to points along the section lines were always known even though measurements were made on the slopes.

In 1929, due to the Forest Service's need for better maps for fire fighting and the administration of National Forest lands, the General Land Office started a program to survey into sections of the high timbered mountains of northwestern Montana. Ernest Parker and I were assigned to that work in the Pinkham Creek, Cripple Horse, Hungry Horse, and Kootenai country. To establish camps far back from roads, pack animals were necessary. Mr. J. Scott Harrison, Supervisor of Surveys, acquired a string of pack animals for our use, consisting of sixteen young mules and three saddle horses. New Decker pack saddles, and a complete outfit of mountain type camping equipment were also provided. Many of the mules were unbroken. Our first job was to break and gentle the wild mules so they could be caught without a corral or rope throwing. For that task experienced horsemen were recruited from Powder River and Belle Fourche. Camp was established at the end of the road east of Eureka, Montana. The packers trained the mules for a week while the crew opened up new trails back into the mountains.

The packers started the training by letting the young mules stand with saddles on for a half day, then they would hang some sacks filled with pots and pans that would rattle, on each side of the animals and lead them

through the timber with pans dangling, until the mules learned to follow the leader. Some mules were not satisfied until they did their best to buck off their noisy load. The mule had also to learn to go on the right side of a tree, or get his neck stretched, and judge how narrow a space he could go through with a pack on. By treating them gently they soon allowed themselves to be caught without being in a corral when feeding them oats from a nosebag. The most wily mule will take a chance on getting caught just to get a mouthful of oats. A gray mare is a good magnet to keep the mules from leaving camp. Picket the mare and the mules will usually be nearby. Due to the lack of grass in the dense brush and timber on those mountains, hay was packed in for the pack animals. At times in mid-day, due to the heavy cover, lantern light was necessary when doing office work in the tents.

In 1931 to 1933, I surveyed the Revised Boundaries of Yellowstone National Park. The ninety-one miles of new line followed the crest of the Absaroka Range of Mountains forming the divide east of Yellowstone Lake. We had many exciting encounters with grizzlies while working in the untamed wilderness areas of the Park.

In 1932, I recommended names for four peaks in Yellowstone National Park, which names were approved by the National Geographic Board. The names are: President Grant, President Arthur, William F. Cody, and Chief Plenty Coups.

Congressional approval of the 'Pick Sloan' plan for the comprehensive development of the water resources of the Missouri River Basin, marked the beginning of extensive surveys and planning by the Bureau of Reclamation and the Corps of Engineers throughout the Basin. The Bureau's plans

Included the preparation of contour and planimetric maps of the irrigatable lands by photogrammetric methods. Cadastral surveys of each project were also needed to determine the boundaries and acreages of the farm units on each project. Mapping from aerial photographs requires accurately located horizontal control points on the ground, and the same points identified and carefully marked on the aerial photographs of the area, so the pictures may be enlarged to scale.

I believed that much time and money could be saved by resurveying the section lines before the maps were made, so the reestablished corners could be used as horizontal control points for the aerial mapping, and thus save the expense of putting in another set of control points. To speed up the work and reduce the overall cost I suggested that consideration be given to having the cadastral survey division of the U.S. General Land Office execute the resurvey of the section lines, on a reimbursable basis. The cadastral surveying division of the General Land Office is the agency authorized by law to survey all public land, and was organized and had the trained personnel available for that particular kind of work.

To get my plan considered by high officials of the Bureau of Reclamation, I started at the grass roots by presenting my plan to my engineer friends in the Bureau in charge of the field work. My plan was favorably received by them; and some of them said they would be glad to be relieved of the land survey work. The first of the field men to apply for help was Fred Munro, project engineer for the Kinsley Resettlement Project for dry farmers on the lower Yellowstone. In 1940 Mr. Munro allotted \$4,000.00 to us for that job. I completed the field work and turned over the resurvey

Township plats to him, at a cost below the estimate. In 1944, an application was received from the Bureau for the resurvey of the right-of-way lands for the Canyon Ferry reservoir site. Mr. R. Y. Lyman, Ernest Parker and I personally did that job without employing additional help. The work was complicated by the many mining claims involved, and because some sections of the original survey had not been tied across the river.

In 1945, the Bureau of Reclamation allotted \$75,000.00 to the General Land Office for the resurvey of project lands on the Marias Irrigation project on Lonesome Prairie north and west of Big Sandy and Box Elder. Mr. Ernest Parker and I completed the survey of the Marias project that season.

In 1946, the payoff for our hard work came! To my great surprise, in January of that year the Director of the U.S. General Land Office put me in charge of all public land surveys in the ten Missouri River Basin states, with special instructions to survey all lands requested by the Bureau of Reclamation. I was directed to prepare to start a crash program of resurveys on Reclamation projects in early spring, with as many crews as I could organize, and have each crew headed by an experienced cadastral engineer. I was further authorized to call to my region any or all experienced cadastral engineers then employed by the Government in California, Arizona, Nevada and other western states. Mr. Glenn R. Haste of Denver was appointed as my assistant, and in April of that year opened an office in Flaxton, North Dakota. I opened an office in Fort Peck, Montana with George F. Rigby as assistant. Ample funds were provided for the work, and to purchase such equipment as was needed. By May 1, survey crews were in the field in the area extending from Superior, Nebraska, to

Hinsdale, Montana, and from Minot, N. Dakota, to Kaycee, Wyoming. Later, Engineers Haste and Rigby were called onto other work, and Engineers Lyman and Parker were designated my assistants.

I was most fortunate to have well-trained and long-experienced party chiefs available for that difficult job. They were all dedicated engineers used to hard work, to operating on a tight budget, and pleased to have a part in that important project. Reestablishing lost or obliterated section corners in a settled community that fix disputed boundary lines between adjoining land owners was much more exacting than where only Government owned land was involved. Exhaustive search for evidence of the original corner monument, examination of previous survey records, and inquiry of old residents was often necessary. The out-of-state engineers brought what equipment they had with them, but it was necessary to buy a number of carry-all type trucks, and other equipment. Orders were placed at once with the Rock Island Arsenal in Illinois for thousands of iron corner posts with brass caps, so they would be available when the field season opened.

An effort was made to visit each party once a month at least, to give the engineers an opportunity to talk over their problems, and hear news of other camps. I traveled a good deal at night returning to headquarters. I remember I could see lights at as many as fifteen small towns at once in North Dakota.

Ant. Hills

In addition to reestablishing section corners on irrigation and reservoir projects, the Bureau of Reclamation requested U.S. General Land Office engineers to pinpoint on aerial photographs the exact position of

at least three-section or quarter-section corners at well-spaced points on each photograph. That was so the photograph could be enlarged to a fixed scale. That service was new to us, and required the training of personnel for that purpose. At first, difficulty was encountered in the great smooth fields of eastern Montana and North Dakota because of lack of detailed topography on the ground that could be identified on the photograph, until ant hills came to our rescue. Ants have a habit of forming a round bare spot about three or four feet in diameter on the ground, which under favorable circumstance may be spotted on the aerial photograph. Our experts soon learned to identify them and make ties to a nearby section corner. A suitable notation was then made on the back of the photograph. The Aero Service Corporation of San Francisco sent men to inspect our ant hills.

Resurveys made for the Bureau of Reclamation, under that cooperative agreement, during the years 1940 to 1955, covered more than fourteen million (14,000,000) acres of land. That project, which is still in operation (in 1970) is thought to be a 'Land Mark' in cooperation between Government Bureaus.

In 1955 and 1956, after retiring from the Bureau of Land Management, I was employed by the Corps of Engineers, U.S. Army, as a consulting cadastral engineer to assist in determining the ownership of lands formed by erosion and accretion along the banks of the Missouri River, which would be flooded by the Garrison Dam, and I also testified in court as the Government's witness in those matters.

-Roy Bandy

A Good Life

Additional facts concerning Mr. Bandy's achievements are listed below:

In 1916, he became a member of the American Society of Civil Engineers, and is now a Fellow and Life Member.

In 1930, he was awarded a Bachelor of Law Degree, and Diploma by the Blackstone Institute of Law, of Chicago, IL.

On several occasions he has been the Government's leading witness in problems concerning ownership and survey of lands bordering on lakes and rivers when formed by accretion, or erosion, or by river channel changes.

In 1964, he appeared, with John H. Morrison, as a witness for the Flathead Indians in the successful suit in the U.S. Court of Claims for more land under the 1855 Treaty.

In 1955, the U.S. Secretary of the Interior awarded him the Citation and Gold Medal Award for Distinguished Service.

In 1918, he introduced a specially designed posthole auger for setting corner posts in hard ground, which saved the field parties much time.

In 1929, he improved the design of the Kimmell Camp Cook Stove by putting asbestos around the oven.

In 1930, he introduced the practice of marking the distances on reference monuments and witness corners.

In 1947, he changed the design of the iron corner post to make all posts the same size, 2-1/2 inches in diameter and 30 inches long.

List of engineers who worked on the Missouri Basin Project; 1946 - 1954.

Ranney Y. Lyman
Arthur Brown
Glenn Haste
Emil Voigt
Tom Crawford
Charles Hunter
Andrew Nelson
George Holland

Leo Peterson
Hugh Crawford
Ernest Parker
Russell MacDonald
Jerry Campbell
William Teller
Claude F. Warner

Wills W. Bandy
Lloyd Toland
Marvin Lytle
George Rigby
James A. Finnie
Hobart Hyatt
Allan Arnold