SUSAN STEELE WEIR…A Biography

I have known Susan Steele Weir since the early 1980's; at that time both of us were young and new to our careers. We met at a meeting of the Association of Engineering Geologists (AEG), where we were part of a tiny but select group of women working in that field. She has been "the first/only" many times in her career, and her pioneering spirit has made a career in geology easier for us who came behind her. Here is her story:

Background

Susan Steele Weir retired in June of 2007 from Denver Water after a distinguished 36-year career as an engineering geologist. She spent her first eight years as a field geologist with the U. S. Geological Survey, and then 28 years with Denver Water, of which the last 15 years were spent as Chief Geologist. She is a dedicated pioneer of field geology in a profession that has been dominated by men, both in the office and out on job sites, and she has held her own with grace and distinction. While working for the USGS, she was the first woman to work underground at the Nevada Test Site, a big contrast from her early years when women were not "allowed" to go into any underground workings. Now, she is a recognized expert on the engineering geologic aspects of tunneling.

Susan has held a variety of advisory appointments. She was appointed by the Governor to the Colorado Geological Survey Advisory Committee, where she served two four-year terms. This opened the opportunity for her to participate with Colorado's Minerals, Energy, and Geology Policy Advisory Board, the "MEGA" Board, which recommends policy for the development and use of Colorado's mineral, energy, and geologic resources to the Governor.

Currently, she is serving on the Geological Mapping Committee, an inter-agency project that is national in scope and innovative in nature. Individual state committees consist of geologists with state geologic surveys in cooperation with geologists from the USGS, other state and local agencies, and individuals from private industry. This is a cooperative effort to determine priorities for the geologic quadrangle mapping program across the nation, and is influenced by land use needs located primarily in developing areas.

Her personal history

Susan is 58 years old, and she is bright, lively, and capable. She grew up in Evergreen, Colorado, in the mountains near Denver; she was always outside: hiking, camping, and horseback riding. Her father was a labor relations negotiator who settled strikes for Climax Molybdenum Company and other companies. He passed away when she was 16, but she believes that his engaging, flexible, and persevering spirit lives on through her. She attended Augustana College, a small, private college of liberal arts and sciences in Rock Island, Illinois. She started with a major in Chemistry, but noted on a hot day in their third-floor lab that the chemistry majors were sweltering away inside, and the geology students were all outside. She switched to geology, continuing her life-long

passion for the out-of-doors, the earth and its fascinations, in preparation for a career in engineering geology.

Nevada Test Site, 1971-1979

While she was still at Augustana College, she was selected for a summer intern position with the USGS. She was fortunate to find a mentor who specialized in engineering geology, and upon her graduation in 1971, the USGS hired her for a position in the Special Projects Branch, the group working on the Atomic Energy Commission's Nevada Test Site. This is the facility where atmospheric and underground nuclear weapons testing was conducted in the 1950's and 1960's, with underground testing occurring until October, 1992.

Her mentor encouraged her to do graduate studies at the Colorado School of Mines in engineering geology, because of her work at the Nevada Test Site with rock bolt installation, slope stabilization projects, and geologic tunnel mapping. The School of Mines required field camp for all their students, including graduate students, and because of her significant field experience with the USGS, she was one of the top students. She would have loved it, whatever her grades; it was outside, in the mountains, so it was right up her alley.

Susan worked at the Nevada Test Site for eight years, periodically detailed from the Denver USGS office, with a lengthy daily round trip between the field site and their unique little government town at Mercury. The Nevada Test Site's geologic investigations were on the cutting edge of technology, both in bedrock characterization and seismic-velocity assessments. She loved the work, which consisted of meticulous mapping of the rocks and structure at the surface, and the deep subsidence craters created by the subsurface explosions. The nuclear testing caused measurable movement along existing faults both at the surface and underground, and she describes her work as "watching geology in action." In addition, she mapped miles of tunnels, and logged miles of drill core.

She was the only woman working underground at the Nevada Test Site for those eight years. At that time, many miners considered women bad luck and they were generally not tolerated underground. As the old saying went: "For every woman who goes into an underground mine, a man comes up dead." These old superstitions were well in place when she arrived, and her initial welcome was not warm. Her philosophy, however, was to "show up and look sharp at all costs", and to do the job she was hired to do. She has always tried to get along with everyone, and firmly believed that most of them would come around. She didn't give up; she didn't get intimidated; she persevered; and she expected the best. Most of her co-workers did come around, impressed by her ability and persistence. If you ask, she will tell you that she was raised by drillers, and that being tall really helped.

Susan began her career at a unique and special time in the history of field geology. The USGS was slowly changing, and the geologists that trained her, she calls them the John Wesley Powells of the USGS, had just retired their government-issued horses. They had

lived in tents in the field for months at a time, and understood field geology in a profound, 24/7 sense, better than any geologists before, or since. Many took their wives and families with them, and the field camps came equipped with technicians to do the harder work, lugging samples and setting up plane tables. They could out-hike mountain goats and they were churning out new quadrangle maps at an unprecedented rate. When Susan was hired, Airstream trailers were slowly replacing the field tents.

She always thought of her job as being "normal" and didn't acknowledge the nay-sayers who though it couldn't or shouldn't be done. She says now that it took her many years in the field before she recognized the pioneer in herself, and understood how unique, and lucky, she was.

She worked on other projects with the USGS. As the price of gasoline rose in the 1970's, the USGS, in cooperation with the Bureau of Reclamation, began a preliminary study of oil shales in the major basins in the West. Their purpose was to find additional fields and reduce America's dependence on foreign oil. In the Piceance Basin of Western Colorado, the USGS drilled three exploratory drill holes over 3,000 feet deep to characterize Tertiary oil shales and identify potentially rich deposits. This was dull core logging, however there were other benefits: she was one of several geologists who got to haul the brand new Airstream trailers out into the field. In the fall and winter of 1976-77 she lived in one from August through the winter to February. They worked shifts of 12 hours on, 12 hours off, they logged the drill core on site, packed boxes of drill core around, and had cookouts with the drill crews. John Wesley Powell never knew what he had missed.

Denver Water, 1979-1982

After eight years with the USGS, she accepted a two-year, temporary position with Denver Water. Denver Water has a vast and elaborate system of dams, tunnels, conduits, pumping stations, and treatment plants that serve the water requirements of the Denver area. Their projects are complex and expensive, and they are critical to the continuous supply of water to the region.

Susan's first job with Denver Water was underground geologic mapping of the Foothills Project, which was under construction at the time. Her Nevada Test Site tunnel mapping made her extremely qualified for this position. The Foothills Project consists of the Strontia Dam, the Foothills Tunnel, which is 3.1 miles long, and the Foothills Water Treatment Plant. This project supplies just over 45 percent of the water that is delivered to Denver. Susan spent much of this time mapping the as-built geology of the tunnel, of which the western two-thirds was drill and blast construction in Precambrian-aged granitic gneisses. On the eastern side, she followed along behind the 13.3-foot diameter tunnel boring machine as it progressed through 5,000 feet of sedimentary units.

Thus far in her career, the two large projects on which Susan spent the most of her time shared two things in common: both the USGS at the Nevada Test Site and Denver Water were committed to developing cutting edge technology, and they introduced many innovations and advances in engineering geology and seismic-velocity assessments.

Secondly, both projects were hotly controversial in the public's perception. Nuclear weapons testing and dam construction were both topics of major political, economic, and environmental debates; and these big projects were subject to intense public and regulatory scrutiny and the topic of many public meetings and hearings. Denver Water had originally started the preliminary investigation and design for the Foothills Project in 1974, yet construction was not initiated until 1979 because of the controversy and intense public scrutiny. The Foothills Project was finally brought on line in 1983, and when construction was completed she was hired as a permanent employee.

Susan also participated in the regular inspection of Denver Water's existing tunnels, several of which had been in use for many decades. The three most prominent are the Moffat Tunnel, which is 6.2 miles long; the 23.3-mile long Roberts Tunnel which at the time of construction was the world's longest major underground water tunnel; and the Foothills Tunnel, at 3.1 miles long. The information gleaned during the site inspections is used to plan the maintenance work necessary to maintain their infrastructure.

1982 – 2007

After completion of the Foothills Project, Denver Water focused its efforts on Two Forks Dam. The controversy over the Foothills Project had taught Denver Water some of the major issues that would arise from the public, and they convened the Geologic and Seismotectonic Advisory Committee to provide sound technical documentation. This committee consisted of geologic, seismic, and engineering experts from both government and private industry, and Susan was appointed to join them. Their charge was to develop a state-of-the-art understanding of the Front Range faults, determine the recency of fault movement, and present a realistic assessment of the seismic potential of the area. They drilled holes, excavated trenches, and performed surface mapping; and they installed a comprehensive regional microseismic monitoring network. Their final report consisted of 15 volumes.

During the latter half of this time period, Susan was the only permanent geologist directly employed by Denver Water (along with their 50-60 engineers), although there were temporary hires from time to time. As such, she was the sole ambassador to Denver Water management and their engineering team for the complicated site geology and its effects on the project's design and construction.

Having a solid background in field geology is a key part of her success. Understanding what works, and what doesn't in the field ("Oh? The drill rig can't get in there?") gives an unequalled advantage in understanding how the projects will function, one that the design engineers in their neat offices, with clean, new-looking hard hats, will seldom have. Like most geologists, the good days are the days spent in the field, the lesser days are spent trying to explain the field to the ones who haven't been there and "just don't get it."

As proposed, the Two Forks project was huge, consisting of a 615-foot high dam and reservoir on the South Platte River. This project was undertaken after the 1970's environmental legislation was passed; and times had changed. The more stringent

regulatory environment dramatically changed their accepted practices, and both system-wide, and site-specific Environmental Impact Statements (EIS) were now required. Denver Water became the test case for the nation's large water utilities, and the public scrutiny intensified.

Susan was a member of the interdisciplinary team that included seismologists, geophysicists, engineers, and environmental engineers assigned to complete the site-specific EIS. Environmental issues included a small, endangered butterfly known as the Pawnee mountain skipper; endangered fish in a gold-medal trout stream; seismicity; oil prospecting, and radioactivity. Among her duties was the interpretation of aerial photographs along the Front Range and delineation of the "linear geomorphic features" (faults!).

After almost ten years, a task force of hundreds of people, and about $37 million, both EIS's were completed. To Susan, this was a fascinating time to be working in that industry. In 1989, the EPA, citing the Clean Water Act, vetoed the construction permit that was under consideration by the Army Corps of Engineers and brought the project to an end. The decision was appealed, but the original ruling was upheld in 1996.

More personal history—two heart transplants

Amazingly, she has survived two heart transplants, one in 2002 and another in 2004. To her, the heart transplants are a small part of her story, and while they were certainly traumatic they do not define her. Geology, her family and friends, travel, and her long history of service to AEG: these are her passions. Susan's strength, determination and her persistently positive attitude helped her survive a procedure that few people have—these characteristics have helped her throughout her career, and they helped her in the hospital as well. Again, she didn't give up; she didn't get intimidated; she persevered; and she expected the best. When many people would have given up, retired, and put up their feet, Susan has chosen to remain active and return to work. She is back at work because she loves it, and has just launched her own company, Steele and Associates, LLC. After all this, she is still "showing up and looking sharp."

And leadership within the profession

Susan Steele Weir exemplifies professionalism; there were no women to follow, so she chose to lead. She has always been on the lookout for new challenges, and has been active in AEG for over 30 years. In addition to her full workload, she has gladly given her of her time, energy, and personal resources to increase the influence and presence of engineering geology; she has taken every opportunity to serve her profession. She is tireless: she has organized meetings, written papers, given talks, and led field trips for AEG, AWG, and any other geologic organization that asks.

She has risen through the ranks of AEG from being an officer in the Rocky Mountain Section to Association President in 1996. In 1999, she received AEG's Floyd T. Johnston Service Award for her outstanding and faithful service, and she has since worked on numerous committees for both AEG and the AEG Foundation. She is currently Chair of the national Mentoring Award Committee.

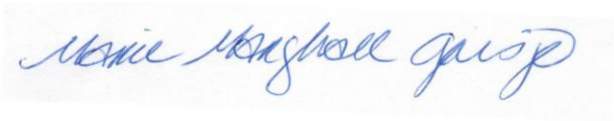
As President, she led the Association through a time of major financial difficulties. During this time she played a key role, and perhaps a civilizing force, in establishing a new direction for AEG. Her energetic and positive attitude and innovative thinking significantly contributed to AEG's recovery, and she encouraged the Association to look ahead and prepare for the 21st Century. That century is here now and AEG has just celebrated its 50th anniversary. Much has changed with the Association; the one constant has been the small percentage of women who are actively involved, even today.

Mentoring

Mentoring is not new to Susan. She has made it a point to actively practice mentoring throughout her career, recognizing the help her original mentor gave to her. She understands what it is like to be a young geologist standing at the door of a room full of experienced geologists, wondering who everyone was, what everyone does, and how can they possibly fit in? In AEG's Rocky Mountain Section, Susan has served as a mentor to many young geologists, consistently seeking them out, introducing herself, and making all feel welcome at meetings and functions.

She has been a particularly positive influence for young women, and has worked to expand the opportunities in engineering geology for them. She has demonstrated how strength, perseverance, and talent can lead to success in the male-dominated field of engineering geology, without compromising one's principles or becoming jaded by the challenges of being a female geologist. She has taken them to lunch, encouraged them, nominated them for committee work, and let them know that they are not out there alone. Many of these women are active in AWG and AEG today, and have advanced to leadership positions within the organizations. All of them recognize her accomplishments and appreciate her mentoring, as do I.

According to Norman Vincent Peale, "there is a real magic in enthusiasm. It spells the difference between mediocrity and accomplishment." Susan exemplifies this passage. Her enthusiasm and passion for engineering geology and the field shine out of her, and her network of co-workers, friends, and geology acquaintances is vast. She is glad to share her story, to give the message that "you can be kind of a regular person and still do these things." She is far from regular, and her encouragement of other regular people has been transforming.



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