Drilling by the Book

An Interview with Geologist, 'The Art of Water Wells' Author

By Brock Yordy

As another drilling season comes to an end and we travel to the Groundwater Week event Dec. 3-5 in Las Vegas, take time to consider how you want to improve in 2020.

I like to reflect on the projects that my team executed superbly and plan to reproduce that success the following year. I also find time to deconstruct the projects that kicked my butt and research solutions to prevent failure in the future. I start my research with the industry standard book "Groundwater & Wells" and move on to the "Hydrogeology Field Manual." I follow these with the "Australian Drilling Manual," then the "Drilling Fluids Processing Handbook" and Halliburton's Red Book. If I can't find what I require in book form, I dive deep into industry articles and columns searching for new concepts and sound advice. This year I added "The Art of Water Wells" by Marvin Glotfelty, RG, as a go-to resource.

Glotfelty graduated from Northern Arizona University and has worked in the groundwater industry for 35 years. "The Art of Water Wells" is based on his work experience and the knowledge he has shared with other hydrogeologists, water well drillers and associated groundwater professionals, such as mud engineers, geophysical loggers and well material representatives. "The Art of Water Wells" is a perfect resource and knowledge bridge between academic and practical field experience.

We wanted to share some of Glotfelty's knowledge with *National Driller* readers, so we reached out to him for an interview. Our talk here is edited for space and clarity.

Q. How's your day going?

A. Pretty good. I am up in Flagstaff today, giving a guest lecture at Northern Arizona University, which is always fun.

Q. Did the drilling industry choose you or did you choose the industry?

A. You know, I fell into the industry, and I have never been able to climb out, and I am glad. I started as a mud engineer with Magabar in Farmington, New Mexico.

Q. What drove you to write the book "The Art of Water Wells"?

A. I had a student in one of my guest lectures a few years ago at NAU who asked: "How much of this information did you learn when you went to school?" I said, "None of it. I learned every bit of this information in the dog house and on drilling rigs watching the things going on."

Geologist and author Marvin Glotfelty, in the book "The Art of Water Wells," emphasized communication among all stakeholders to ensure the successful design, installation and lifecycle of a well. *Source: Marvin Glotfelty photos*

The goal [for the book] was not to duplicate information already available, except for times that I needed to put things into context.

Q. Tell me about your writing process. Did you enjoy writing the book?

A. I really enjoyed writing that book. It was kind of something that I had been thinking about writing, but [it] was really me just memorializing what I had been teaching on and speaking about for decades. It was a lot of work but I really enjoyed every bit of it.

Q. The diagrams in "The Art of Water Wells" are excellent. How did you find them?

A. Except for the photographs, all of the diagrams I drew — but I drew them in PowerPoint. However, my wife is a graphic designer, and she was able to make them look amazing and more useful to the reader.

Glotfelty says orientations for trainees used to include directions to the rig and a command to get to work. Now, he takes trainees out, and ensures they understand each task and how to safely get the job done

Q. You start the book with a discussion of communication challenges. What is the biggest challenge?

A. You know there a lot of different people on a project and you have to deal with multiple personality types. I tell hydrogeologists — or, really, well drillers and everybody I lecture to — that you can be the most brilliant individual in your field as a technician or scientist, but if you can't communicate that knowledge to the next person it's worthless. If that person has a big ego, you need to be able to identify with it and roll with it. In yesterday's lecture I got into a discussion about communication, and I explained to the students that if an individual on the site is large and in charge on the jobsite, you never start a conversation by saying, "You have to understand ..." because they might think, "I don't have to understand. I am in charge here." Now, if you start the same conversation with, "As you know ..." they might have a better ability to hear it and think, "Oh yeah, I do know that and hear the knowledge you are communicating." I find that egos can control people's ability to listen to what is required.

Q. Talk about how you created the "involved party" section at the beginning of the book. I find that, all too often, we just think about the customer and regulator as key customers, when there can be multiple levels of customers. And, a second part to that question: How many different parties have you been over the years?

A. The section came from many experiences. I have only played a few roles. I am a licensed driller and I have advocated for drillers. I am a licensed driller without a rig, though I have had a license since 1990. My practice is hydrogeology, as a consultant. I have worked with drillers enough that I can see the world through their eyes. I interacted with the clients and represented them enough and acted as an expert witness, so I can see their point of view. I love to hear the perspective from clients, drillers, regulators and water system operators, and understand where they are coming from.

Q. What is one complication of working with multiple levels of customers?

A. How different we communicate about the same thing, such as units of water flow. You have cubic feet per second, acre-feet per year, million gallons per day, gallons per minute, and all these different flow rates when it is just a volume of water moving from one point to the next. When this happens, how do we expect to communicate with each other? I see it as a core of misunderstanding. That misunderstanding becomes a thorn in my side and it is a topic that we need to talk about.

Q. As an industry, how do we start that discussion?

A. That goes directly to the title of the book: It's an art to start this discussion. It's a dance you have to understand: a perception of the background, the knowledge base and the communicational nature of the person you are trying to convey information to. For example, if I am trying to talk to an administrator at a water company and explain to them why the well isn't producing what was expected, often that individual will have unrealistic, preconceived notions. I will need to explain the science, the drilling trade to him, the limits to the project, the economics of the project, the schedule to him — and explain all of this to them in a way that is understandable without their personality jumping in the way and complicating things. All of that discussion is a dance to navigate the maze that is that conversation.

Q. Walk me through your preferred water well design process.

A. The steps I talk about in the book are for a large municipal well that is expected [to yield] 1,000 to 2,000 gallons a minute, and if you applied that to a household well it would be much different. I have a diagram that discusses the design process from the outside in and the inside out. It's on page 26, figure 2.2. That is where we should start. It discusses the type of well and all the things we need to consider before we jump right into it. It would be crazy to build a building before we knew if it was a house or a barn. However, all too often, a well design is taken from the last project. They white out the name of the previous location and start from there. It is the wrong way to design. We need to start with the well purpose and work from the inside out. Start with the pump, then casing and screen, with the length of screen based on what we know about the aquifer, and all working out to the exterior borehole.

Q. Once you have the design, how do you work with the driller?

A. I start with drilling a slim hole ... or a pilot hole and test it. Then we have site-specific data that I can [use to] write a technical spec to work with the driller, instead of against him. That works better than redesigning the well on the fly. The best design comes from collecting data to build a perfect spec.

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Q. What is the biggest challenge you see in the well design process?

A. The biggest challenge is how to accommodate real-world logistics and a timeline. Filter pack, for example. Conventional knowledge is to collect cuttings, do a sieve analysis, determine the grain size of filter pack, and then order the filter pack. That way, you have the right grain size relative to the sediment you have drilled. In the real world the filter pack can take up to six to eight weeks, and we can't delay a driller that long. Often we have to find different solutions, other than ordering the best analysis. Beyond that, it comes down to how to discharge water on site, followed by subsurface utilities and even sound abatement. All of these expectations require proper design into the technical spec. We have to think through every step, logistics and moment through time. The final challenge is considering the lifecycle of the well, including where the water table might change and other conditions can change that will affect the performance of the well. Many challenges to consider.

Q. After the design and as we head into the drilling process, where do problems arise?

A. The top issue is communication. Often, we have a clause for loss circulation or a slow-footage clause to change to time versus footage.

"The Art of the Water Well" deals more with higher capacity wells, like those for large-scale irrigation or municipal use. But some of the advice, particularly about communication, can smooth out work at any jobsite. *Source: Sam's Well Drilling / File Photo*

However, the driller might say to the engineer on site, "We might be in a loss zone," or "We are expecting slow footage," without actually saying, "We need document the switch to slow footage." Therefore, they continue to drill believing that the right information has been communicated while believing that they are reading our minds. We need a higher level of communication between engineers and driller. At our firm, we ask the drillers to text their dailies to us every day where we can confirm a change in communication. I have had to introduce better communication as a form as project management to fix miscommunication between driller and engineer. In reality, that is the role of the project manager: to facilitate all the moving parts.

Q. What do you like to tell a young hydrogeologist entering the industry?

A. Read the book. [Laughs.] I have many young hydrogeologists that I work with that spend time in my office talking about the industry. The first thing I want to tell them is to believe the adage "there is never a dumb question." When they ask that question, it is useful, and they can share that information back at the office. When they are afraid to ask a question, then I believe they knew the answer and the communication ends.

Q. What do you look for in new hires at your firm?

A. We look for a good work ethic and professional presence, along with the right skills. They have a degree in geology or environmental science, so they have a background. Next comes the learning curve — that can be slow, or fast learn and [they] become very successful in their career. The difference comes from communication, the willingness to understand and the final is bliss. If they truly love it, they will be successful.

Q. What is the first job or task of a new hire?

A. We have an internal training program that teaches them about each task. When I started, our orientation was the directions to the rig. Go and do it. However, today we take them out and ensure they understand each task and how to do it, which is a better and safer way to do it. The real task is when they get out to do that task the first time alone. They don't realize that everyone is watching and if they weren't paying attention, it will show. When I get field forms and workbooks back, I expect to see quality information. I don't want to see blanks in the form. I want an N/A or line so that they have the attention to detail. Something I would be proud to see is an appendix.

Q. Do you believe our field notes and project logs have regressed in the past two decades?

A. Yes, and the reason is the handheld technology that we over-rely on. We need to raise our eyes up away from the phone. We need to be listening when we are instructed, but they are not. As a geologist, what really bothers me with technology is people's inability to read a physical map. I expect people to be able to read maps.

Q. Final question. You write about the economics of wells and lifecycles. What would you say to drill companies as rig prices and material prices increase and well-costing stays flat?

A. The problem starts with, how much does a well cost today? When a well is installed, it's with materials that are selected into it, and the design of the well is all designed around the lifecycle. Then we consider the value of that well to the owner. Let's say its drinking water well for a municipality. If that's the case, then how long will it last versus a well for dust suppression water for a short construction project? Each well has its use and amount of time it is required. That municipal well, if maintained, could be there 100 years. You need to consider not just the cost of day one when it was installed, but [the cost] over the life of the well. In a real-world case for the city of Phoenix, the more expensive well correctly designed would save the city $3 million over the life of the well 75 years out. That construction realization [led to] switching from mild steel to stainless steel, because around here the water is aggressive enough for scaling and corrosion on mild steel. Having a low-carbon steel well is a lower lifecycle versus stainless steel well. If you look at all the way to the end of the lifecycle, it is the right way to build a well. We don't eat with low carbon forks and spoons. ND

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