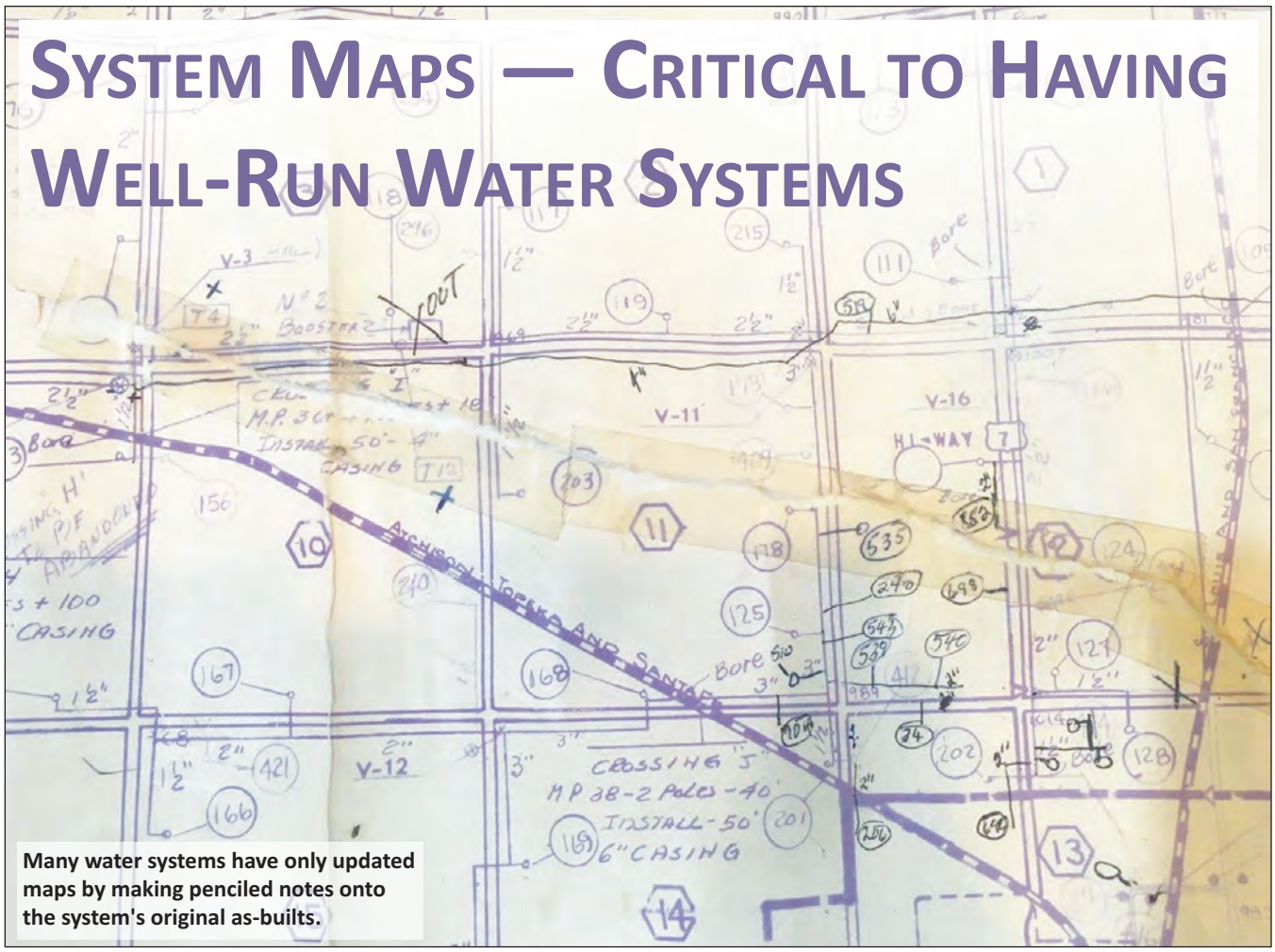
By Elizabeth Dietzmann, JD

System Maps — Critical to Having Well-Run Water Systems



Many water systems have only updated maps by making penciled notes onto the system's original as-builts.

Capacity development, asset management, sustainable systems. These lofty terms (objectives) pepper every small utility guidebook and board reference manual from *The Water Board Bible* (by Kansas Rural Water Association, first published in 1993) to *Rural and Small Systems Guidebook to Sustainable Utility Management* (USEPA, 2016) to *The Big Guide for Small Systems* (RCAP, 2011) and countless others. What these objectives really boil down to is long-term planning. Just the lead time alone required to mesh with funding cycles for USDA or CGBG, typical funding sources, forces small systems to plan well in advance of an application for funds for even relatively small projects. I've never met a board member or system operator who didn't agree that their system needed a 5-year or 10-year long-term plan in order to analyze and predict infrastructure maintenance and system improvements/expansion. So most of us would agree that in order to achieve long-term goals, needed long-term plans are essential. It sounds obvious. But the key to this is that if boards, councils and operators don't know what or even where the system's infrastructure is, it is impossible to develop a plan to improve, manage or sustain it. So the very first step on that road to a long-term plan is a system map.

Without a system map, there is no way to do long-term planning, and without long-term planning, there is no way to achieve capacity development, asset management or a sustainable system. Even if long-term planning wasn't the goal, having an up-to-date map of the entire system is essential. Unfortunately, if they have a map at all, many small systems only have a yellowed and faded distribution line map up on the wall or rolled up in an office, that dates back to the original formation of the system, with hand-written notations added as line extensions were made. And maybe some as-builts from various extensions made through the years. One rural water district I worked with had taped all the various construction drawings

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together, all in different scales, just so that there was some sense of what areas the system served. And of course there were plenty of handwritten notes just for good measure. But too many small systems still rely on that one operator or board member or backhoe operator who remembers where every line, connection and main is located.

KRWA has made an incredible start on mapping the boundaries for most public water supply systems (PWS) in Kansas (525 municipalities, 289 rural water districts and 13 public wholesale water supply districts), as well as primary infrastructure data for rural water districts (RWDs) and public wholesale water supply districts (PWWSDs). For more information see http://krwa.net/ONLINE-RESOURCES/RWD-Maps. But boundary information cannot take the place of a detailed system map which lists connections as well as total infrastructure. Preparation of a map like this could require the system to hire an engineer and this means there should be a contract. Engineering contracts themselves are a thorny subject. (See Engineering Contracts 101 – a crash course in negotiating and reading contracts. *The Kansas Lifeline*, March 2009). Most small systems either end up following the USDA engineering services template which has some inherent problems involving ownership of the as-built drawings and construction plans, or they allow the engineer to provide a form contract (probably an American Institute of Architects (AIA) or Engineers Joint Contract Documents Committee (EJCDC) template), which will of course favor the engineer. The goal of both these groups it to protect engineers and make sure that they own the intellectual property rights to whatever they design.. The easy thing to recommend is that cities and RWDs contact their attorney before negotiating ANY contract. But in reality, many small systems do not have a regular attorney and even if they do that attorney might not have much experience in dealing with engineering contracts.

So let's walk though some steps that will help hire an engineer to map the system AND make sure that the city or RWD ends up with a map that is owned and can be modified in the future.

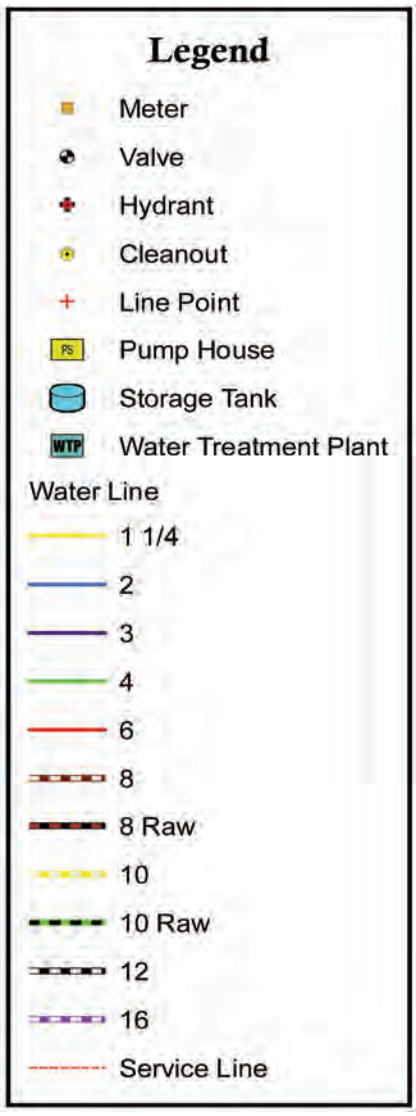
System maps critical in rulings on territorial disputes

I cannot overstate how crucial it is to have an actual system map that shows every connection and distribution line, but that also shows water district and city boundaries, as well as sub-district boundaries. And this map must be updated in order to track system expansions as well as city annexations. The lack of a system map became evident in a number of territorial disputes where in spite of accusations over encroachments, neither side could actually produce a system map that showed a judge or each other where actual lines ran or where the city and small system boundaries overlapped. In one lawsuit, the boundaries between the city and the system, even down to the individual connections were so muddled in some of the overlapping areas that the engineers were unable to conclusively demonstrate where the boundaries overlapped or when the connections had been made and service provided. These are two of the key elements of a territorial encroachment claim! The local judge in that case was so confused and frustrated that he ended up just picking a date and ordering the parties to keep whatever customers they had on that date and noted that both sides had historically failed to notice when the other side had added connections in their territory. Future connections were then allocated on an alternate basis between the city and the system. This did nothing to clear up the confusion or resolve the legal issues.

Even when there is no territorial dispute, it is essential to have a map, just so that you can track sub-districts and the residences of board members. One district I know of spent the time and effort to map their entire system and to indicate all the sub-districts, only to discover that three of their board members, including the chairman, did not actually live in the area from which they had been elected. Another district outside Kansas, with legislative requirements for sub-districts, discovered after mapping that none of its board members had filed from the correct sub-district and thus were not properly elected. Some small systems have split the cost of mapping with a neighboring city just so that both sides could have a current map and work together to identify opportunities for shared services that became readily apparent when they could actually see where the lines ran. Above all else, a map is needed for both daily use (where to dig or where to send a repair crew) and for long-term planning. How can anyone possibly brainstorm about eliminating dead-end water mains or identify a possible site for a new water storage tank or get a sense of where the growth is occurring if there is no way to see the entire district? I repeat, without a comprehensive map, there is no way to create a long-term plan and without a long-term plan, there is no way to build capacity development, asset management, or a sustainable system.

The key issue to remember is that the engineer is NOT being asked to design anything. A system map is not the same thing as a set of engineering plans. It isn't being submitted for regulatory approval and technically doesn't even require a PE seal on it. It is a map which simply reflects what infrastructure is in the ground now. It does not require any design work. This is a very important distinction, because an engineer will probably want to use the same type of contract he or she usually uses for engineering design work and that type of contract is specifically designed to allow the engineer to retain ownership of the plans in order to secure future revenue. And the courts have held that if a contract is silent on the

This graphic shows the typical legend from a GPS mapping project that was prepared by Kansas Rural Water Association. KRWA has mapped hundreds of water, wastewater and gas systems for cities and RWDs.



issue of who owns the plans, then the engineer owns the plans. The technical term is "copyright", but the bottom line is that AIA and EJCDC contracts both reflect the idea that the engineer owns the plans. This is important because the owner of a copyright in engineering plans enjoys three basic rights: 1) the right to reproduce the plans; 2) the right to prepare derivative works based on the plans; and, 3) the right to build the structure depicted in the plans. So if the engineer writes the contract, that means that he treats the map like a set of plans (which it is NOT) and will give the client (you) however many copies of the map you pay for, but you will not be able to obtain electronic, modifiable versions of the map for your own future use.

Who owns the maps?

This whole topic of who owns the engineering plans is a hot one right now, with more and more clients demanding the rights to the plans. But I assure you, long before now engineers have used ownership of maps as a way to guarantee future business. On more than one occasion, I have dealt with engineers who had prepared a system map and years later refused to give the system an electronic version of the map so that they could update it. This caused the system to either give in and agree to use the original engineer to update the map, or pay for duplicate work. The consolation is that if they paid for duplicate work, they could ensure that going forward the map belonged to them and hopefully build a relationship with a better engineer.

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So regardless of what contract template is used, it must state that the system owns the map and that the engineer must provided a printed map AND a modifiable electronic version of the map in an agreed upon format. The engineer should also assist in identifying what software might be needed in order to utilize the electronic version of the map. This is because the city or RWD might choose to have someone else like a surveyor or even a talented employee assist you with future updates.

Most small systems will probably not prepare a request for qualifications (RFQ) and a request for proposal (RFP) the way they should for actual engineering services, but a written scope of work should be prepared for negotiations about price with the engineer. In this age of GOOGLE Earth, GIS, AutoCAD and electronic overlays, it is much simpler to prepare a system map than it was in the past. First, figure out what you want on the map. Infrastructure seems obvious: the general location of the pipelines in the

distribution system; the connections, the source water wells and surface water intakes; facilities (storage tanks, pump stations and surface water treatment plants). But what about system boundaries, municipal boundaries and other overlays? And is the map to be color coded so that each new expansion is marked by date? This can include data on repairs, leaks, water pressure. Think of all the useful information that anyone would want on the map and spec that out. Kind of like selecting the options on a new truck. With the technology that is available at our fingertips, this isn't just a map, it can serve as an analysis of the system on many levels by capturing data from the field and displaying it visually.

After all the options are selected, do some research on what resources the system may already have for the preparation of the map. What existing maps are available? What as-builts for system extensions could be incorporated? What plans provided by developers might be included? Does the county assessor have GIS maps of the county? Are they free to the public? The more information that you can identify, the more that you can negotiate price effectively. Sadly, I have seen engineers charge prices that included information that they obtained for free. But if you don't know enough about what resources are available, you won't be able to negotiate a fair price.

And while you are gathering the resources, consider this shocking idea. What if you didn't hire an engineer at all? What if you sent an employee for GIS mapping training and bought the software to do your own mapping? (Check out "How to Map Your Water Supply using GPS and Google Earth" at http://smallwatersupply.org/Blog/tabid/38/ctl/ArticleView/mid/390/articleId/110/How-to-Map-your-Water-Supply-using-GPS-and-Google-Earth.aspx.) What if you collaborated with a local college or tech school (Google "University mapping projects" to see just a few of the places that use projects like this to train students) to make your map? What if you reached out to groups like KRWA technical assistance and participated in their GIS mapping projects? The reality is that in this age of electronic information a utility does not need to hire an engineer to prepare a system map. You may decide to, and if you do, follow the steps above. But if you are willing to put the time and effort into exploring the alternative mapping capabilities that exist, cities and RWDs can develop a modifiable system map that is so much more than a map on the wall. A printed map can be developed but also an electronic data system that will guide the city or RWD on the path to capacity development, asset management, and a sustainable system.

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