SPECIAL DISTRICT ASSOCIATION OF COLORADO

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Can You Afford to Let Your Drinking Water Supply Become Contaminated?

Guest article by Gary L. Vanderslice, P.G., Lytle Water Solutions, LLC

As a consumer of water, would you rather be drinking high-quality water, or drinking water that contains other people's pharmaceuticals and causes minnows to have involuntary sex changes? I'll bet I can guess your answer. Or how about if your only well field no longer provides safe water without costly treatment—do you wish that it had not become contaminated? These are not pleasant things to think about.

While infrequent, people can become gravely ill or die when they drink contaminated water. For example, just Google the 2000 Walkerton, Ontario *e. coli* contaminated well incident, which resulted in bloody diarrhea affecting 5,000 people and caused multiple deaths. Or the 1993 Milwaukee surface water *cryptosporidium* outbreak that sickened approximately 400,000 people and killed approximately 100 people. Superfund sites with chemical impacts to drinking water will also yield numerous examples.

Failure to preserve water quality has costs in money, health, and public confidence. When water quantity declines, as it has in many areas of Colorado, pollutants become concentrated. It's likely that most of our raw water sources in Colorado are of high quality, but there is the potential that our future raw water will be of poorer quality unless preservation measures are implemented. After your water quality has been impacted is not the best time to take action. That is like waiting until you're thirsty to start drilling your well.

Taking protection measures sooner, rather than later, should be the goal. Did you know that in Colorado we have the means to take actions to provide watershed protection for our valuable surface water resources? Section 31-15-707(1)(b) of the Colorado Revised Statutes allows community surface water systems to place some restrictions on land uses within five miles upstream of their intake(s).

Spend proactively to save on reactive spending

Cleaning up contaminated water is costly. Ground water remediation costs may range from $100K for very simple cleanups to more than $1 billion for metropolitan-scale impacts to aquifers. The costs to mitigate surface water impairments are difficult to quantify, as the costs are spread among wastewater treatment plants, industrial dischargers, and other pollutant loading sources. It is generally recognized that the costs to prevent contamination are only a small fraction of reaction measures.

Declines in raw water quality can require additional treatment to ensure safe drinking water. Water treatment plant engineers and operators do a great job of removing regulated contaminants from the water we drink. But it is important to maintain raw source water quality as high as possible to avoid or delay expensive treatment plant upgrades. If your raw water supply becomes contaminated, a search for an alternate water source is often not realistic, because even if the necessary water rights could be obtained, the costs of constructing infrastructure (pipelines, pumps, etc.) may not be feasible.

And as one might expect, lawsuits are not uncommon when degraded water quality harms people, necessitates seeking alternative water supplies, or requires increased water treatment costing more than the water supply customers can reasonably afford.

Poor water quality results from causes such as inappropriate land use planning, animal wastes, agricultural runoff, leaking storage tanks/containers/ pipelines, chemical spills, poor business operations, improper design or operation of septic systems, road and runway de-icers, naturally-occurring compounds, natural disasters, and (Heaven forbid) intentional poisoning.

Causes of contamination

From my experience in using databases and GIS to assess public water systems throughout Colorado and Oklahoma, it becomes quite clear that susceptibility of a drinking water source to contamination is greatest when two factors coincide, (a) vulnerable physical setting and (b) high-risk contaminant threats.

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As land use changes from raw land to agricultural or urban land, chemical use increases. But not all commercial/ industrial/agricultural development is a concern. A predictive risk-based assessment can be conducted to evaluate risk magnitude by examining the type of operations, type of contaminants (acute vs. chronic), volumes used/stored, likelihood of release, and potential to migrate to your drinking water source at a concentration of concern.

Vulnerability of ground water settings

Colorado definitely has widely varying geologic conditions and corresponding ground water settings that are not equally vulnerable. Shallow ground water (less than 100 feet below land surface) requires special consideration, particularly in rural areas where it may be used for domestic supply. The proximity to land surface and the level of human activity increase the susceptibility of shallow aquifers to contamination.

When wells pump, they may draw ground water down from the shallower/ younger water zone to mix with deeper/ older water. If shallow ground water becomes contaminated and mixes with the deep water, even deep wells can be impacted. Because ground water migrates at widely-varying velocities and pumping wells alter the dynamics of the natural course of ground water flow, understanding these dynamics is critically important to better comprehend the risks and time frames for potential contaminants to reach your water supply.

Extensive protection strategies are, in general, less critical for most deep aquifers when compared to shallow ground water in similar land-use settings. However, ground water at all depths is part of an integrated system and ground water at whatever depth is susceptible to contamination, so no one is exempt from concern.

Ground water quality responds slowly to changes in chemical use or adoption of land-management practices, typically lagging by many years. Once impacted, it can take several decades, or longer, to clean up ground water, if it can be done at all. Therefore, practical efforts to preserve ground water quality should be undertaken for potable aquifers that realistically yield enough water to be used now, or in the future, as drinking water sources. This can be done through ground water management plans.

Impacts to surface water are more immediate than to ground water

It is much easier to envision the upstream source area for surface water than it is for ground water. However, there are times when artificial conveyances such as tunnels, pipelines, and ditches, complicate matters by importing water to your watershed that would not otherwise be present. Therefore, mapping your source area to identify imported water conveyances is critical to understanding your source area.

Most streams in Colorado are small and thus more vulnerable to rapid, intense, contamination than are larger rivers. In contrast, larger rivers generally have more moderate levels of contaminants, but for longer durations. Knowledge of these differences can help target the appropriate timing and degree of watershed management and protection for different types of streams.

The susceptibility to contamination of streams can differ seasonally, and increased monitoring and management of water supplies may be needed during high-flow conditions and periods of agricultural chemical applications. To understand the surface water flow/quality relationship, a hydrologic assessment of stream flow gages and corresponding water quality is needed. Overlooking impacts from ground water discharges to surface water may prevent a full understanding of relationship between surface water and ground water, and may limit the effectiveness in stream restoration and protection efforts.

Outlook for the future

Population analysts see a more crowded Colorado in the future, putting additional strain on our limited water resources. In Colorado's Front Range, we are withdrawing ground water from older, deeper aquifers much faster than they recharge, which is not sustainable. In locations dependent on deep aquifers that exhibit declining ground water levels, in the future it may not be possible to irrigate or pump out the minimum amount of water for daily needs. Furthermore, as water levels in aquifers decline, there is less dilution of pollutants resulting in higher concentrations of contaminants in our waters. Therefore, planning and implementation of source water protection measures are critical to reduce the negative impacts on water quality and quantity.

There are many unknowns which remain due to a lack of data on contaminant trends and migration. But, common sense and caution should be used to prevent future potential impacts, even when impacts have not yet been identified. It takes years to measure long-term trends in water quality changes, so it behooves you to understand what monitoring is being done, or needs to be done, in your area to collect these data.

So whose responsibility is it to protect drinking water sources?

In Colorado, public water systems are not required to develop source water protection programs—it is strictly voluntary. However, sustainability practices are now in vogue and backing for protection planning has gained momentum as people recognize the economic value and health benefits of taking proactive measures, rather than waiting until a problem exists and then taking costly reactive measures.

While public water system involvement is critical, other stakeholders have large roles in source water protection and may take the lead in, or help to fund, protection efforts. Borrowing the words of many wise people throughout history: If not us, whom? If not here, where? If not now, when?

Taking protection measures

When you are ready to take action, resources to help you plan protection strategies are available from the Colorado Department of Public Health and Environment's source water assessment and protection program and from the Colorado Rural Water Association. But in general, the protection process typically involves:

1. Identifying stakeholders to help implement protection measures. Public water systems will need the help of many other stakeholders to implement an effective protection approach. These commonly include parties such as other nearby public water systems, city and county planners, environmental health departments, town councils, county commissioners, public land managers, agricultural extension offices, road maintenance departments, farmers and ranchers, and local citizens.

2. Identifying all water withdrawal points (both wells and surface water) and mapping their anticipated source water areas.

3. Assessing times of travel for water to reach your point(s) of withdrawal. For ground water, the travel time frame of interest is typically two years for biological contaminants to 20+/- years for chemical impacts. For surface water, the time frame of interest is typically measured in hours and days.

4. Evaluating physical settings to locate areas most vulnerable to contaminant impacts, such as wellheads, aquifer-recharge areas, alluvial deposits adjacent to streams, and streams with small watersheds.

5. Inventorying known and potential contaminant sources and land uses, as well as evaluating likely future uses.

6. Identifying your key contaminant concerns and possible measures to prevent impacts. To gain momentum in protection measures, you should first focus on a few issues that the stakeholders agree on. Then, for other issues that are less straightforward, a quantitative risk evaluation can aid in decision-making.

7. Selecting protection tools such as ordinances to restrict high-risk land uses and operations in the most vulnerable physical settings, and providing training and education on best management practices.

8. Developing a written protection plan that identifies specific goals and a schedule for implementation of protection efforts and measuring progress. If the plan sits on the shelf, it will not do much good. So put it into use.

9. Communicating source water concerns and protection measures to others. Training emergency responders on critical source water protection areas can result in rapid cleanup measures to minimize contaminant migration from high-risk spills in vulnerable areas. Educating school children on measures where residents can assist, such as removing pet waste, reducing fertilizer, and pesticide use. Training businesses on best management practices is another way to reduce impacts.

10. Instituting a monitoring program to evaluate water quality trends of raw source. Regional water monitoring and management approaches can cost-effectively benefit many parties.

11. Contacting environmental regulatory agencies to communicate your protection areas, and specifically request that they notify you when releases occur in your source area (currently, this is not always done). Additionally, you can request that they prioritize release cleanups in your highly-vulnerable physical settings. The squeaky wheel often gets the grease.

12. Updating your source assessment and protection strategies periodically as conditions change over time.