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A-1 Services uses simple and more complex methods to keep customers' septic systems from freezing in northern Minnesota winters.



It gets cold — very cold — in northern Minnesota, where Jim Bertucci operates A-1 Services Inc. The company is based in Eveleth, about 100 miles south of International Falls and 60 miles north of Duluth.

"You may have noted that International Falls is usually the coldest place in the lower 48," says Bertucci. "And it's not all that much warmer 40 to 100 miles south." The company services septic systems and installs new systems for customers in a 60- to 70-mile radius.

Naturally, a key challenge for the business is to install systems that resist freezing — and to protect existing systems against frost that can penetrate deep and freeze septic tanks and underground piping. Bertucci's methods range from applying ground cover in fall to provide insulation, to installing heaters that protect tanks or drainfields.

His innovations with cold-weather systems embody his general approach to the business, which is to learn continuously and apply new knowledge and new tools to help solve customers' problems.

Small yet innovative

A-1 Services was born in 1981, when Bertucci bought a vacuum truck from a plumber friend. "When I started this business, I knew nothing," he says matter-of-factly. By learning from his peers, Bertucci avoids common pitfalls and achieved success.

"Almost immediately, we got into repairs and installations when our pumping customers needed these additional services," Bertucci says. The company installs about five onsite systems in a typical year. While that number is small, it does not signal a diminished commitment to quality installations or innovative technology on the part of Bertucci and his four employees.

A-1 Services was the first company in the area to substitute EZflow synthetic media for traditional rock aggregate. "You don't have to be a big business to use the most advanced technologies or techniques," Bertucci says. He has installed Ecoflo and Bord na Mona peat systems and is working to become qualified to install Orenco advanced treatment systems.

Bertucci's son Jamie and employee Jamie Metcalf are full-time vacuum truck operators. Bryan Sampson helps with onsite installations. Sam Leatte delivers, services and maintains the company's fleet of more than 200 portable restrooms. In the office, Mary Johnson interacts with customers, orders supplies, and keeps the books.

Changing weather

Bertucci is a keen observer of weather and how systems perform in varying conditions. In two of the last four years, unseasonably warm weather during and just after snowfalls has changed some “truths” about how septic systems operate in cold climates.

“It’s not that the systems behave unexpectedly; it’s that we have seldom seen these conditions and have not yet fully developed strategies to offset their impacts,” Bertucci ÂÂÂsays. The winters remain quite cold, but short duration changes in temperature in winter have prevented establishment of the long-familiar November to March snow-covered landscape. “It is the loss of snow cover that has caused onsite wastewater system components to behave understandably different,” Bertucci believes.

“Snow is an insulator that protects all that lies below from drastically colder air temperatures. Snow keeps the ground from freezing more than a few inches below the soil surface.” Without a snow blanket, or when covered by an ice sheet, the soil freezes to greater depths.

In a typical snow-covered year, about 15 calls about frozen pipes were the norm. With bare ground, the frost effect generates as many as 60 calls a day. “Homeowners call seeking solutions for problems we seldom encountered in the past,” Bertucci says.

Freezing deeper

In the past, frost-related failures followed a pattern. The calls started in late January, when frozen effluent delivery lines topped the list. Company technicians jetted these with hot water, sometimes repeatedly, to get them flowing again.

With bare or ice-covered ground, Bertucci has seen building sewers and effluent delivery lines frozen solid. “The pipe was encased in frozen soil, which protected the pipe from bursting when the water in it froze and expanded,” Bertucci believes. Without the snow cover, the frost-related problems go deeper, and the solids and liquids in septic tanks and the liquid in pump tanks freeze too.

Although the arriving effluent brings a modest amount of heat energy, it is not enough to keep pipes and tanks ice-free. Liquid in tanks freezes from the top down. The first negative effects are seen at the inlet, where arriving material begins to accumulate on the ice surface, then freezes. If the baffle does not immediately clog, the liquid fills the space above the ice surface and begins to back into the building sewer. All too soon, the entire building sewer is filled and the homeowner has a backup.

As the liquid surface in a pump tank freezes, it disables the floats, which can no longer energize the pump. While the pump may remain surrounded with liquid, it never gets the call to turn on. The water level rises until the effluent delivery line from the upstream tank fills. Whether that pipe or the upstream tank freezes matters little, as the effect on the homeowner is the same.

Seeking solutions

This pattern of system behavior has sent Bertucci and colleagues to discussion tables and workshops. Bertucci believes he is seeing microclimate changes related to temperature and precipitation.

"I am not a believer in global warming except as a continuation of natural cycles that have been going on for thousands or millions of years," he says. "If we see a transition from short-lived, sporadic occurrences to long-term changes, the industry will have to make significant changes to system design, installation, management and operation." Whatever causes the changes, their effects must be understood and abated.

Bertucci sees two pressing questions: How to protect existing systems from freezing conditions that penetrate deeper into the ground, and how to design and install new systems to offset these same conditions. Meetings among installers, designers, and regulators are ongoing. The service providers have also looked beyond the onsite industry for insights and technologies to borrow and adapt.

Farmers, dealing with frozen drinking water supplies for animals, simply install a stock heater in the clean water supply tank. This submersible heater is installed before the freeze sets in. Bertucci has installed these in frozen septic tanks by chipping a hole in the ice and inserting the heater through the hole. "That's a lot of extra work that could have easily been avoided," he says.

He quickly discovered that the idea would work well, but because the constituents of sewage attack the heaters, they need to be redesigned for service in septic and pump tanks. These heaters bring maintenance and service opportunities, and they increase the owner's operating costs. Rated at 1,500 watts, they typically run continuously from late January through early April.

What about the pipes?

While immersion heaters keep tanks from freezing, they do not prevent freeze-ups in small-diameter delivery pipes, distribution laterals or manifolds, which may lie just a few inches below the soil surface. Therefore, Bertucci has retrofitted some systems with a device called the Septic Heater, developed in the cold climate of northwestern Minnesota, and sold by Septic Heater Co. of Gully, Minn.

Like the submersible heaters, this device operates around the clock. It heats air, which is distributed throughout the gravity piping network by a fan. A-1 Services has installed several such



heaters, and the owners report satisfactory results. (The heaters are not suitable for pressure distribution systems or in pump discharge lines.)

Some landowners have warded off freezing by applying several inches of straw placed on the ground above the absorption area. "A layer as much as 6 inches thick has been shown to have an effect similar to a snow cover," Bertucci observes. "If you don't have snow, straw is a good substitute. If the straw is applied too early in fall or left in place too long in the spring, the underlying grass may be harmed.

Solving problems

The words "triage" and "septic" system are not often used together, yet triage is the word Bertucci uses to describe his approach to call response, and then to whatever situation he finds in or on the ground.

He requires first-time customers to know with certainty where the treatment tank and absorption area are located. "When the ground is frozen for miles around, probing to find subsurface features is not an option," he says. "When the ground is frozen, we dig as little as possible." In some cold climates a backhoe is equipped with a frost hook to break through the concrete- hard frozen ground. After that, a traditional bucket can be used.

Every task — installation, pumping, or thawing a system — requires the right tools and equipment. A-1 Services owns a John Deere 310 loader backhoe and a New Holland LX665 skid-steer, both well suited to cross-over applications for installation and repair. These are supplemented by four Chevy pickups and a 2003 Ford E250 service van.

To tackle frozen systems, A-1 crews can select from four jetters, including a Harben DTD 4016, two General model 3000 units with hotbox attachments, and an Alkota 4,000-psi hot water jettter.

As changing conditions create new headaches for homeowners, Bertucci is most often found in or near a vacuum truck, a backhoe or at a meeting, working to address his customers' traditional and unconventional needs. It all starts with careful observations, which gel into conclusions that lead to solid approaches that meet the new challenges Mother Nature brings to this industry.