



HDD Geothermal Loop Installation



A ground source heat pump residential retrofit project in Rock Hill, S.C.



The backyard on the property.

Extrême weather conditions, such as the harsh deep freeze we endured this past winter or the stifling record heat that blanketed the United States this summer, should be enough to convince any business or homeowner about the benefits of geothermal heating and cooling sys-

tems, not to mention the accompanying federal and state tax credits that are available. Although vertical drilling is the most common method of geothermal loop installation, horizontal directional drilling offers additional benefits, options and flexibility for loop installation, along with the

installation of header pipes that connect the loops to geothermal heating and cooling systems. The benefits of horizontal directional drilling can be fully appreciated in ground source heat pump (GSHP) retrofit applications where well-established landscaping and structures present a

problem. Benefits of horizontal directional drilling were realized on a recently completed residential retrofit project in Rock Hill, S.C.

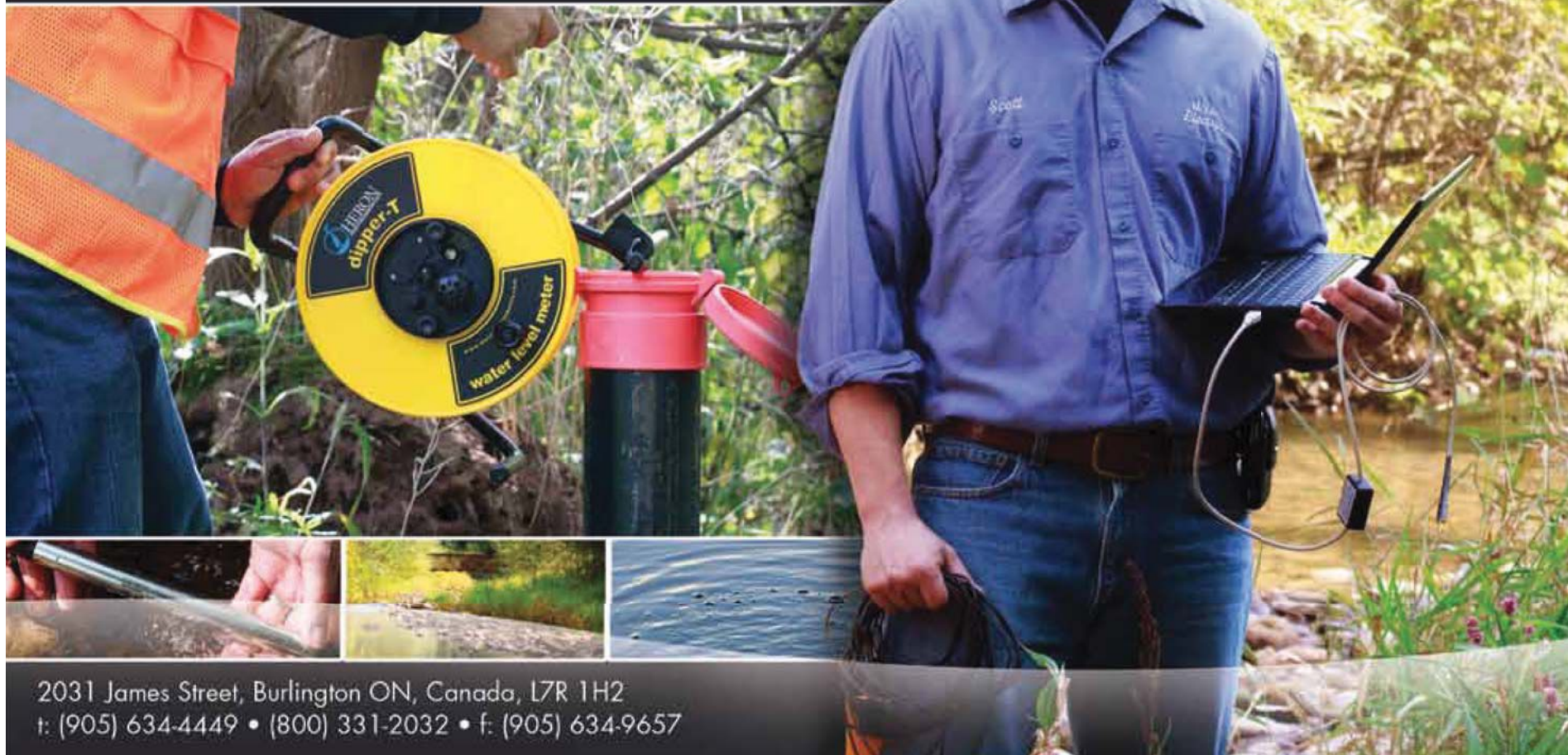
Harold Peeples, owner of Tarheel Contractors Supply, needed to up-

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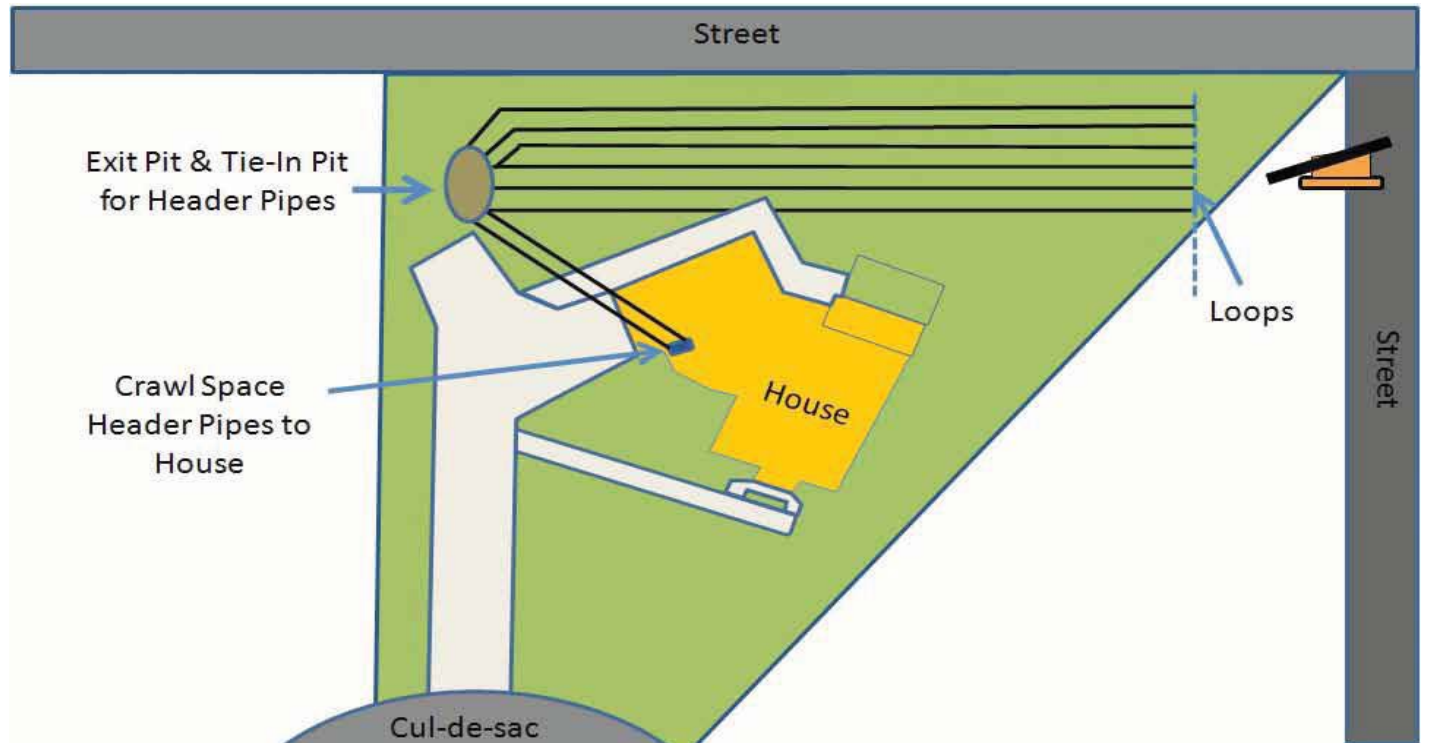


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(Dugan - Continued from Page 28)

grade his residential heating and cooling system. As a supplier to both the geothermal heating and cooling industry and the HDD market, Peeples is well aware of the benefits these two converging technologies have to offer. A vertical drill would have severely damaged the extensive backyard landscaping, and installing loops in the front yard just was not an option; therefore, horizontal directional drilling was the only logical choice.

Utilizing a Ditch Witch 1220 horizontal directional drill, Lee Electric from Aberdeen, N.C., set up and drilled from the side of the road, under the fence and landscaping, and punched out into an exit pit just beyond the end of the driveway. Once the drill punched out into the exit



Property layout.

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pit, 1-inch geothermal loops, along with a 1¼-inch grout tremie line, were pulled behind the drill bit, back toward the drill entry point. Mule tape was utilized as a spacer between the u-bend and the bit, so that when the bit was out of the ground, and the mule tape was cut loose, the u-bend of the loop was in the desired position/depth. Additional depth (35-ft. deep) was added to the bore profile to compensate for the lack of linear footage, and six 250-foot-long, 1-inch-diameter loops were installed.

After the installation of each loop, a thermally enhanced grout mixture of 16 gallons of water, a 150-pound bag of geothermal grout, and 200 pounds of sized silica sand (provided by U.S. Silica), was pumped through the tremie line via a ChemGrout grout mixing and pumping unit to fill the void area between the loops and the borehole. This recipe was used to achieve a thermal conductivity of 0.90 Btu/hr/ft/F. Thermally enhanced grout increases the efficiency of the ground loop system by providing better heat transfer from heat loops to the earth, and the grout provides a low permeability seal in the annular space of the borehole.

After all of the loops were installed and grouted, the drill was repositioned behind the exit pit where Lee Electric drilled from the exit pit, under the driveway, and punched out into a small exit pit below a crawl space under the house. Once they punched out under the crawl space, two 1¼-inch header pipes, which connected the loops to the geothermal heating and cooling system in the house, were pulled back. Panther Heating and Cooling of Rock Hill, S.C., installed the WaterFurnace heating and cooling system, purged the loops, and got the system up and running in time for the Christmas holiday season.

Horizontal directional drilling provided a means of installing the geothermal loops and header pipes

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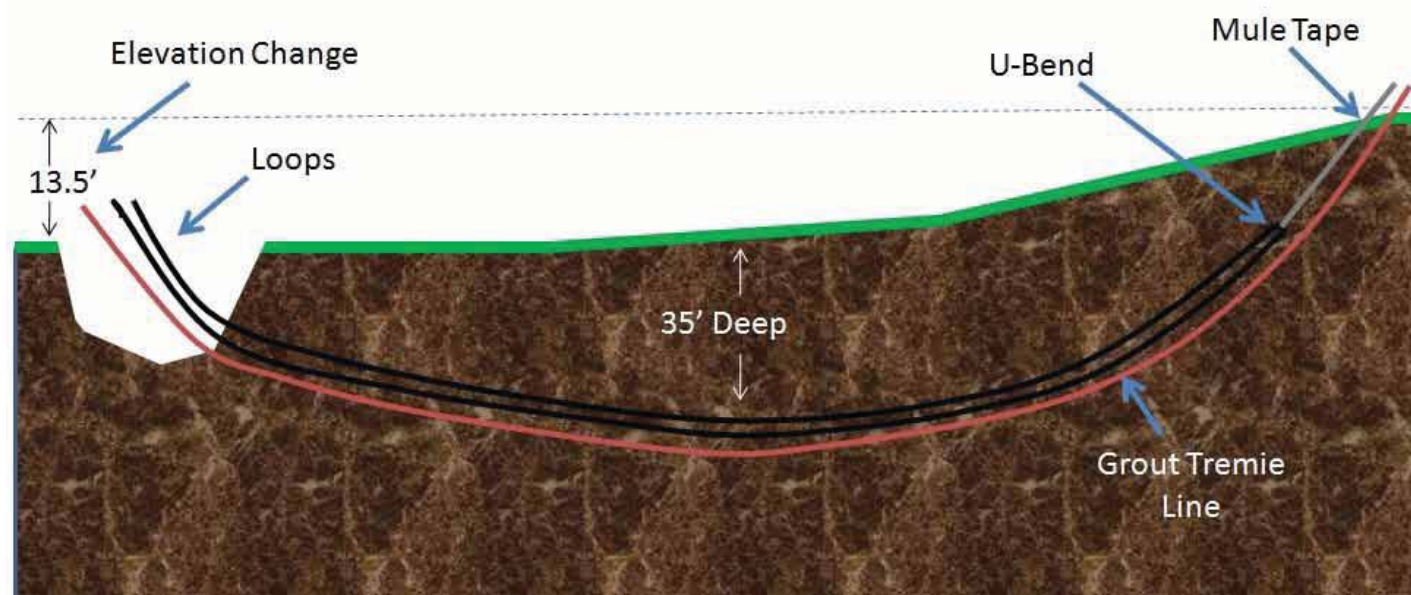
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Lee Electric on the job.



The tremie line.



Bore profile.

without damaging the picturesque backyard. Today, there are no visible signs outside of the home to indicate that such a system was installed and operating – other than the lack of a noisy air-conditioning unit and an electrical meter that now turns quite a bit slower. Peeples and his wife have been enjoying the comfort and savings provided by the WaterFurnace ground source heating and cooling system, which immediately was put to the test by starting up in the harsh winter of 2010-2011 before going up against record-high temperatures of the summer of 2011. **ND**

George Dugan is a regional manager for CETCO.

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York Colonial Courthouse Converts To Geothermal

A revolutionary approach to ground source heat pump installations

by Randy Happel

More than two centuries ago, during Pennsylvania's cold winter months, smoke would billow from the twin chimneys of the quaint York County Courthouse, a sign that the delegates of the Second Continental Congress had gathered, huddled next to the inefficient crackling fires of two wood-burning fireplaces that mirrored each other inside the chamber. The original structure was demolished in 1841, leaving Continental Square – the site where the famed courthouse stood for nearly a century – with a huge void.

In 1976, the locals rebuilt a replica. However, after 35 years, the time had come to replace the aged and inefficient system that heats and cools Colonial Courthouse. So the York Country Heritage Trust met to discuss options. According to Susan Smith, the Heritage Trust's chief financial officer, the decision to invest in geothermal made the most sense.

"The geothermal system cost more initially," Smith



from the ground is extracted and transferred back to the building. It's an extremely efficient and cost-effective system."

R. R. Kling & Sons began installing horizontal-loop geothermal systems in 2007 after encountering challenges with some vertical installations that required big truck-mounted, well-drilling rigs and confined drilling spaces. That's when Kling caught wind of a new type of drill offered by Vermeer Corp.

"We researched the new D20x22FX flex angle drill that Vermeer had just come out with, and went to see a demonstration," Kling recalls. "After seeing the drill in action, especially in light of the soil formations prevalent in our area, we decided the flex angle drill was the solution we were looking for."

Tread Lightly on Historic Ground

The York Colonial Courthouse replica is flanked by the scenic banks of Codorus Creek and Heritage Trail. Several overhanging trees dot the landscape of the property that also is enclosed by a split rail fence. Given the proximity of the rail trail and the structure's historic significance, there also is a lot of foot traffic. These factors combined made limiting the footprint of this hallowed site all the more important.

The geothermal system designed for the courthouse is composed of 1,500 feet of vertical loops that tie together and connect to an existing supply and return line. Due to space confinements of the jobsite, Kling decided to install 10 vertical lines at approximately 150 feet deep in two rows composed of five bores each. Each loop was bored at a particular angle to maximize footage in the ground and maintain the 15-foot separation between the loops at a depth of 20 feet.

"The flex angle drill allowed us to change the angle of the bore and more effectively use the confined space that was available for the loop field," says Kling. "The counter-rotating tracks on the D20x22FX drill also al-

lowed us to easily reposition the drill, providing a great deal of flexibility – a something that is very important when dealing with confined spaces."

Rock 'n Drill

Having drilled in this area on several previous occasions, Kling was familiar with the rock-laden conditions, and also anticipated having to control some ground water infiltration in the boreholes, especially since the site was located within 100 feet of Codorus Creek. He was surprised, even delighted, that ground water infiltration didn't occur until reaching a depth of about 140 feet. For tooling, Kling selected a 4-inch air hammer, and alternated between a 4½-inch- and 5-inch- diameter bit.

"With the D20x22FX flex angle drill, we definitely have the right tool for geothermal installations," Kling says. "This machine has opened up the prospects for a whole lot more people to be able to install geothermal ground source heat pump systems



says, "but after crunching the payback numbers, we estimate going with a geothermal system will save several thousand dollars each year in utility bills. We will recoup the additional upfront expense within seven years, and continue the savings for many years beyond that."

After completing its geothermal ground source heat pump research, the Heritage Trust put its faith in Mt. Wolf, Pa., contractor R. R. Kling & Sons. Scott Kling, general manager, explains how the new geothermal system works.

"The Colonial Courthouse's geothermal system has loops running through the ground that take heat out of the building in the summer and push it into the ground," Kling explains. "Conversely, during winter months, heat



for their homes, especially in tight spaces where it wouldn't have been possible to get into with other equipment."

As for the Heritage Trust and the new heating/cooling system R. R. Kling & Sons was able to install on its prized, historic site with minimal disruption, Smith is elated. "I'm sure the 56 members of the Continental Congress would consider the installation of our new geothermal system somewhat revolutionary in its own right," Smith says. "The juxtaposition of the old vs. new ... it's all very interesting."

Randy Happel is a features writer for Two Rivers Marketing.

Historic Geothermal Project in Illinois

Kickapoo Drilling installs loops at the Lincoln Tomb

We certainly hear a lot about geothermal systems being installed in new construction projects – both commercial/industrial and residential. But geothermal also can prove to be quite appropriate for historical construction as well, as is the case with the Lincoln Tomb in Springfield, Ill. An efficient environmental-control system is important, as it will serve to protect the historic interior and all its furnishings. Another bonus with the new geothermal system is the removal of a rather unattractive air-conditioning unit in an otherwise pristine setting.

Drilling operations for the project were handled by Kickapoo Drilling Co., Downs, Ill. Says Kickapoo president Jim Layten, “We took care of all the outside work for this particular project – the water supplies, the irrigations systems that had to be changed out and the 24 boreholes for the loops.”

Using a 2006 Versa-Drill rig, Layten’s crew drove 5-inch boreholes for the 1-inch loops; the boreholes went down to 220 feet, and had 1.2 grout in them. Asked about the drilling conditions encountered, Layten explains, “It was mostly all shale, with a few streaks of limestone and a few streaks of coal. We didn’t anticipate some of the hard spots, and didn’t have the proper bits on-site at first. After first using drag bits, we got some PDC bits in there, and they went right on through. Overall, it was pretty straight-forward.”

The job site itself, however, did pose a couple unique challenges. One was making sure to keep the site as clean as possible because of its stature as a national historical site – it’s the second-most-visited cemetery in the country. Layten tells of another: “We didn’t think

much of it at the time when we were asked to respect the funeral processions and such. We figured, no big deal; we’ll go ahead and just shut down for a brief period of time. We soon found out that there were two and three processions a day coming through, and that became somewhat of an issue for us at the beginning. But the cemetery staff worked with us and got the processions moved to an alternate route, so we didn’t have to shut down all the time.”

And the horizontal drillers – Kickapoo subbed out that part of the operation – had a little difficulty getting into the tomb. “It was built in 1870s, and the drawings weren’t that great,” Layten explains. “There was some trouble getting under and around the footings – there were double-wall footings – so it was a challenge to get into the center of the tomb.”

The job was completed in two weeks. “I was reminded that we were drilling there on Election Day for a project honoring our 16th president,” Layten relates.

Kickapoo is on its third generation. Layten recounts: “My father started drilling in 1937. He did have to take a little bit of time off to deal with World War II. When he got back, he went out and bought a cable-tool rig to use. In 1963, we went into a partnership with a guy fairly close to here who had a rotary rig – that’s how we got into the rotary drilling business. In 1967, we bought out the partner, and it’s been us ever since. My son, Mark, and my daughter, Sarah,



both work with me now, so I’m starting to look at going fishing more often. My son is doing most of the managing of the drill rigs on the water well side, and I’m kind of expanding into the geothermal side, which is growing rapidly. We started into it in 2002, but didn’t do too much of it until about three years ago. We got into the commercial side, and went after some of these larger jobs. We’re probably not quite 50 percent on the geo side, but it’s growing rapidly.”

The company runs four rigs – two Failing cable-drive rigs that do most of the water well work, and two Versa-Drill rigs that concentrate on geothermal. Kickapoo typically employs 15 people, and besides drilling, also does complete water systems. “We’re trying to get more service crews up and running on our water well side,” says Layten. “The rural water district systems are on their way, but they’re not here yet. What’s happening is the water well industry is getting older and older, and there aren’t many people coming in behind the companies that are going out of business, so our territory is expanding a little bit in that area.”

Layten looked into geotechnical work back in the 1980s, but says, “The equipment we had just didn’t fit. With the geothermal work, most of your equipment does transfer over. You find that you do need a lot more specialized equipment, and there is a bit of a learning curve, but it’s easy enough to make the transition.” Like making the transition from worms and minnows to spinnerbaits and spoons.