

Case Study – Project in Action

A GEOTHERMAL SYSTEM GROWS IN BROOKLYN

BROOKLYN - While New York City, especially Manhattan, is known for thousand-foot skyscrapers, its newest feat, however, occurred nearly 500 feet underground in the Borough of Brooklyn. Now being built at the East River waterfront just north of the Williamsburg Bridge, the 1 Java Street Lendlease (New York, NY) project is the largest mixed-use development in New York State to have a ground source geothermal system for heating and cooling. When completed in 2026, there will be more than 800 residential apartments plus retail spaces in two towers, and three other buildings, all of which are connected. The complex will be fully electric, using no natural gas or fuel oil. The developer's goal is to achieve absolute zero carbon across scopes 1, 2, and 3 by 2040, be LEED® Gold plus WEDG Waterfront Certified, and ensure that the project will meet or exceed Local Laws 97 and 154, both of which are part of New York City's decarbonization legislation.

The geothermal system included 321 vertical boreholes drilled 499 feet into the ground, spaced on 15-foot centers with a 1 ¼ nominal diameter high-density polyethylene (HDPE) PE4710 DR11 U-bend assembly inserted into each. The boreholes were just 3.875" in diameter.



A total of 326,000 feet was used in the boreholes with another 31,000 feet of HDPE pipe in various diameters used for lateral distribution. The boreholes were drilled by Geosource Energy, Inc. (Ancaster, Ontario), which also installed the

geothermal pipe loops as ground heat exchangers. The Ontario-based company was brought in to solve the problem of drilling in rock under 90 feet of overburden, with the top 50 feet being soft fill and muck, then 40 feet or more of solid silt. Brightcore Energy, LLC (Armonk, NY) oversaw the geothermal installation.

"We were running dual rotary Novamac Geo-Max rigs," explained Stanley Reitsma, P.Eng, Ph.D. chief executive officer, Geosource (left in photo below). "So, getting to the rock at a hundred feet was no problem, because of those machines. Then, drilling the rock was a success because we had multiple techniques at our disposal. This was heavily fractured with an awful lot of water production, and couldn't be done drilling with air, which would be typical.



"We had already tested, done an awful lot of water drilling during our 20 plus years in business, which is what we did there. And we managed to get that first hole in and we knew that, okay, now we're good. We know we're going to be good for the rest of the holes, and started drilling, picking away at the beginning with one rig, and eventually got elbow room to do two, and then three, and then four rigs."

The crew was working in the middle of all the other construction. "Pilings, the beginnings of elevator shafts...it was all going in there," Reitsma continued. "A very, very congested site, and that was challenging, especially if you were running truck (drilling) rigs in there, for example, which a lot of the operators in the U.S. particularly do. Mostly Canadians are now on tracks, just because we've been at it a little longer, with most of our projects

A Pipe Performance Report from the Field

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being urban construction. This forced us to adopt track machines for those types of applications.

“Our geothermal crew has to be able to spin around on a dime to go one way and then turn the other way, creep up right against the side of a pile cap...those kind of situations. It was just really, really tight. So that was very difficult. And to be honest, we keep saying to people, please let us drill first, and then you go in and do the rest of your construction.



“The 321 holes are on 15-foot centers,” he continued. “That’s 225 square feet per hole, totaling some 72,000 square feet, which is about 1.7 acres. We were in there with four rigs knocking out 20 holes a week with the crew of twelve. Just the grid pattern of 15 feet by 15 feet by 321, of them. On this site, basically every available area that could be drilled was drilled.

“Then we looped all the holes and routed them back with a bentonite graphite mix. Very standard product for running geothermal. And all the loops were pressure tested.”

The 499-foot depth – not an even 500 feet – was required due to New York State regulations. Drilling 500 feet or deeper required a mining permit, adding to the cost of a project. The state has since exempted deep boreholes for geothermal projects.

The 1 Java Street job was voted the 2023 Project of the Year by the Building & Construction Division of PPI for its use of HDPE pipe delivering such a sustainable and resilient project. Each year the PPI membership reviews and votes on the Project of the Year for each of the five PPI divisions. The award was presented to PPI-member company Versaprofiles Products, Inc. (Saint-Lazare-de-Bellechasse, Quebec), manufacturer of the pipe, during the association’s annual membership meeting held in May 2024.

PPI is the major North America trade association representing the plastic pipe industry.

“According to the US Department of Energy, ground source heat pump systems use 25 to 50 percent less electricity than conventional heating and cooling systems. This means that geothermal heat pumps are economical to operate and can significantly reduce operating costs during the life of the system” said Lance MacNevin, P. Eng., director of engineering for PPI’s Building & Construction Division.

“Geothermal systems also operate with fewer emissions than fossil fuel burning appliances, reducing CO₂ emissions. These systems use sustainable plastic piping materials as ground heat exchangers, another example of how plastic piping is helping the environment. The popularity of geothermal systems continues to grow so much that we even have a committee devoted to it.”

The division’s Geothermal Steering Committee focuses on the geothermal industry with activities that include supporting industry efforts to update geothermal standards and codes, such as CSA/ANSI/IGSHPA C448, IAPMO’s UMC and USHGC, and ICC’s IMC and IRC; working closely with IGSHPA, GEO and other related organizations; publishing documents about the use of plastic piping systems for geothermal applications; and serving as a technical resource for geothermal system designers, with regards to plastic piping technologies.

To provide guidance in selecting the proper materials and also installation, the group has recently updated its technical document, *PPI TN-55 “Plastic Piping Materials for Ground Source Geothermal Heating and Cooling Applications”*. The new technical note describes eight types of installation techniques, such as vertical boreholes, inclined or angled configurations, horizontal directional drilling (HDD), and energy piles, and discusses design topics, such as the effects of borehole depth on static water column pressure. It also addresses why oxygen diffusion barrier layers are typically not required for ground heat exchanger piping.

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According to NY Geo, the not-for profit founded in 2014, “GHP Systems work to improve utility load factors while reducing peak demand.”

The geothermal loops consist of two strands of pipe (one up, one down) heat-fused at the bottom of the hole to a U-bend fitting. The U-bend assemblies of 1 ¼ DR11 PE4710 pipe, named Verticalloop™, are produced at the Versaprofiles™ factory, fused and pressurized to the exact length required by the project. The sections of the 31,000 feet of lateral distribution pipe are 40 feet long and also made with PE4710 HDPE resin.

“We end up with factory-fused pipe loops done in a clean environment, and pre-cut to length,” Reitsma said. “If you push it in the hole and there’s still a whole bunch left over, you know you haven’t hit the bottom. It’s another way to double check your depth.

“Well, we’ve been using the Versaprofiles pipe for about 15 years. The PE4710 is great pipe. It’s a longer lasting pipe with less chance of fatigue. You’re never getting back in under a building like 1 Java, so we need stuff that’ll last as long as the building. And we think PE4710 should last a hundred years plus.”

Reitsma, who has more than 20 years of geothermal planning and drilling experience, shared advice for geothermal project managers and designers. “Because we’re the deepest, we should go in first. That is how we do 99 percent of the jobs happening in Toronto. We just haven’t seen that yet in New York, for example, because they haven’t really caught onto that concept because its unfamiliar. It’s just the sequence the work -- allow the geo to go in, and then the piles, and foundations. By the time the site is ready for that, we should be well done and out of the way.”

Additional information and data about ground source geothermal systems is available from the PPI Building & Construction Division at www.plasticpipe.org/buildingconstruction

The news article about the project can be found in **PLUMBING ENGINEER**:



And view the video Field Report on the PPI YouTube Channel:
<https://www.youtube.com/watch?v=2AKgllhhrVY>



More information can be found at <https://plasticpipe.org/building-construction/index.html>

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About PPI:
The Plastics Pipe Institute, Inc. (PPI) is the major North American trade association representing the plastic pipe industry and is dedicated to promoting plastic as the materials of choice for pipe and conduit applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in the development and design of plastic pipe and conduit systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.