

Lost — but comfortable — Kingdom

Tulsa Zoo utilizes radiant technology in multimillion-dollar renovation.



Johnson Tiger, McIntosh, works to install the more than 50 lineal ft. of ProMelt electric radiant heat cable encased in each of the 24 sq. ft. tanning beds, dishing out 50 watts per sq. ft. The hot rocks will be located strategically to provide optimal viewing for guests and offering animals the chance to seek warmth whenever they like.

It's a dense jungle setting, murky and damp. The low murmur of tree frogs pulse through lush vegetation that clings to stone-hewn Asian ruins. Monkeys screech in the distance and large reptiles lurk in the shadows.

You've entered a place beyond even the imagination of Steven Spielberg and not unlike a scene from "Jumanji" — sans motorcycling primates.

Of course, you're in Tulsa, Okla. The Tulsa Zoo, that is.

Today, the environment is under construction and, when complete, will transport visitors back in time 4,000 years.

Zoo officials call this place "The Lost Kingdom." Outside the walls of the ancient architecture will be bright, sunny courtyards with the hum of excitement from folks, young and old, moving between shops and a themed restaurant with up-close and personal views of jungle cats.

A master plan

The Tulsa Zoo opened in 1928 with just a handful of animals. Nearly a century later, the zoo campus has grown into an impressive 84 acres with more than 400 animal species organized by different world regions.

Nearly 650,000 guests walked through the zoo gates last year, distinguishing it as the area's largest daily attraction.

In 2012, zoo managers began development of a 20-year master plan with goals

Photo credits: Don Frisch/Watts Radiant

to renovate the zoo completely, section-by-section. Several exhibits built in the 1960s and '70s are beyond repair, so the plan is to start from scratch with the development of entirely new exhibits.

New displays will give animals the choice of being indoors or out, and guests the opportunity to see them behind the scenes as never before.

Zookeepers opted for radiant floors as the primary source of heat because large animals often receive more direct heat from the ground.

“Most zoos locate animal dens out-of-sight, making it difficult for guests to see the animals during certain times of the year,” says Ellen Averill, director of marketing and public relations at Tulsa Zoo. “Our Lost Kingdom exhibits will have visible dens with every comfort for the animals so guests can see them, no matter what the weather is.”

The Lost Kingdom’s \$20 million exhibits will be home to Malayan tigers, snow leopards, binturongs (a.k.a. bearcats), red pandas, Siamang monkeys, Chinese alligators and Komodo dragons — the largest reptile on Earth.

Radiant for rhinos

In 2012, **Cary Pestel**, owner of Tulsa-based Boone & Boone Sales, the manufacturers representative firm for the job, aided engineers with the specification of 8,500 linear ft. of 1/2-in. Watts RadiantPEX+ to heat a new barn for the zoo’s giraffes to serve as a nighttime shelter. Zoo personnel can change the floor temperatures at any time, should the need for warmer or cooler floors arise.

In 2014, Pestel was called back for a new white rhinoceros barn. The rhino barn also serves as a hospital area for the zoo’s crash (what biologists refer to as a group of rhinos). Specified at this time were 10,000 linear ft. of 1/2-in. RadiantPEX+ tubing with Watts hydronic panels.



Cary Pestel, owner of Tulsa-based Boone & Boone (left, foreground) reviews radiant heat layout with engineers during installation of Watts RadiantPEX+ for an interior animal space within the Lost Kingdom exhibit prior to the concrete pour.

The building uses the radiant floor as the primary source of heat, says Joe Barkowski, the zoo’s vice president of animal conservation and science. While the rhino barn has additional sources of heat, radiant provides the necessary heat in cold weather for the rhinos.

Zookeepers opted for this method because large animals often receive more direct heat “coming up” from the ground, rather than forced air, radiating down from above (as opposed to primates who can climb to different levels, for example).

Zookeepers say they are pleased both with the radiant heat solution for the animal exhibits, and working with Pestel, who specified the equipment for the job. This led the zoo to rehire Boone & Boone for the Lost Kingdom project.

Making ‘hot rocks’ warm

Both inside and out, radiantly heated “hot rocks” will be located throughout the Komodo dragon and Malayan tiger exhibits.

“Komodo dragons are ectotherms, meaning they’re dependent on external sources of body heat, like the sun,” Barkowski explains. “They regulate their temperature by basking in the sun, or seeking shade.”

Critically endangered Malayan tigers come from an equatorial climate where it’s hot and humid throughout the year.

Below the surface of the man-made rocks in the exterior exhibits for the Komodo and the tigers, Watts Radiant ProMelt electric snow- and ice-melt cable will keep the rocks warm and dry during even the coldest winters.

Greg Sutcliffe, engineer at Tulsa-based Philips + Gomez, says the hot rocks will be located strategically to provide optimal viewing for guests while, at the same time, offering animals the chance to seek warmth whenever they like.

More than 50 lineal ft. of the snow-melt cable is encased in each of the 24 sq. ft. tanning beds, dishing out 50 watts per sq. ft.

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“Typically, out of the factory, ‘cold leads’ — those parts of the wired ProMelt product that do not heat — are 10 ft. long,” Pestel says. “These lengths of braided steel wire lead to the heating elements of the cable. For the job at the zoo, they needed cold leads that were much longer — 50 ft., in fact.”

Bob Rohde, project manager at Tulsa-based mechanical contractor McIntosh Service, adds: “In each of the hot rock applications, dual-sensing tekmar 519 sensors help to govern the temperature of the rocks using pulse width modulation technology — allowing precise control of heat to maintain surface temperatures ideal for the critters. The tekmar 519s send a signal to a Watts Radiant controller, which activates or deactivates power to the ProMelt wires encased in the concrete.”

“Tulsa winters aren’t anything at all like the Komodo dragon’s natural monsoon climates of Indonesia,” Barkowski notes. “Their body temperature is roughly the same as the ambient temperature, so providing them with the warmed rocks is not only necessary for their health; it helps to replicate their natural environment, too.”

Creature comforts

Crocodilian species benefit from lying directly on a warmed surface. In the Chinese alligator exhibit, the sources of warmth are three in-slab hydronically heated radiant zones encased in concrete.

“The largest of the Chinese alligator’s concrete radiant zones is covered with a

heated,” Pestel says. “In-slab sensors send signals back to Watts Radiant HydroNex panels, which pull water from two 50-gal., 40,000 Btu Bock electric water heaters — tasked with heating fluids for all of the interior radiant zones.”

A Bell & Gossett PL-30 circulator, in-line air separator and expansion tank

Below the surface of the man-made rocks ... electric snow- and ice-melt cable will keep the rocks warm and dry during even the coldest winters.

layer of sand, where nesting will take place and females can lay up to 40 eggs,” Averill explains.

The zones provide the endangered reptiles with more than 100 sq. ft. of warm area to bask in year-round. These spaces are heated by 425 lineal ft. of 1/2-in. Watts Radiant barrier PEX.

“All of the Lost Kingdom’s interior radiant zones and hot rocks are hydronically

are installed on one of the HydroNex panels. Also present are Miljoco pressure gauges and thermometers, typical for any closed system.

“While the entire Chinese alligator exhibit will have forced-air heat to maintain constant temperatures, animals — like people — prefer to have options,” Barkowski says. “If they’re too warm, the gators can access the pool. If they’re too cool, they can move to a heated area to absorb the heat directly.”

Interior areas of the Malayan tiger exhibits have received in-slab radiant heating, in addition to the exterior hot rocks. Three separate hydronic radiant heat zones, served by 400 ft. of 1/2-in. RadiantPEX+, provide the tigers with warmth whenever they need it.

Zoo creatures won’t be the only ones happy with the upgrades: With the animal dens, stalls and dayrooms made visible to guests, opportunities to view animals will be greatly improved.

The zoo relocated an on-campus restaurant, The Trunk Stop, to reside next to the Lost Kingdom, where floor-to-ceiling glass walls will allow guests to see into the exterior tiger exhibits while dining. Talk about dinner and a show!

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Cary Pestel, owner of Tulsa-based Boone & Boone (left), and Greg Sutcliffe, engineer at Tulsa-based Phillips + Gomez (right), discuss radiant system pressure during installation of Watts RadiantPEX+ for an interior hydronic radiant space.