Center for City Park Excellence

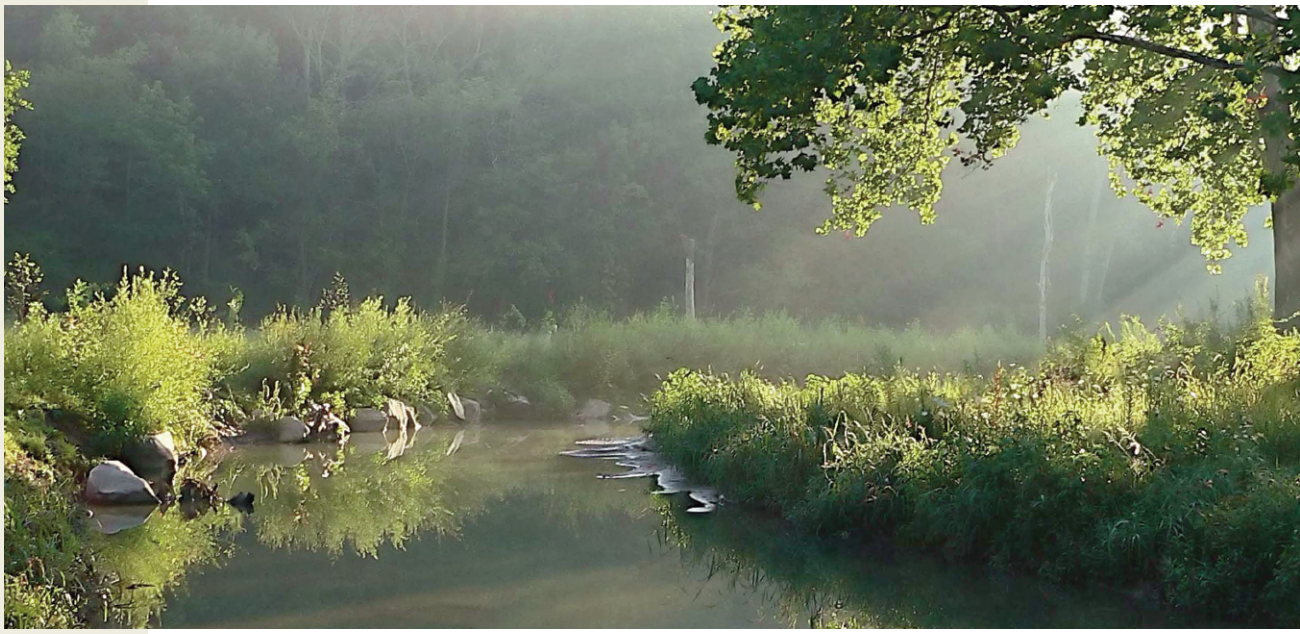

Photo: John Moyer

Nine Mile Re-Run

In Pittsburgh, activists bring a biologically dead stream back to life

Landscape Architecture Magazine, November 2007
Peter Harnik

If Pittsburgh was "Hell with the lid off," as it was famously called during its industrial heyday, then its River Styx was surely Nine Mile Run. Polluted into lifelessness, buried in culverts, insulted with trash, gouged by flash floods, and stripped of its floodplain by vast piles of slag, Nine Mile Run was as close to biological death as a stream could get. Today it is the site of the largest urban stream revitalization project ever undertaken by the U.S. Corps of Engineers.

It is fitting that Nine Mile Run would be the site of such a grand experiment. For, as Jane Jacobs pointed out in her book, *The Economy of Cities*, it is large urban areas that are always the first to confront mankind's newest problems and they are also always the first to be forced to solve them. The very industrial processes that led to Pittsburgh's once-immense wealth also caused unprecedented problems for Nine Mile Run. Today the city is using some of that old wealth along with the creative energy of its politicians and some of its newest residents to devise solutions. But fixing the environment is harder than damaging it in the first place.

Nine Mile Run was named for the distance from its mouth on the Monongahela River to Pittsburgh's Point, where the "Mon" meets the Allegheny to form the Ohio River.

(Actually, they counted wrong; it should be Seven and a Half Mile Run.) Over the decades Nine Mile Run has been severely modified. The entire lattice of its five-mile-long upper watershed is buried under the streets, yards and buildings of the eastern edge and suburbs of Pittsburgh. Eventually the westward-flowing waters reach the lush forest of Frick Park and emerge for the first time into the open, 2.2 miles upstream from the Monongahela. Soon after, the run merges with its main tributary, Fern Hollow, coming in from the north through the center of Frick Park. Joined together, the larger stream flows southwest under the massive superstructure of I-376, the Penn Lincoln Highway. The final race to the Monongahela takes it through a narrow channel between two astoundingly steep and high banks of slag that had been dumped for half a century on the former wetlands and wide floodplain of the stream.

In 1998, the last year of its almost two centuries of deterioration, Nine Mile Run was what is called a "flashy" —as in "flash flooding." It's a characteristic of most urban streams. Five million dollars of reconstruction later, it is still flashy, but a bit less so. And every succeeding year its ecology functions a bit better. To understand the problem—and the solution—requires getting down into the stream bed.

The first drop of any rainstorm in the Nine Mile Run headlands runs from rooftop to gutter and is whisked into a sewer, mixed with household wastewater and channeled to a sewage treatment plant near downtown Pittsburgh. But no sewer pipe is mammoth enough to handle the water from a large storm. The hundred-billionth drop of a deluge overflows the sewer (as it was designed to do) and spills into Nine Mile Run itself (the headwaters of which are still underground in a large pipe). When the filled pipe comes to the surface, a torrent of raging water crashes into the run's historical streambed. Traveling at 15 to 18 feet per second, the roiling water sweeps everything in its way – silt, sand, sediment, soil, pebbles, underwater and streamside plants, mollusks, fly larvae, midges. Then, when the rain ends, the maelstrom vanishes just as fast—too fast. Like a bathtub whose plug has been pulled, the water gurgles away and the run is soon almost dry, drained and empty. All that remains is a scoured streambed, individual pools sunk far down in the channel, a haphazard collection of invasive plant materials and a depressing array of old plastic bags, soda cans and candy wrappers. Pre-restoration, this regimen was catastrophic for fish. During wet weather fish weren't strong enough to battle the rapids; during dry weather there wasn't a continuous enough current to float in.

X

"What we have is an upside-down stream," says Marijke Hecht, director of the Nine Mile Run Watershed Association. "Most urban streams start out pure in the fields or forests of an upper watershed and end up in a pipe only half way down. Nine Mile Run starts out in lots of pipes and comes out into the open half way down."

Perhaps that was the stream's salvation—that it flows through Frick Park, Pittsburgh's largest, wildest park, where thousands of citizens could see and smell its pain and suffering. Or perhaps it's due to the Studio for Creative Inquiry at Carnegie-Mellon University, an unusual amalgam of artists, scientists, lawyers and landscape architects that stepped in to defend it when no one else cared. Or perhaps it's due to Hecht and her passionate commitment to the stream. In addition to providing hundreds of educational tours and community workshops, as

well as leading programs to plant trees, develop community gardens and install rain barrels, the Watershed Association has served as a leading advocate for state, local and federal funding for the major physical remediation effort. Since joining the fledgling Association in 2002, Hecht has built it up to a staff of five and an annual budget of $450,000.

The attempt to save Nine Mile Run grew not out of a conservation campaign but out of reaction to a housing project. The property in question was a 238-acre parcel which had been used as a slag dump for more than 60 years. Slag, a gravel-like by-product of steelmaking, lay in two gargantuan, steeply sloped rows, 150 feet high, with a 40-foot slot between – through which ran lower Nine Mile Run. After ceasing operations in the late 1970s, the owner of the land, the Duquesne Slag Company, spent the next 15 years entertaining offers from a variety of industrialists and developers to do everything from mine and re-use the slag to construct a golf course or a shopping center on the property. Finally, in 1994 then-Mayor Tom Murphy decided that the city itself would buy the land for housing. Not low-income housing, but housing for more affluent out-of-towners looking for spectacular views in a brand new neighborhood in Pittsburgh. Murphy turned the task over to the Urban Redevelopment Authority which named the development Summerset and got to work planning for 1,200 units. A key aspect of the proposal was to put Nine Mile Run into a pipe and regrade the slag over it.

The proposal stirred opposition from the neighbors and ecologists. "What had formerly been a garbage dump was suddenly referred to as 'the wildlife preserve of the East End,'" says Jerry Dettore, director of the redevelopment authority.

Many of the neighbors protested simply because they liked having the privacy provided by the huge undeveloped brownfield. ("Their kids liked to ride ATVs on the slag," said one environmentalist.) Others didn't mind new housing but were worried that excavation and construction would release toxic fumes and runoff from the slag. Activists from the Studio for Creative Inquiry were offended by the URA's proposal to bury lower Nine Mile Run.

Ironically, the firms which developed the stream burial strategy were Cooper, Robertson & Partners, a New York architecture and urban planning company with a "green" image, and Andropogon Associates of Philadelphia, one of the country's most ecologically-oriented landscape architecture firms.

"I still believe that our concept was the best way to go," said Colin Franklin, an Andropogon founding principal. "This is an extraordinarily difficult site. It combines extremely steep slopes with a terrible growing medium. Slag doesn't retain moisture – after even a relatively brief dry period everything dies."

It isn't possible to simply throw a layer of topsoil onto slag: tree roots can't penetrate the dense, metallic material below. Successfully growing on slag requires the use of large industrial plow-like machines and the gradual mixing in of greater and greater quantities of soil material. It's a slow, expensive art and it doesn't always work.

"It's unlikely that you can ever have a healthy stream in those conditions," Franklin said. "Even now the jury is still very much out on this. We proposed a design that would put the stormwater runoff into an underground pipe while allowing the smaller amount of normal flow to be used as an artificial stream on the surface. That would at least have taken care of the catastrophic scouring that follows every rainstorm. And by decreasing the angle of the slag banks the plant material

would have had a better chance."

Regardless of Andropogon's careful analysis, the neighbors' outcry for a "living stream" carried the day, forcing the Urban Redevelopment Authority back to the drawing board. After a period of mistrustful acrimony, the agency, the city planning department and the citizens formed a working committee which met monthly and began hammering out a plan of action —a plan which led to a massive rethinking of both Summerset and Nine Mile Run. In order to keep the stream, grading was eliminated, the steep slopes were retained, buildable lots were reduced, and the number of houses was cut back to 700. With fewer homes, 115 acres of parkland was created—the stream and its valley—which was added to Frick Park, making it the only one of Pittsburgh's four major parks to reach all the way from ridge to river.

The elements of an ecologically healthy waterway are fantastically complex and go beyond clean water. Nine Mile Run's water wasn't—and still isn't —sparkling, but the stream's worst problem had to do less with pollution than with sediment. Nine Mile Run has too little sediment. With all its upper reaches in pipes, the run comes bursting out of its conduits essentially sediment-free, erodes its bed and has no gravel or cobble load to replace it with. The streambed gets more and more deeply cut. (Unhealthy rural streams have too much sediment, but unhealthy urban streams have the opposite problem.)

"The study of how rivers take their shape is called fluvial geomorphology," says Chris Streb, an ecological engineer with BioHabitats, Inc., a Baltimore-based ecological restoration firm hired to design the waterway's reconstruction. "Is it eroding? Is it depositing? What is the best form for the river so that it may remain physically stable and ecologically productive over time? At Nine Mile Run, we found that the channel was so downcut in locations that storm flows were unable to reach its floodplain. Floodplains are crucial for dissipating energy, slowing water velocities and mitigating erosion. High peak flows are typical in urban watersheds, where precipitation is quickly conveyed to storm drains. This limits [groundwater] recharge so that in the summer, the base flow—the flow when the weather is dry—almost disappears. Healing Nine Mile Run meant reconnecting the channel to its old floodplain by realigning its course, stabilizing the channel bed with cobble and boulder structures, creating habitat features like pools and riffles and finally, incorporating living plant material and woody debris along the channel banks."

In order to calculate the required height of the channel, it is necessary to know not only the stream's hydraulics —the way the water traverses the streambed—but also the area's hydrology (the amount, intensity and frequency of rainfall). The hydrological computations were done by Camp Dresser and McKee (CDM), a firm that does much work for the U.S. Army Corps of Engineers and for sewer authorities but that had never before worked on this kind of stream rehabilitation effort.

"We were fortunate to have the rainfall numbers over the watershed from a 20-year period," says Terry Meeneghan, P.E., a principal of CDM. "So we built the model using the actual numbers." The calculations yielded results that were not trivial. In some cases the streambed had to be raised by as much as five vertical feet. Pipes that had crossed above the eroded stream, blocking the passage of fish, would actually be overtopped by the new bed and rendered invisible. "Even though

you can't bring the watershed back to pristine conditions, you can still use natural techniques and they will still work," said Meeneghan.

After all the planning and political action, eventually someone had to get into the streambed of Nine Mile Run with some heavy equipment. In 2004, five years into the seven-year process, the engineers and excavator operators of Meadville Land Service, Inc. (MLS) actually began moving dirt, rocks and stumps.

"First thing, you have to turn off the stream," explains Tracy Litwiler, project supervisor with MLS. "To do that, you build a coffer dam—a temporary dam—and install a pump that sends the water down below where you're working. Nine Mile Run required two pumps. We had to move 3,600 gallons a minute. It was a big one."

And if it rains?

"You head for the hills! We were constantly monitoring the weather. We tried to work in small sections at a time, no more than about 200 feet of channel. In a storm we vacated to a wetland area and worked there."

The work itself is as much art as science. Using excavators—essentially huge tread-driven backhoes with movable "thumbs" that can not only lift rocks but also twist them—the operators followed the computer-generated grading lines but also fit the rocks together like a mason building a wall. Three broad goals guided the work:

❖ creating a riffle-pool complex – some places deep enough for fish to rest and feed and other places shallow enough to keep the water moving.

❖ deconcentrating the stream flow – making it wider and therefore shallower. "The more contact the stream has with the ground, the slower it will go, the more impurities will come out and the more it will regenerate the water table," said Litwiler.

❖ reusing as much material as possible from the stream itself. "Since bringing stone in and carting out dirt is enormously expensive," Litwiler explained, "we want to balance as much as possible what we cut out with what we fill."

First, the excavators harvested the material in the middle of the stream, the natural cobble, which are rocks anywhere in size from a baseball to a soccer ball, and they stockpiled the stones for reuse. They then cut down the vertical walls and used large quarry rocks to put in weirs and other shapes to spread the water, aerate it and help the stream meander. And they constantly recycled. "If we had to take down a large tree when we moved the streambed," Litwiler said, "we cut and used it, burying the trunk in the ground and exposing the roots. That's called a root wad revetment and it slows the water down, gives the fish habitat, adds carbon and adds shade. If we had to raise the water so high that it resulted in a waterfall, we left some pipe holes under the surface so the fish can get through."

The final step involved the planting of sedges, rushes, grasses and trees—among them willows, alders, sweet gums and poplars—that can survive in a wet-soil environment and can help hold and stabilize the stream's floodplain. Like everything else in this new field of mimicking nature, this too is far from guaranteed, with obstacles constantly arising, from erosion to deer predation. After an initial period of fairly severe washing out, the soil has now become knit thanks to the roots of the new plantings, and it seems to be holding. And the Pittsburgh Parks Conservancy has erected temporary fencing to keep deer away from the most important young trees and stands of native grasses as they establish themselves.

At 2.2 miles in length, the Nine

Mile Run project is not only the largest ever undertaken by the Corps of Engineers, it may well be the largest stream ecology revitalization effort thus far in the U.S. The $7.7 million price tag for analysis, design and construction was paid for largely by the Corps (under its Aquatic Ecosystem Restoration Program, known as "Section 206") with matching funds from the city of Pittsburgh, the Pennsylvania Department of Environmental Protection, the Allegheny County Sanitary Authority and the Heinz Endowments. Whether it is a success will take years to fully determine, partly because the project has so many aspects and objectives.

Here is an early tabulation:

❖ Adding the 115-acre corridor to Frick Park is an unquestioned benefit. "You can now walk from what was Pittsburgh's most industrial waterfront on the Monongahela River up Nine Mile Run through the main park all the way up to the restored Henry Clay Frick Mansion," says Meg Cheever, president of the Pittsburgh Parks Conservancy. "It's a mini-case history of the development and preservation of the city." The city is also planning an upgrade to the trail and construction of a pedestrian bridge across the stream.

❖ The Summerset neighborhood, with its proximity to and views over Nine Mile Run, is a triumph. "It's got everything from rental units to condos to million-dollar estates," says Jerry Dettore of the development authority. "It has among the highest priced housing in the city and it's generating tax money for Pittsburgh and Allegheny County."

❖ Fish are gradually returning to Nine Mile Run. Between 1999 and 2006, the number of fish species increased by 40 percent, the number of fish collected in a scientific survey increase by 30 percent, and the biomass of the samples—reflecting the size of the fish—shot up by 505 percent. The fish community "continues to be overwhelmingly dominated by pollution tolerant" species, according to the study, but it is moving in the right direction.

❖ The reconfigured streambed seems to be holding, even though the Corps did have to come back once and replace a section that had given way. "Rerouting the channel involved moving a lot of soil," said Phil Gruszka, director of park management for the parks conservancy. "Even though they did a lot of planting, it's taken awhile for the soils to knit." Whether the run becomes less flashy will take time to determine.

❖ The slopes of the slag pile are vegetating, but spottily. "The grasses have done very well and are mostly established," said Gruszka, "but many of the initial trees we planted haven't made it. Where we amended the soil they're doing better, and I believe they'll slowly colonize."

The Watershed Association's Marijke Hecht, uniformly called the heart and soul of the Nine Mile Run restoration, is both enthusiastic and philosophical. "This effort will never be 'done,'" she says. "Nature is never 'done.' That is why we are monitoring the stream so closely—fish, invertebrates, fecal coliform, dissolved oxygen, geomorphology, alkilinity. The stream changes all the time, not just from storms, even from regular rain. Our work is restoration ecology and it will need constant readjustment."

She sums up with her favorite quote, from the late American plant ecologist Frank Egler, "Ecosystems are not only more complex than we think, they are more complex than we can think."

Contact:

Peter Harnik
Director, Center for City Park Excellence

The Trust for Public Land
660 Pennsylvania Ave., S.E.
Washington, D.C. 20003
(202) 543-7552
peter.harnik@tpl.org