

Stream Restoration Improves Water Quality, Play at Lost Nation Golf Course



After just a few months, native grasses and woody shrubs have taken root in the riparian area at hole 13, where rock-enhanced stream banks combine with deep-rooted plants to prevent erosion.

Imagine two very different water features.

One cuts through neatly trimmed fields with harsh, steep embankments that

drop straight to feature-less flat water. Short turf runs flush right to the edge of the ditch. Soil crumbles daily from its undercut banks into a brownish, slow-moving

tributary.

Now picture the second stream as it meanders through the same manicured fields. Its riparian floodplain slopes gently



Erosion control matting at hole 13 kept soil and fledgling plants in place through the winter in the newly excavated riparian flood plain.

down over a broad area of colorful, native grasses and woody vegetation to meet rock-enhanced stream banks. Babbling water falls gently past bendway weirs and stream riffle structures, which shore up the banks and provide habitat for aquatic life.

Both streams are actually one and the same. The stream restoration ecologists at Davey Resource Group, a division of The Davey Tree Expert Company, transformed a severely eroded Ward Creek into the attractive waterway now winding through Lost Nation Golf Course in Willoughby, Ohio.

Planning started in March 2013. The Chagrin River Watershed Partners, Inc. (CRWP), a non-profit technical organization comprised of the 36 member cities, villages, townships, counties and park districts of the Chagrin River watershed, secured grant money from the U.S. Environmental Protection Agency Great Lakes Restoration Initiative. The grant paid for three projects aimed at restoring Newell/

Ward Creek: storm water retrofits at Great Lakes Mall in nearby Mentor, Ohio; free rain gardens, rain barrels and shade trees for sub-watershed residents; and the stream restoration at Lost Nation.

At the golf course, CRWP's goal was to return 1,450 linear feet of stream and riparian corridor within the course to a more natural state by minimizing stream bank erosion, enhancing nutrient filtering and providing wildlife habitat in the Newell/Ward Creek corridor, which is a tributary of the Chagrin River that flows into Lake Erie about 20 miles east of Cleveland.

Project Hurdles

"One of the hurdles we faced is the fact it's an active 18-hole golf course," said Ken Christensen, senior biologist with Davey. "We worked on five holes, so we were right in the play area on the back nine. Maintaining play on the course was important to golf course managers and patrons."

The course is owned by the city of

Willoughby, which did not want to see play stopped for construction.

"Our first concern was how much the project would disrupt play," said Greg Hill, golf course superintendent at Lost Nation.

Actual construction did not start until October when activity on the course slowed and made it easier for construction crews to pause for the occasional golf group. Davey's preferred partner for ecosystem restoration involving earth moving, Marks Construction, faced a tight deadline with a Dec. 1 target finish date.

Access to the site also proved challenging, as construction equipment could not risk damage by traveling directly across the greens, tees and other sensitive areas of the course. An off-road CAT 300 dump truck was used, and most of the equipment, including two 30,000-pound excavators, was equipped with tracks for low-pressure contact with the turf. Work started the furthest from the clubhouse and main parking lot at hole 13. Construction progressed up-

stream from holes 14, 15 and 16 to hole 18, where the improvements are visible to golfers arriving at the course. Work at each hole lasted two to three days and was finished before moving on to the next site.

“There were a few benefits to that,” Christensen said. “We made our own access roads and repaired and worked our way out as we finished a hole. We weren’t spread out all over the golf course, and impact to play and the turf was very minimal.”

Another challenge associated with the golf course was the fact the restored riparian corridor also had to accommodate play. That meant instead of tall trees and shrubs, a mix of shorter woody vegetation, including red buckeye and bottlebrush buckeye, were planted alongside native grasses. Where applicable, the restored grade of the stream banks incorporated a floodplain bench, which improves storm water management. The native vegetation also improved on-site infiltration of storm water.

“Ideally on a stream restoration site you like to restore it to a wooded state,” Christensen said. “There also was some infrastructure, including irrigation lines, bridges and utility lines we had to work around, relocate or incorporate into the design.”

Planning & Construction

The restoration plan targeted only in-play areas of the stream as it crossed fairways, but the restoration team studied the entire sub-watershed to develop the restoration plan.

Using the hydraulic modeling, their team quantified discharge, flood stage elevations, stream velocity and stream power for a range of storms. This information, along with an assessment of channel dimensions upstream and downstream of the restoration areas, was used for detailed design of the headwater streams.

Wetlands found in the riparian corridor between fairways and adjacent to the restoration areas were identified so that these areas could either be avoided or enhanced by construction. A topographic

survey determined the existing stream profile and dimensions of the stream channel upstream and downstream of the eroded areas within the course to aid in preliminary modeling geometrics.

Prior to construction, Davey also performed a hydraulic study of Ward Creek and used the model to determine baseline storm water conditions. Storm water flows from the sub-watershed were used to develop the restoration design plans. Using the hydraulic modeling, their team quantified discharge, flood stage elevations, stream velocity and stream power for a range of storms. This information, along with an assessment of channel dimensions upstream and downstream of the restoration areas, was used for detailed design of the headwater streams.

Construction started in the riparian area with removal of the topsoil, which was stockpiled on-site—a bonus considering it averted having to drive a dump truck loaded with heavy soil in and out of the site for disposal. Next the bendway weirs, modified Newbury riffle structures and other stone elements were installed to stabilize the stream corridor, protect outside meander bends and reduce flow energy near the banks. Excavation of excess soil

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Above: New bendway weirs protect the stream bank upstream of hole 18. Below: Construction at hole 13 involved rerouting a section of the stream away from a heavily eroded embankment, which was reinforced with rock.



in the flood plain improved the grade and provided a slight increase in on-site storm water retention.

Excavation work occurred on one side of the stream before equipment moved to the other side in order to reduce construction equipment effects on sensitive play areas. To move machinery, the contractor installed a temporary stream crossing at each hole to drive equipment back and forth. Where possible, temporary crossings stood where a riffle grade control structure was installed at each site.

“It was a little challenging making a temporary stream crossing because we had

to leave that in overnight, so it had to be strong enough to withstand storm events and the weight of a bulldozer,” Christensen said.

Once major excavation finished, seeding and cover was put down quickly to avoid leaving soil exposed overnight due to concerns about potential flooding from rain and snowstorms. Herbicide applications controlled growth of common reed (*Phragmites australis*) to eliminate the invasive species and allow native plants to populate the new riparian areas.

Adding new, native plantings was the final step and included lizard tail (*Sauru-*

rus cernuus), prairie chord grass (*Spartina pectinata*) and other species with longer root systems to aid in bank stabilization. Certain species, such as blue flag iris (*Iris virginica*) and spicebush (*Lindera benzoin*), were chosen for their resistance to browsing by geese and deer, respectively, because the area of Northeast Ohio where the course is located sees large populations of both.

Before winter set in, Davey’s team had restored 1,450 linear feet of stream, 2.2 acres of riparian corridor with deep rooted, native grasses and 0.8 acres of riparian corridor with native woody shrub and tree species.

Restoration Benefits

Keely Davidson-Bennett, project manager for CRWP, said stream bank stability has vastly improved since construction ended thanks to the native vegetation’s deeper roots, re-grading of banks to a more stable slope and installation of the bendway weirs.

“As the native vegetation establishes, we expect that the restoration work will provide greater aesthetic improvement for the golf course,” she said. “Furthermore, as the vegetation establishes, especially woody vegetation, the stream banks will become more stable.”

Another immediate benefit has been a reduction of sediment and nutrient loading. In one example, at hole 14 a bendway weir directs the main current away from the bank towards the center of the channel near an existing bend. The redirection slows the water velocity and, as a result, the water loses energy and can no longer sustain the weight of the silt it had been carrying to that point. The result is the silt has been deposited in a natural bend of the stream, creating a new sandbar that is filling in what had previously been eroded.

“It’s actually building up a nice bank that’s going to serve as a base for vegetation to become established in this small wetland area,” Christensen said.

One benefit of the project was the fact it was completed using a design-build process and not a design-bid-build method. In that way, from the very beginning the team incorporated concerns of all involved, including the construction contractor, a golf course landscape architect, CRWP, the city of Willoughby, U.S. EPA, U.S. Army Corps of Engineers, Ohio EPA and Lake County Soil and Water Conservation District.

Davey obtained all necessary permits from the USACE, Ohio EPA and city, coordinated plan submission, review and final design, conducted all necessary surveys and worked in the field to oversee construction with the contractor.

The design-build process eliminated cost overruns and helped facilitate necessary on-the-fly changes to the plan due to unforeseen circumstances.

Other project benefits include the elimination of an existing golf cart bridge at hole 15 that had served as a choke point for the stream and a collection point for debris during and after storm events.

Restoring the floodplains with native vegetation by removing turf grass is another benefit. Turf grass roots are not deep or strong enough to hold stream banks together and prevent erosion. The native plants installed have extensive root systems which, in addition to the stone structures, will maintain the riparian area and help stop further erosion.

And, Hill said, the more natural riparian areas led to less maintenance for the golf course—a savings in labor costs and equipment wear-and-tear.

“We used to have to mow and string

trim right up to the edge of the creek,” Hill said. “Now we can do less maintenance there because it’s so much more natural a riparian area. Eventually we will have to prune back some of the woody vegetation, but I anticipate only having to do that once a year.”

Some erosion control fabric was used to hold soil in place through the winter as grasses and shrubs developed, and biodegradable matting was used. Christensen said such restoration projects always provide lessons and teachable moments, and in this case that moment came from the matting.

“The fabric we used was designed to handle the stream velocities present in Ward Creek, but it didn’t allow for as much light and soil penetration as I would have liked for germination underneath,” he said. “The plants are coming up fine, but a more open weave would have allowed for better light penetration.”

Heavy construction and all final grading were finished by the Dec. 1 due date, but due to weather conditions the team returned in May 2014 to finish planting some of the shrubs and trees. The total project cost was \$286,000.

The project has required almost no post-construction maintenance, but course workers have been watering the new plantings to ensure healthy growth. Davey will complete a post-construction habitat assessment in 2015 as required by the USACE permit.

Project parameters did not stipulate post-construction water quality monitoring in Ward Creek.

“CRWP is pleased with the improvement from this stream restoration project,” Davidson-Bennett said. **L&W**

by Matt Fredmonsky, Project Manager, The Davey Tree Expert Company

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