Fawn River Restoration

CAPTION

In 1998, approximately 100,000 CY of sediment was discharged to a 5-mile section of Fawn River, in Steuben County, Indiana as the result of a rapid draw down of an upstream reservoir (the "Event").

Prior to 1998, Fawn River below the Orland dam ("lower Fawn") was recognized as one of the best-preserved sections of river in the State of Indiana. The Fawn had a deep swift thalweg, high water quality, and a clean gravel hyporheos interconnected with the underlying aquifer. Unlike most Indiana Rivers, this section of the Fawn had never been ditched and a wide riparian corridor of undisturbed woodlands and wetlands protected it.

When the massive sediment flow entered the river in 1998, there was a large fish kill, and mussel and macro-invertebrate colonies were rapidly buried under the silt and sand. The hyper-concentrated flow (> 60% solids) buried the gravel bottom, filled the deep pools and cuts, and reduced connectivity to the underlying aquifer. The filling of the main thalweg also initiated disastrous bank erosion, and over the next several years the Fawn's banks and trees toppled into the stream. The result was a wide, shallow, slowed, warmed, and mud-choked river with anoxic conditions

at the benthic interface, algal blooms, and advancing colonization by invasive aquatic vegetation. Available habitat for fish and macro invertebrate populations was reduced and the survival of the most sediment sensitive species was uncertain.

The riparian landowners sought funding over the following 13 years for restoration of the Fawn, which was finally accomplished in 2011, resulting in the founding of the Fawn River Restoration and Conservation Charitable Trust ("Trust").

As part of initiating clean up operations, the Trust had to decide on an operational model. Prior to 2011, an international environmental firm had recommended a restoration process that far exceeded the Trust's budget, including several million dollars for preparing and implementing a pre-engineered design. The Trust and its lead consultant, Strategic Sediment Solutions ("S3") decided against a pre-engineered approach, and instead chose an adaptive management process, which allows for flexible design and oversight. It was predicted that adaptive management would provide a far more cost efficient operation, and after a year and a half of operations this has proven to be true. The Trust now estimates its budget will accommodate recovery of the entire main stem to pre-1998 conditions by 2014-2015 at less than a third the cost predicted by the prior feasibility studies.

Initial operational choices were also dictated by the decision not to use heavy equipment in the river, and riparian corridor. This led to selection of the low impact, man operated, Sand Wand™ technology from Streamside Environmental, LLC, ("Streamside"). The Sand Wand™ selectively jets and suctions out of the hyporheos only the fine materials, leaving gravel and cobble in place. The removed sediments are pumped as slurry to dewatering pits located on former agricultural fields.

Permitting was initiated, which the Trust expected to be relatively limited based on the following advantages: 1) the Sand Wand™ selectively removes only the fine sediment; 2) has a low impact in the flood plain; 3) eliminates any discharge back into the river; 4) poses no significant risk to aquatic resources; 5) and restores the habitat necessary to increase macro-invertebrate and fish populations, together with improving the chance of survival for at-risk species.

The permitting process with USACE and IDEM went smoothly, and the only obstacle was the Indiana Flood Control Act. A permit was eventually approved, but "special conditions" prohibited work during the most advantageous times of the year. As an alternative to a Flood Control Act permit, the Trust decided to modify operations so that the work would be authorized under Indiana prospecting permits of general application. The Sand Wand™ discharge would first go through sluice boxes, which would be regularly evaluated for precious metals and gems.

There remained one last regulatory problem. Originally, the work was to start at the farthest point upstream and move downstream, but concerns existed as to the potential for bed load recontamination from a large, recently altered, surface drainage. In order to guard against the risk, a temporary low profile, low impact, bed load Collector designed by Streamside was to be installed. However, the Indiana Flood Control Act regulators would not allow the collector to be used during the time of year when it would be most needed.

Rather than argue with the regulators, the Trust moved the start of operations one-half mile downstream to a location where the work could be protected by a large pool that was 12 to 15 feet deep and 50 feet in diameter. Prior to operations, the pool was filled with Event materials, but after cleaning, the restored pool would serve as a sediment trap.

With protection in place against the risk of upstream bed load movement, a pilot test of bank-to-bank Sand Wand™ operations began November 18, 2011. The pilot cleaned to within 3 ft. of the average high water mark in an eroded channel that averaged between 33-73 ft. wide. The bank-to-bank method was based on the pre-2011 feasibility studies that recommended "total removal" of all Event sediments. However, over the next few months, the qualitative data and field observations increasingly indicated this was not the best possible restoration technique.

As an alternative to total removal, the Trust had long considered leaving the most consolidated and stable bars in place, and cleaning only a narrowed thalweg to the historically documented width of 20-25 ft. Precise delineation of where to locate the new thalweg would be determined by observation of subtle differentiation existing within the eroded channel, including lateral changes in depth, bed load striation, bottom coarseness, surface flow patterns, and other fluvial considerations.

The removal of sediment in a strategically narrowed area deepens and accelerates flows through the cleaned thalweg. Inset: The Sand Wand™ is a manually operated and selectively removes the non-native silts & fine sand material.

The narrowed area to be cleaned was marked with wood stakes and the Sand Wand™ crew instructed to stay within those boundaries and taper the lateral edges. The Trust leadership, consultants, and contractors were all charged with regularly walking the river to evaluate the integrity of the restored areas. The new approach has proven to be optimal. The removal of sediments in a strategically narrowed area deepens and accelerates flows through the cleaned thalweg, and conversely slackens flows over the deposits left undisturbed and where the river was already attempting to redevelop bank. The result is a beautifully restored gravel bottomed river.

Fortunately, the magnitude of the 2012 discharge was far less than the 1998 Event, and while initially causing serious worry, it ended up being an important test of the integrity of the restoration effort.

The material removed using the Sand Wand™ is pumped to discharge or dewatering pits. These pits are temporary and excavated in upland areas.

While selective removal continued to work flawlessly throughout 2012, there was a setback last August, with a new release of an estimated 10,000 CY of sediment in a single event from the Orland reservoir ("new Event").

Fortunately, the magnitude of the 2012 discharge was far less than the 1998 Event, and while initially causing serious worry, it ended up being an important test of the integrity of the restoration effort. Over the next several months, where selective sediment removal had been used, the river proved capable of dynamic cleansing, and by early spring 2013 those areas were fully recovered.

The new Event also led to an agreement with the reservoir managers for a more closely defined governance of dam operations, and an increasingly constructive relationship, including the potential to cooperate on important projects of mutual interest.

Once the major issues surrounding the 2012 discharge were resolved, the Trust accelerated consideration of further options to enhance the recovery of native fluvial geomorphology, and decided to add into operations the installation of large woody debris structures (LWD). The Trust consulted with the regulators on further permitting, and sought maximum flexibility, emphasizing that LWD was: 1) a nationally accepted restoration practice; 2) no risk to aquatic resources; 3) well established as ecologically beneficial; and 4) a de minimis addition. USACE, IDNR and IDEM all agreed that the work would be covered under existing permits and agreements, so long a knowledgeable LWD contractor would perform the installations using generally recognized best practices.

LWD structures are strategically placed in coordination with the sediment deposits left in place to help stabilize depositional areas.

The Trust chose Kanouse Outdoor Restoration ("Kanouse") based on the company's prior experience in observational based stream restoration and adaptive management. Kanouse mobilized a crew 2 days after the final regulatory approval, and rapidly worked to install the most critical LWD structures ahead of high spring waters. The structures are strategically designed to enhance the focus of flows through the restored thalweg, prevent erosion of the sediments selectively left in place, and simultaneously capture and incorporate excess sediments into those areas already rebuilding bank. As water levels drop this summer, rebuilding bank will be further stabilized with plantings of native vegetation.

Currently, the project has reached the point where the Trust's bundle of techniques can be evaluated for success. In addition to the stark visual contrast of a clean cobble thalweg versus the muddy sediment choked conditions of unrestored areas, other objective data is continuously being collected to validate the recovery. For example, during the summer of 2012, comparative studies found 42 nests of Longear Sunfish in the restored areas and only 14 in unrestored areas. Qualitative testing, and field observations of macro-invertebrates documents a return of high-density colonies, and grain size sampling of the thalweg, before and after restoration, shows substantial improvement in porosity. The Trust has also engaged Indiana University, School of Public and Environmental Affairs (IU) to follow the recovery over several years, and initial data shows positive results from IU's geochemical and biological testing.

The Trust's goal of restoring the native ecology of the main stem of the lower Fawn River is now within budgetary reach, and with some new grant partners, the Trust will expand its recovery work beyond current project boundaries into other areas of the Fawn River. A comprehensive watershed plan is in the early stages of development by SNRT, Inc., and exciting possibilities exist for restoring large sections of the Fawn as a showcase Indiana river worthy of a federal Scenic River designation. **L&W**

by Neal Lewis; with Bill Priore; Cora Lewis; Darrell Nicholas; and Emily Tucker-Halm

Requests for site visits or consultations with the Trust and its contractors can be directed to FawnRiverTrust@Yahoo.com and for further information on the restoration progress, primary contractors, and technologies, visit www.FawnRiverRestoration.org and www.facebook.com/FawnRiverRestoration *© Fawn River Restoration and Conservation Charitable Trust and Neal Lewis, 2013.*

The Fawn River Restoration & Conservation Charitable Trust is a 501(c)(3) organization and contributions are tax deductible. The Trust leadership is Rev. Thomas E. Smith, Eric Clyde Lewis & Neal Lewis, PO Box 68, Orland IN 46776.

Photographs and graphics by Emily Tucker-Halm and Neal Lewis.