Project Description

Maury River Stream Restoration II at Echols Farms, Glasgow, VA

Primary Purposes: Aquatic-habitat restoration, Sediment-loading reduction

Background: For decades, the Echols Farm, located on the Maury River in Rockbridge County, has been experiencing extensive bank erosion. Significant hydrologic changes on the Maury River began in 1915, when Virginia Electrical Power Company (VEPCO) built a 15-feet high dam on the James River at Balcony Falls for electricity generation. The dam was located just downstream of the confluence of the Maury and the James. The plant was in operation until 1969. The dam provided many recreational opportunities on the James and Maury Rivers as it created an impoundment of flatwater. Citing concerns following the devastating flood in 1969, citizens of Glasgow petitioned to have the dam removed (Miller, 1992). In 1974 VEPCO removed the dam.

After the dam was removed, the water level dropped as far upstream as the Echols Farm, leaving the channel entrenched and mature trees "high and dry" at the top of exposed banks. As those banks eroded, the trees fell in, the channel migrated laterally and down valley, and the meander above the Route 130 bridge became more and more unstable in its planform configuration. In October 2003, prior to replacing the Route 130 bridge, VDOT armored the downstream half of that meander in order to protect the approach to the soon-to-be-constructed bridge. Though their armoring prevented further erosion within their work area, the upstream bank continued to erode as did the downstream, opposite bank. This bank-hardening set the stage for erosion further downstream as the river attempted to adjust to the alignment upstream from the bridge. In 2014, the upstream meander bend (approximately 2,000 feet of channel) was restored through a voluntary, stream-restoration partnership between the landowner and VDGIF.

The currently proposed project site (downstream of the bridge on river-left) has eroded laterally more than 100 feet since 2000 and taken roughly 9,384 tons of soil downriver to the James and eventually the Chesapeake Bay. This bank will continue to migrate if unaddressed. Since heavy sediment loading is considered a serious threat to habitat of all aquatic species, including endangered mussel species, restoring fluvial processes, channel competency, and floodplain access is critical to protect these populations (Brian Watson, VDGIF malacologist, 2/9/16 email communication to Chris Powell, USACE).

Work to be Performed: In order to restore the stream channel, reduce excessive sediment input, and improve aquatic habitat along an approximately 400 linear-foot reach of Maury River in Rockbridge County, this proposed, voluntary restoration project (utilizing State Wildlife Grant cost-share funds which are specifically designated to restore and enhance habitat for species of concern in Virginia) involves the following activities:

- Restoring appropriate dimension, pattern, and profile to 400 linear feet of channel;

- Creating a vegetated bankfull, floodplain bench;
- Installing two rock vanes to deflect flow and protect the bankfull bench and bank while vegetation is becoming established;
- Sloping, seeding, mulching, and planting 450 linear feet of streambank and the entire riparian buffer for long-term stability.

Project Schedule:

1. Project construction will adhere to an in-stream time-of-year restrictions for James spinymussel (*Pleurobema collina*) and will occur only after August 1 and before May 15 of any year.
2. The estimated period of construction is 2-3 weeks following commencement of activity. The target start date is between August 1 and September 1 for optimal low-flow conditions.
3. At least two weeks prior to construction, metal signage will be installed upstream in Buena Vista at the Glen Maury boat access site and downstream at Locher Landing (Maury and James Rivers boat access site) in Glasgow notifying river users of the activity. Signage will remain until after construction is complete. Similar notification will be posted on the Rockbridge County and VDGIF websites.
4. A navigable channel will remain open during all phases of the project. Construction activity in the channel will be suspended when boaters are present.

Resource Protection:

1. A Phase I historic-resources study was completed by Louis Berger consultants at the Maury II project site in May 2016, and the report is being finalized for submittal to SHPO and the Corps of Engineers.
2. A mussel habitat assessment and survey was completed by Brian Watson of VDGIF on June 22, 2016 (results and recommendations tobe submitted to the Corps of Engineers).
3. The contractor will be selected based on stream restoration experience and training.
4. Refueling will occur more than 100 linear feet away from the stream channel.
5. Equipment will be parked outside of the floodprone area (on the terrace) outside of working hours.
6. All equipment will be inspected daily for leaks and repaired prior to working in or near water.
7. Tree removal within the work area is prohibited.

Erosion and Sediment Control Measures:

1. In-stream work will be carried out under low-flow conditions (<500 cfs at Maury River gauge station at Buena Vista, USGS 02024000).

2. An ESC plan will be submitted to Rockbridge County for review and approval, as required.
3. Any disturbed bank area (e.g., access path to the river) will be protected from overland stormflow by straw bales at the end of every workday.
4. All disturbed bank area will be stabilized with seed and straw immediately upon final grading, or prior to final grading in the event of a pending storm event.

Construction Sequence:

1. Mobilization of equipment and materials onto jobsite via an existing construction entrance located north of Route 130, on the eastern side of the river.
2. River access for equipment will be located immediately upstream of the project area where the bank grade is more gradual and the impact to vegetation will be minimal. Access path will be blocked from overland flow by straw bales at the end of each working day.
3. Excavation of the new-channel thalweg will be carried out by trackhoe starting at the downstream end of the project area. The material will be stockpiled between the thalwegs of the active channel and the newly constructed channel until the new channel is opened. This material will be used to form the floodplain bench.
4. The channel area that is filled to form the floodplain bench will be filled from the upstream to the downstream end of the project area.
5. Class 3 stone will be delivered to the site via trucks and used to build the rock vanes and floodplain sills.
6. The portion of the streambank above the elevation of the cultural horizon will be graded to at least a 3:1 slope. That material will graded into the bank profile below the cultural horizon to establish a slope that can be regevetated, so as to not disturb the cultural horizon.
7. The entire disturbed area will be seeded and mulched immediately and will be planted with trees and shrubs during the dormant season.

Alternatives analysis: Project alternatives included three actions – two bank stabilization approaches and one stream restoration approach – as well as non-action. These alternatives are described as follows:

Alternative 1: No action.

Current sediment supply to the Maury and James Rivers and ultimately the Chesapeake Bay from the river-left bank erosion at this site is estimated to be 468 cubic yards or 702 tons of sediment per year. This lateral migration and sediment supply will increase with the passage of time.

Alternative 2: Bank stabilization using bioengineering methods.

Bank stabilization using bioengineering such as sloping, planting, fascines, and/or rootwads is practicable when the channel is in a relatively stable pattern, dimension, and profile and the bank instability is a result of bank vegetation disturbance rather than near-bank shear-stress forces (DCR, 2004). Without addressing the velocity and shear stress resulting from the steep, transverse riffle, over-widened channel, and mid-channel bar at this project site, "soft-engineering" approaches to bank stabilization will not be effective. Continued excessive sediment supply will negatively impact aquatic habitat downstream. This approach will not achieve the project goals.

Alternative 3: Bank stabilization using armor.

Applying a bank-hardening approach without addressing the channel hydraulics referred to above would result in the erosive energy being transferred downstream of the armored bank (Fischenich, 2003), causing loss of existing, mature vegetation, and requiring additional armoring over time. To simply armor the left bank in its existing location would be an attempt to confine the channel in an unstable pattern/radius of curvature without addressing the near-bank shear-stress, channel incompetence, and channel instability as a whole. Long-term impacts would include loss of riparian-succession potential and sediment loading from continuing erosion on the left bank immediately downstream of the armoring as well as from the right bank as the mid-channel bar continues to build and put pressure on the right bank. Continued excessive sediment supply will negatively impact aquatic habitat downstream and impacts to riparian-vegetation succession will negatively impact both riparian and in-stream habitat. This approach will not achieve the project goals in the long-term.

Alternative 4: Stream restoration.

A comprehensive restoration approach creates the appropriate channel pattern, dimension, and profile based on reference reach data and the hydraulic model developed for the upstream reach (Ecosystem Services, 2014). It results in a competent channel and an active floodplain – key components of an aquatic system in balance (Rosgen, 2006).

The proposed design calls for excavating a stable riffle channel pattern, dimension, and profile; filling the over-wide channel on river left to create a floodplain bench; and installing associated deflection structures to protect re-vegetated areas. These features are critical to the overall hydrology of the stream in that they 1) narrow the currently over-wide bankfull channel thereby increasing competence, 2) reduce near-bank shear stress that is causing excessive erosion and continued widening, and 3) provide appropriate pattern, dimension, and profile for sediment transport through the riffle thalweg (Ecosystem Services, 2014). This alternative is considered the best approach for achieving the project purpose and goals as it addresses the impacts of channel instability on sediment supply and aquatic and riparian habitat.

Least Environmentally Damaging Alternative: We determined that Alternative 4, Stream Restoration, is the least environmentally damaging practicable alternative to achieve the project goals.

The proposed project applies a comprehensive approach to the river reach that involves both the active-channel bed, the banks, and the floodplain, as it is well-established that they function as integrated parts of the whole system (Charlton, 2008; Rosgen, 1996). Addressing one aspect without addressing the other is not an effective means to improve aquatic resource function and service, which is the primary objective of this endeavor. A system-based approach of natural-channel design which takes into account the pattern, profile and dimension of the stream, as opposed to just the streambank "in a vacuum" results in the most benefit to the aquatic resource.

With regard to a net increase in aquatic resource function, a short-term disturbance in the channel from excavation to restore the riffle thalweg to the appropriate dimension, profile, and location relative to the upstream and downstream pools will be more-than offset by the reduction in sediment loading from the rapidly eroding river bank and improve overall aquatic habitat value, as a result (Brian Watson, VDGIF malacologist, 2/9/16 email communication to Chris Powell, USACE). The proposed design incorporates construction of a vegetated floodplain bench at the appropriate elevation that will compensate for temporary loss of in-stream channel wetted perimeter as a result of this restoration project. The project will also provide functional value in dissipation of energy and maintenance of sediment transport processes within and beyond the active, bankfull channel.

Excavation of the mid-channel bar is integral to meeting the project goals. The presence of this depositional feature resulted from the lateral migration of the channel due to entrenchment and lack of floodplain access, causing a wide, shallow bed (308-feet bankfull width versus 196 feet for the reference/modeled cross-section bankfull width; Ecosystem Services, 2014) that disrupted sediment transport, leading to deposition in the center and erosion at the margin of the channel. The presence of a mid-channel bar and its associated transverse riffle puts undue shear stress on the toe of the left bank leading to more and rapid bank migration. Any temporary in-channel impacts from this excavation (33,750 square feet of mid-channel bar material) will be more-than offset by establishment of a competent bankfull channel and 53,750 square feet of bankfull-bench floodplain and vegetated riparian buffer where currently none exists. The function and services provided by this area include water quality improvement as a function of decreased bank erosion and in-channel sediment competence, floodflow attenuation across the bankfull bench, energy dissipation due to roughness of the vegetated floodplain and riparian area, overland flow infiltration and filtration from adjacent agricultural fields, and enhanced riverine and riparian habitat within the entire project area.

Construction/Project Monitoring:

Photographs will be taken before construction begins, at the end of each week during active construction, and post-construction. Annual photos will be taken during the month that the project was completed for each of three years following project completion. The photos will be submitted to the Norfolk District West Central Field Office.

Each set of photographs will include the following five photos:

- Four photos taken from two streamside photo stations (one station at each end of the project - two photos taken from each station, one looking upstream and one looking downstream), and
- One photo taken from the Route 130 bridge looking downstream.

Photos will be labeled with the photo station number, photographic orientation, date and time of the photograph, and name of person taking the photograph.

Topographic surveys

An as-built cross-section survey at the mid-point of the project reach will be submitted within one month after completion of construction, and annually for three years thereafter.

A longitudinal profile of the thalweg from the upstream end of the project area to the downstream end of the project area will be surveyed and submitted within one month after completion of construction, and annually for three years thereafter.

The completed reports will be submitted to the Norfolk District West Central Field Office.

REFERENCES

Charlton, Ro. 2008. Fundamentals of Fluvial Geomorphology. Routledge.

DCR. 2004. The Virginia Stream Restoration & Stabilization Best Management Practices Guide, VA Department of Conservation and Recreation, Division of Soil and Water Conservation.

Ecosystem Services. 2014. Hydraulic model: Maury River at Echols Farms. Submitted to USACE Norfolk District West Central Field Office and VDOT.

Fischenich, J.C. 2003. Effects of Riprap and Riparian Ecosystems. EDRC/EL TR-03-4, US ARMY Engineer Research and Development Center, Vicksburg, MS.

Miller, Lynda Mundy-Norris. 1992. Glasgow Virginia: One Hundred Years of Dreams. ISBN 0-9623572 5-1.

Rosgen, Dave. 1996. Applied River Morphology. ISBN 0-9653289-0-2.

Rosgen, Dave. 2006. Watershed Assessment of River Stability and Sediment Supply.ISBN-13: 978-0-9791308-3-0.