

# Supplemental Report: 2011 Stream Restoration of the Lake Julia Outfall (Reasonover Creek) at DuPont State Forest

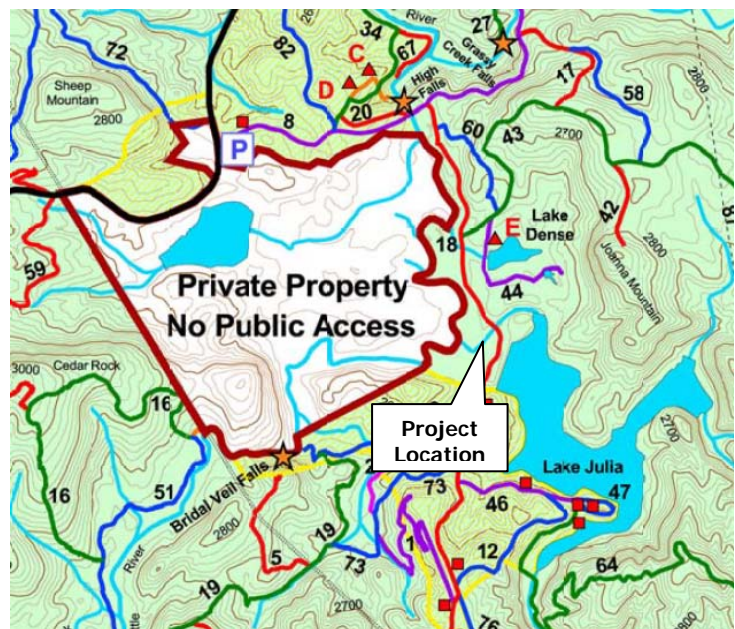
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This report focuses on background information, preliminary phases, and on-the-ground restoration work that was completed in May 2011. This report is primarily intended for internal use and reference, and is not an official publication. However, it is in the public domain and it may be reproduced or referenced.

## Introduction & Background

The 99-acre Lake Julia was constructed in the 1960's. The lake's outfall channel was established to connect the lake spillway back into Reasonover Creek. In 2008, the property through which the outfall flows became part of DuPont State Forest.

This man-made outfall channel was not situated within a natural floodplain area, and the resulting erosive forces of the perennial stream flow from the spillway have created steep escarpments alongside the stream.



The soils of the upper reach of the lake's outfall are relatively rocky, creating a canyon-like appearance that remains fairly stable due in large part to the abundant rock substrate and lack of intensive use by the public.

The lower reach of the lake's outfall flows through an area of fine alluvial sediments, and a segment of the outfall was situated immediately against a soil embankment that had become unstable. This embankment consists primarily of a mixture of sand and clay, with very little rock substrate to retain the soil from slumping as the outfall/stream continued to undermine the embankment.

After a series of significant rainfall events in the mid-to-late 2000's, this embankment exhibited a considerable increase in the frequency of soil loss and subsequent slumping of large trees that were atop the embankment. This eroding and collapsing embankment also began migrating downstream and upstream towards the permanent bridge on Conservation Road that is a vital travel route on DuPont State Forest.





Two photos of the stream's eroding and collapsing right-bank escarpment: Above taken May 2009. Below taken Sept.2009. Note the safety vest hung on a limb to show relative height of the escarpment (circled).







Photo above taken Sept.2009 showing close-up of escarpment. Photo below from Dec.2010, taken from the bridge on Conservation Road. The escarpment can be seen through the trees in the background (arrow).





In addition to the concerns of the unstable embankment, the outfall stream had limited functionality to support aquatic organisms and fish due to a lack of in-channel woody debris, deep pools, or cobble substrate. The outfall was functioning much like a ditch, with a heavily silted substrate, incised channel banks, and was disconnected from its floodplain area.



Both photos taken May 2011. Above shows a typical pattern of the stream: somewhat incised banks, silted substrate, and lack of pools. Below shows left-bank of the stream. Sediment deposition did occur at places along both sides of this stream, but the stream was still largely disconnected from its floodplain.



## Funding & Contracting

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By 2009, staff of the N.C. Forest Service (NCFS) began to investigate solutions to restore this segment of the lake's outfall. Funding for the project was originally allocated by a competitively-awarded grant from the [American Recovery & Reinvestment Act](#) (ARRA, also known as the 'federal stimulus' program), via the USDA-Forest Service (USFS). A portion of this ARRA grant was used to reimburse the costs associated with the design, engineering, permitting, and oversight of the restoration work. However, upon completion of this initial phase, an unforeseen delay related to trout stream buffer disturbance (discussed later in this report) halted all work on the project. This delay began to conflict with the timeline that was allocated to expend the ARRA funds that were obligated for this project. With no clear guidance available to the NC Forest Service as to when the project could once again resume, a decision was made with support from the USFS to re-allocate the ARRA grant to partially fund two existing personnel within the NCFS who would have otherwise been subject to a reduction/in/force had the ARRA grant not been re-allocated. Concurrently, the [North Carolina Water Resources Development Grant Program](#) solicited requests-for-proposals to fund water resource improvement projects. The NCFS successfully competed-for and received a grant from the state's Water Resources program to reimburse the remaining expenditures related to the restoration project, once the project was eligible to progress.

### Grant Fund Allocations:

- \$30,000: ARRA Grant via USDA-Forest Service
- Planning, Survey, Design, Engineering, and Permit Preparation
- \$120,000: Water Resources Development Grant via N.C. Division of Water Resources
- Restoration Construction, Oversight, Monitoring, and Tree Establishment

The NCFS contracted with the [Department of Biological & Agricultural Engineering at North Carolina State University](#) (NCSU) to complete the restoration project, via Task Order #2876. Faculty and staff of NCSU completed the first phase of work related to design, survey, and engineering, while assisting with permitting and oversight. A subcontractor ([North State Environmental, Inc.](#)) was hired by NCSU to conduct on-the-ground restoration construction work and assist with the training and outreach component of this project.

## Timeline

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The timeline below outlines significant project trigger points.

Feb.17, 2009.....Submitted initial application to USFS for ARRA funding.  
Apr.17, 2009.....Received notice of ARRA grant award from USFS.  
Nov.1, 2009.....Executed task order with NCSU.  
Dec.1, 2009.....Executed agreement with USFS.  
June 22, 2010....Submitted Federal & State water quality permit applications.  
July 14, 2010....Submitted state erosion & sediment control permit application.  
July 15, 2010....(a) Submitted state trout stream buffer disturbance waiver request.  
.....(b) Personal comm. between NCFS staff and N.C. Division of Land Resources (NC-DLR) to learn about trout buffer waiver moratorium.  
July 19, 2010....(a) Notice of denial of state erosion & sediment control plan.  
.....(b) Received letter of recommended water quality permit conditions from N.C. Wildlife Resources Commission.  
July 23, 2010.....Notice of denial of trout stream buffer disturbance waiver.  
July 29, 2010....(a) Received state (Div. of Water Quality) Sec.401 Certification.  
.....(b) Discussed re-allocation of ARRA funding with USFS representative.  
July 30, 2010.....Submitted funding request to NC Water Resources grant program.  
Aug.12, 2010.....Received federal (US Army Corps of Engineers) Section 404 permit.  
Sept.3, 2010.....Notice of inquiry from NC-DLR seeking additional information on design and erosion control aspects of the project.



Sept.27, 2010.....Notice of award from N.C. Water Resources Development Grant.  
Nov.17, 2010.....Submitted request to USFS for amending ARRA agreement.  
Jan.4, 2011.....Executed amendment of ARRA grant for re-allocating funds to support two personnel in the Division.  
Jan.5, 2011.....Submitted response letter to NC-DLR with additional information on design and erosion control aspects of the project.  
March 3, 2011.....Submitted second response letter to NC-DLR, per their inquiry, with further information on operational aspects (regarding pump-around options).  
March 22, 2011....Received waiver to disturb within trout stream buffer zone.  
April 6, 2011.....Received state erosion & sediment control plan permit & DWQ NPDES construction stormwater permit.  
May 2, 2011.....Subcontractor mobilizes on-site; restoration work begins.  
May 11, 2011.....On-site field training workshop led by NCSU and NSE hosting about 25 individuals as part of "[River Course](#)" series.  
May 18, 2011.....(a) Conducted final walk-through with NCSU and NSE. Restoration complete.  
.....(b) Erosion & sediment control inspection conducted by NC-DLR; site documented as in-compliance.  
May 22, 2011.....Self-guided tour of restoration site by group from American Ecological Engineering Society, consisting of about 45 persons.  
May 24, 2011.....Submitted signed certificates of completion to NC-DWQ and US-ACE.

### **Trout Buffer Waiver Delay**

The segment of stream that was restored is classified as trout water, despite the lack of any verification or data that supports this classification. This classification is driven mainly by the fact that this segment of stream is a direct tributary of the Little River, which itself is a bonafide trout-supporting waterbody. Under North Carolina's waterbody use-classification system, if a body of water is not otherwise classified then it defaults to the same classification as the immediate downstream body of water that does have a use-classification assigned to it. Thus, this segment of the Lake Julia outfall stream is considered a Class C/Trout waters.

Disturbances within Trout waters are prohibited between the months of October and April to minimize disturbance to trout spawning activity. The original schedule for this restoration would have allowed for completion prior to October 2010 and a seamless transition to re-establishing tree seedlings within the new floodplain and along the new streambanks during the dormant winter months. The NCSU field training workshop originally planned for October 2010 had to be re-scheduled to May 2011.

In addition, any ground-disturbing activities intended to occur within 25 feet of a designated trout stream must first receive an authorization waiver from the N.C. Division of Land Resources (NC-DLR). A waiver typically is issued concurrent with the site's erosion & sediment control plan; however unlike the erosion control plans, all trout buffer waivers are issued directly from the NC-DLR's Central Office in Raleigh.

On July 15, 2010 the NCFS Forest Hydrologist and BMP Staff Forester personally delivered a written request for a trout buffer disturbance waiver to the NC-DLR Land Quality Section Chief. At that time, the Section Chief informed us that NC-DLR had been directed by the N.C. Attorney General's Office to cease and desist issuing any trout buffer disturbance waivers until further notice. The NC-DLR Section Chief stated that no trout buffer waivers had been issued since approximately December 2009. This information had not been previously or openly communicated by NC-DLR, as neither the NCFS personnel, NCSU personnel, nor the contractor NSE were aware of this moratorium on trout buffer waivers. This lack of transparency and customer-service communication by NC-DLR was noted during the conversation with the Section Chief, and is an unfortunate example of a lack of proactive customer service orientation within some agencies of state government.

After further research by NCFs personnel after this meeting with NC-DLR, it was learned that a 2008 lawsuit against the State of North Carolina, and subsequent judicial appeal ruling against the State, had resulted in this moratorium (reference *N.C. Court of Appeals Case Number COA08-1307; filing date 17-November-2009; Clean Water for North Carolina v. NCDENR and Mountain Air Corp.*).

This unforeseen delay led us to seek alternative funding to complete the restoration project on a timeline that was yet to-be-determined. As noted earlier, a subsequent state grant was secured to reimburse the restoration costs, and in March 2011, notice was received by NC-DLR that they were once again allowed to issue trout buffer disturbance waivers.

## Design Elements

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The old outfall channel had a U-shaped cross-section, and had some limited connectivity to the floodplain, but only minimal structure within the substrate.

A new stream channel was excavated to the south of the old channel for an estimated length of 500 to 600 feet. The new channel is situated in a flat legacy floodplain area. Some design considerations had to be adapted to accommodate the site conditions. Upon initial excavation, it was determined that little to no rock or cobble existed within the soil profile of the new stream channel's location. The soil was nearly completely fine alluvial sediments and, in fact, the sediments were perched upon a thick layer of heavy clay that was found at a depth of about four feet. Having no suitable rock or cobble to work with, this type of material was salvaged from the old channel as needed during construction. In addition, the alluvial sediments necessitated the reduction of the new stream channel's sinuosity; with the fine sediments and expected heavy water flows, a meandering design would have been very challenging to maintain for structural integrity.



Photo above showing construction of one of the rock vanes. The new channel is situated in the legacy floodplain area.



Five boulder cross-vanes were installed in the new channel, each with a corresponding pool that allows the water to calm and sediments to settle out. Two riffles were established with large cobble taken from the old channel. Special attention was made to incorporate woody debris and organic matter in the design of the new stream channel.



Photo above taken from the Conservation Road bridge during construction. Seen in the photo is the first large boulder vane immediately downstream from the bridge. Also note the bundles of small vegetation installed along the right bank to incorporate organic matter. The excavator on right is establishing a riffle segment.



Photo above shows close-up of one rock/boulder vane arm on the new left-bank.



Bundles of small limbs, tree tops, and other loose woody material were installed along the stream banks within the new riffle segment. These bundles help to simulate natural overhanging vegetation to provide cover for fish and provide enhanced colonization by aquatic insects. Root wads and log-vanes were also installed within the channel, as well as an X-log vane within one of the pools.



Photos above show close-up of woody material that was incorporated into the design.  
Top-Left: A log X-vane was installed within one of the pools, below a rock/boulder vane structure.  
Top-Right: Bundles of small woody material were partially buried in sections of the new streambank.



Photo above shows a log vane with attached rootwad installed along new left-bank.



A new floodplain bench was excavated along the length of the new left-bank to improve hydrologic connectivity between the new stream and the legacy floodplain. A similar bench, and a boulder sill, was established along the section of new right-bank upon backfilling of the old stream channel, against the base of the embankment escarpment.



Photo above shows the new slope gradient along the left-bank, to improve the hydrologic connectivity to the floodplain.

All of the boulders and backfill material for the project were obtained from various locations on DuPont State Forest with coordination and agreement of the Forest Supervisor. The use of existing state-owned materials allowed this project to be financially viable.



Photo above shows the former right-bank escarpment back-filled and ground surface stabilized. The upper portion of the escarpment was left intact to sustain active nesting cavities for swallows. With the stream no longer undermining this embankment, we do not expect any significant soil loss or slumping.



## Restoration Construction

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The contractor, North State Environmental, mobilized on the site May 2 and completed the work by May 18. Notification to NC-DWQ was provided by the Division via email to their Asheville Regional Office, per the conditions of the 401 permit. No work was conducted during weekends or nights. The contractor's roster of equipment included two tracked-excavators, one on-road dump truck and two off-road articulated dump trucks. The two off-road dump trucks proved their worth in quickly transporting boulders and fill material to the project site from various locations on DuPont State Forest. These locations were an existing rock pit on Rock Quarry Road; from atop Joanna Mountain; and alongside the airstrip. The trucks were capable of traveling on public roads for short distances which provided the contractor with flexibility on how and where the trucks could be used.

Stream bank stabilization and erosion & sediment control measures were implemented promptly by the contractor. Stream bank stabilization consisted of installing coconut (coir) matting along the length of new stream banks and live-staking with willow and silky dogwood. Erosion & sediment control measures were implemented after scarifying the ground surface with the teeth of the bucket on the tracked excavator, to alleviate surface soil compaction and allow grass seed to properly set in the soil. The area of disturbance (about 50-feet from top/of/bank) was seeded with a native grass mixture, with granular fertilizer applied, and then a layer of straw.



Photos above show steps taken for streambank and groundcover stabilization. Top-Left: Live stakes to be installed, and coir matting already installed. Top-Right: Straw is blown across the area after grass seed has been applied.

### Oversight

Division personnel from the Nonpoint Source Branch in Raleigh were on-site for nearly the entire duration of construction, to oversee the work and liaison between the contractor and DuPont State Forest personnel. Additionally, the Nonpoint Source personnel served as safety lookouts and addressed questions or concerns from forest visitors. Personnel from NCSU assisted with designing and placement of the stream structures and general engineering/construction oversight for the project.

### Rainfall

DuPont State Forest has a [remote automated weather station](#) located on the "Guion Farm/Flatwoods" area of the Forest, situated approximately 2.5 nautical miles from the project site. For the period between May 2 and May 18 this weather station recorded 0.89-inches of rainfall, with the majority occurring on May 3<sup>rd</sup>.





Photo above showing completed restoration work, view from the Conservation Road bridge. Soil surface on either side of the new stream channel has been covered with seed and straw.

## Communication

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A communication plan was prepared for this project by the NCFCS. Such a plan is thought to be the first of its kind for a stream restoration; similar plans are prepared on wildfire prevention assignments and emergency/incident management deployments. This restoration project served as a pilot for a communication plan and it is expected that future projects that may occur in high-visibility areas will warrant the preparation of such a plan.

An information poster was printed and installed on the bridge of Conservation Road over the outfall stream, overlooking the project site. This information poster explained the intent of the restoration work and is believed to have been a useful communication tool to address concerns or questions of Forest visitors with minimal interruption or intrusion on the construction operations.

Additional safety notices were posted at entry points of the High Falls Access Area, Hooker Falls Access Area, and on the bridge railings to alert visitors of



increased traffic and construction activity. A notice was also posted on the [DuPont State Forest website](#).

Based upon feedback from the Forest Supervisor, at least one phone call was received at the Forest Office questioning some 'muddy water' downstream of the project site. The Forest Supervisor explained that the restoration work was ongoing, and it is believed that no further inquiries or concerns were received.

## Lessons Learned

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### Stay in communication with permitting and funding agencies.

- Despite the delay related to permitting, we were able to complete this project within the timelines of the respective funding grants. Being able to quickly and openly communicate with the funding agencies and explain the situation, allowed us to implement a plan to re-allocate funding and secure additional funding with minimal overall disruption.

### Using on-site materials was the only way this project could be done.

- All of the boulders, cobble, soil, rubble, and other backfill material were obtained from various locations on DuPont State Forest. If we had been forced to purchase this material from commercial vendor sources, this project would not have been financially viable.

### Having adequate resources to do the work will expedite completion.

- The contractor assembled a roster of equipment and personnel that allowed smooth and continuous progress, with no noteworthy delays. The lack of significant rainfall also aided in the expeditious completion of the work.

### Maintaining on-site engineering & construction expertise is valuable.

- Both NCSU and the subcontractor (NSE) maintained personnel on the site that had the expertise necessary to adapt to the site's conditions, develop cooperative solutions, and implement the design with minimal delay. Some trial & error will always occur on restoration projects, especially those which handle large volumes of water. The trial & error work on this project was minimal, with NCSU and NSE working together well when a new solution was required.

### An on-site coordinator should be used on high-visibility sites.

- The Division maintained at least one additional person on the job site for nearly the entire duration of the restoration work. This person proved valuable for safety oversight, addressing questions from forest visitors and serving as overall project coordinator. The explanatory poster that was installed on the bridge was frequently referenced by visitors and is believed to have been very successful in keeping visitors out of the construction zone while explaining the project.



## Budget & Match Contribution

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Table below outlines expenditures and match through June 30, 2011.

Expenditure Item	ARRA Funds	Water Resources Grant Funds	NCFS 319-Grant Funds
Planning, Survey, Design, Engineering, and Permit Preparation: NCSU Voucher #1 (7/2/10)	\$30,000		
Permit Fees: NCDWQ, NCDLR			\$765.00
Construction & Oversight: NCSU Voucher #2 (5/20/11)		\$105,000	\$975.81 <sup>A</sup>
Monitoring: NCSU Voucher #3 (12/16/11)		\$15,000	
Tree Seedlings:			\$370.00
Interpretive Signs:			t/b/d
<b>Sub-Totals:</b>	<b>\$30,000</b>	<b>\$120,000</b>	

<sup>A</sup> Expenses of the NCFS Nonpoint Source Branch personnel incurred during construction oversight.

## Next Steps

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- Plant bare-root tree seedlings along the new stream banks and within the floodplain area during the winter of 2011/2012. These seedlings will be acquired from the Division's Claridge State Nursery. At this time we expect to need about 300 to 400 seedlings. Precautions will likely be needed to prevent browse damage to the seedlings from deer and rodents.
- Produce and install permanent information & education signs that explain the restoration project. A series of signs is tentatively planned for installation at different locations along the restored stream channel to describe various components of the stream's structure. The sign artwork and design is largely complete.
- Continue monitoring of the site via periodic site inspections and photo documentation. Compile and submit a final project report by 12/31/2011.
- It is anticipated that this site will be used for future training and educational workshops related to stream restoration, in cooperation with NCSU.