United States Department of Agriculture | **Forest Service** | **National Forests in North Carolina**
Pisgah National Forest
Pisgah Ranger District
1001 Pisgah Hwy
Pisgah Forest, NC 27868-7721
828-877-3265

File Code: 1950-1
Date: April 17, 2006

Dear Interested Members of the Public and Forest Users:

The U.S. Forest Service proposes to improve watershed conditions within the Bent Creek watershed and at Stony Fork, within the South Hominy Creek watershed, by repairing extensive damage to the banks and channels of these streams caused by the remnants of hurricanes which occurred during September of 2004.

I am sending the enclosed environmental assesment *Storm Recovery Actions: Improvements on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch, and Stony Fork* for your review. Pursuant to 36 CFR 215.5, as the District Ranger for the Pisgah Ranger District of the National Forests in North Carolina, I am requesting written or oral comments on the proposed action for the project listed above. The project is located in Buncombe County within both the Bent Creek and South Hominy drainages. Three alternatives have been developed and analyzed; Alternative 1 – No Action, Alternative 2 – Proposed Action and Alternative 3. A decision will be made that selects one of these alternatives or a modification of one. While Alternative 2 has been identified as the Preferred Alternative, a final decision has not yet been made. I am seeking your input on this EA before I reach a decision.

Your comments need to be as specific as possible and you must provide the following information: 1) Your name and address; 2) Title of the Proposed Action; 3) Specific substantive comments (215.2) on the proposed action, along with supporting reasons that the Responsible Official should consider in reaching a decision; and 4) Your signature or other means of identification verification. For organizations, a signature or other means of identification verification must be provided for the individual authorized to represent your organization.

Following the 30 day notice and comment period, I will publish a decision and, pursuant to 36 CFR 215.11(a) and 215.15(a), my decision may initiate a 45-day appeal period. Only those who submit timely and substantive comments will have standing to appeal. In accordance with 36 CFR 215.6(a)(2)(4), comments must be postmarked or received within 30 days beginning the day after publication of this notice in *The Asheville Citizen-Times.* Comments may be mailed to:

Pisgah Ranger District
ATTN: District Ranger
1001 Pisgah Highway
Pisgah Forest, NC 28768

Comments may be faxed to (828) 884-7527. Oral or hand-delivered comments must be received within normal business hours of 8:00 a.m. to 4:30 p.m. Comments may also be mailed electronically, in a common digital format (rtf.) to: comments-southern-north-carolina-pisgah-pisgah@fs.fed.us. The subject line must contain the name of the project for which you are submitting comments and the sender should normally receive an automated electronic acknowledgement from the agency as confirmation of receipt. If the sender does not receive an

automated acknowledgement of the receipt of comments, it is the sender's responsibility to ensure timely receipt by other means. A decision is expected in May 2006.

If you have questions regarding this proposal, you may contact Brady Dodd, Project Leader at (828) 257-4214 or Michael Hutchins, Zone NEPA Coordinator, at (828) 682-6146. Thank you for your continued interest in management of your National Forest.

Sincerely,

/s/ Randy Burgess

RANDALL BURGESS, District Ranger
Pisgah Ranger District
Enclosure

United States
Department of
Agriculture

Forest
Service

April 2006

Environmental Assessment

Storm Recovery Actions: Improvements on Bent Creek, Boyd Branch, Laurel Branch, and Rich Branch in the Bent Creek Watershed and Stony Fork in the South Hominy Creek Watershed

Pisgah Ranger District, Pisgah National Forest
Buncombe County, North Carolina

Photo of erosion of Bent Creek looking upstream at proposed Bent Creek Bank Stabilization site (UID# 3317).

For Information Contact:
Randall Burgess, District Ranger
Pisgah Ranger District
1001 Pisgah Highway
Pisgah Forest, NC 28768
Telephone: 828-877-3265

Title: Environmental Assessment - Storm Recovery Actions: Improvements on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch and Stony Fork

Lead Agency: USDA Forest Service

Responsible Official: Randall Burgess, Pisgah District Ranger, Pisgah National Forest

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SUMMARY

The U.S. Forest Service proposes to improve watershed conditions on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch and Stony Fork on the Pisgah Ranger District in Buncombe County, North Carolina. Boyd Branch, Laurel Branch and Rich Branch are tributaries to Bent Creek above Lake Powhatan. Stony Fork is a tributary to South Hominy Creek. The Proposed Action is needed to repair damage to the banks and channels of these streams, which was caused by heavy precipitation from the remnants of three hurricanes that affected western North Carolina in 2004. The purpose of the action is to return channel morphology to the Pisgah National Forest's desired condition, which is to have stable stream channels and to improve water quality and aquatic habitat.

As required by Code of Federal Regulations (40 CFR 1502.14), the Forest Service also evaluated a No Action Alternative, wherein none of the above activities would be implemented to improve watershed conditions on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch and Stony Fork.

The results of an analysis of the potential impacts of the Proposed Action and No Action Alternatives are reported in this environmental assessment. Based upon these results, the Pisgah District Ranger will decide whether or not to authorize (1) implementation of the Proposed Action, with required mitigation measures, as described in this Environmental Assessment (EA); or (2) take no action to remediate existing conditions.

Implementation of the Proposed Action may lead to short term (< 1 year) sediment increase during project implementation, however, the long term (> 1 year) objective is maintenance of high quality riparian areas, hydrologic function, stream stability and to minimize erosion. The Proposed Action would provide structural habitat improvements that use native materials and mimic naturally occurring structures to protect and improve fisheries habitat and stream channels.

The No Action Alternative will not improve existing conditions. Under this alternative no restoration activities will be conducted and the sites will not be improved toward desired conditions described above. The current rate of bank erosion will continue or increase due to the instability of the stream banks of the streams within the Bent Creek watershed. An increase in the current rate of erosion could occur as the undercut trees and stream banks fall over and expose more soil to be deposited into the streams. Increasing the potential sediment into the streams could cause adverse effects to channel integrity and stability and place the water quality of Bent Creek at risk.

CHAPTER 1 – PURPOSE AND NEED

1.1 Document Structure

The Forest Service has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the Proposed Action and alternatives. The document is organized into four parts:

Chapter 1 – Purpose and Need: This section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2 – Alternatives: This section provides a more detailed description of the agency's Proposed Action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on key issues raised by the public, other agencies, and the Forest Service. This discussion also includes possible mitigation measures. This section also provides a summary of the environmental consequences associated with each alternative.

Chapter 3 – Environmental Consequences: This section describes the environmental effects of implementing the Proposed Action and other alternatives. This analysis is organized by key issues. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.

Chapter 4 – Preparers and Public Involvement: This section provides a list of preparers and members of the public consulted during the development of the environmental assessment.

1.1.1 Project Record

This EA incorporates by reference the project record (40 CFR 1502.21). The project record contains specialist reports and other technical documentation used to support the analysis and conclusions in this EA. The specialist reports provide additional detailed analysis. This EA incorporates by reference the Nantahala and Pisgah Management Indicator Species (MIS) Report. This report along with Monitoring and Evaluation Reports for the National Forests in North Carolina determine the forest population trends for MIS.

Relying on specialist reports and the project record helps implement the Code of Federal Regulations' provision that agencies should reduce National Environmental Policy Act (NEPA) paperwork (40 CFR 1500.4), and that NEPA documents be analytic rather than encyclopedic and kept concise and no longer than absolutely necessary (40 CFR 1502.2). The objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated, without repeating detailed analysis and background information available elsewhere. The project record is located at the Pisgah Ranger District Office in Pisgah National Forest, NC. This EA also incorporates the Land and Resource Management Plan for the Nantahala and Pisgah National Forests and all relevant laws, acts and executive orders. Additional information about the Proposed Action is available for public review in the Project Record (PR) of this EA, which can be accessed at the Pisgah Ranger District Office[1].

1.2 Background

In September of 2004, the remnants of three hurricanes (Frances, Ivan, Jeanne) adversely affected many natural resources and facilities, as well as the infrastructure, of the four National Forests in North Carolina (NFsNC): the Nantahala, Pisgah, Uwharrie, and Croatan (Figure 1). Heavy precipitation primarily affected national forests in western NC.

Figure 1. The light shaded areas show the location of the four National Forests in North Carolina.

[1] 1001 Pisgah Highway, Pisgah Forest, NC 28768; telephone: (828) 877-3265

On the Pisgah National Forest, the stream banks of Bent Creek, Boyd Branch, Laurel Branch, Rich Branch, and Stony Fork experienced severe erosion and slope failure as a result of heavy precipitation and runoff from this event. Forest Service staff have identified one site on Bent Creek, three sites on Boyd Branch, two sites on Laurel Branch, two on Rich Branch, and two sites on Stony Fork that require improvements to unstable stream banks and channels.

To evaluate the potential for environmental impacts from the proposed improvements and to comply with the National Environmental Policy Act (NEPA) of 1969[2], the Forest Service has prepared this EA. This document was prepared in accordance with the President's Council on Environmental Quality (CEQ) and Code of Federal Regulations (CFR) that implement NEPA[3], U.S. Department of Agriculture NEPA regulations[4], and Forest Service Handbook (FSH) 1909.15, Chapter 40. It discloses the direct, indirect, and cumulative environmental impacts that would result from implementation of the Proposed Action including reasonably foreseeable activities within the project area.

Considering the purpose and need for the Proposed Action, the Pisgah District Ranger will review the impacts analysis reported in this EA to determine whether or not to authorize (1) implementation of the Proposed Action, with required mitigation measures, as described in this EA; or (2) take no action to remediate existing conditions.

1.3 Purpose and Need for Action

The purpose and need (objectives) of this proposal is to remediate extensive damage to the stream banks and channels of Bent Creek, Boyd Branch, Laurel Branch, Rich Branch, and Stony Fork caused by heavy precipitation and runoff from the remnants of hurricanes that affected western North Carolina in September 2004. The purpose of the action is to return the channel morphology to the Forest's desired condition, which is to have stable stream channels and to improve water quality, and aquatic and botanical habitat.

The project area is within Management Area (MA) 8, which includes experimental forests, which are lands managed for forest research; MA 3B, which emphasize a sustainable supply of timber, few open roads and limited disturbance from motorized vehicles; and MA 18, which emphasizes management that will enhance riparian and aquatic ecosystems and their closely associated plant and animal communities. The proposal responds to the goals and objectives outlined in the Pisgah National Forest Land and Resource Management Plan (FLRMP), Amendment 5 (March 1994) (pp. III-1, 2), and was designed according to the Forest-wide general direction and standards for Soil and Water Management described in the Plan (pp. III-40, 421, 42). The proposal helps to move the project area toward the desired conditions as described in the Forest Plan (Forest-wide Management Requirements pages III-24, 25, 40 and 179) as shown here:

- Provide structural habitat improvements. Give priority to use of native materials and mimic naturally occurring structures.

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[2] Public Law (Pub. L.) 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), Sept. 13, 1982
[3] 40 Code of Federal Regulations (CFR) Part 1500-1508
[4] 7 CFR Part 1b

- Protect and improve fisheries habitat for self-sustaining fish populations.
- Emphasize the protection of stream channels.
- Maintain high quality riparian areas, hydrologic functioning, stream stability and minimize erosion.

1.3.1 Why Here, Why Now?

Historically, the watershed was logged and valley bottoms were farmed; therefore, stream channels were impacted by changes in the sediment and flow regimes. Following the creation of the Bent Creek Experimental Forest, the influence of farming in the valley bottoms was eliminated and streams were able to begin the process of regaining more natural channel geometry in both pattern and profile. It is evident that this process continues today in several drainages. This proposal implemented at this time and in these locations would advance natural processes of establishing stable stream channels and would improve water quality and aquatic habitat in Bent Creek and Lake Powhatan by reducing sedimentation caused by erosion.

The Stony Fork drainage was also logged and farmed, but much of the drainage remained in private ownership, with the exception of several headwater drainages that currently are in public ownership. The site proposed for stabilization in this document is located on Forest Service land but is closely surrounded on three sides by private ownership where occupation of the floodplain and disturbance of stream banks is common due to home sites and roads. Future loss of both private and public land is imminent without the implementation of streambank stabilization activities. This proposal implemented at this time and in this location would advance natural processes of establishing stable stream channels and would improve water quality and aquatic habitat in Stony Fork.

1.4 Proposed Action

In order to stabilize stream channels and improve water quality and aquatic habitat, the Forest Service proposes the following activities in the Bent Creek Experimental Forest and in Stony Fork on the Pisgah Ranger District, Buncombe County, NC. Planned implementation is expected for the spring and summer of 2006. However, these projects may be implemented across a staggered timeframe. The Stony Fork proposal is dependent upon an agreement between the Forest Service and the private landowners who own property adjacent to the Forest Service parcel. A detailed discussion of the activities that comprise the Proposed Action and site-specific maps are provided in Chapter 2.

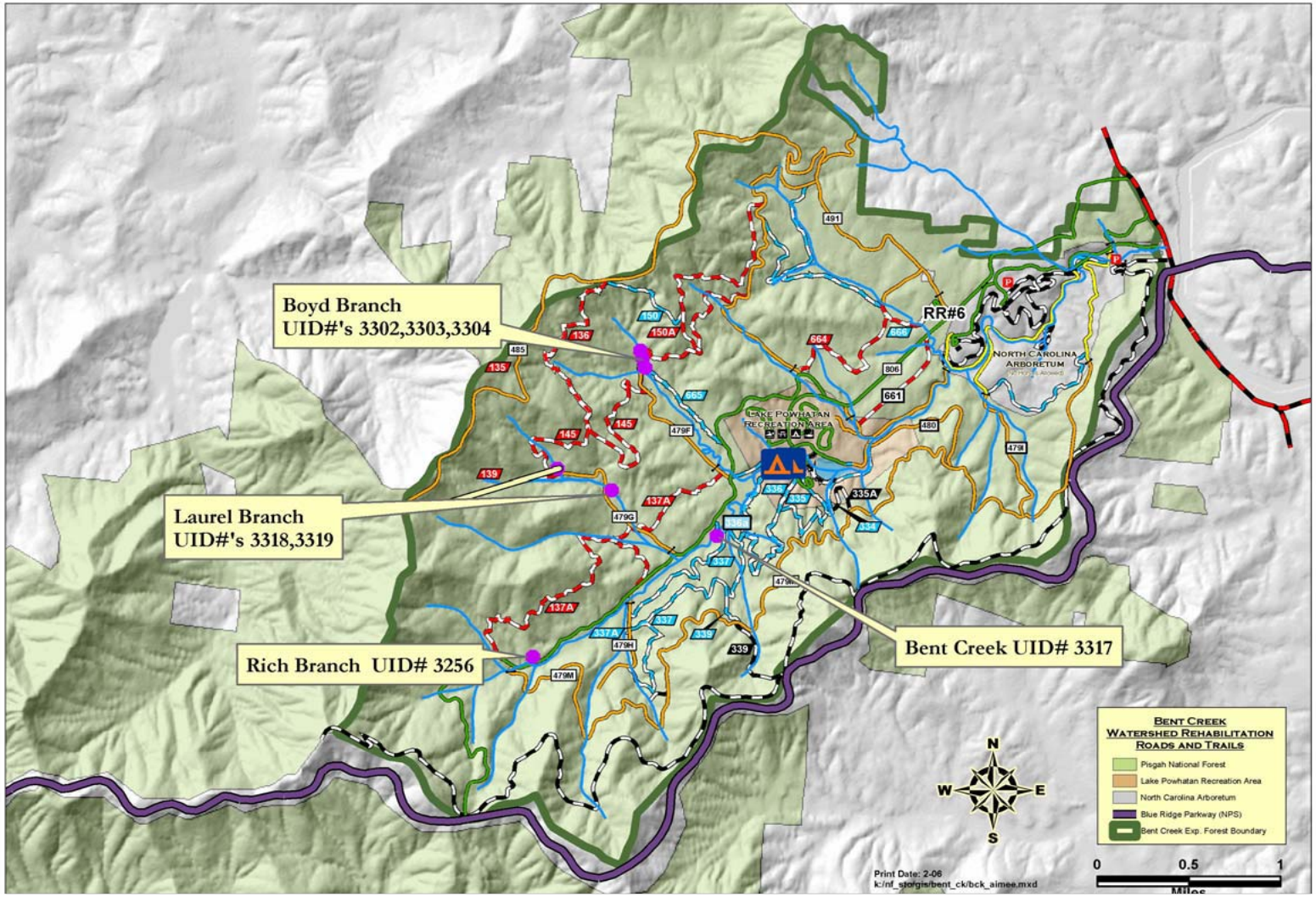

Figure 2. General location of proposed watershed improvement projects on Bent Creek, Boyd Branch, Laurel Branch, and Rich Branch.

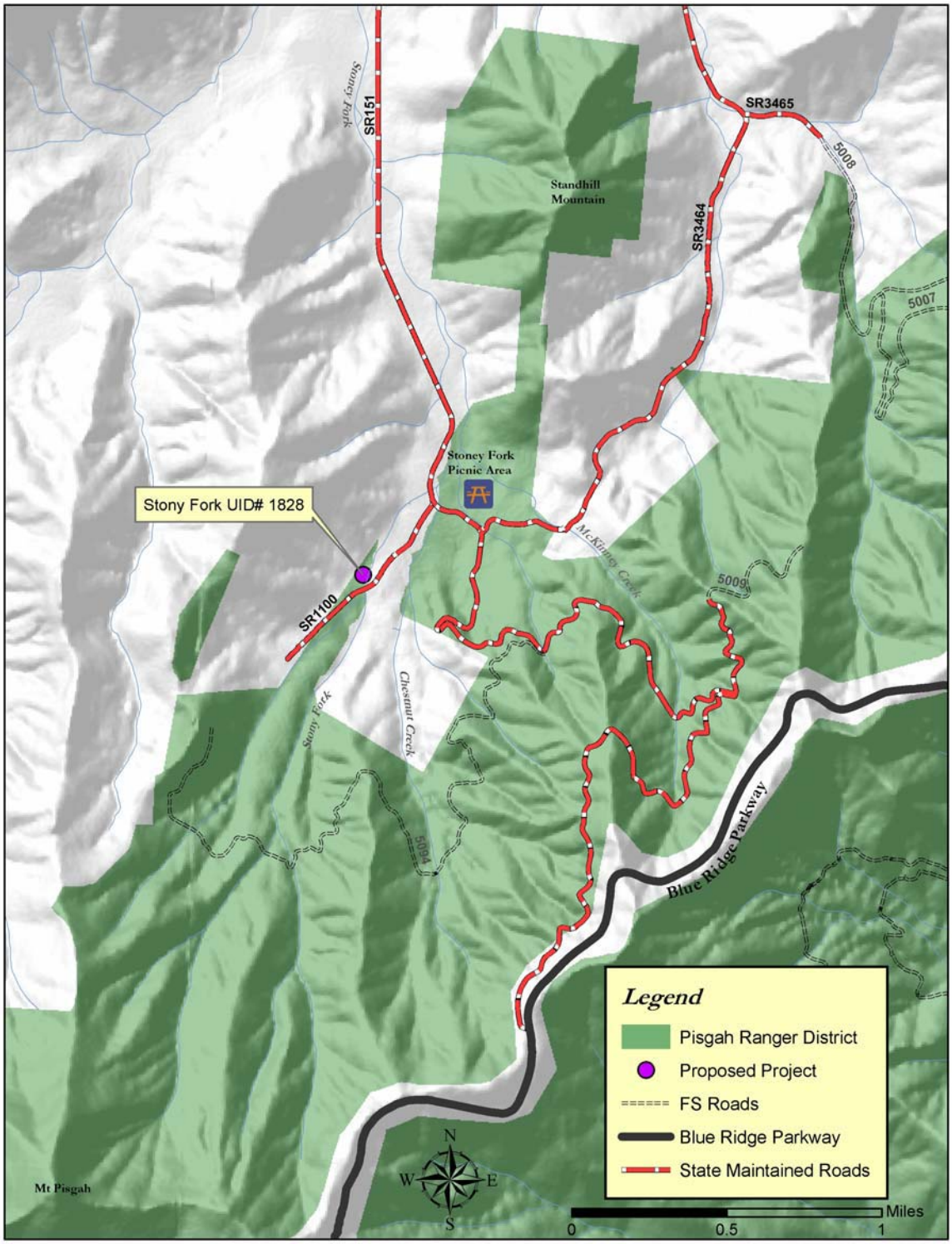

Figure 3. General location of proposed watershed improvement projects on Stony Fork.

The Proposed Action (Alternative 2) would:

- Stabilize banks with logs and boulder placement, slope back vertical bank and plant riparian vegetation on Bent Creek (Figures 4-7);
- Remove an old road crossing culvert (off Forest Service Road 479F), decommission the adjacent segments of the old road bed, reestablish a stable step/pool channel profile, stabilize stream bank with large wood, plant native trees and shrubs, and stabilize a headcut (unstable stream bed) on Boyd Branch (Figures 8-12);
- Slope back vertical banks, plant riparian vegetation, stabilize stream bank with large wood, and construct a rock vane and single-arm vanes on Laurel Branch (Figure 13-16);
- Armor the toe slope, construct a rock vane and single-arm vanes, and plant riparian vegetation on Rich Branch (Figures 17-20); and
- Recontour vertical banks, plant native trees and shrubs, use several instream boulders to build a rock vane, place and reinforce trees on left bank parallel to channel, and slope back the existing point bar using material from the opposite bank at the toe of the slope at Stony Fork (Figures 21-23).

1.5 Decision Framework

Based on the analysis disclosed in this EA, the Responsible Official would make a decision and document it in a Decision Notice and Finding of No Significant Impact. The Responsible Official can:

- Select the action alternative that has been considered in detail, or
- Select a modified action alternative, or
- Select the No Action Alternative.

1.6 Public Involvement

The public was informed of the Proposed Action by its listing in a Schedule of Proposed Actions posted on the NFsNC website (http://www.cs.unca.edu/nfsnc/). Public input is being conducted through scoping during a 30-day comment period on this EA in which interested members of the public and forest users are invited to participate. This EA was mailed to 28 individuals, organizations, and agencies for comment. Using comments received from the public, agencies, and organizations during this period, as well as internal review, the interdisciplinary team (IDT) will refine, as necessary, the issues to address for the decision maker.

1.7 Issues

The Forest Service separated issues into two groups: key (significant) and non-key (non-significant). Issues are defined as a point of discussion, debate, or dispute about environmental effects of the Proposed Action. Issues are used to develop alternatives or mitigation measures.

The Code of Federal Regulations (CFR) specifies that environmental analysis focus on significant (key) issues. Issues determined not to be significant (non-key) shall be discussed only briefly and eliminated from detailed study [40 CFR 1500.1(b), 1500.2(b), 1500.4(c), 1501.7(3), and 1502.2(b)]. The key issues will be analyzed in Chapter 3 of this EA and will also help form any alternatives. The non-key issues will be disclosed in Chapter 1 with an analysis, but not in Chapter 3. They will not be used to form the alternatives.

1.7.1 Key Issues

This EA separated the issues into two groups: (key) significant and non-key (non-significant) issues. Each key issue was analyzed with effects disclosed in Chapter 3.

1.7.1.1 Key Issue #1: Water Quality

The proposed stream banks restoration activities may affect water quality over the short term (within 1 year of the project, until vegetation is established) in the project area by introducing an influx of sediment to waters in and downstream of the project area.

Indicator:

- The linear distance of exposed soil within the riparian area of the proposed project area will be used to measure differences between alternatives.

1.7.1.2 Key Issue #2: Aquatic Habitat

The proposed stream banks restoration activities may have an additional affect aquatic habitat over the short term (within 1 year of the project, until vegetation is established) in the project area, primarily when heavy equipment enters the stream channel during implementation. No proposed activities will take place during the trout spawning period of October 15th through April 15th.

Indicator:

- The condition of the aquatic habitat, which includes stream stabilizing features such as rocks, boulders, and large woody debris in the stream channel, will be used to measure the differences between alternatives.

1.7.1.3 Key Issue #3: Wildlife and Plants

The proposed stream banks restoration activities may have an affect on threatened, endangered, sensitive, Forest concern and/or management indicator species in the project area.

Indicator:

- Effects (adverse or beneficial) to individuals and their habitat for threatened, endangered, sensitive, Forest concern and/or management indicator species aquatic, plant or terrestrial wildlife species.

1.7.1.3 Key Issue #4: Heritage Resources

The proposed stream bank restoration activities may impact cultural resources Heritage or cultural resources have been evaluated through site specific field verification in the project area within the Bent Creek watershed. The private land associated with Stony Fork site remains to be field verified and will be surveyed when the landowners agree to the proposed restoration activities. Cultural resource sites will be avoided.

Indicator:

- Existence of cultural sites located in the project area based on site specific field verification.

1.7.2 Non-key Issues

1.7.2.1 Non-key Issue #2 – Other Resources

Restoring channels in the project area may impact park lands, prime farmlands, wetlands, wild and scenic rivers, ecologically critical areas, local law, socio-economics, local geology, public health and safety, recreation, and visual and air quality.

Indicator:

- Non-key because the project does not propose actions within park lands, prime farmlands, wetlands, wild and scenic rivers, ecologically critical areas. It would also not violate local law or requirements imposed for the protection of the environment.

CHAPTER 2 - ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 Range of Alternatives

The range of alternatives developed and analyzed by the interdisciplinary team (IDT) was driven by the purpose and need underlying the proposal (Section 1.4, Chapter 1), and by the key issues (Section 1.7, Chapter 1). An alternative should (1) reasonably respond to the purpose and need and (2) address one or more key issues. The only exception is the No Action Alternative, which is required by regulation [40 CFR 1502.14(d)]. The interdisciplinary team (IDT) considered two alternatives.

2.2.1 Alternatives Considered but Eliminated from Detailed Study

2.2 Alternatives Considered in Detail

Three alternatives were developed by the IDT in response to the issues and concerns regarding the Proposed Action; Alternative 1 – No Action, Alternative 2 – Proposed Action and Alternative 3. Alternative 2 fulfills the specific purpose and need for these actions. Alternative 3 addresses the ability of the Forest Service to conduct stream restoration work on National Forest lands only, in the event that landowners are unable to enter into an agreement with the Forest Service to implement the specific proposal for Stony Fork stream stabilization.

2.2.1 Alternative 1 - No Action

Under this alternative, the projects described in the Proposed Action (Section 1.3, Chapter 1) would not be accomplished. No management actions would take place at this time to improve the existing condition of the environment in the project area. There would be no stream restoration activities implemented and the storm-related damage to these areas on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch, and Stony Fork would persist and possibly worsen over time. Runoff and seasonal high flows would continue to exacerbate the poor condition of stream banks and introduce additional sediment to stream channels.

2.2.2 Alternative 2 - Proposed Action

The Proposed Action comprises separate activities to the main channel and tributaries to Bent Creek (Figure 2) and Stony Fork (Figure 3). The following locations for the proposed improvements are within the French Broad watershed on the Pisgah Ranger District, Pisgah National Forest:

- Bent Creek, which drains into the French Broad River;
- Boyd Branch, a tributary of Bent Creek and located above Lake Powhatan;

- Laurel Branch, a tributary of Bent Creek located above Lake Powhatan;
- Rich Branch, a tributary to Bent Creek located above Lake Powhatan; and
- Stony Fork, a tributary to South Hominy Creek.

A tracked excavator will be used to accomplish the objectives of the Proposed Action. Where the placement of logs is proposed, trees will be used from the sites, either from slash piles near Boyd Branch Site 1 (Figure 8) or from trees that will be removed along the excavator path. If additional trees are needed for sites, then fallen trees beside access roads or trails will be used. Where tree and shrub planting is proposed, native species such as doghobble (*Leucothoe fontansiana*), silky dogwood (*Cornus amomum*), sweet pepperbush (*Clethra acuminate*), and rhododendron (*Rhododendron maximum*) will be planted in disturbed areas. The Proposed Action also includes planting an erosion control mix of non-persistent annual grasses to stabilize the soil after disturbance. The general locations of these sites are shown in Figures 2 and 3. This alternative was developed to improve existing stream conditions in the project area. Temporary closure of roads and trails may be necessary during project implementation for public health and safety. These closures will be posted in the project area prior to implementation. The following projects are proposed:

- **Bent Creek Bank Stabilization (Unique Identifier (UID #3317)**
    - Stabilize banks with logs and boulder placement, slope back vertical bank, and plant native riparian vegetation and an erosion control seed mix to stabilize banks (Figures 4-7).

- **Boyd Branch Channel Stabilization (UID #3302, 3303 & 3304)**
    - Remove the old road crossing (old Forest Service Road 479F since portion has been relocated), decommission the adjacent segments of an old road bed, re-establish a stable step/pool channel profile, place large wood in channel, stabilize a headcut, and plant native vegetation (Figures 8-12).

- **Laurel Branch Bank Stabilization (UID #3318 & 3319)**
    - Slope back vertical banks, plant native riparian vegetation and an erosion control seed mix, construct a rock vane, and place large wood in the channel (Figures 13-16).

- **Rich Branch Stream Bank Stabilization (UID #3256)**
    - Armor the toe of the eroded bank/slope, construct a rock vane and single-arm vanes, and plant native riparian vegetation and an erosion control seed mix (Figures 17-20).

- **Stony Fork Stream Bank Restoration Project (UID #1828)**
    - Recontour vertical banks, plant native trees and shrubs, use several instream boulders and boulders from a local quarry to build one rock vane, place and reinforce trees on left bank parallel to channel, and slope back the existing point bar utilizing material from the opposite bank at the toe of the slope (Figures 21-22).

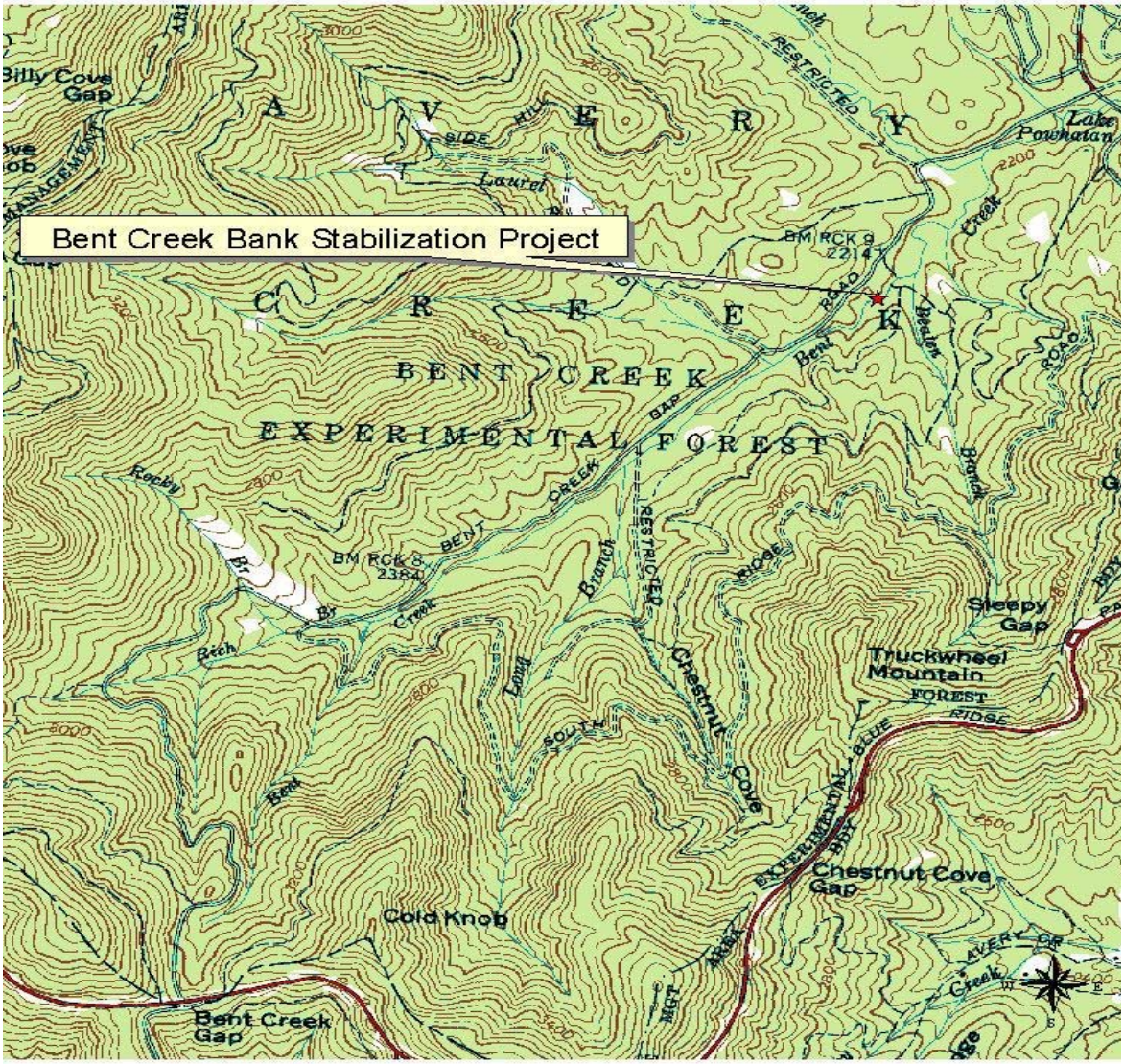

Figure 4. Relative location of proposed Bent Creek Bank Stabilization project (UID #3317).

Bent Creek Bank Stabilization (UID #3317)

A portion of this proposed storm recovery project is located on Bent Creek at one location that is a source of sedimentation in the channel. The general location of the site is shown in Figure 2, and the relative location on a topographic map is shown in Figure 4. The Bent Creek Bank Stabilization project intends to achieve the following objectives: 1) stabilize approximately 50 feet of stream bank; 2) reduce the extent of bare ground and potential erosion; and 3) reduce sediment loading to Bent Creek.

In order to achieve the stated objectives, the initial step will be to install sandbags or a silt fence at the toe of the bank, in order to trap sediment before it reaches the stream. The bank will be returned to a 1:1 slope for a 40-foot length to allow the establishment of riparian vegetation (Figure 5). Two boulder-sized rocks will be placed at the toe of the bank. These boulders will be buried in the streambed about 2/3 of their height, roughly 30 feet apart. A log approximately 25- to 30-feet long will be placed atop the boulders and secured against the bank. A third boulder will be placed at the toe of the bank and against the upper end of the log, which will be buried in the streambed about 1/3 its height. Branches will be placed in the gaps between the log and the bank. Two 15-foot-long logs with root wads will be placed on the top of the bottom log with the root wads facing the channel and the stems anchored into the bank (Figures 6 and 7). A log vane structure will be constructed at the upstream end using a log with a root wad and several boulder-sized rocks to keep it in place. A final log with root wad will be placed over the entire structure. The stream bank areas disturbed during implementation will be covered with erosion control matting.

The area (approximately 0.03 acres) that recieves heavy equipment traffic will be scarified to alleviate the surface compaction. The stream banks and scarified area will be planted with native trees and shrubs and seeded with an erosion control mix and mulch.

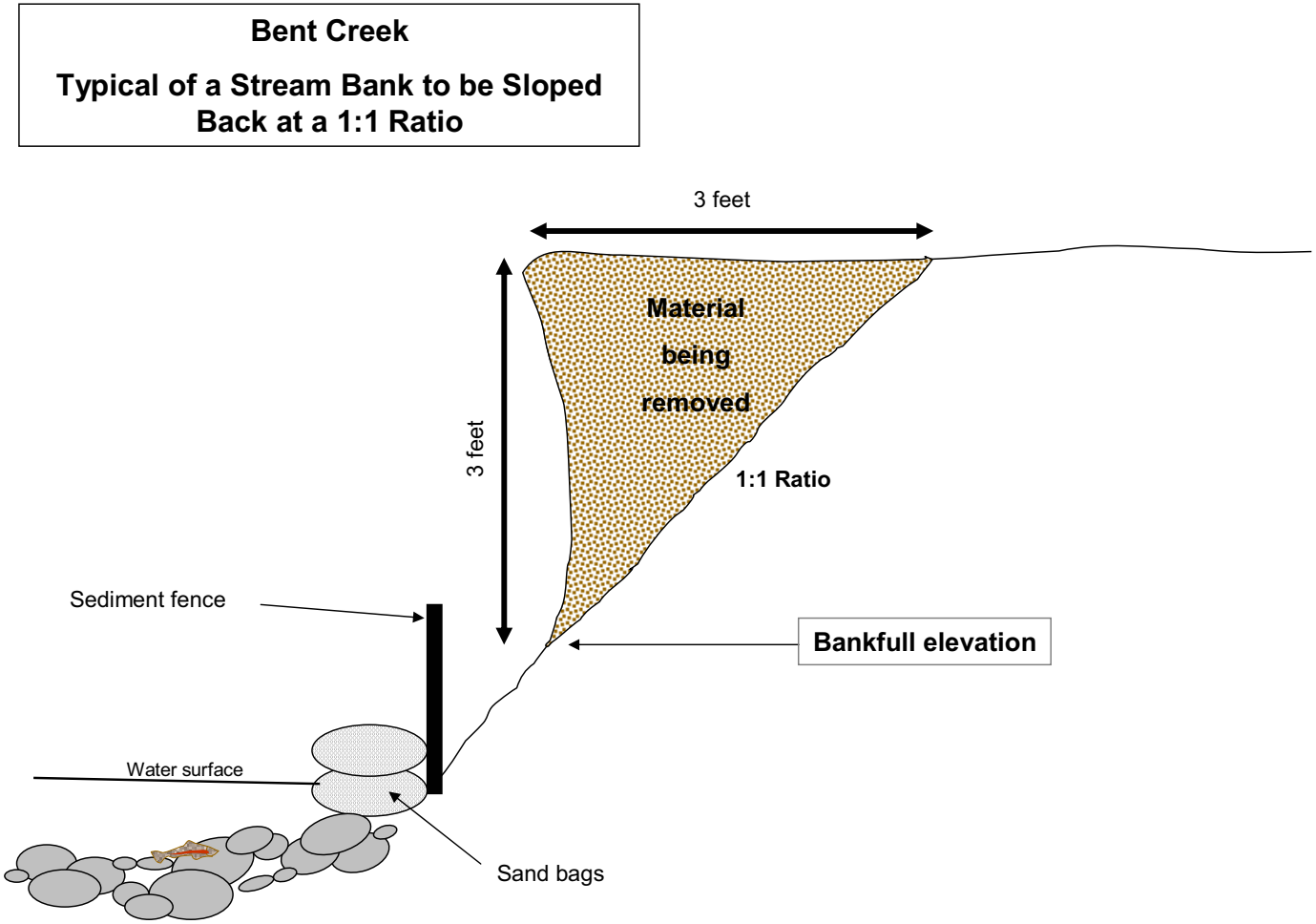

Figure 5. Site map of Proposed Action to re-contour bank for Bent Creek Bank Stabilization project (UID #3317).

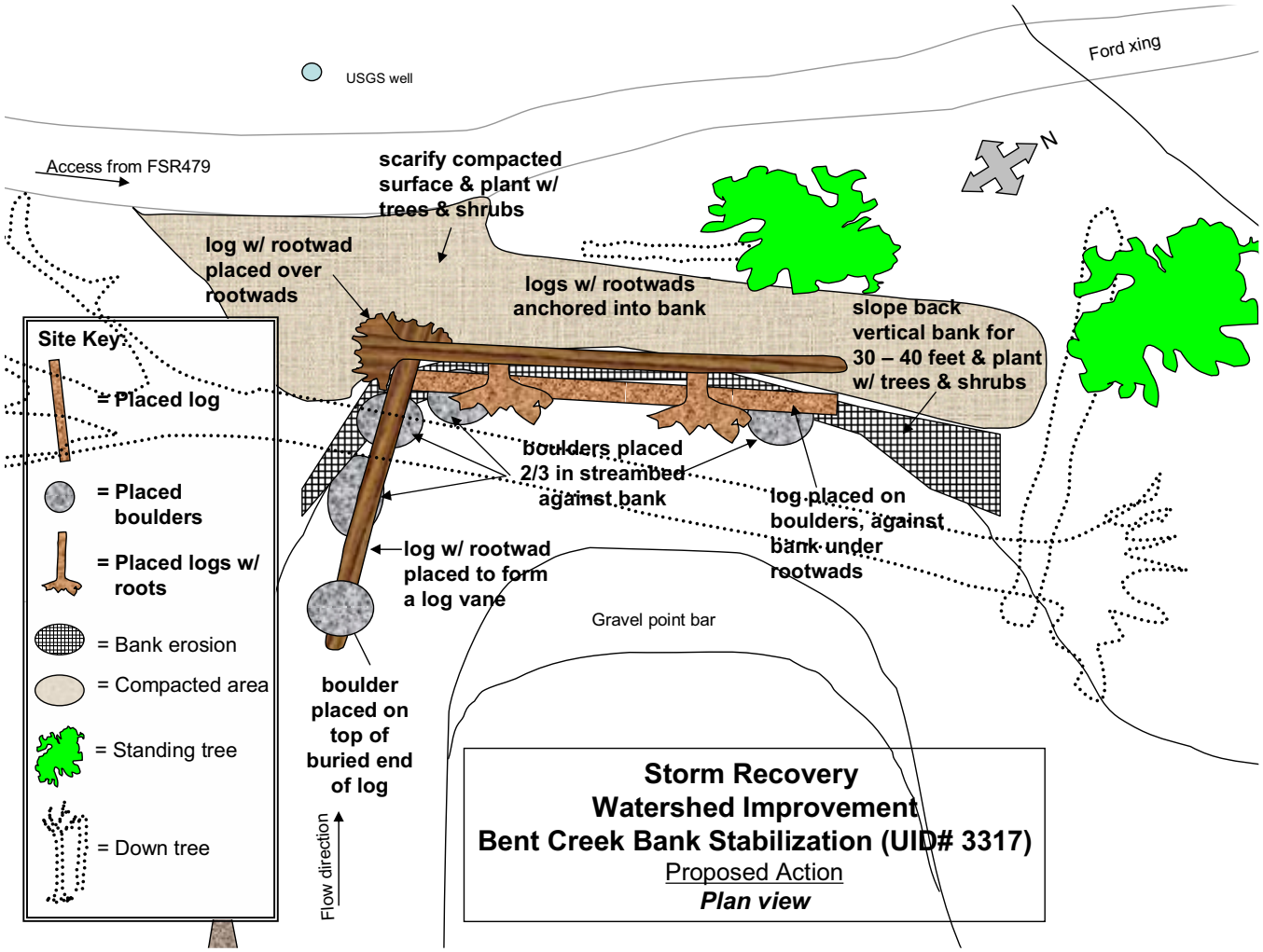

Figure 6. Site Map of Proposed Action for Bent Creek Bank Stabilization project (UID #3317).

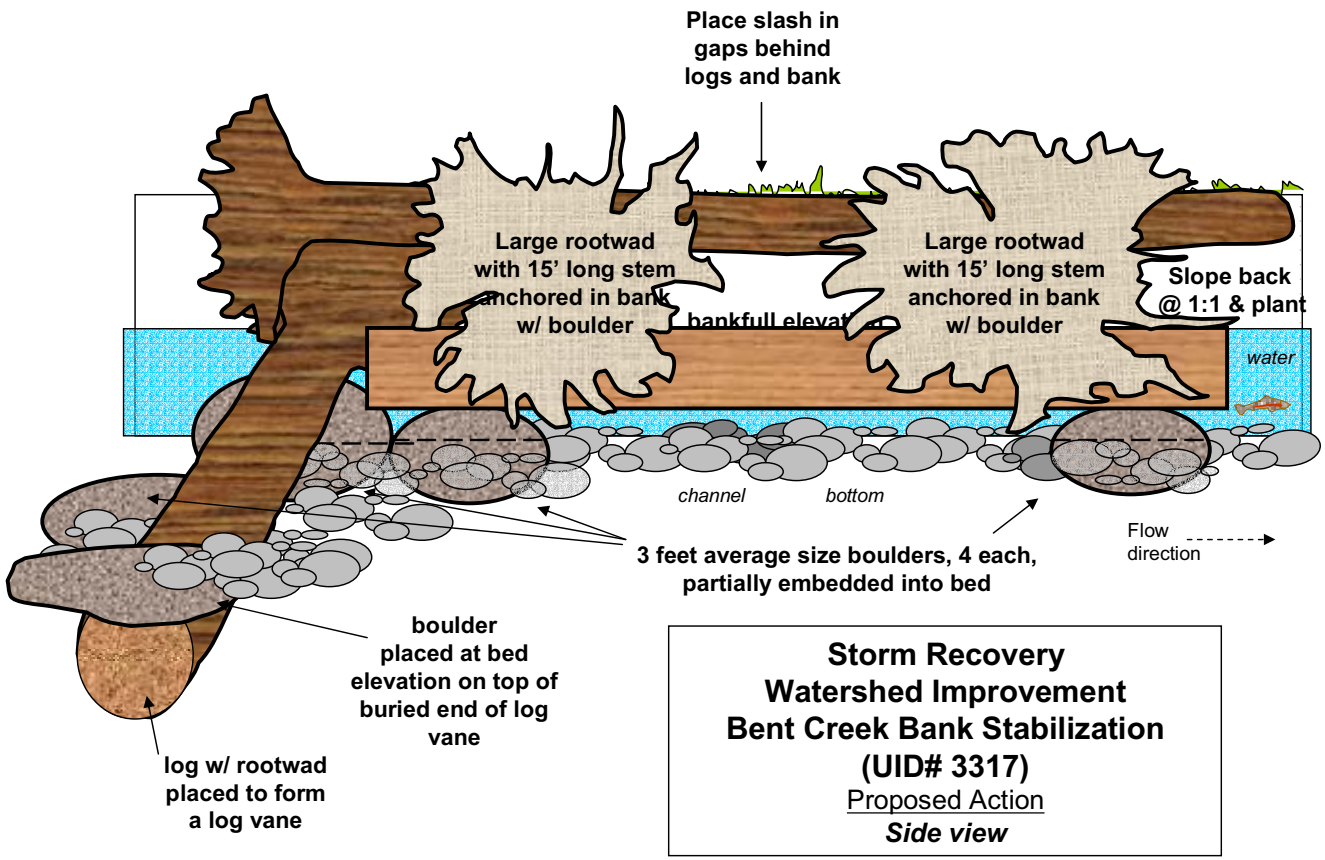

Figure 7. Side view of Proposed Action for Bent Creek Bank Stabilization project (UID #3317).

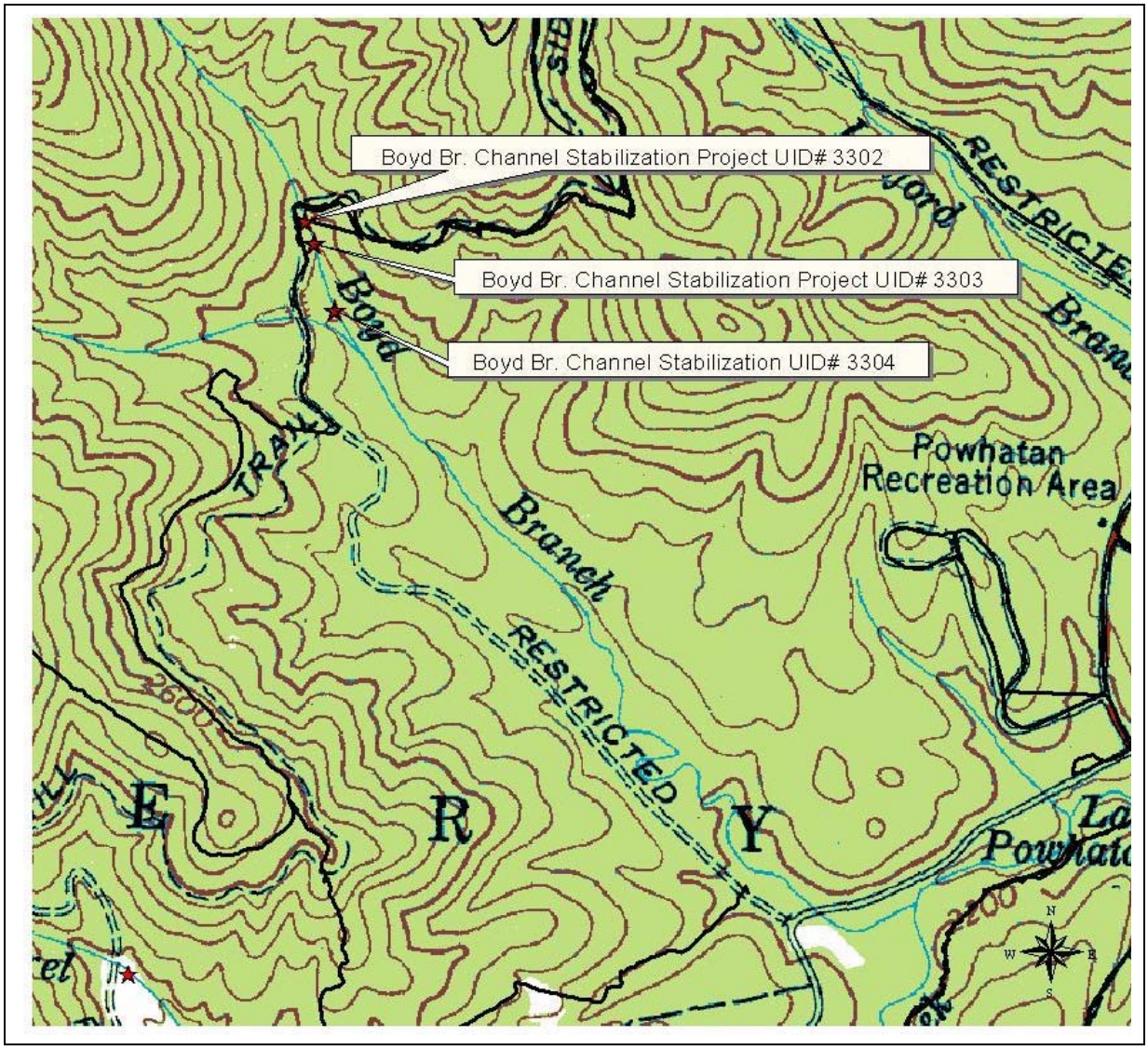

Figure 8. Vicinity map of Boyd Branch Channel Stabilization Projects (UID #3302, 3303, & 3304).

Boyd Branch Channel Stabiilzation Project (UID #3302, 3304, 3305)

Boyd Branch is a tributary of Bent Creek, upstream of Lake Powhatan, in the Bent Creek Experimental Forest, Pisgah National Forest. Three sites on Boyd Branch upstream of Lake Powhatan are presently chronic sources of sedimentation in the channel. The general locations of the sites are shown in Figure 8.

Boyd Branch Channel Stabilization Project Site 1 (UID #3302). Site 1 is located just below the current crossing of Boyd Branch with FSR 479F (Figure 9). Heavy runoff during the 2004 hurricanes has deposited considerable amounts of sediment, blocking a culvert that provides a road-stream crossing, and making the crossing vulnerable to collapse during future high flow and/or storm events (Figure 10). Such a failure would result in increased downstream sedimentation. To prevent this, Figure 10 shows the planned work. Work is planned to be completed by the fall of 2006 and will take approximately three to five days to implement. Access to the project site will be via the old road bed off of FSR 479F. Most of the work should be accomplished from the old road bed without disturbing adjacent areas. This project intends to:

1. Remove old road crossing, including the culvert;
2. Re-establish a stable step/pool channel profile; and
3. Decommission the adjacent road segments on an old road bed that contribute road runoff and sediment to Boyd Branch.

In order to achieve the stated objectives, the project will include the following activities (Figures 9 and 10) a tracked excavator would be used to relocate 10 large pieces of woody debris over 12 inches diameter from a nearby slash pile (see Figure 9) on the old road segment along FSR 479F. Approximately 200 feet of old road bed to the east of the channel would be decommissioned by pulling in the berm and restoring the contour (Figure 10). About 20 cubic yards (cy) of fill material would be excavated from the abandoned road-stream crossing and placed in the decommissioned road bed to help restore the contour (Figure 10). One tree would be removed from the crossing. No trees over 12 inches diameter will be removed by road decommissioning work. After the stream-crossing culvert is removed and the side slopes are adjusted, several pieces of woody debris and boulders would be placed in about 100 feet of the channel to form a step/pool profile. The stream banks would be planted with native vegetation.

Boyd Branch Channel Stabilization Project Site 2 (UID #3303). Site 2 is approximately 250 feet downstream of Site 1 (Figures 8 and 9). In this reach, storm damage resulted in about 40 feet of unstable, bare banks and considerable erosion, which is exacerbated during high flows. Normal channel width in this reach has doubled from 7 to approximately 14 feet, due to erosion (Figure 11). This project intends to:

1. Reduce erosion and sedimentation from stream banks; and
2. Improve aquatic habitat in the channel.

Two or three large pieces of woody debris, with attached root wads, would be placed, as shown in Figure 11, within the 40-foot reach. The root wads would stabilize the stream

banks and this woody debris would trap sediment, which would naturally accumulate behind the debris. As a result, the stream bed would aggrade, which is the process which raises the gradient of the stream by the deposition of sediment and materials in the stream bed to ultimately form a new floodplain and point bars[5]. Immediately downstream, the redirected water will create a scour pool and improve aquatic habitat.

Any potentially compacted surfaces would be scarified to break-up compacted soils created by the excavator. Access to Boyd Branch would be gained from FSR 479F by a newly created trail over a distance of 66 feet. Work would be completed within one to two days.

[5] Point bars are deposits of alluvium (unconsolidated accumulation of stream deposited sediments) and form when alluvium is deposited on the inside bend of a meander.

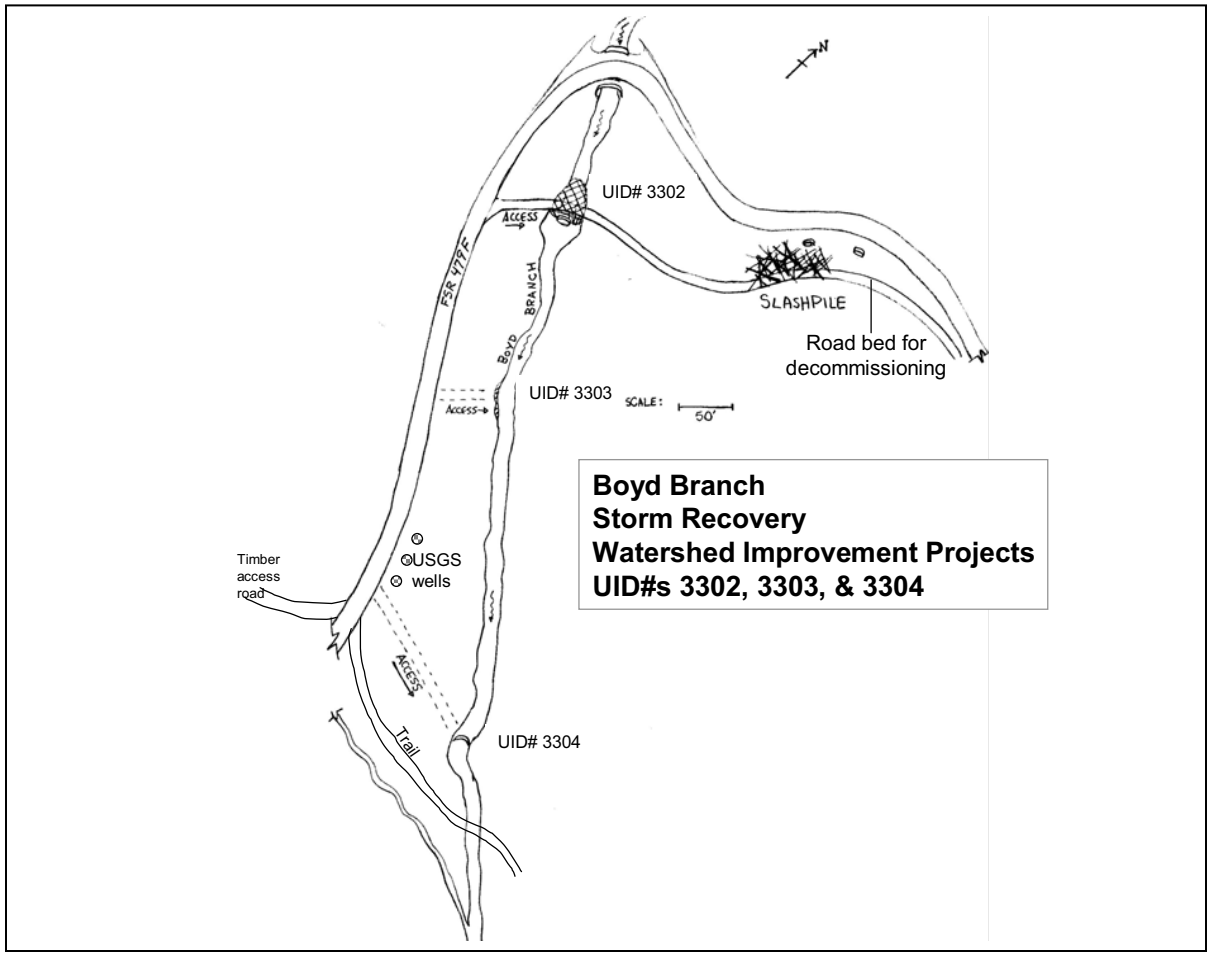

Figure 9. Diagram for Boyd Branch Channel Stabilization Projects (UID #3302, 3303, & 3304). Shows old road bed FSR 479F with the slash pile. Other slash piles are located off of the road above this site (not shown).

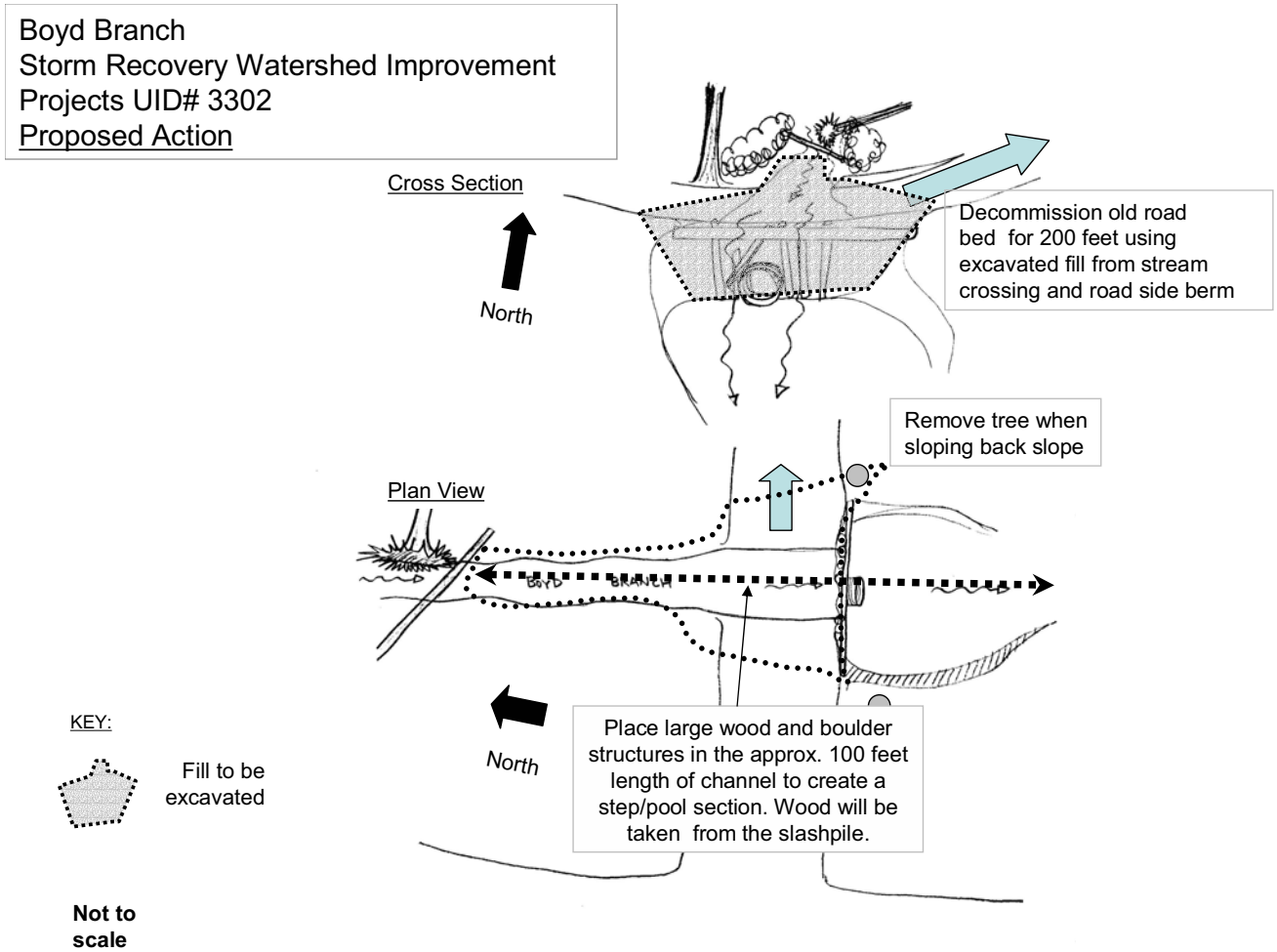

Figure 10. Placement of fill to decommission a road-stream crossing and improve channel conditions at Site 1 (UID #3302) on Boyd Branch. Refer to Figure 8 for site location.

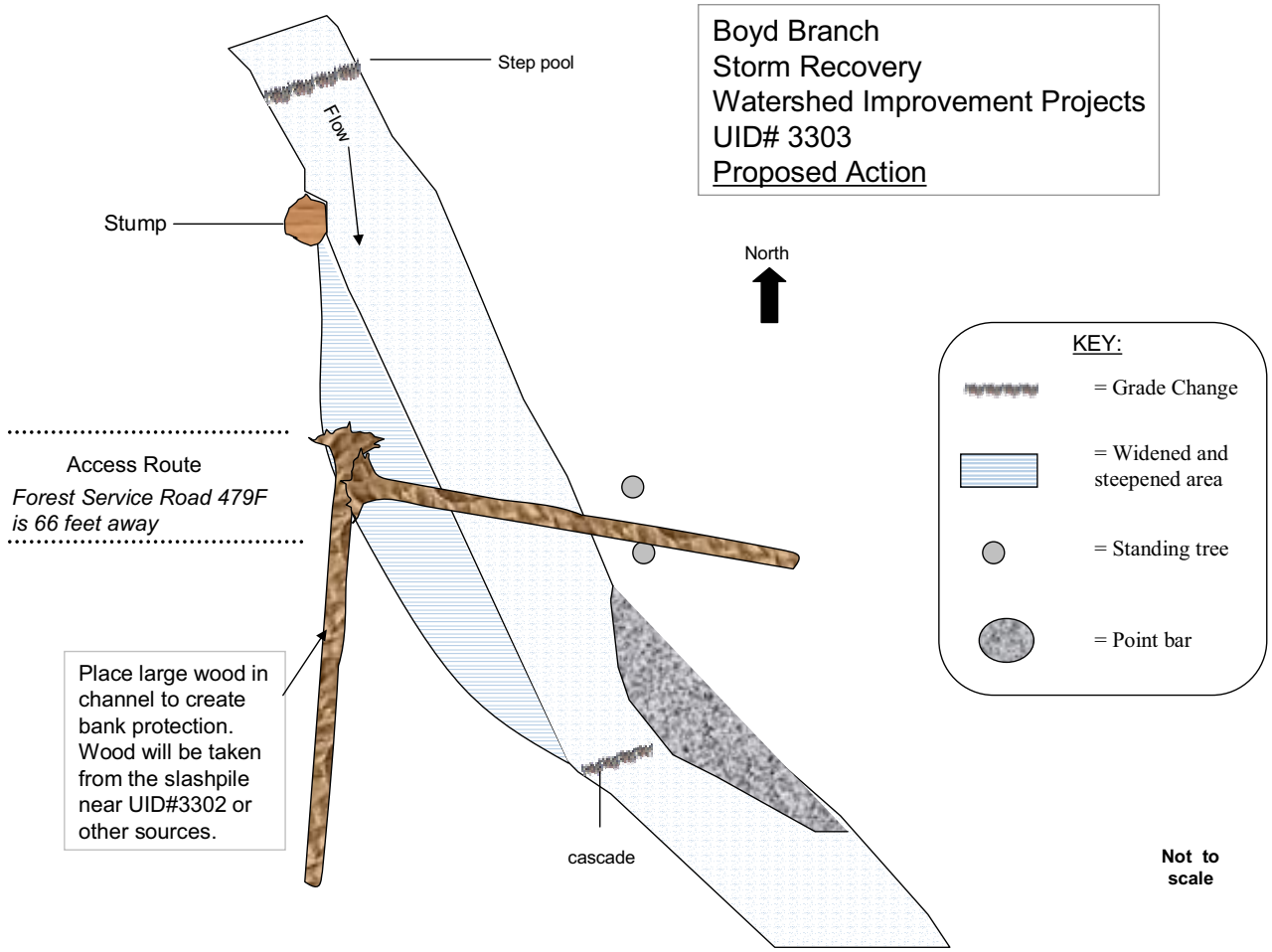

Figure 11. Placement of woody debris proposed at Site 2 (UID #3303) on Boyd Branch. Refer to Figure 8 for site location.

Boyd Branch Channel Stabilization Project Site 3 (UID #3304). Site 3 is approximately 500 feet downstream of Site 2 on Boyd Branch (Figures 8 and 9). At this site, heavy runoff from the main channel and an oxbow have created a three-foot high and five-foot wide headcut[6] in the channel. Immediately downstream, the right bank has bare, exposed banks. The channel width has tripled from a normal of 5 to 6 feet up to 15 feet (Figure 12). If not repaired, the headcut could migrate upstream until it reaches bedrock, which is a stable bed control. In the interim, the stability of the channel is seriously compromised. This project intends to:

1. Stabilize existing headcut, and
2. Reduce erosion and sedimentation from stream bank.

To arrest the migration of the headcut and restore the channel gradient, a small-tracked excavator with an opposable thumb would be used to place four boulders (two- to three-feet in size) side-by-side at the base of the headcut (Figure 12). Three additional boulders would be placed about 15 feet downstream of the first group and approximately five cy of river cobble would be placed from the top of the headcut downstream to the newly placed boulders. Large woody debris would be placed in the channel to create bank protection (Figure 12). Access to Site 3 would require the removal of about 150 square feet of rhododendron to allow equipment to transport materials from an old road bed between FSR 479F and the channel. This site would be replanted with native vegetation after work is completed.

[6] Downward erosion of the stream bed that continues over time until the bed reaches a stable slope or a stable material causing the erosion to cease. Until that point the headcut can be a large source of erosion and sedimentation.

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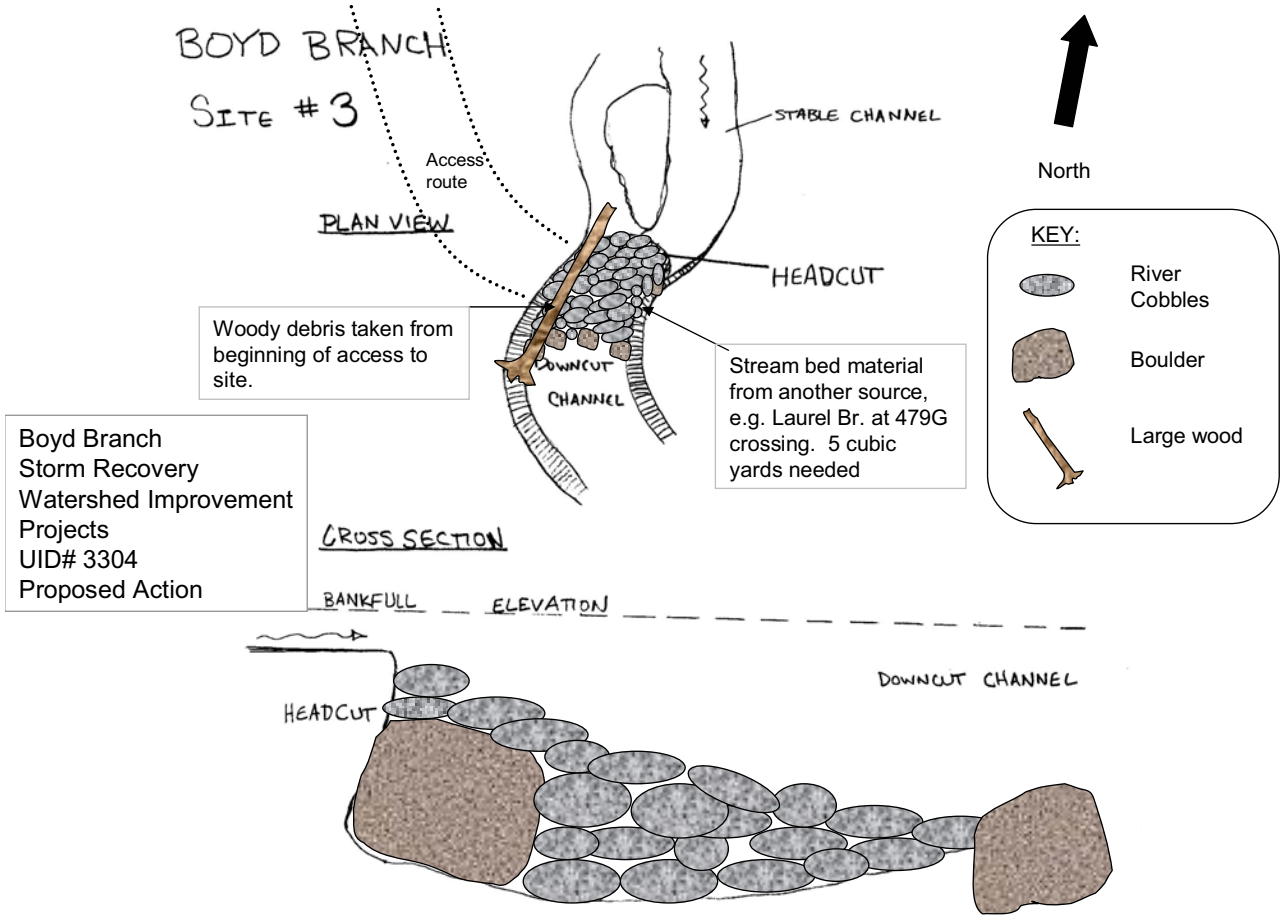


Figure 12. Plan view and cross-section of channel improvements at Site 3 (UID #3304) on Boyd Branch. Refer to Figure 8 for site location.

Laurel Branch Bank Stabilization (UID #3318 & 3319)

Laurel Branch is a tributary of Bent Creek, upstream of Lake Powhatan, in the Bent Creek Experimental Forest, Pisgah National Forest. Two sites on Laurel Branch have notable stream channel damage due to the 2004 hurricane storm events, and are proposed for watershed improvement (Figure 13). These two sites were identified as a chronic source of sediment and are sites where channel condition does not meet the Forest Service's desired condition. These sites were selected for restoration because they are accessible from Forest Service Road 479G and have a high potential for success.

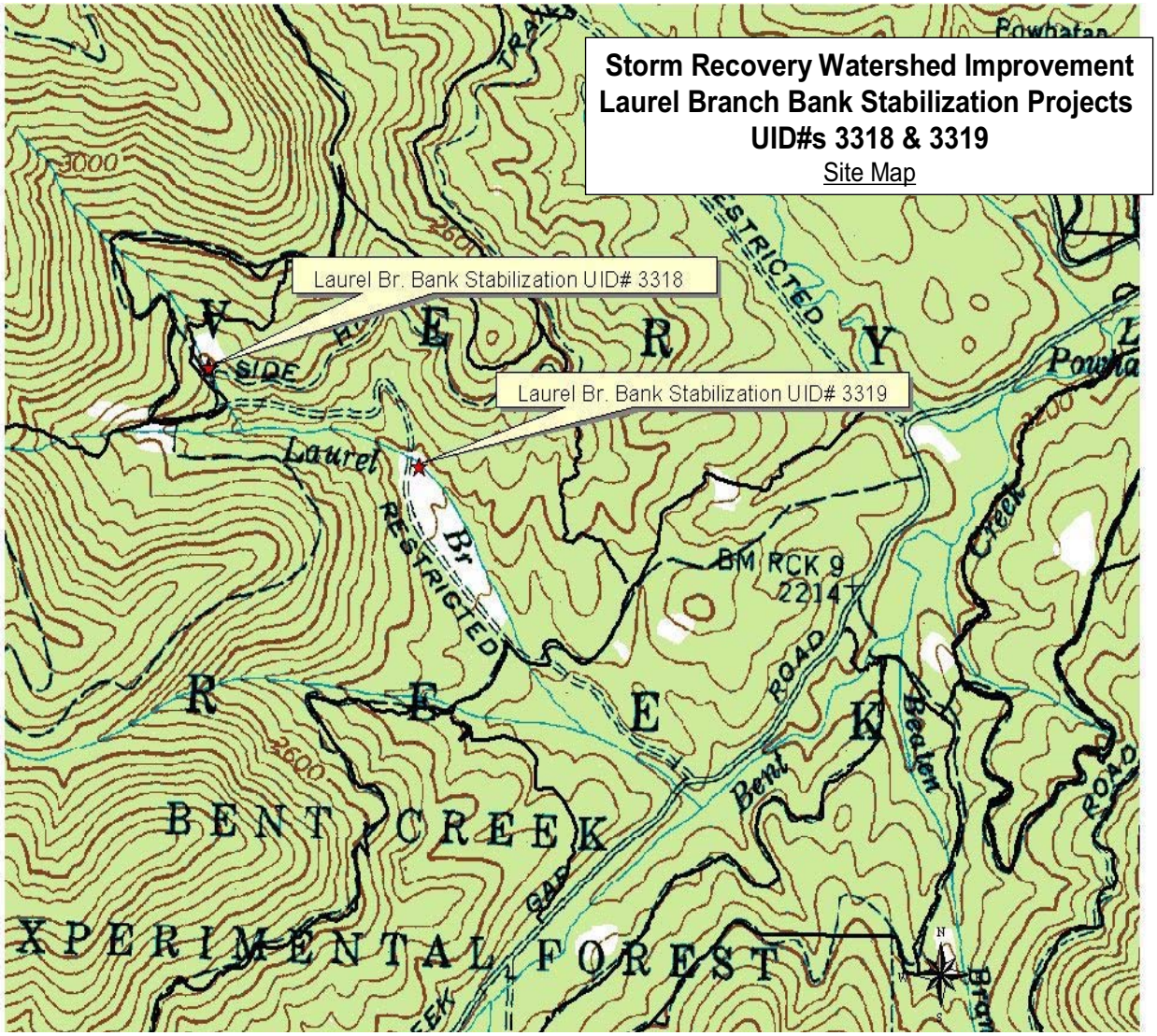


Figure 13. Vicinity map of Laurel Branch Bank Stabilization project (UID #3318 & 3319).

Laurel Branch Bank Stabilization Project (UID #3318)

Laurel Branch (UID #3318). A small tracked excavator with a thumb is required to grip and place rock and logs in the channel. Entry into the channel will not be required for this site because work can be accomplished from the right bank. Road construction is not needed. However, an access route will be established to provide excavator access from Trail 136 to the channel (Figure 14). Any potentially compacted surfaces would be scarified to break-up compacted soils created by the excavator. Approximately five trees less than 10 inches in diameter would likely have to be removed for access to the stream channel. One hazard tree at the trailhead of Trail 136 would be used for woody debris for this project.

Storm damage resulted in approximately 30 feet of unstable bare bank and considerable erosion. This site has a high risk of slumping in the near future and could result in further sedimentation downstream within Laurel Branch and Bent Creek and finally be deposited in Lake Powhatan. This project intends to:

1. Improve streambank stability, and
2. Reduce erosion and sedimentation from stream erosion.

This project proposes to implement stream bank stabilization techniques to improve stability of the eroding bank. Work would include placing two boulder-sized rocks (one 4 feet by 2 feet by 2 feet and the other 2- to 3-feet average size) at the toe of the bank, buried into the bed about 1/4 their height. The upstream rock would be the larger of the two and would be placed to turn streamflow from the bank. A 20- to 25-foot-long log, with root wad, would be placed atop the boulders and against the bank and oriented so the root wad is facing upstream. An additional 30-foot-long log, with root wad, would be placed against the bank on top and across the other log (Figures 14 and 15). The bank and access route would be planted with trees and shrubs and the disturbed soil would be seeded with an erosion control mix and mulched.

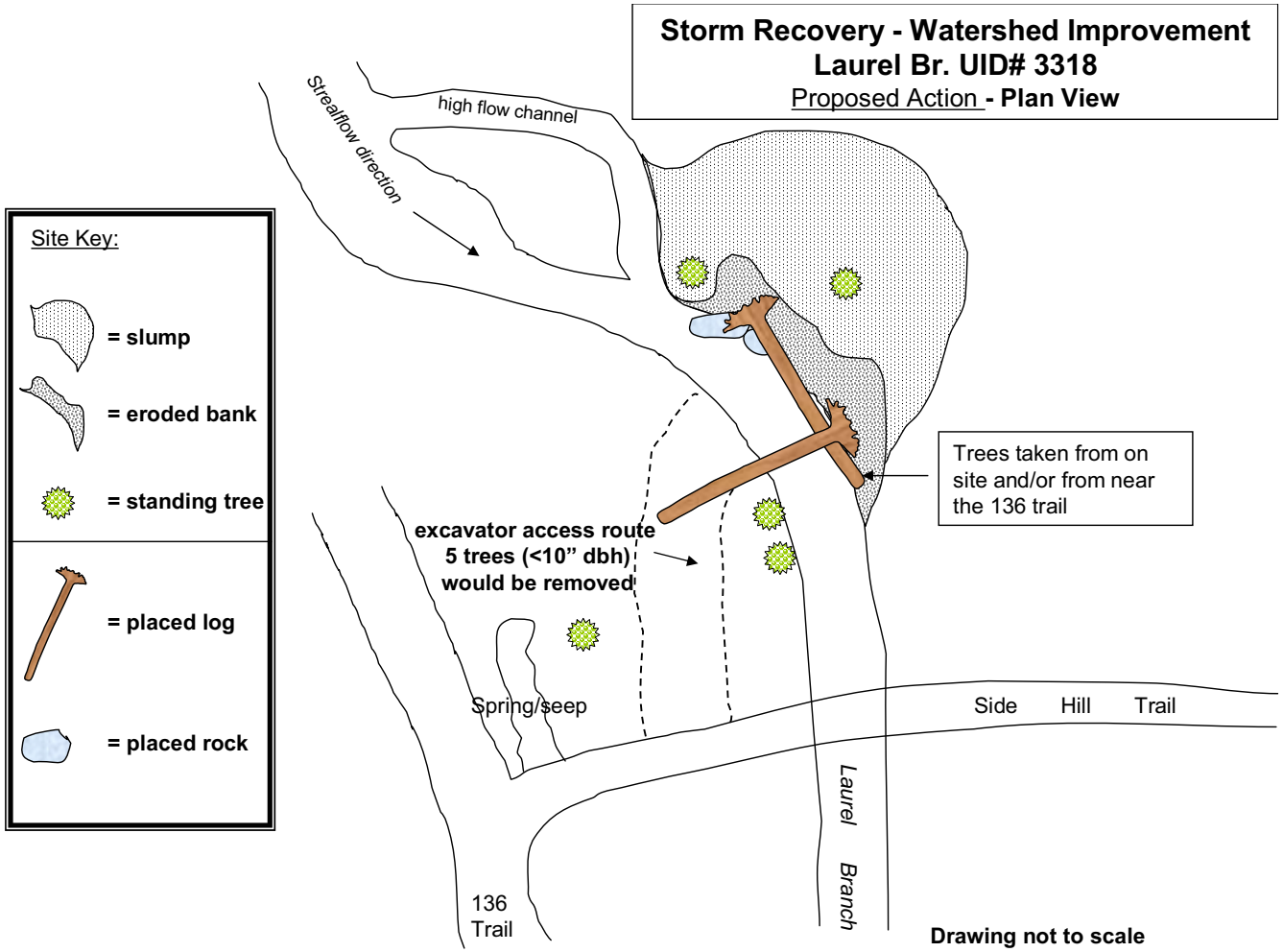


Figure 14. Proposed Action site plan of Laurel Branch Bank Stabilization Site 1 (UID #3318).

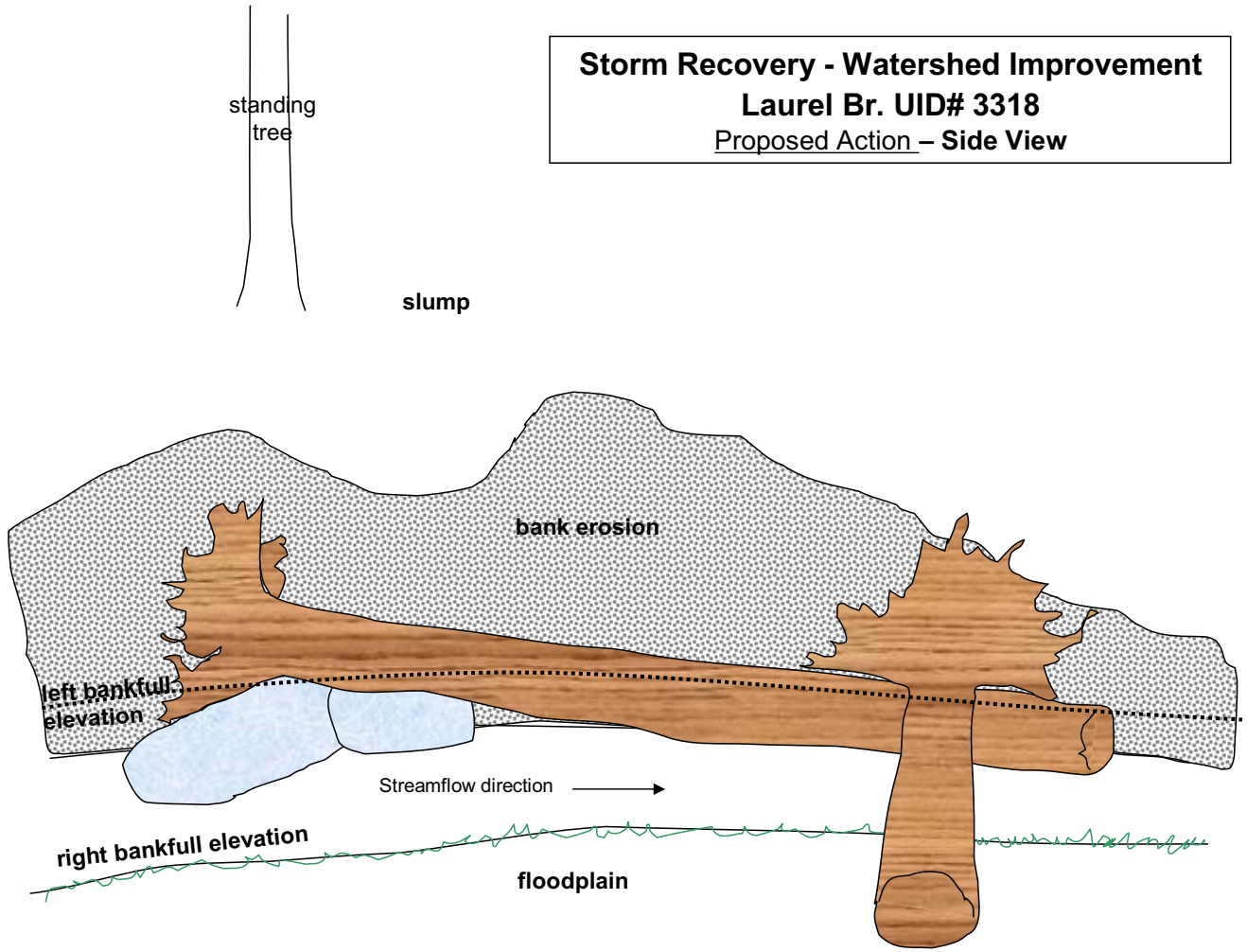


Figure 15. Proposed Action site plan (side view) Laurel Branch Bank Stabilization Site 1 (UID #3318).

Laurel Branch Bank Stabilization Project (UID #3319)

Laurel Branch (UID #3319). An approximately 150-foot-long section of Laurel Branch experienced notable stream bank erosion as a result of the 2004 flood events below the FSR 479G road crossing. Site 2 (UID #3319) (Figure 15) is approximately 0.25 miles downstream from Site 1 (UID #3318). A small tracked excavator with a thumb is required to grip and place rock in the channel. Entry into the channel will be required for this site. Road construction is not necessary. However, an access route will be established to provide excavator access from FSR 479G to the channel (Figure 16). Any potentially compacted surfaces would be scarified to break-up compacted soils created by the excavator. Several trees less than three inches in diameter may be damaged for access to the stream channel.

This project proposes to implement streambank stabilization techniques to improve stability of the eroding bank. Figure 16 shows the site plan of the Proposed Action. Sandbags or a silt fence would be placed to catch potential sediment from project implementation activities. The proposal includes placing 10 to 12 boulder-sized rocks (three-foot diameter on average) at the toe of the bank and in the channel. One rock would be placed to turn streamflow from the bank, while the other rocks would protect the toe of the slope. At the culvert outlet, the eroded stream banks would be returned to a 1:1 slope. The stream banks at both sites and access route would be planted with trees and shrubs. The disturbed sites would also be seeded with an ersosion control mix and mulched.

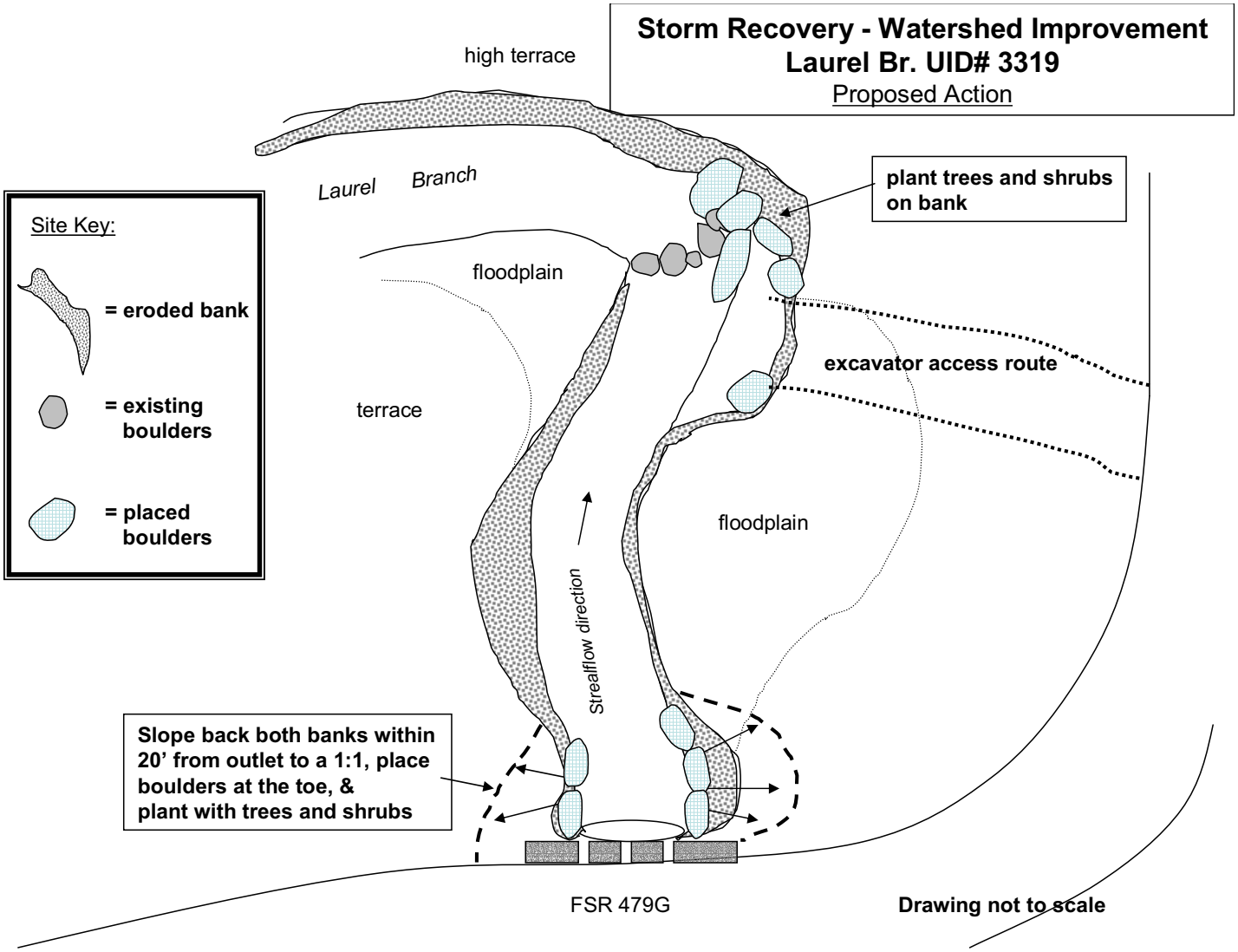


Figure 16. Site plan of Proposed Action at Laurel Branch Bank Stabilization Site 1 (UID #3319)

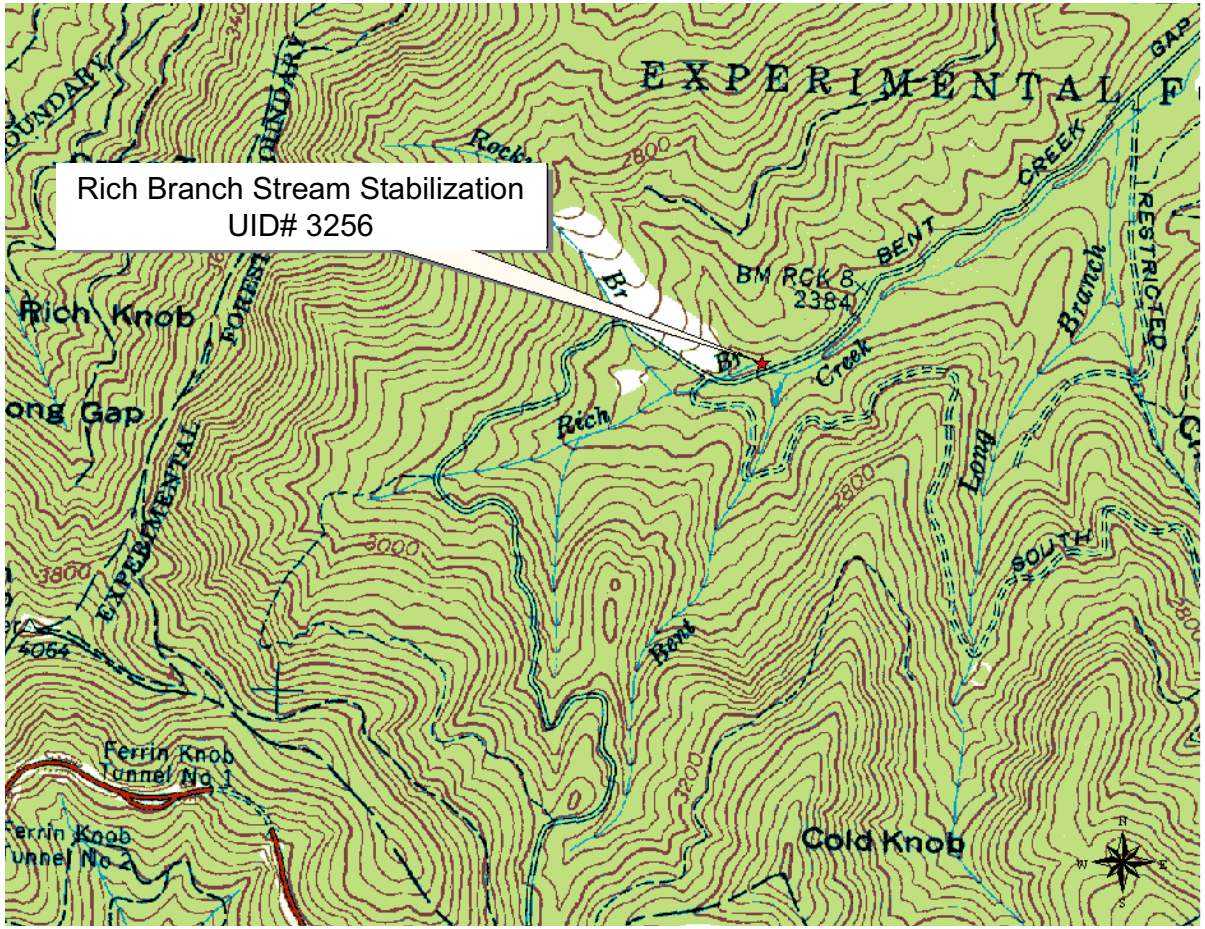


Figure 17. Vicinity map Rich Branch Stream Bank Stabilization Project (UID #3256)

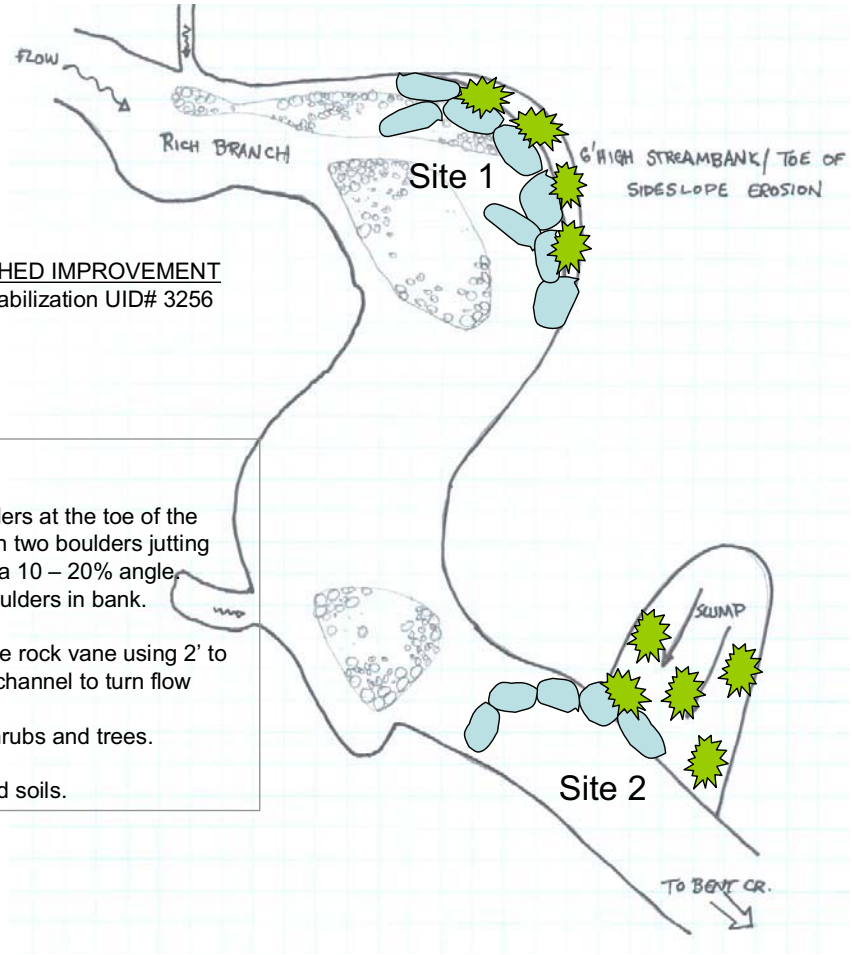
Rich Branch Stream Bank Stabilization Project (UID #3256)

Forest Service surveys after the flood events of 2004 identified two sites on Rich Branch for streambank stabilization. The two sites that make up this project are approximately 500 feet upstream of the confluence of Rich Branch and Bent Creek (Figure 17). A tracked excavator will be used for this project. Site 1 is experiencing erosion along the toe of the steep side slope. This site has a high risk of slumping in the near future and could potentially deliver approximately 290 cy of sediment downstream into Rich Branch and Bent Creek and finally be deposited in Lake Powhatan. Site 2 is an unstable slump adjacent to the channel, which has the potential to deliver 10 cy of sediment into Rich Branch and further downstream.

Access and staging will be from the day use site off of FSR 479. This area has two access roads from the main road and a total compacted area of about 0.2 acre. No new road construction would be necessary. To reach Sites 1 and 2, access from the day-use site to the channel is about 100 feet and 120 feet, respectively. Potentially three trees could be removed for the excavator to access the sites. If trees are removed, they would be used in the stream stabilization structures at other sites within this proposal. Disturbed areas would comprise less than one acre and both sites would be seeded with native grass and mulched. This project intends to:

1. Stabilize the stream bank,
2. Reduce erosion and sedimentation into the stream, and
3. Stabilize these two large sources of sediment.

To accomplish this, three- to four-foot boulders would be placed at the eroded toe slope and stream bank at Site 1. Two boulders would be placed so they jut out into the channel at a 10- to 20-percent slope, similar to a single arm rock vane structure. A J-hook style rock vane will be constructed in the channel using two- to three-foot boulders to direct flow away from the slump at Site 2. Both sites would be planted with woody riparian vegetation along the stream banks where the work is conducted (Figures 18-20).



BENT CREEK WATERSHED IMPROVEMENT
Rich Branch – Stream Stabilization UID# 3256

Proposed Action

Recommendations:

Site 1:

1. Place 3 to 4' size boulders at the toe of the eroded bank/slope, with two boulders jutting out into the channel at a 10 – 20% angle.
2. Plant shrubs behind boulders in bank.

Site 2:

1. Construct a J-hook style rock vane using 2' to 3' size boulders in the channel to turn flow away from the slump.
2. Plant the slump with shrubs and trees.

Both Sites:

Seed and mulch all disturbed soils.

Brady Dodd
Nov. 15, 2005

Figure 18. Proposed watershed improvements at two sites on Rich Branch Bank Stabilization (UID #3256).

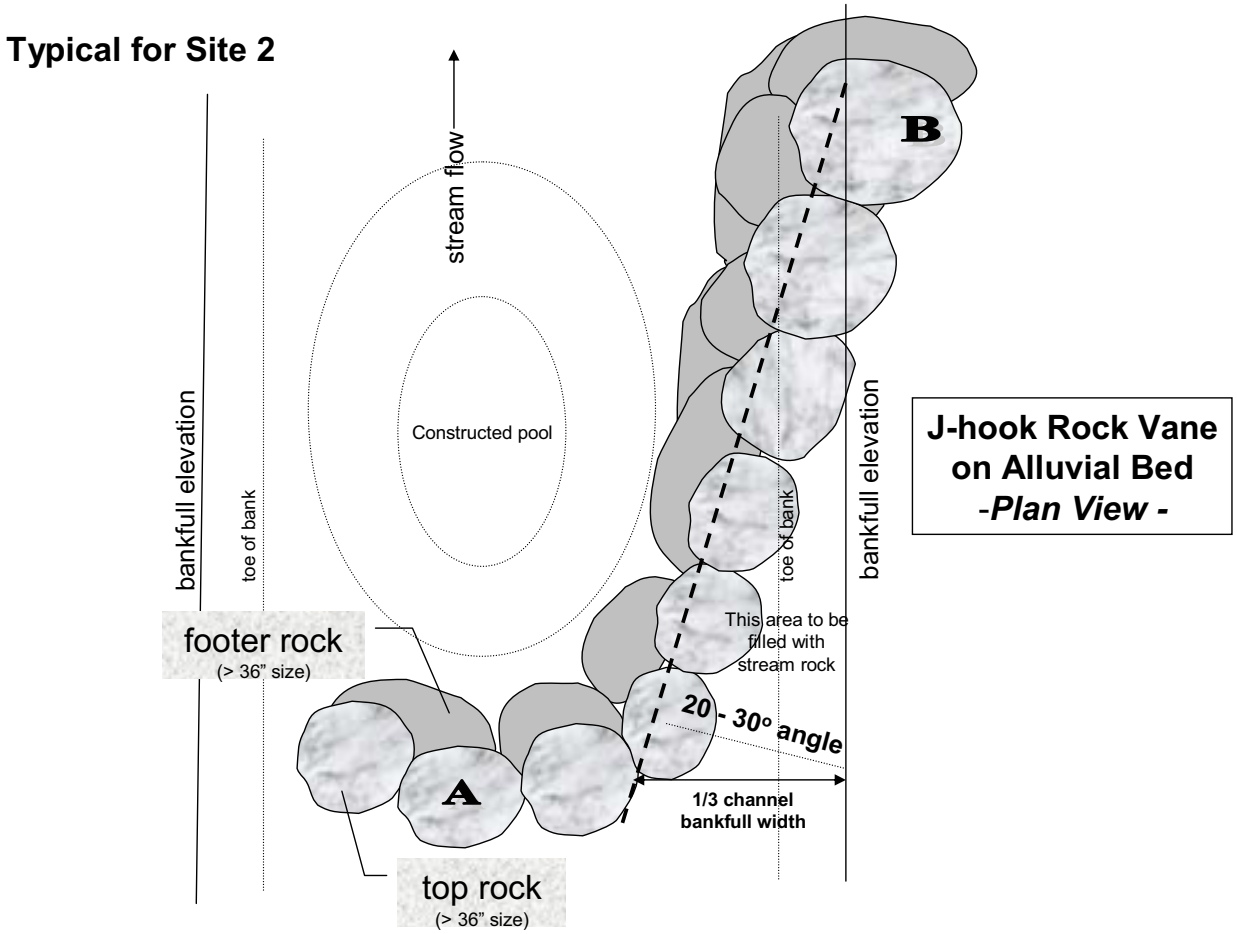


Figure 19. Example of a rock vane proposed at Site 2 to re-direct runoff away from sloughed banks at Rich Branch Bank Stabilization project (UID #3256).

Typical for Site 2

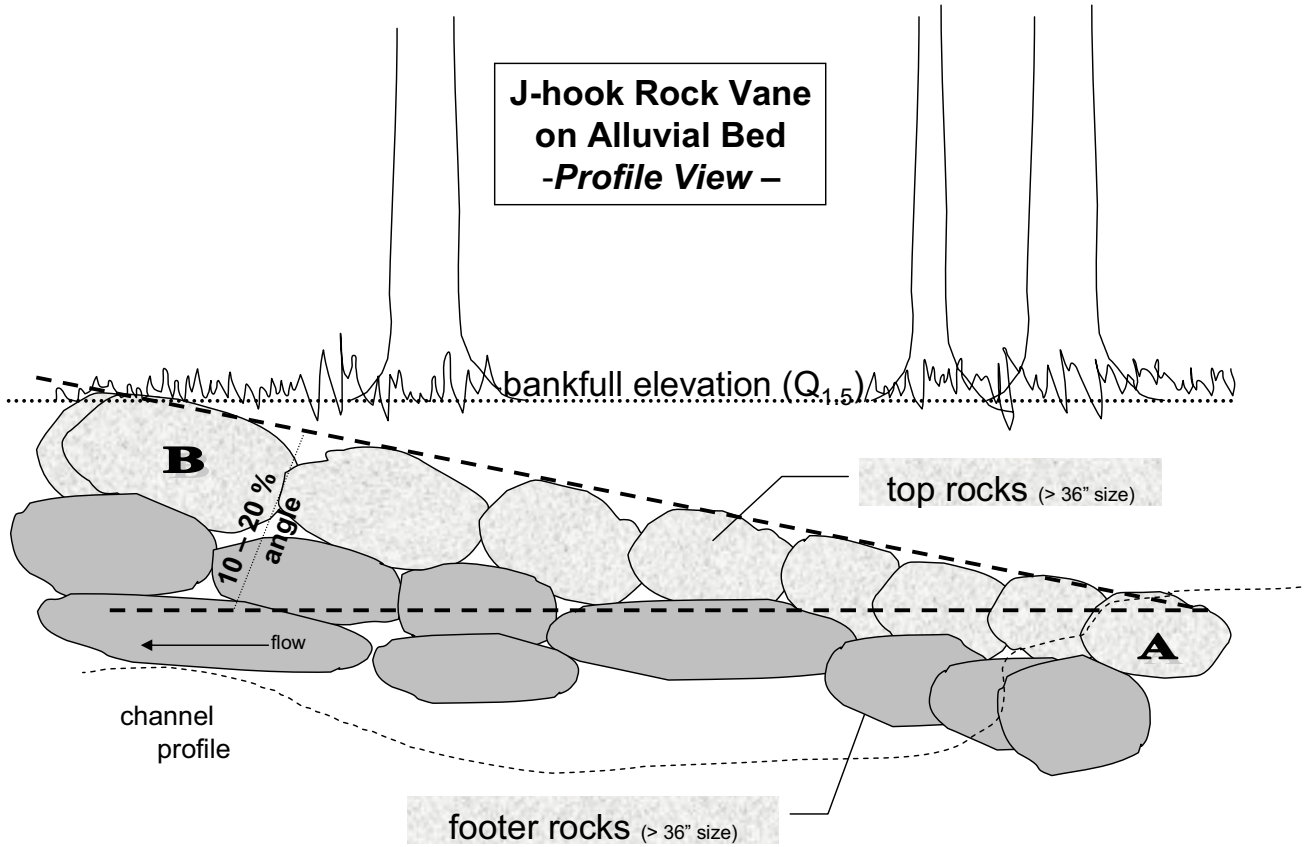


Figure 20. Channel profile view of example of a Rock Vane proposed at Site 2, Rich Branch Bank Stabilization (UID #3256).

Stony Fork Stream Bank Restoration Project (UID #1828)

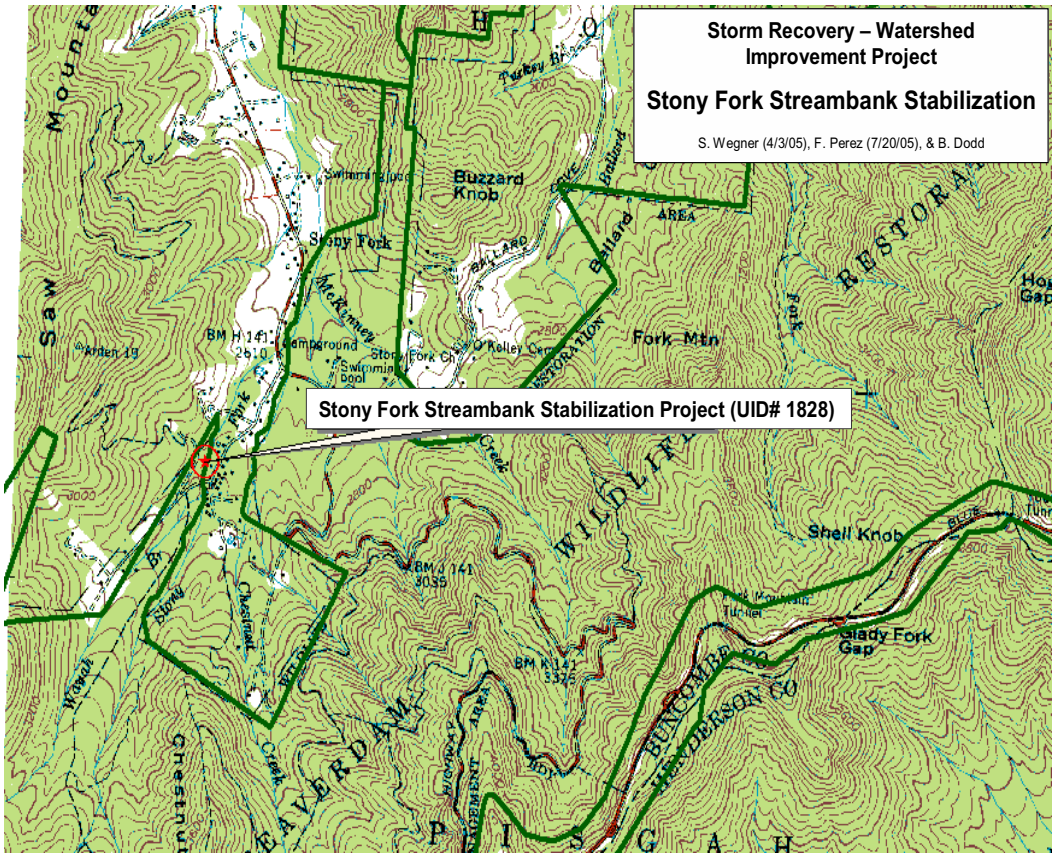


Figure 21. General vicinity of Stony fork Stream Bank Restoration Project (UID #1828).

The Stony Fork project proposes activities on both federal and adjacent private land. The action alternatives intend to:

1. Reduce erosion and sedimentation from stream banks,
2. Stabilize the stream bank, and
3. Protect private and national forest lands from future flood damage.

Proposed activities include reshaping the vertical, unstable stream banks at Sites 1 and 2 and planting them with native trees and shrubs in order to stabilize the slope. The excess material would be hauled off-site and erosion and sedimentation control devices would be put in place prior to any activity.

A portion of the proposed activities on Site 2 are on private land. The Wyden Amendment (Public Law 105-277, Section 323 as amended by Public Law 109-54, Section 434) authorizes the Forest Service to enter into cooperative agreements to benefit resources within watersheds on National Forest System lands. Agreements may be made

with willing landowners to conduct activities on private lands for the protection, restoration, enhancement of fish and wildlife habitat, other resources, and/or for the reduction of risk for natural disaster where public safety is threatened. A Wyden Amendment agreement and land use agreement would be made between the landowners adjacent to this site in order to implement the objectives of Alternative 3.

Surveys for heritage resources and threatened, endangered, sensitive, and Forest concern species would need to be conducted on the private land adjacent to the Stony Fork sites before the project can be implemented. Currently, private land owner agreements—which include authorizing access to the two parcels of private land—are pending for these private land surveys. After permission is granted, surveys would be completed prior to any action being taken.

If heritage resources are found and can be avoided, then Alternative 2 (Proposed Action) could be implemented. If the heritage resources cannot be avoided without adverse impact, then Alternative 2 would not be a viable alternative and could not be implemented. If the Forest Service is unable to obtain permission from the private landowners to conduct the required surveys, then Alternative 2 would not be possible and Alternative 3, which involves only the Forest Service land at Stony Fork, could be selected and implemented. Both action alternatives include the proposed activities within Bent Creek watershed.

Two rock vane structures would be constructed with three- to four-foot-sized boulders to divert flow away from eroded stream banks at both sites (example rock vane design shown in Figures 19 and 20). Some instream boulders would be removed and used to build the rock vanes and remaining material would be obtained from a local quarry. Trees with root wads that are in the channel and along the banks would be moved and specifically placed parallel to the channel to protect the left bank at Site 2. Additionally, the existing point bar at Site 2 would be sloped back and three- to four-foot-sized boulders from this area would be used to armor the opposite bank and to keep the logs in place. All disturbed soil would be planted with an erosion control mix of annual grasses and mulch (Figure 22).

2.2.3 Alternative 3

This alternative comprises the same proposed activities in Bent Creek as described under Alternative 2 (Figure 2), however, proposed activities would occur only on the federal land within to Stony Fork project area (Figure 23), and no activities would occur on the adjacent private lands. The following locations for the proposed improvements are within the French Broad and South Hominy watersheds on the Pisgah Ranger District, Pisgah National Forest:

- Bent Creek, which drains into the French Broad River;
- Boyd Branch, a tributary of Bent Creek and located above Lake Powhatan;
- Laurel Branch, a tributary of Bent Creek located above Lake Powhatan;
- Rich Branch, a tributary to Bent Creek located above Lake Powhatan; and

- Stony Fork, a tributary to South Hominy Creek.

This project proposes intend to:

1. Reduce erosion and sedimentation from stream banks,
2. Stabilize the stream bank, and
3. Protect private and national forest lands from future flood damage.

Alternative 3 proposes the following at Site 1 (no activities would occur in conjunction with Site 2):

- Pulling back the vertical, unstable stream banks at Site 1,
- Placing boulders at the toe of the sloped bank, and
- Planting native trees and shrubs in order to stabilize the slope at Site 1.

Excess material would be hauled off-site and erosion and sedimentation control devices would be put in place prior to any activity. Erosion and sedimentation control devices would be put in place prior to any activity.

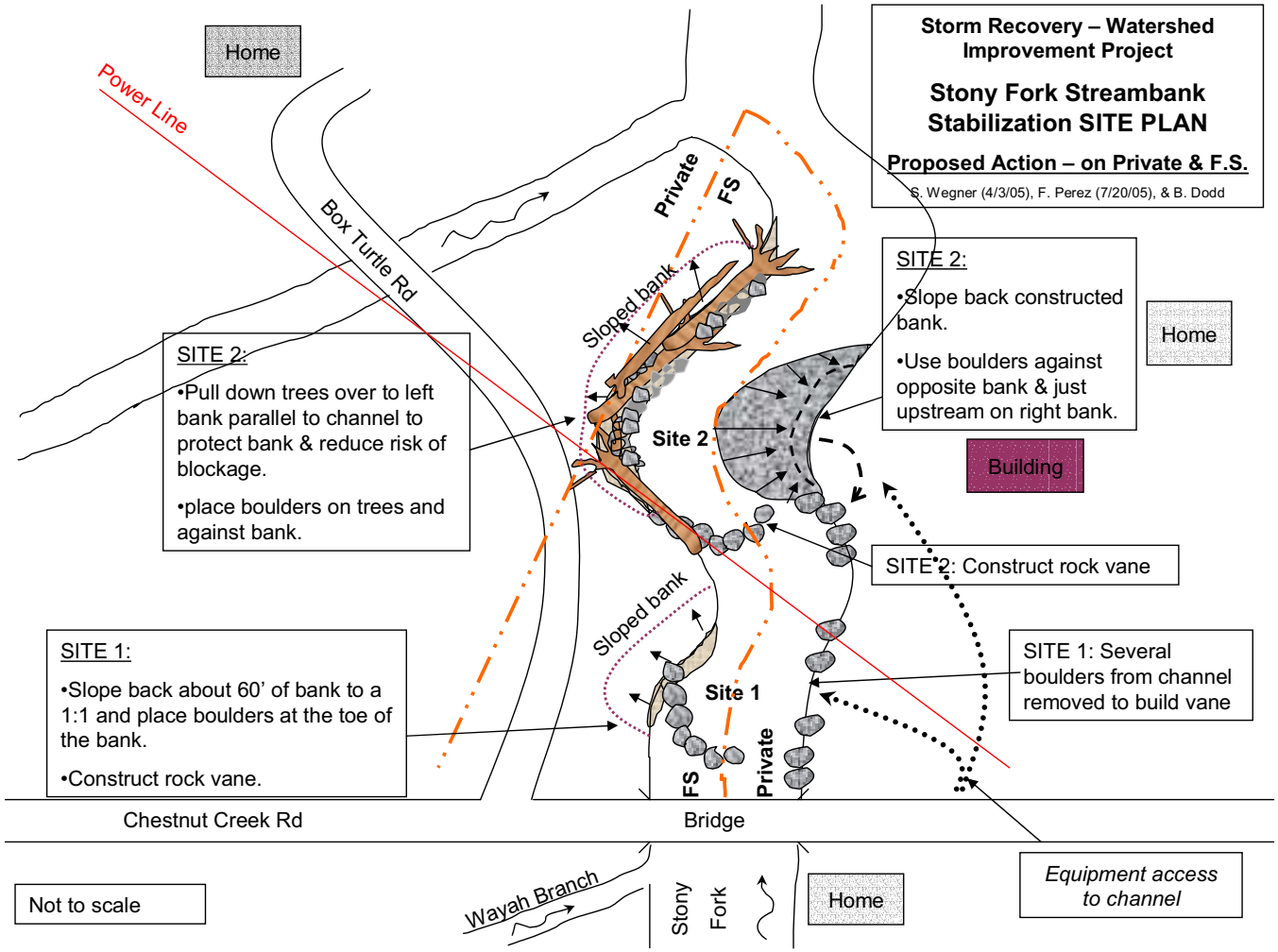


Figure 22. Alternative 2 – Proposed Action for Stony Fork Streambank Stabilization project (UID #1828). Forest Service lands are delineated by the dashed line. Adjacent areas are private land.

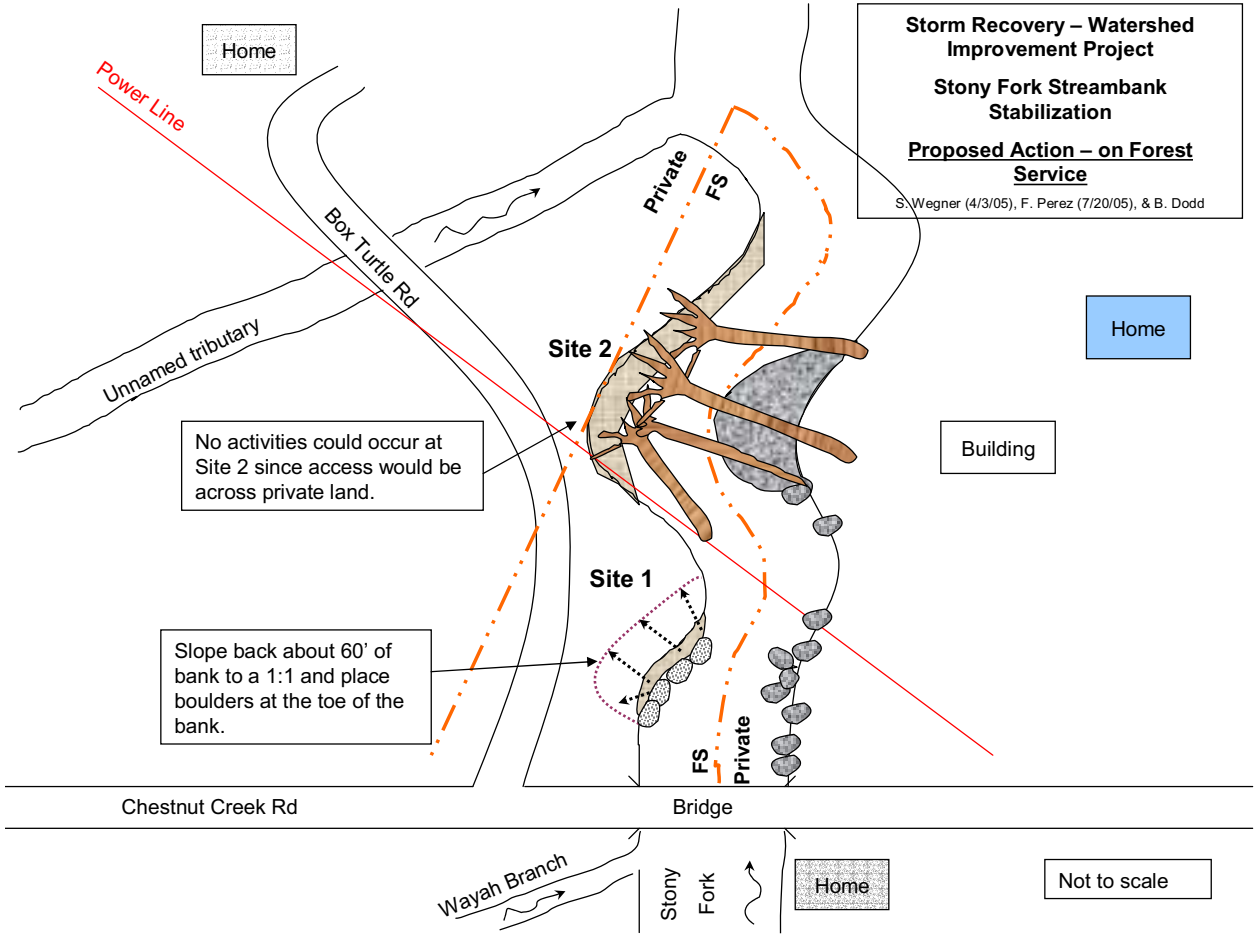


Figure 23. Alternative 3 proposal showing proposed restoration work on Forest Service lands only (UID #1828).

2.3 Comparison of the Impacts of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 1. Comparison of the potential impacts of the No Action with the Proposed Action alternatives.

	Alternative 1: No Action	**Action Alternatives** **(Alternatives 2 and 3)**
Issue 1: Water Quality	• Continued sedimentation both short and long term from the eroding stream banks. • Increased potential for additional sediment to be transferred from unstable channels.	• Sedimentation would be substantially reduced over the long term, even though a pulse of sediment delivery would occur during implementation due to the instream restoration activities. The pulse of sediment would be minimized by project design features listed below.
Issue 2: Aquatic Habitat	• Continued simplification of aquatic habitat due to historic and recent impacts. • The frequency of large wood and boulders would remain similar. The stream channels may continue to widen and become shallower, thus limiting pool habitat and cover	• Improvement of aquatic habitat by providing additional shade, large wood and boulders, improving the substrate composition, reducing channel width, and increasing water depth and pool habitat.
Issue : Plants and Wildlife	• No adverse effects to proposed, endangered and threatened species. • Potential adverse impact to sensitive species habitat.	• No adverse effects to proposed, endangered and threatened species. May adversely affect individual sensitive terrestrial wildlife species (Table 5), but would not impact viability across Forest.
Issue 4: Heritage Resources	• Continued erosion and sedimentation would have adverse cumulative effects to heritage resources within the watershed.	• No adverse effects due to site-specific field verification and avoidance during implementation.

2.4 Project Design Features

This Proposed Action has been designed to improve natural stream condition. The Proposed Action includes design features outlined in the Forest Plan Standards and Guidelines and Best Management Practices (BMPs). The following design features would be applied during project implementation under both action alternatives to reduce erosion and sedimentation in the project area.

Objective: Minimize the area and degree of soil disturbance that reduces infiltration capacity and permeability and destroys protective forest floor and ground cover:

1) Work would be accomplished in stages so as to not expose large areas of bare soil simultaneously;
2) Work between sites would be staggered, so that work at one site would only commence upon completion of work at another site;
3) Clearing of vegetation would be limited to the minimum required for the project;
4) Work activities would not be scheduled on rainy days;
5) All heavy equipment would be cleaned before entering the project area and stream to reduce the risk of fine-grained sediment, oils, and grease from entering the stream;
6) Operations would not occur on wet soils when they are most susceptible to damage and erosion;
7) Points of entry to sites would be designated by a hydrologist or soil scientist;
8) Heavy equipment would not be operated on overhanging stream banks;
9) A skilled heavy equipment operator, trained in stream restoration and construction of in-stream structures, would be used;
10) The equipment operator would be instructed to minimize disturbance to the streambed;
11) The number of times required to enter the sites for the installation of large woody debris and rock would be minimized;
12) Activities would be conducted during periods of low flow;
13) Disturbance to stream banks would be minimized; and
14) A sediment fence to trap potential sediment and stabilize any disturbed areas would be installed at the end of each workday.

Objective: Re-vegetate exposed soils as soon as possible to take advantage of the loose soil conditions for seeding:

1) Exposed soil would be covered with straw mulch or biodegradable and certified weed-free erosion control matting at the end of each workday; matting would be secured in place with staples, stakes, or live stakes of trees where conditions allow;
2) Temporary seeding would occur on all bare soil within five days of ground-disturbing activities to provide erosion control;

3) Channel banks would be stabilized with a temporary seed mix of wheat, millet, or similar non-persistent annual grains, as work is completed to minimize erosion and invasive species establishment;
4) Sediment trap devices would not be moved until the vegetation in the disturbed areas has been established;
5) Any side cast material would be stockpiled on upland sites and contained within sediment fences;
6) Sediment fences would be installed around the project area (including staging area) to direct runoff away from the project area; and
7) Visual inspections for turbidity would be conducted while work is ongoing at all sites.

Objective: Avoid impacts to naturally reproducing populations of game fish:

1) In-stream work and land disturbance within 25 feet of the top of the stream banks would be prohibited during the trout spawning season of October 15 through April 15, as required by the North Carolina Wildlife Resources Commission;
2) This project requires a permit to be issued by the Army Corps of Engineers prior to implementation, as required by Section 404 of the Clean Water Act, as amended. This project would incorporate design features included in the Army Corps of Engineers permit and the State of North Carolina's Water Quality Certification and Erosion and Sedimentation Control Plan, which is part of the project record.

Objective: Minimize direct effects to subsurface heritage resources not detected during surveys:

1) An archaeologist or qualified heritage representative would need to be on site to observe activities that involve the removal of root wads.
2) The heritage resource sites associated with Boyd Branch and Stony Fork Stream Stabilization project (UID #3304 and 1838) would be avoided during project implementation. A qualified archaeologist or certified heritage resource technician (HRT) would monitor the ingress and egress of heavy equipment transported to and from the site. The archaeologist or HRT would provide a report of the monitoring activity and its findings to the Forest archaeologist or HRT representative for inclusion in the project file. If cultural resources are discovered during the implementation, all activities would stop and the Forest archaeologist or HRT representative would be contacted immediately. Any further data recovery and site mitigation would be initiated at the direction of the Forest archaeologist or HRT representative.

CHAPTER 3 – ENVIRONMENTAL CONSEQUENCES

This chapter forms the scientific and analytical basis for the comparison of alternatives as required by the National Environmental Policy Act (NEPA). Included in this chapter are disclosures of direct, indirect, and cumulative effects of the alternatives on the different resources relevant to the key issues. Direct and indirect effects occur at, or near, the same time and place as a result of the action [40 CFR 1508.8 (a) and (b)]. They have been combined in this chapter because it is difficult to completely separate between the two effects. Cumulative effects result "…*from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time"* (40 CFR 1508.7). Reports from different resource specialists supplied information for portions of the analysis in this chapter. The project area is the location of the proposal. The analysis area is the anticipated extent of effects by resource and is generally larger than the project area.

Effects analyses are disclosed by key issues in this chapter. The four key issues associated with this proposed project were identified through a public participation process, which included input from Forest Service natural resource specialists, other government agencies, organizations, and individuals (see Section 1.6, Chapter 1). The key issues were determined to be relevant to the decision to be made concerning the proposal for *Improvements on Bent Creek, Boyd Branch, Laurel Branch, Rich Branch and Stony Fork.* The following text describes the existing condition of the environment in the geographic area potentially affected by the project and reports the effects that would result from implementation of the alternatives. Where applicable, the scientific and analytical bases of the findings are reported in Chapter 3.

3.1 Water Quality

Existing Condition

Existing channel morphology integrates all past and present disturbances and natural processes. In all stream systems, there exists a unique balance between many interrelated variables, including sediment quantity and size, stream flow, substrate size, and channel geometry. A major shift in any of these variables would cause the stream channel to adjust one or more of the other variables. This adjustment is necessary to maintain equilibrium between the components. The adjustment process would normally move the stream channel toward a new, usually less stable condition.

An unstable stream generally has an inefficient form and is sensitive to further disturbance. A stream in equilibrium can efficiently process flow and sediment (both bed load and suspended) under which the system formed. Stable streams dissipate their energy by transporting sediment, accessing the floodplain, and flowing over obstructions and other channel roughness elements. When streams move out of equilibrium, the

system generally responds by becoming either energy-limited or sediment-limited. In an energy-limited stream, deposition occurs as quantities of sediment exceed the stream's energy to transport it. In a supply-limited stream, where flows are increased or roughness elements are removed, an energy surplus may occur, causing channel scour as the stream tries to transport (route) more or larger materials. When this scoured material moves into an energy-limited reach, it would be deposited along with fine sediment from other sources.

In the Bent Creek drainage and at the Stony Fork site approximately 900 feet and 200 feet, respectively, of stream bank has a vertical surface that is bare of vegetation. These areas have become unstable and would continue to erode during high flows.

Bent Creek Watershed

Historically, the sources of sediment input to Bent Creek at Lake Powhatan have been landslides and other mass soil/rock movements in the headwater areas and on the valley slopes adjacent to the streams. These ancient landslides are a clay/silt/fine sand matrix containing rocks of all sizes, including large boulders. The stream valley walls are composed of this old landslide material.

Stream channels of Boyd Branch, Laurel Branch, and Rich Branch, which are tributaries to Bent Creek, have reaches that are cutting through these old landslide deposits as supply-limited streams, resulting in unstable channel conditions and erosion. Typically, below these reaches where the large landslide deposits end, material scoured from the upstream reach is deposited on the wide floodplain (valley slope), causing flow to spread out and form new channels during flood events. These reaches are energy-limited reaches where the channel periodically changes its location. Below the influence of the landslide deposits, channel conditions are largely stable and in dynamic equilibrium with relatively small sites of instability.

Historically, the Bent Creek watershed was entirely logged and much of the area farmed. Logging activities likely increased hillside erosion and runoff of sediment and water to the stream channel network. Farming and valley bottom roads caused channel reaches to be straightened from their natural meander pattern and increased erosion and runoff to channels. Since that time, watershed and channel conditions have improved with the regrowth of vegetation. However, several stream reaches in Bent Creek and its tributaries remain in unstable condition.

The waters of Bent Creek watershed are not listed as "water quality limited" by the N.C. Department of Environment and Natural Resources, Division of Water Quality as of the latest 303(d) listing of stream channels impaired from meeting state water quality standards. Therefore, all protected water uses are currently identified as "supported" at some level. Protected uses of water in Bent Creek, from the source to Lake Powhatan, include primary recreation, fishing, aquatic life including propagation and survival, and wildlife. In addition, waters are further protected for natural trout propagation and survival of stocked trout. However, it is apparent that stream channel erosion does not

support maintenance of the Forest's desired condition for water quality, aquatic habitat, and overall channel integrity in several stream reaches.

Stony Fork Watershed

The Stony Fork drainage was logged and farmed, but much of the drainage remained in private ownership, with the exception of several headwater drainages that are in public ownership today. The site proposed for stabilization in this document is located on Forest Service land, but is closely surrounded on three sides by private ownership where occupation of the floodplain and disturbance of stream banks is common due to home sites and roads. The headwaters of Stony Fork, including Wayah Branch and Chestnut Creek, are occupied by stable channels with good water quality and drain a forested landscape.

The waters of the Stony Fork drainage are not listed as "water quality limited" by the N.C. Department of Environment and Natural Resources, Division of Water Quality as of the latest 303(d) listing of stream channels impaired from meeting state water quality standards. Therefore, all protected water uses are currently identified as "supported" at some level. Protected uses of water in Stony Fork, from the source to its confluence with South Hominy Creek, include secondary recreation, fishing, aquatic life (including propagation and survival), and wildlife. In addition, waters are further protected for natural trout propagation and survival of stocked trout.

Bent Creek Bank Stabilization (UID# 3317)

Bent Creek is a tributary to the French Broad River, of the French Broad River Basin (Figure 4). This reach of Bent Creek is located above Lake Powhatan.

Dispersed camping and intense day use have impacted this site in Bent Creek. This use has trampled the stream bank and caused a loss of stream bank vegetation. These conditions resulted in a bank prone to erosion prior to the 2004 storms. The 2004 storms caused 50 feet of bank undercutting and erosion, and accentuated the disturbed condition of the area (Figures 24 and 25). Bent Creek is not a municipal watershed, nor does it contain inventoried roadless[7] areas, Wild and Scenic Rivers, Wilderness, Wilderness Study Areas, national recreation areas, or research natural areas.

[7] Areas where no roads have been built and where, as a result, no logging or other development has occurred.

Figure 24. Photo of erosion of Bent Creek looking upstream at proposed Bent Creek Bank Stabilization site (UID #3317).

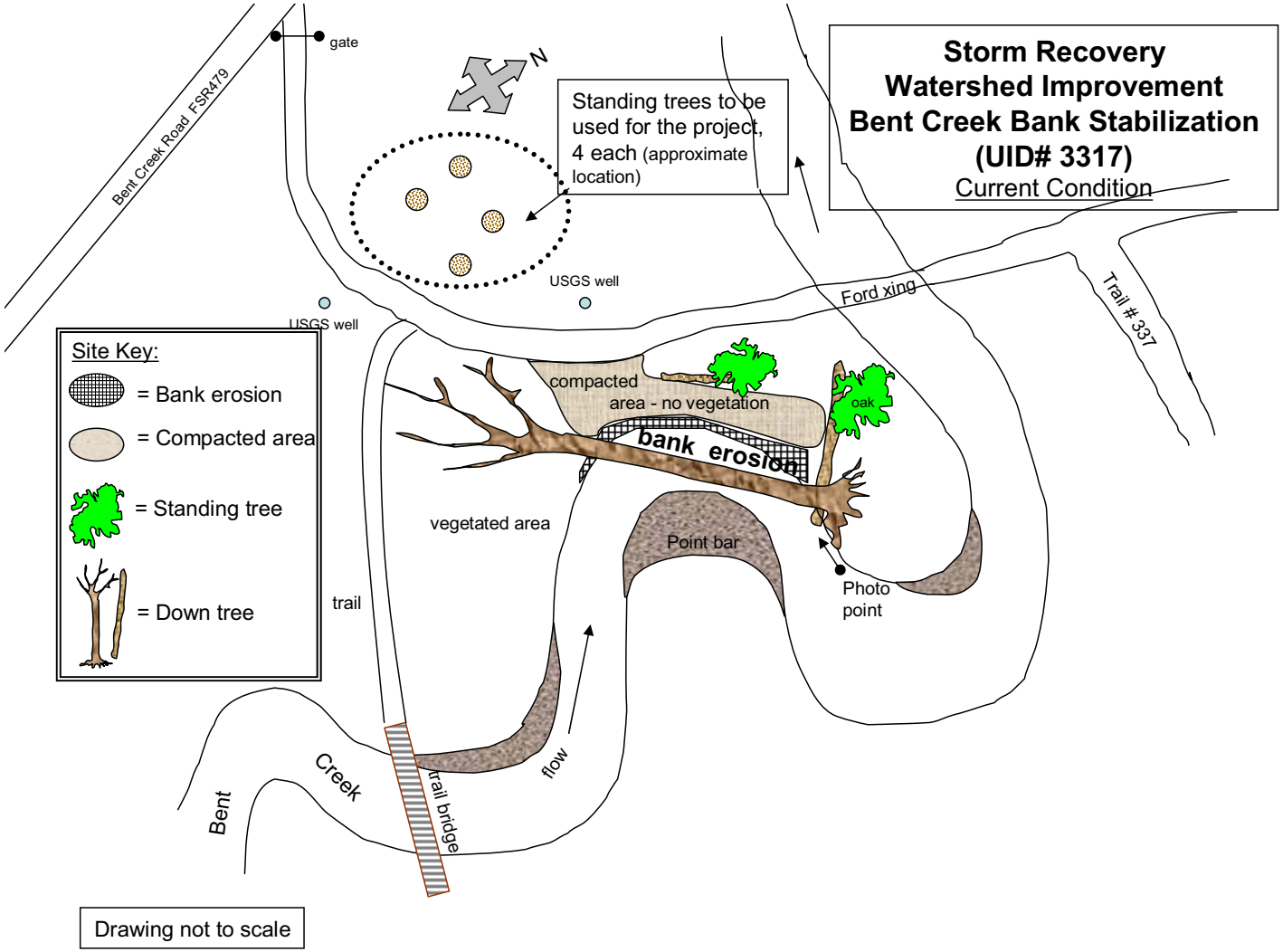


Figure 25. Site map of existing condition for Bent Creek Bank Stabilization project (UID #3317).

Boyd Branch Channel Stabilization (UID #3302, 3303, & 3304)

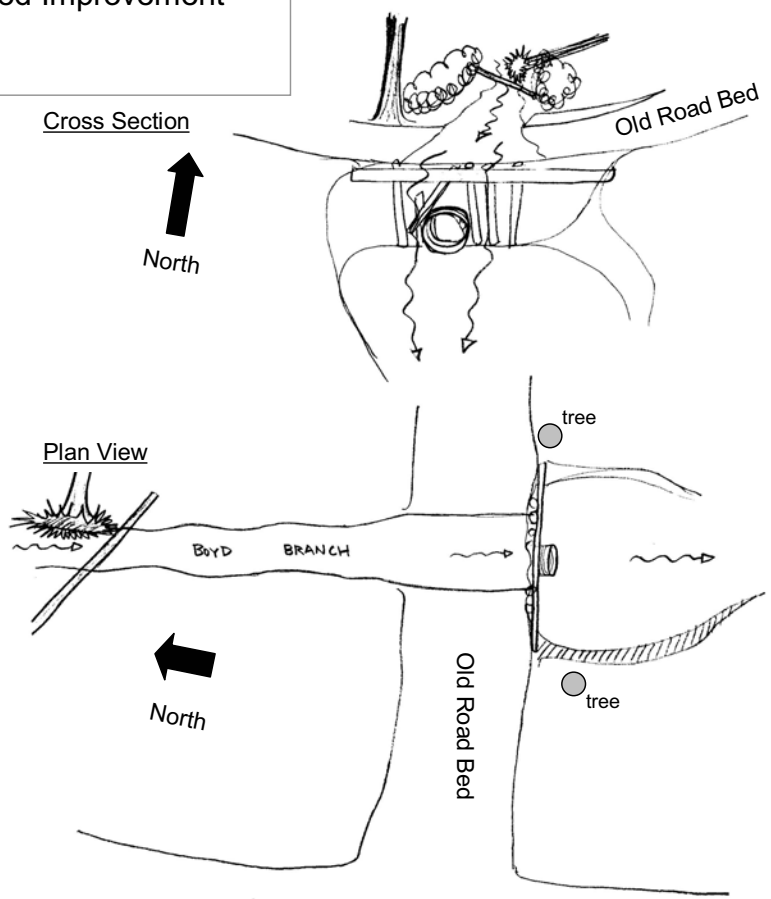
Site 1. Boyd Branch Culvert Removal (UID #3302): High runoff due to the hurricanes in 2004 caused sedimentation to fill and block the inlet of an old road crossing on Boyd Branch, resulting in an unstable road/stream crossing (Figures 8, 9, and 27). This crossing is setup to fail during future high flow storm events and, thus, is a potential source of downstream sedimentation.

Site 2. Boyd Branch Large Woody Debris Placement (UID #3303). Past management activities and the 2004 storms resulted in 40 feet of unstable stream bank and streambank erosion. Stream banks in this reach are bare and susceptible to erosion during high flows. The channel has widened to 14 feet. Normal channel width is approximately seven feet. FSR 479F is located 66 feet from the project area (Figures 8, 9 and 28).

Site 3. Boyd Branch Streambed Stabilization (UID #3304). High runoff due to the hurricanes in 2004 and previous land management practices on Boyd Branch, have resulted in the development of a three-foot high and five-foot wide headcut (Figures 8, 9, 26 and 29). Immediately downstream, the right stream bank is bare of soil and highly erodible. The channel here has widened up to 15 feet. Normal channel width ranges between five and six feet. If the headcut is left untreated it could migrate upstream and downcut until it reaches bedrock. Until the headcut reaches stable bedrock control, the migrating headcut will threaten stream stability.

Figure 26. View of headcut on Boyd Branch Site 3 (UID #3304)

Boyd Branch
Storm Recovery Watershed Improvement
Projects UID# 3302
Current Condition



Not to scale

Figure 27. Existing condition at Site 1 showing the road and stream crossing at Boyd Branch (UID #3302).

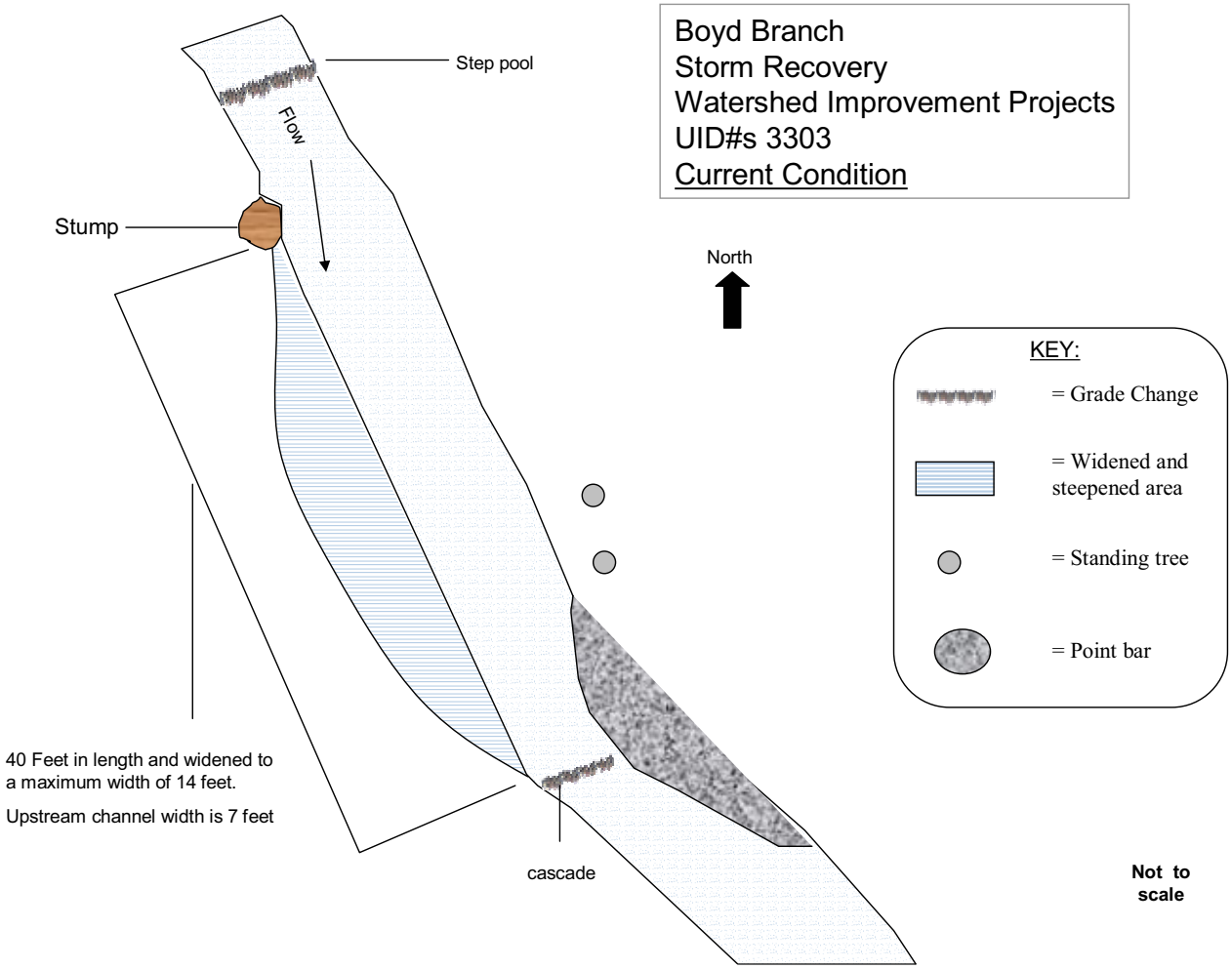


Figure 28. Plan view of Site 2 on Boyd Branch (UID #3303). Forty feet of the channel has over-widened to a width of 14 feet, twice its normal width of 7 feet.

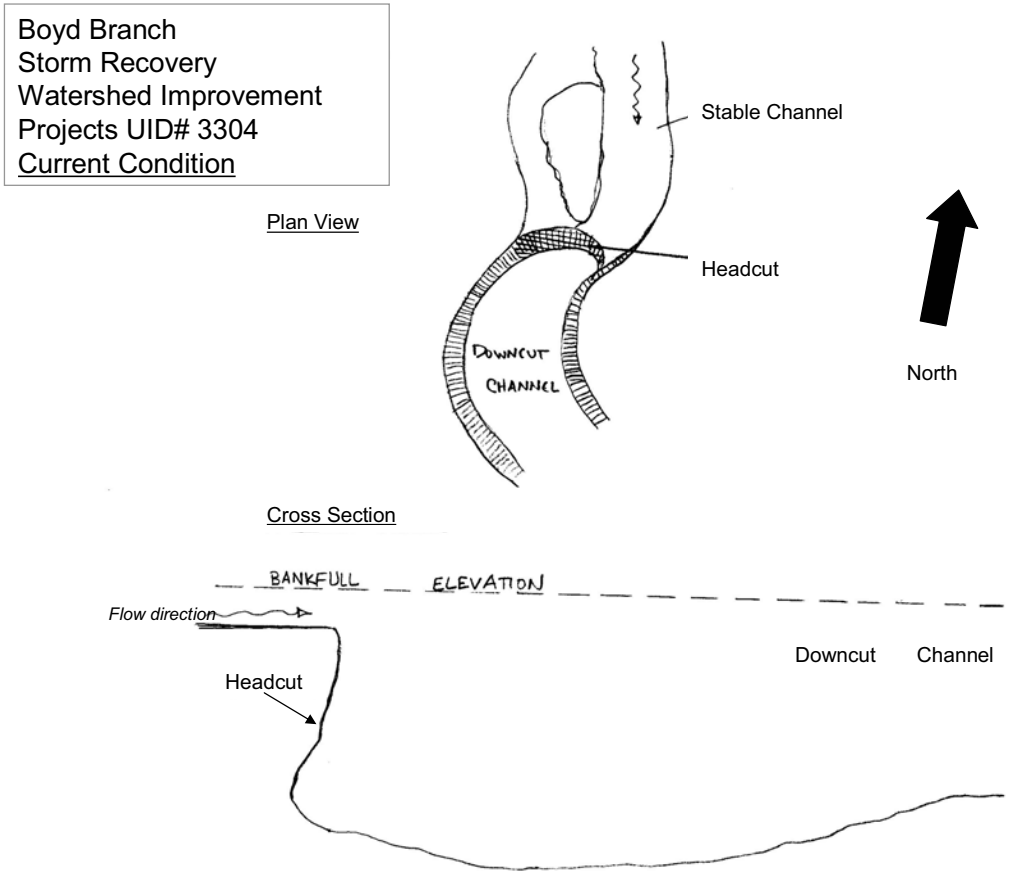


Figure 29. Diagram of Site 3 (UID #3304) on Boyd Branch showing channel instability downstream of the site. High runoff from the main channel has caused vertical channel scour represented currently by a 3-foot high and 5-foot wide headcut. The channel has widened to a width of 15 feet and the headcut threatens the stability of the channel upstream.

Laurel Branch Stream Stabilization (UID #3318 & 3319)

Site 1 Laurel Branch Bank Stabilization (UID #3318). A 30-foot section of the left bank of Laurel Branch has experienced notable stream bank erosion as a result of the 2004 flood events (Figures 13, 30, and 31). This site has a high risk of slumping in the near future. If this happens, further sedimentation would occur in the Laurel Branch channel. Sediment would likely continue downstream into Bent Creek and Lake Powhatan.

Site 2 Laurel Branch Bank Stabilization (UID #3319). An approximately 150-foot section of Laurel Branch has experienced streambank erosion as a result of the 2004 flood events below the FSR 479G road crossing (Figure 13) . This site has a high risk of sloughing into the channel in the near future (Figures 32, 33, and 34). If this happens, further sedimentation would occur in the Laurel Branch channel and likely downstream in the Bent Creek channel and Lake Powhatan.

Storm Recovery - Watershed Improvement
Laurel Br. UID# 3318
Current Condition – Site Photo looking upstream from trail crossing

Figure 30. Photo of Laurel Branch Bank Stabilization Site 1 (UID #3318).

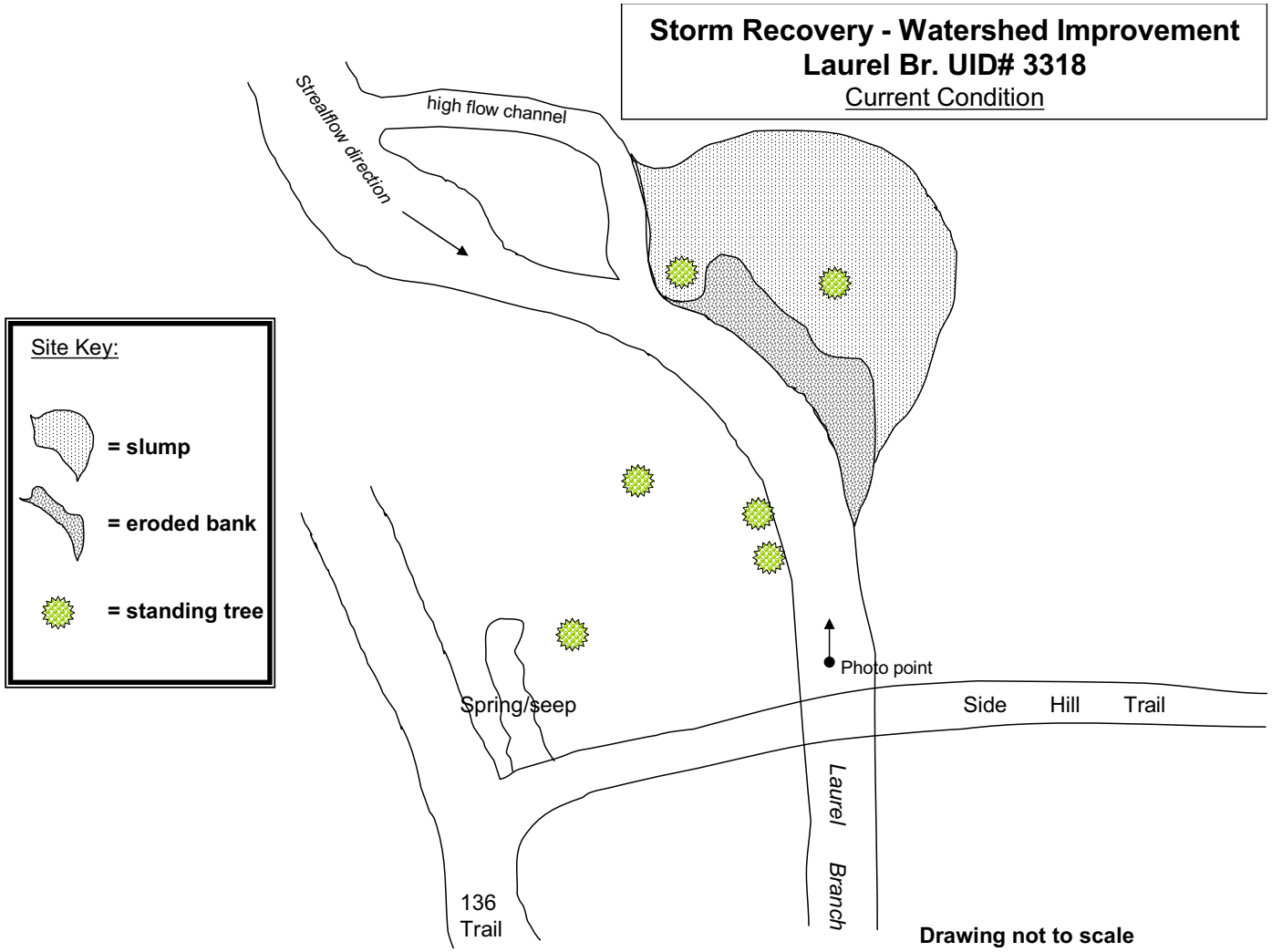


Figure 31. Current condition of Laurel Branch Bank Stabilization Site 1 (UID #3318).

Storm Recovery - Watershed Improvement
Laurel Br. UID# 3319
Current Condition – Photo point #1

Figure 32. Photo of the current condition looking downstream at Laurel Branch Bank Stabilization Site 2 (UID #3319), downstream location.

Storm Recovery - Watershed Improvement
Laurel Br. UID# 3319
Current Condition – Photo point #2

Figure 33. Upstream view of Laurel Branch Bank Stabilization Site 2 (UID #3319).

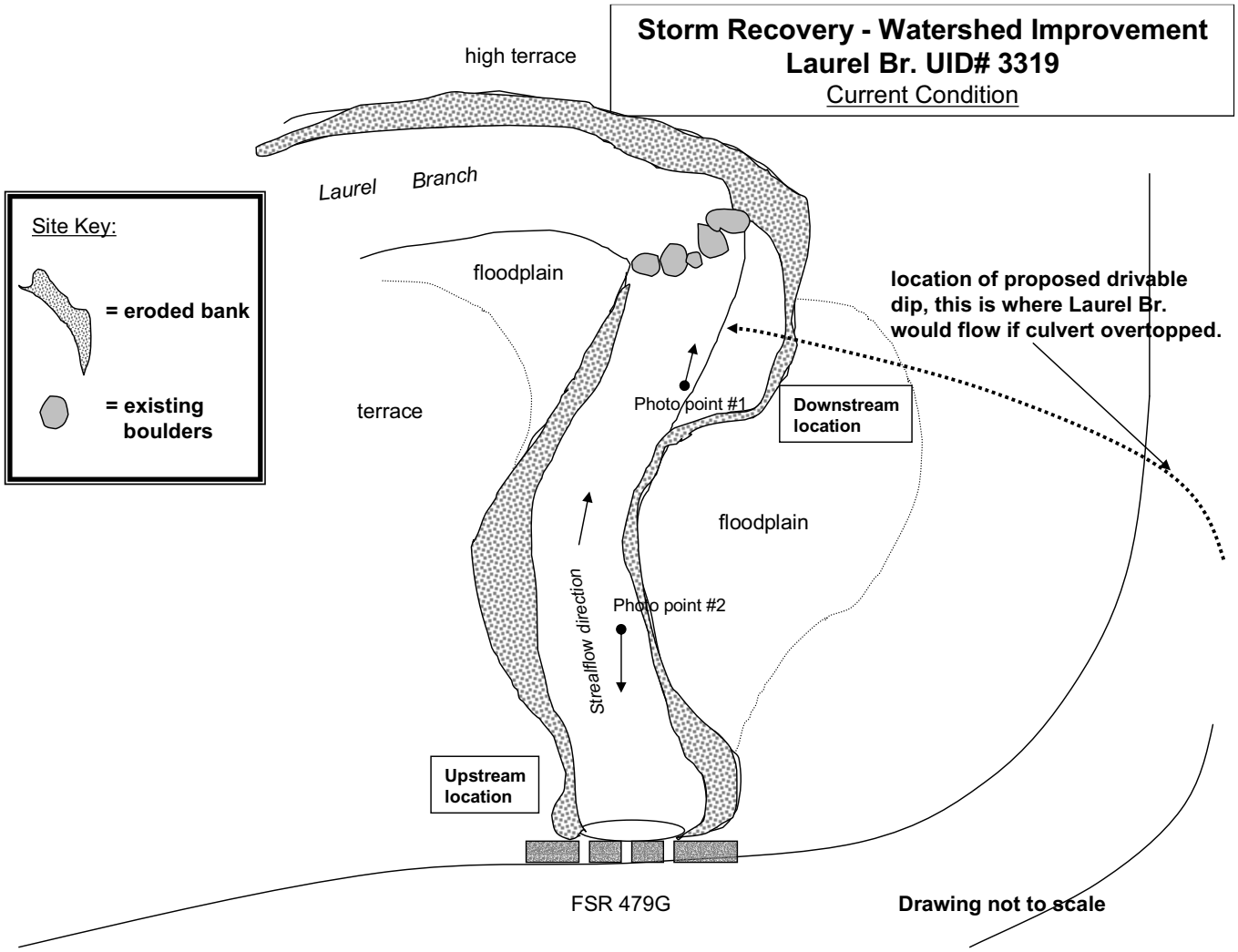


Figure 34. Site plan of current condition at Laurel Branch Bank Stabilization Site 2 (UID #3319) upstream and downstream locations.

Rich Branch Stream Bank Stabilization (UID #3256)

Rich Branch Sites 1 and 2 (UID #3256). High erosion from the 2004 flood events destabilized stream banks on two different sites on Rich Branch (Figures 17 and 36). The two sites were affected by the current day-use activities and dispersed camping (Figure 36). Site 1 is experiencing erosion at the toe of a steep side slope and there is a high risk that slumping would occur at this point in the near future. About 50 feet of the banks in this location have been undercut to a depth of about six feet, increasing the chances of future slumping.

The second site is approximately 50 feet downstream of the first site. Site 2 is an unstable, 20-foot wide slump adjacent to the channel (Figures 35 and 36) where all of the vegetation has been removed or fallen. Slumping occurred here during the 2004 flood events and potential exists for more slumping to occur in the near future.

Figure 35. Existing condition of left bank of Rich Branch Site 2 (UID #3256).

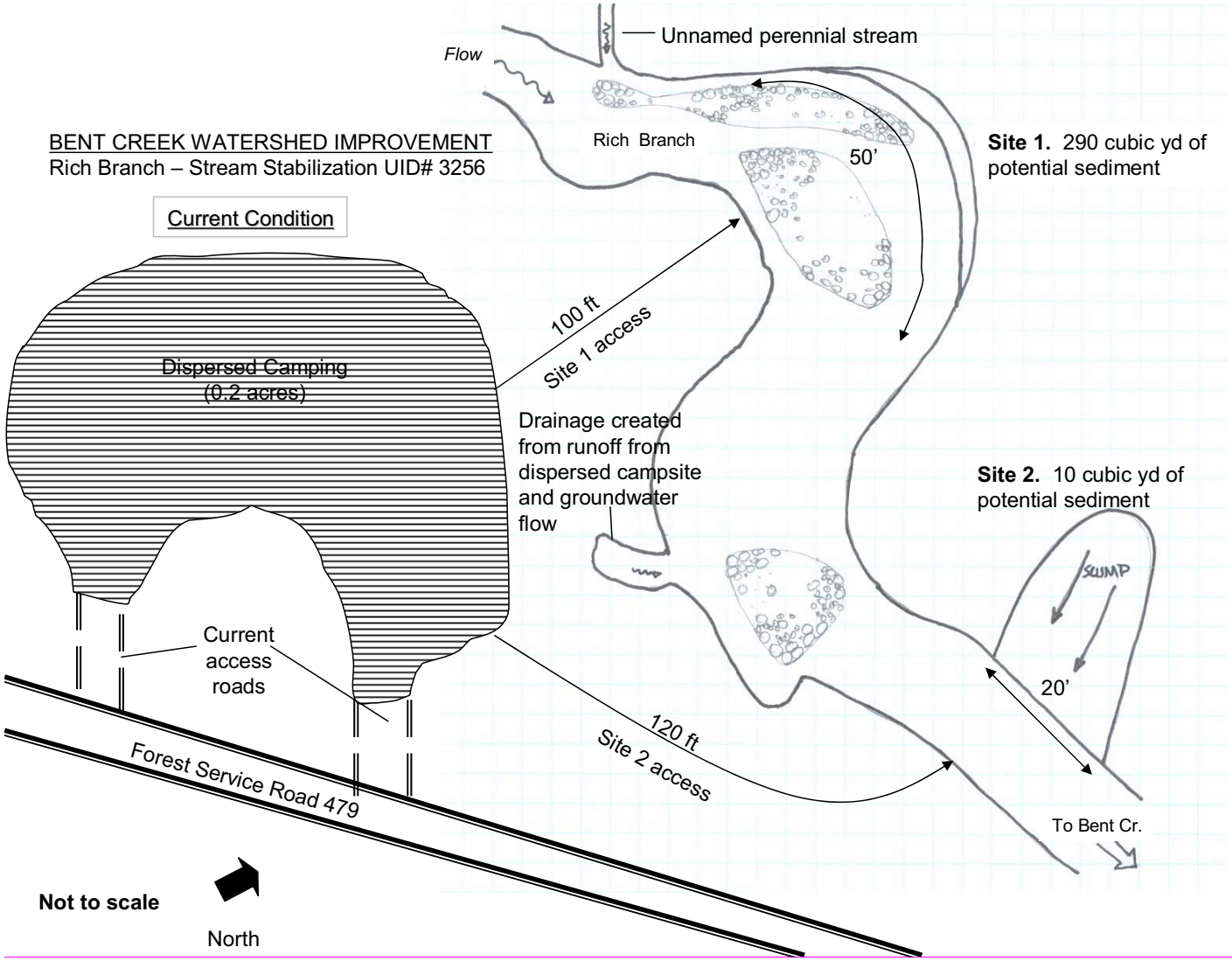


Figure 36. Diagram of current channel at proposed Rich Branch Stream Bank Stabilization project (UID #3256).

Stony Fork Streambank Stabilization project (UID# 1828)

Stony Fork is a tributary to South Hominy Creek, which flows into the French Broad River, in Buncombe County on the Pisgah Ranger District (Figure 21) and is classified by the State of North Carolina as Class C trout waters. The floods of 2004 increased bank erosion in this entrenched section of the Stony Fork channel and increased the risk of damage to adjacent private property. Some in-stream structures, such as individual boulders and deposition areas, are diverting flow against the banks. A human-made "point bar" feature that looks to have been constructed with boulders at Site 2 is diverting flow to the left bank and is causing erosion. Also, four logs that are across the channel have the potential to block the stream flow in future floods events (Figures 37 and 38).

Figure 37. Existing condition of Stony Fork bank looking downstream of Chestnut Hill Road (State Road 1100).

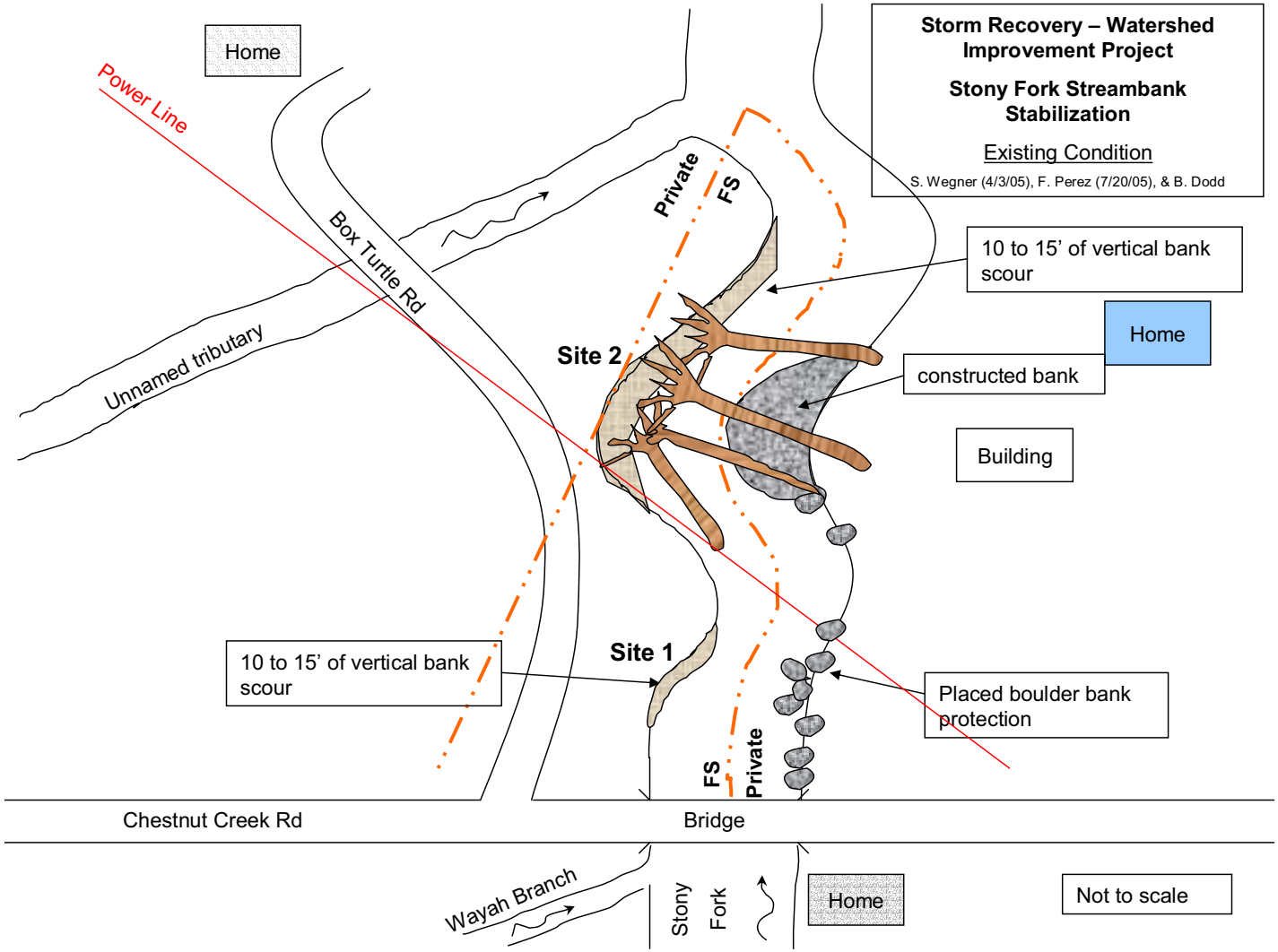


Figure 38. Existing condition of Stony Fork Streambank Stabilization project (UID #1828).

Forest Service lands are delineated within the dashed line. All adjacent areas are privately owned lands.

3.1.1 WATER QUALITY - DIRECT, INDIRECT, & CUMULATIVE EFFECTS

Direct and indirect effects to stream channels will be analyzed at the site level within the analysis area. Cumulative effects will be analyzed at Lake Powhatan and at the confluence of Stony Fork and South Hominy Creek. Below these locations, if effects from the proposed activities occurred, they are assumed to be masked, and ties with potential site disturbance would not be apparent.

The stream banks in the project area are a source of sediment to waters in and downstream of the project area, affecting water quality and aquatic habitat. Approximately 900 feet of stream bank has a vertical surface that is bare of vegetation in the Bent Creek watershed projects and approximately 200 feet of bank is exposed along Stony Fork. These areas have become unstable and would continue to erode during high flows. Fine sediment within the stream channels can fill the interstitial spaces in gravel, affecting the reproductive success and hiding places of fish and other aquatic organisms. Linear feet of exposed soil and unstable banks will be used as an indicator to measure the differences between alternatives.

Alternative A – No Action

Direct & Indirect Effects

Under the No Action Alternative the current rate of bank erosion would continue or increase due to the instability of the stream banks on streams within both the Bent Creek and Stony Fork watersheds. The current rate of erosion could increase as the undercut trees and stream banks fall over and expose more soil to be deposited into the streams. Increasing the potential sediment into the streams could cause an adverse effect to channel integrity and stability and place the water quality of Bent Creek and Stony Fork at risk.

Bent Creek Bank Stabilization Project (UID #3317)

If the No Action Alternative were selected, sedimentation would continue from the exposed stream bank and the dispersed recreation site. The dispersed recreation site would remain compacted and void of vegetation. Approximately 50 feet of stream bank would remain unstable and susceptible to continued erosion.

Boyd Branch Channel Stabilization Projects (UID #3302, 3303, & 3304)

If the No Action Alternative were selected, an increase in sedimentation from bank instability would occur at the three identified sites. Approximately 200 feet of stream bank would remain exposed and unstable and could erode into the stream. Increased sediment from Boyd Branch could move downstream into Bent Creek and into Lake Powhatan. At Site 1 (UID #3302) on Boyd Branch, the stability of the road-stream

crossing would continue to decline and large quantities of sediment and fill would be released into the stream. At Site 2 (UID #3303) erosion would continue due to the unstable stream bank and would increase sedimentation into Boyd Branch. Also with the widened stream channel, at high flows Boyd Branch would erode more sediment from the unstable stream bank that could change the stream morphology and channel substrate. Site 3 (UID #3304) would continue to have an unstable channel bottom that has potential to create a large volume of sediment as the headcut migrates upstream over time.

Laurel Branch Bank Stabilization Projects (UID #3318 and 3319)

If the No Action Alternative were selected, there would be an increased potential of high sediment influx from Laurel Branch during high flows. Approximately 150 feet of stream bank would remain exposed and easily erodable. With increased sediment, Laurel Branch might become a larger sediment source for Bent Creek and Lake Powhatan than it is currently. At Site 1 (UID #3318) the slump would not be stablizied and would continue being a sediment source into Laurel Branch. Increased bank erosion and sloughing would continue at Site 2 (UID #3319) and could indirectly affect the stablity of the culvert on FSR 479G.

Rich Branch Stream Bank Stabilization Project (UID #3256)

If the No Action Alternative were selected, there is a high probability of streambank slumping into Rich Branch in the near future because about 100 feet of stream bank would remain exposed to erosion. Site 1 (UID #3256) has a high risk of streambank slumping in the near future if no action is taken. If this occurs, approximately 290 cy of sediment could potentially be delivered into Rich Branch and subsequently into Bent Creek and Lake Powhatan. Rich Branch Stream Bank Stabilization Site 2 (UID #3256) has an unstable slump adjacent to the channel, which has the potential to deliver approximately 10 cy of sediment into Rich Branch and further downstream.

Stony Fork Stream Bank Stabilization Project (UID #1828)

If the No Action Alternative were selected, there is a high probability that about 150 linear feet of stream bank would remain exposed and likely slump into Stony Fork in the near future. Failure of this stream bank has the potential to deliver approximately 600 cy of sediment to Stony Fork and downstream into South Hominy Creek. Additionally, the loss of this bank would jeoporadize the integrity of a historical site, a private access road, and a power pole.

Cumulative Effects

Bent Creek Watershed

As a result of past landform development and management, several stream reaches in Bent Creek and its tributaries remain in unstable condition. Timber harvest activities have occurred in the Bent Creek watershed above Lake Powhatan, including hazard and right-of-way tree removal in a campground and recreation areas, salvage of damaged, blown-down timber from southern pine beetle infestation and tropical storms Opal and Beryl, and the harvest of timber along the Boyd Branch Road (FSR 479F) in the Bent Creek Complex Timber Sale (Table 2). Also associated with the Bent Creek Complex Timber Sale is the upgrade of unclassified roads, reconstruction of system roads, and new

road construction. All timber sale activities—including harvest, road building, and herbicide application—require implementation of state and national forest Best Management Practices (BMPs) to reduce the potential for sediment reaching stream channels. Where BMPs are not effective during timber sale projects, sedimentation to streams can occur and add to adverse cumulative effects. The dredging of Lake Powhatan in 1994 increased the area of storage potential for sediment in the reservoir, while it also degraded downstream reaches with the deposition of sediment released from the dam.

Other potential effects on water quality include recreational activities, such as trail maintenance and reconstruction and excessive public use of near-stream areas that remove vegetation and compact soils. Wildfires and fire suppression in the watershed have potential to increase sediment loads in streams. The proposed dredging of Lake Powhatan in 2006 or 2007 may temporarily increase sediment below the dam during implementation and would allow greater storage capacity for sediment after dredging is completed.

Selection of the No Action Alternative would allow the continuation of the unstable stream sites to add adverse cumulative effects to water quality. These effects would continue to add to adverse effects of management activities and natural channel morphology. Sedimentation produced from these drainages would continue to be transported downstream, adversely impacting turbidity and sedimentation on the channel bed, and eventually flow into Lake Powhatan. Furthermore, the No Action Alternative would not move stream channels toward the goal of meeting desired conditions set forth in the FLRMP and Clean Water Act.

Stony Fork Watershed

In the federally owned headwater drainages of the Stony Fork watershed, timber sale activities have occurred that may have added sedimentation to Stony Fork, although any notable adverse effects to water quality were mitigated by BMPs (Table 2). Other activities, such as road building and maintenance and dispersed camping, have likely contributed sediment to stream channels. Foreseeable future activities include similar actions of timber harvest, road work, and recreational use. Such activities would continue to increase sediment delivery to stream channels. Downstream from federal ownership, agricultural land uses dominate the valley bottom and have the greatest potential for degradation of water quality due to sedimentation and chemical runoff. Residential development is expected to increase in the watershed. Such use permanently changes the landscape to compacted surfaces that quickly carry runoff and pollutants to the stream channel.

The selection of the No Action Alternative would allow the continuation of the unstable stream sites to add sedimentation cumulative effects to water quality. These effects would continue to add to adverse effects of management activities. Sedimentation produced from these drainages would continue to be transported downstream, adversely impacting turbidity and sedimentation on the channel bed, and eventually into South Hominy Creek, where the channel is listed as “water quality limited” by the State of

North Carolina due to habitat degradation from agricultural uses. Furthermore, the No Action Alternative would not move stream channels toward the goal of meeting desired conditions set forth in the Forest Plan and Clean Water Act.

Table 2. Past, current, and foreseeable future management activities and events within the Bent Creek watershed (above Lake Powhatan) and Stony Fork area.

Date	Name of Action	Action	Location	Acres (unless noted)
05/21/96 – 04/30/97	Opus I Salvage Timber Sale	Salvage damaged and blown down timber form tropical storms Opal and Beryl.	Over most of Bent Creek Experimental Forest in the Lake Powhatan and downstream.	162
03/09/96 – 05/30/96	Big John Salvage Sale	Remove timber damaged by tropical storms Opal and Beryl.	Lake Powhatan Campground and Recreation Area.	45
01/24/00 – 05/23/00	Lake Powhatan Hazard Tree Removal Service Contract	Remove hazard trees from Lake Powhatan Campground Loops.	Lake Powhatan Campground.	20
05/23/00 – 06/26/00	Lake Powhatan Hazard Tree Removal Service Contract	Remove additional hazard trees that became infested with southern pine beetle during earlier contract.	Lake Powhatan Campground.	2.3
03/31/2001 – 05/31/01	Lake Powhatan Round 2 Salvage Sale	Remove southern pine beetle infested pines from Lake Powhatan Recreation Area.	Big John Campground Loop, Hardtimes Loop, Lakeside Loop, dump station loop, and Lake Powhatan Beach area.	50
06/2004	Campground Improvements	Construction of water and sewer lines.	Lake Powhatan Campground, Rice Pinnacle and Hard Times trailheads.	5
10/04/04 – 10/30/08	Bent Creek Complex Timber Sale	Upgrade 4.3 miles of unclassified roads, reconstruct 2 miles system roads, construct 0.23 mile new road. Harvest timber on 148 acres.	Bent Creek Experimental Forest along Ledford Branch, Boyd Branch, Farm Woodlot and Hard Times roads.	148

Table 2. Past, current, and foreseeable future management activities and events within the Bent Creek watershed (above Lake Powhatan) and Stony Fork area (*continuation from previous page*).

Date	Name of Action	Action	Location	Acres
2004	Construction of Box Turtle Road	Improvements to existing road	Box Turtle Road at Chestnut Hill Road junction (State Road#1100)	Less than 1
03/2006-09/2006	Bent Creek Experimental Forest road and trails rehabilitation	Road reconstruction, trail relocation and obliteration	Bent Creek Experimental Forest	Various locations throughout the watershed
02/2006	Hard Times Trail Relocation	Construction of trail and rock wall	Trail 661 (Bent Creek Watershed)	Less than 1 mile
03/31/05 – 05/30/05	Powhatan Waterline Timber Sale	Remove Right of Way Timber along new sewer and waterline in Lake Powhatan Campground and Recreation Area	Lake Powhatan Campground	100
04/2006	Farm Woodlot Landslide Repair	Repair of failed slope	Trail 145 (Bent Creek Watershed)	Approximately 1
Summer 2006	Campground Maintenance	Repairs to facilities at campgrounds	Locations within Bent Creek watershed	Various locations throughout the watershed
09/2006	Lake Powhatan Dredging	Dredging sediment from Lake Powhatan	Lake Powhatan	Less than 10
Past, Present and Future	Residential home development	Construction of residential homes	Adjacent to Stony Fork project area	Variable (private land)

Alternative 2 – Proposed Action

Direct & Indirect Effects

Implementation of the Proposed Action would temporarily increase sediment delivery to Boyd Branch, Laurel Branch, Rich Branch, Bent Creek, and Stony Fork. Therefore, turbidity and sedimentation of stream substrate would temporarily increase. These increases would likely occur during construction and potentially within the following month's time as planted vegetation becomes established. BMPs, as outlined by state and Forest guidelines and in Chapter 2, would be implemented, and state permit requirements would be met to minimize sedimentation, such as meeting the state turbidity standard for trout streams. Therefore, the increases in turbidity and sedimentation are not likely to have an adverse effect on water quality.

Immediately following the completion of the proposed projects the sites would likely be more stable than before and improved aquatic habitat would likely be available for occupation by aquatic biota. Stream channels would maintain stable dimensions for width and depth without excessive scour at the proposed sites. Because the proposed work is designed to remain in place for more than 50 years and to withstand flood flows in the respective streams, a long-term benefit to water quality would occur.

Bent Creek Bank Stabilization (UID #3317)

Proposed activities at Bent Creek would stabilize 50 feet of eroding stream bank and reduce sediment and bare ground. The dispersed recreation site would be closed to the public and restored. Streamside vegetation would grow on the dispersed recreation site where there is no vegetation growing currently.

Boyd Branch Channel Stabilization (UID #3302, 3303, & 3304)

Approximately 200 feet of unstable stream banks would be stabilized and made more resistant to erosion. At Site 1 (UID #3302) on Boyd Branch, removal of the culvert, reshaping the channel into a step/pool channel, and decommissioning old FSR 470F would reduce the risk of this stream reach of stream failing during flood events. At Site 2 (UID #3303), approximately 40 feet of stream bank would be stablized. The in-stream structures would encourage Boyd Branch to stay within its natural stream channel width (approximately 7 feet) instead of at the current over-widened width of 14 feet. This would reduce increased erosion rates from flood events on the currently exposed stream bank. At Site 3 (UID #3304), the three-foot-high headcut would be stabilized so it would not migrate upstream. Also, restoration activities at Boyd Branch would cause the channel to stay within its normal width of 6 feet instead of widening to 15 feet. Stream banks would have vegetative cover to stablize the stream banks, which would reduce erosion during high flow events.

Laurel Branch Bank Stabilization (UID #3318 & 3319)

Approximately 150 feet of stream bank would be planted and stabilized with either large wood or rock. At Site 1 (UID #3318), a 30-foot section of the left bank of Laurel Branch will be stabilized and would have a reduced risk of slumping in the future. At Site 2

(UID #3319), the stream banks would be more resistent to erosion after vegetation has been planted; the flow path would encourage water away from the weakened stream banks and reduce the amount of sediment entering Laurel Branch; and the structural intergrity of the stonework around the culvert at FSR 479G would not be compromised during future high flow events.

Rich Branch Stream Bank Stabilization (UID #3256)

Approximately 100 feet of Rich Branch (UID #3256) would be stabilized. In-stream structures at both sites would promote water to flow away from the unstable left bank (looking downstream). Also, planting vegetation would help stabilize both the slump at Site 2 and the steep six-foot bank at Site 1. The left bank would be more stable and able to resist increased sedimentation rates during flood events, especially after the vegetation has taken root within the currently unstable left bank.

Stony Fork Stream Bank Stabilization (UID #1828)

Alternative 2 – Proposed Action

Approximately 150 feet of Stony Fork would be stabilized by implementing this action. In-stream structures at both sites would promote water to flow away from the unstable left bank (looking downstream). Also, sloping back tall vertical banks and planting vegetation would help stabilize slopes. Implementation of this alternative would reduce the risk of losing approximately 600 cy of soil from the left bank and, thus, reduce the risk of increased sediment loading to Stony Fork and downstream to South Hominy Creek. Additionally, stabilizing the stream bank would help secure the historical site, a private access road, and a power pole.

Alternative 3

Approximately 50 feet of Stony Fork would be stabilized by implementing this action. Sloping back the tall vertical bank and planting vegetation would help stabilize the slope. Implementation of this alternative would reduce the risk of losing approximately 200 cy of soil from the left bank, thus reducing the risk of increased sediment loading to Stony Fork and downstream to South Hominy Creek. Additionally, stabilizing the stream bank would help secure the historical site; however, the private access road and a power pole would remain at risk of damage. Alternative 3 would do less to restore the entire stream bank than Alternative 2, but would be an improvement to existing conditions and to water quality.

Cumulative Effects

Bent Creek Watershed

As a result of past landform development and management, several stream reaches in Bent Creek and its tributaries remain in unstable condition. Timber harvest activities that have occurred in the Bent Creek watershed above Lake Powhatan include hazard and right-of-way tree removal in campgrounds and recreation areas, salvage of damaged and blown down timber from southern pine beetle infestation and tropical storms Opal and Beryl, and the harvest of timber along the Boyd Branch Road (FSR 479F) in the Bent

Creek Complex Timber Sale (Table 2). Also associated with the Bent Creek Complex Timber Sale is the upgrade of unclassified road, reconstruction of system road, and construction of road. All timber sale activities (harvest, road building, herbicide application, etc.) require the implementation of state and national forest BMPs to reduce the potential for sediment reaching stream channels. Where BMPs are not effective during timber sale projects, sedimentation to streams can occur and add to adverse cumulative effects. The dredging of Lake Powhatan in 1994 increased the area of storage potential for sediment in the reservoir, while it also degraded downstream reaches with the deposition of sediment released from the dam.

Other potential effects on water quality include recreational activities, such as trail maintenance and reconstruction and excessive public use of near-stream areas that remove streamside vegetation (2006). Wildfires and fire suppression in the watershed have the potential to increase sediment loading to streams. The proposed dredging of Lake Powhatan in 2006 or 2007 may create temporary increases in sediment below the dam during implementation and allow greater storage capacity for sediment after dredging is completed.

With the selection of the Proposed Action, beneficial effects to water quality would be added to potential adverse effects of management activities and natural channel morphology. Furthermore, the Proposed Action would move stream channels toward the goal of meeting desired conditions set forth in the Forest Plan and Clean Water Act.

Stony Fork Watershed

In the federally-owned headwater streams of the Stony Fork watershed, timber sale activities have occurred that may have added sediment to Stony Fork, although any notable adverse effects to water quality were mitigated by BMPs (Table 2). Other activities such as road building, road maintenance, and dispersed camping have occurred that likely contributed to a small degree to sedimentation to stream channels. Foreseeable future activities include similar actions of timber harvest, road work, and recreational use. Such activities would continue to increase sediment delivery to stream channels. Downstream from federal ownership, agricultural land uses dominate the valley bottom and have the greatest potential for degradation of water quality due to sedimentation and chemical runoff. Residential development is expected to increase in the watershed. Such use permanently changes the landscape to compacted surfaces that quickly carry runoff and pollutants to the stream channel.

Alternative 2 – Proposed Action

The Proposed Action would move Stony Fork toward the goal of meeting desired conditions set forth in the Forest Plan and Clean Water Act.

Alternative 3

With the selection of this action, beneficial effects to water quality would be added to potential adverse effects of management activities in the watershed. This alternative would produce less of a beneficial effect than Alternative 2. However, the Proposed Action would still move stream channels toward the goal of meeting desired conditions set forth in the Forest Plan and Clean Water Act.

3.2 Aquatic Habitat

Existing Condition

Aquatic habitat within the project area has been affected by the flooding events of 2004. Streambank erosion can change the channel substrate, widen the channel, and cause riparian vegetation to grow further away from the stream channel reducing shade and/or cover. Fine sediment within the stream channels has filled the spaces within the gravel, affecting the reproductive success and hiding places of fish and other aquatic organisms. Habitat created through the use of features such as rock vanes, boulders, and large woody debris in the stream channel is used to measure the differences between alternatives.

3.2.1 Aquatic Habitat Direct, Indirect, & Cumulative Effects

Alternative 1 – No Action

Direct & Indirect Effects

Implementing Alternative 1, the project streams would continue to be a source of sediment and aquatic habitat degradation that could increase during high water events. The majority of this sediment would be moved downstream while some would remain in the channel near the project sites, particularly in the margins of the river below the eroding stream banks. This sediment has the potential to affect water clarity and substrate composition. Stream sedimentation reduces habitat quality and quantity for all fish species, particularly trout. Adult trout need clean, sediment free gravel-sized substrate for spawning; eggs need this clean substrate for hatching. Without successful spawning, trout populations become unstable and suppressed. The effect of not implementing the Proposed Action would have adverse direct and indirect effects to water quality and aquatic species, such as brook trout, brown trout, rainbow trout, and blacknose dace. Suitable habitat for these species would not be increased with the No Action Alternative, as the sites in the Proposed Action would continue to be a sediment source.

Bent Creek Bank Stabilization (UID #3317)

If the No Action Alternative were selected, sedimentation would continue from the exposed stream bank and the dispersed recreation site. The dispersed recreation site would remain compacted and void of riparian vegetation. This site would continue to lack channel stabilizing features, such as large wood and boulders, and shade-producing riparian vegetation which may also enhance aquatic habitat.

Boyd Branch Channel Stabilization (UID #3302, 3303 & 3304)

If the No Action Alternative were selected, Boyd Branch would see a continued loss of high quality aquatic habitat due to an increase in sedimentation from the bank instability at the three identified sites. These sites would continue to lack channel stabilizing features, such as large wood and boulders that enhance aquatic habitat. At Site 1 (UID #3302) on Boyd Branch, the stability of the road-stream crossing would continue to decline and eventually large quantities of sediment and fill would be released into the stream. Site 2 (UID #3303), would continue to lack the large wood needed to improve aquatic habitat, and Site 3 (UID #3304) would continue to be without the boulders and rocks needed to stabilize the channel bed.

Laurel Branch Bank Stabilization (UID #3318 and 3319)

If the No Action Alternative were selected, the condition of the aquatic habitat would continue to degrade without stream stabilizing structures. At Site 1 (UID #3318), the slump would not be stablized by rock and large wood and, thus, would continue being a sediment source and lack aquatic habitat. Increased bank erosion and sloughing would contintue at Site 2 (UID #3319) and habitat condition would continue to degrade.

Rich Branch Stream Bank Stabilization (UID #3256)

If the No Action Alternative were selected, there is a high probability of stream bank slumping into Rich Branch in the near future and further loss of aquatic habitat due to a the channel instability and lack of structural habitat.

Stony Fork Stream Bank Stabilization (UID #1828)

If the No Action Alternative were selected, there is a high probability of stream bank slumping into Stony Fork in the near future and the further loss of aquatic habitat due to a the channel instability and lack of structural habitat.

Cumulative Effects

Bent Creek Watershed

As a result of past landform development and management, several stream reaches in Bent Creek and its tributaries remain in unstable condition. Timber harvest activities that have occurred in the Bent Creek watershed above Lake Powhatan include hazard and right-of-way tree removal in campground and recreation areas, salvage of damaged and blown down timber from southern pine beetle infestation and tropical storms Opal and Beryl, and the harvest of timber along the Boyd Branch Road (FSR 479F) in the Bent Creek Complex Timber Sale. Also associated with the Bent Creek Complex Timber Sale are the upgrade of unclassified roads, reconstruction of system roads, and road construction. All timber sale activities (e.g., harvest, road building, herbicide application, etc.) require the implementation of state and national forest BMPs to reduce the potential for sediment reaching stream channels. Where BMPs are not effective during timber sale projects, sedimentation to streams can occur and add to adverse cumulative effects. The dredging of Lake Powhatan in 1994 increased the area of aquatic habitat in the lake.

Other potential effects on water quality include recreational activities, such as trail maintenance and reconstruction and public use of near stream areas that remove streamside vegetation. Wildfires and fire suppression in the watershed have the potential to increase sediment loading to streams. The proposed dredging of Lake Powhatan in 2006 or 2007 may create temporary increases in sediment below the dam during implementation and allow greater storage capacity for sediment after its completion.

With the selection of the No Action Alternative, sediment sources from the unstable stream banks in Bent Creek, Boyd Branch, Laurel Branch, and Rich Branch sites would continue to add to the adverse cumulative effect of other sediment sources within the watershed. Sedimentation produced from these drainages would continue to be transported downstream, adversely impacting turbidity and sedimentation on the channel bed, and eventually into Lake Powhatan.

Stony Fork Watershed

In the federally owned headwater drainages of the Stony Fork watershed, timber sale activities have occurred that may have added to sedimentation to Stony Fork, although any notable adverse effects to water quality were mitigated by BMPs. Other activities, such as road building, road maintenance, and dispersed camping, have occurred that likely contributed sediment to stream channels. Foreseeable future activities include similar actions of timber harvest, roadwork, and recreational use. Such activities would continue to increase sediment delivery to stream channels. Downstream from federal ownership, agricultural land uses dominate the valley bottom and have the greatest potential for degradation of aquatic habitat due to sedimentation and chemical runoff. Residential development is expected to increase in the watershed. Such use permanently changes the landscape to compacted surfaces that quickly carry runoff and pollutants to the stream channel.

The selection of the No Action Alternative would allow the continuation of the unstable stream sites to add adverse cumulative effects to aquatic habitat. These effects would continue to add to adverse effects of management activities. Sedimentation produced from these drainages would continue to be transported downstream, adversely impacting stabilizing features, such as large wood and boulders that enhance aquatic habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Since implementation of the Proposed Action would temporarily increase sediment to the stream channel, both turbidity and sedimentation of stream substrate would temporarily increase. These increases would likely occur during construction and potentially within the following month's time as planted vegetation becomes established at the site. BMPs, as outlined by state and national forest guidelines and in Chapter 2, would be implemented, as would permit requirements for trout streams. Therefore, the increases in turbidity and sedimentation are not likely to have an adverse effect on the aquatic habitat. It is anticipated that immediately following the completion of the proposed projects the

sites would be more stable than before and that improved aquatic habitat would be available for occupation by aquatic biota. The proposed activities would result in an increase in suitable habitat for sensitive species in both watersheds.

Bent Creek Bank Stabilization (UID #3317)

If the Action Alternative were selected, the bank stabilization work at Bent Creek would install several boulders and logs to create a complex designed to stabilize the bank and provide aquatic habitat improvement. Streamside vegetation would be growing on the dispersed recreation site where there is no current vegetation and aquatic habitat would be improved.

Boyd Branch Channel Stabilization (UID #3302, 3303, & 3304)

Approximately 12 pieces of large wood and several boulders would be added to the Boyd Branch channel. These projects are designed to stabilize the stream and provide aquatic habitat improvement. At Site 1 (UID #3302) on Boyd Branch, removal of the culvert and reshaping of the channel into a step/pool channel with large wood would provide a notable improvement to aquatic habitat by eliminating the migration barrier. At Site 2 (UID #3303), the placement of large wood would encourage Boyd Branch to stay within its natural stream channel and improve aquatic habitat. At Site 3 (UID #3304), the three-foot-high headcut would be stabilized using boulders and rock. This work would reestablish the ability of aquatic organisms to migrate up stream. In addition, the woody debris would provide cover from predation and fewer fines would fill intersitial areas in substrate of gravels that is necessary for trout spawing.

Laurel Branch Bank Stabilization (UID #3318 & 3319)

Approximately two pieces of large wood and several boulders would be added to the Laurel Branch channel. These two projects are designed to stabilize the stream and provide aquatic habitat improvement. At Site 1 (UID #3318), the placement of large wood and boulders would improve aquatic habitat by stabilizing the slump and by decreasing the potential for fines to enter into the stream channel to fill in pools and interstitial areas for spawning. The project would insert woody debris into the stream channel which would provide cover for aquatic organisms from predation and keep stream temperatures down to levels acceptable for aquatic organisms. At Site 2 (UID #3319), the placement of boulders in the channel would enhance aquatic habitat by providing structure to the stream channel.

Rich Branch Stream Bank Stabilization (UID #3256)

If the Action Alternative were selected, the bank stabilization work would install several boulders along the stream bank at Site 1 and a rock vane at Site 2. These projects are designed to stabilize the bank and provide aquatic habitat improvement.

Stony Fork Stream Bank Stabilization (UID #1828)

Alternative 2- Proposed Action

The construction of in-stream rock vane structures at both sites would encourage water to flow away from the unstable left bank. By doing so these structures help to stabilize the bank and decrease the potential deposition of fines. Implementation of this alternative would reduce the risk of losing approximately 600 cy of soil from the left bank and, thus, reduce the risk of increased sediment loading and subsequent habitat degradation to Stony Fork and downstream to South Hominy Creek.

Alternative 3

This alternative would not construct rock vanes but would place rock at the toe of the bank that would be sloped back to stay within the Forest boundary. Sloping back the tall vertical bank and planting vegetation would help stabilize the slope. Implementation of this alternative would reduce the risk of losing approximately 200 cy of soil from the left bank and, thus, reduce the risk of increased sediment loading and subsequent habitat degradation to Stony Fork and downstream to South Hominy Creek. Alternative 3 would do less to improve aquatic habitat than Alternative 2, but would be an improvement to existing conditions.

Cumulative Effects

Bent Creek Watershed

As a result of past landform development and management, several stream reaches in Bent Creek and its tributaries remain in unstable condition. Timber harvest activities that have occurred in the Bent Creek watershed above Lake Powhatan include hazard and right-of-way tree removal in campgrounds and recreation areas, salvage of damaged and blown down timber from southern pine beetle infestation and tropical storms Opal and Beryl, and the harvest of timber along the Boyd Branch Road (FSR 479F) in the Bent Creek Complex Timber Sale (Table 2). Also associated with the Bent Creek Complex Timber Sale is the upgrade of unclassified roads, reconstruction of system roads, and road construction. The dredging of Lake Powhatan in 1994 increased the area of storage potential for sediment in the reservoir, while it also degraded downstream reaches with the deposition of sediment released from the dam.

Other potential effects on aquatic habitat quality include recreational activities, such as trail maintenance, train reconstruction, and public use of near-stream areas that remove streamside vegetation. Wildfires and fire suppression in the watershed have the potential to increase sediment loading to streams. The proposed dredging of Lake Powhatan in

2006 or 2007 may create temporary increases in sediment below the dam during implementation and allow greater storage capacity for sediment after its completion.

With the selection of the Proposed Action, beneficial effects to aquatic habitat for fish and other aquatic organisms would be added to adverse effects of management activities and natural channel morphology. Furthermore, the Proposed Action would move stream channels toward the goal of meeting desired conditions set forth in the Forest Plan and Clean Water Act.

Stony Fork Watershed

In the federally owned headwater drainages of the Stony Fork watershed, timber sale activities have occurred that may have added sediment to Stony Fork, although any notable adverse effects to water quality were mitigated by BMPs. Other activities, such as road building, road maintenance, and dispersed camping, have occurred that likely contributed sediment to stream channels. Foreseeable future activities include similar actions of timber harvest, road work, and recreational use. Such activities would continue to increase sediment delivery to stream channels. Downstream from federal ownership, agricultural land uses dominate the valley bottom and have the greatest potential for degradation of aquatic habitat due to sedimentation and chemical runoff. Residential development is expected to increase in the watershed. Such use permanently changes the landscape to compacted surfaces that quickly carry runoff and pollutants to the stream channel.

Alternative 2 – Proposed Action

With the selection of this action, beneficial effects to aquatic habitat for fish and other aquatic organisms are expected. Indirect effects include positive changes in the amount of shading, and increases in turbidity and water temperature. The Proposed Action has a long-term benefit to aquatic habitat and fisheries by reducing fines in the bed load so that more interstitial spaces between gravels are available for successful trout egg reproduction.

Alternative 3

With the selection of this action, beneficial effects to aquatic habitat for fish and other aquatic organisms would be added to potential adverse effects of management activities in the watershed. This alternative would produce less of a beneficial effect than Alternative 2 because less stream channel will be restored in the Stony Fork area under this alternative.

3.3 Wildlife and Plants

Existing Condition

Various branches, streams, and creeks within the Bent Creek watershed incurred damage to their stream banks. An assessment across the watershed identified sites with chronic and potentially catastrophic sources of sediment that do not currently meet channel morphology desired conditions for the Forest.

Most of the streams within the Bent Creek watershed are surrounded by varying widths of Acidic Cove Forest (Schafale and Weakley 1990). Dominant canopy species within this type include *Liriodendron tulipifera*, *Betula lenta*, *Magnolia fraseri, Pinus strobus*, *Fagus grandifolia*, *Tsuga canadensis, Quercus alba,* and *Acer rubrum*. A dense shrub layer of *Rhododendron maximum* was prevalent along most of the stream reaches. Where the heavy shrub layer occurred, few herbs persisted, primarily consisting of *Goodyera pubescens, Chimaphila maculate,* and *Polystichum acrostichoides.* In less shrub dense areas, other shrubs such as *Hamamelis virginiana*, *Pyrularia pubera*, *Leucothoe fontansiana*, and *Clethra acuminata* were present. Herb species seen within these areas consisted of the previously listed species as well as *Galax urceolata, Solidago curtisii, Eurybia divaricata, Conopholis americana, Hexastylis arifolia, Lysimachia quadrifolia, Monotropa uniflora, Viola blanda,* and *Polystichum acrostichoides*.

Within Laurel Branch, a Mesic Oak-Hickory Forest primarily surrounds the proposed project areas. Canopy dominants are *Quercus alba*, *Quercus rubra*, *Pinus strobus*, *Carya glabra* and *Acer rubrum*. Mid-story trees include *A. rubrum*, *Liriodendron tulipifera,* and *Tsuga canadensis*. The ground cover was relatively sparse and included *Thelypteris noveboracensis*, *Athyrium asplenoides*, *Viola rotundifolia*, *Euphorbia corollata*, *Iris cristata*, *Pedicularis canadensis*, *Solidago curtisii, Eurybia divaricata, Symphyotrichum sagittifolium,* and the non-native invasive *Celastrus orbiculatus*.

The Stony Fork Branch project area is surrounded by an Acidic Cove Forest dominated by *Tsuga canadensis, Liriodendron tulipifera, Quercus rubra, Quercus alba, Betula lenta, Tilia Americana,* and *Acer rubrum*. *Rhododendron maximum* is thick adjacent to the stream gradually diminishing in density away from the waters edge. Other shrubs present include *Leucothoe fontansiana* and *Pyrularia pubera*. The sparse ground layer included *Goodyera pubescens, Chimaphila maculata, Huperzia lucidula, Mitchella repens, Monotropa uniflora, Botrychium biternatum, Conopholis americana, Eurybia divaricata, Solidago spp., Polystichum acrostichoides,* and *Viola sororia.* A powerline corridor transects the western boundary of this narrow USFS land. Ruderal species noted within these open conditions included *Lolium arundinaceum*, *Danthonia spicata, Erigeron pulchellus*, *Leucanthemum vulgare, Eragrostis curvula*, and *Solidago* spp.

Proposed, Endangered, Threatened, and Sensitive Species

Federal agencies are mandated to analyze effects of proposed projects on TES species according to the Endangered Species Act of 1973. Section 7 of the Endangered Species Act directs all federal agencies to use their existing authorities to conserve threatened and

endangered species and, in consultation with the U.S. Fish and Wildlife Service (USFWS), to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to the management of federal lands as well as other federal actions that may affect listed species, such as federal approval of private activities through the issuance of federal funding, permits, licenses, or other actions.

To meet this requirement, a biological evaluation for species known to occur or which may occur in the analysis area has been prepared by a Forest Service biologist (Kauffman 2006). The Bent Creek watershed has few documented rare species. Proposed, endangered, and threatened species considered in this analysis are those currently listed by the USFWS. Sensitive species are those listed by Region 8 of the USDA-Forest Service in 2001.

No known federally listed proposed, endangered, threatened, or sensitive aquatic or botanical species are known to occur within the analysis area. Six sensitive terrestrial wildlife species may occur within the project area based on surveys, habitat elements, and filed records. Table 3 displays the known and potential sensitive species in the project area.

Table 3. Known and potential sensitive species evaluated for this project. All the species are terrestrial animals.

Species	Group	Habitat	Likelihood of Occurence
Northern bush katydid (*Scudderia septentrionalis*)	Insect	Treetops at edges of broadleaved forest	May occur
Diana fritillary butterfly (*Speyeria diana*)	Butterfly	Deciduous and pine woodlands	May occur
S. Appalachian salamander (*Plethodon teyahalee*)	Amphibian	Moist forests at all elevations	May occur
Eastern small-footed bat (*Myotis leibii*)	Mammal	Roosts in hollow trees in summer	May occur
Rafinesque's Big-eared Bat (*Myotis rafinesquii rafinesquii)*	Mammal	Roosts in hollow trees near water in summer	May occur
Southern water shrew (*Sorex palustris puntulatus)*	Mammal	Small streams 12-15' wide above 3000'	May occur

Effects to a species can be direct, indirect, or cumulative. Direct effects are those occurring at the same time and place as the project activity. Watershed repair, including road access and stream bank repair, could potentially affect rare species directly through the trampling of animals or the uprooting or crushing of plants. Repair activities could directly affect aquatic organisms that are non-mobile, particularly during reshaping of stream banks and decommissioning road access routes. Indirect effects are also caused by the project activity, but they occur after the activity has taken place or at some distance from the activity area. While they do not cause immediate death to an individual,

they do negatively alter some condition of an individual's environment; which can lead to a loss of viability. Indirect effects include changes in the amount of shading, an increase in turbidity, or water temperature.

Cumulative effects are those resulting from incremental impacts of the Proposed Action added to other past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor, but collectively significant actions that take place over a period of time. Previous, on-going, and anticipated activities within the Bent Creek watershed are listed in Table 2. Cumulative activities within the Stony Fork watershed include construction of Box Turtle Road two years ago, on-going construction of residential homes, and an anticipated residential home development west of the activity area.

3.3.1 Wildlife and Plants - Direct, Indirect, & Cumulative Effects

Alternative 1 – No Action

Direct and Indirect Effects

The No Action Alternative will have no effect on any federally listed species because there are no threatened or endangered species or their associated habitats occurring within the project area based on preferred habitat elements and survey results (Table 4).

Implementation of the No Action Alternative would perpetuate the existing condition within all five streams and could impact potential sensitive species habitat. A slight increase in the current rate of erosion could occur as the undercut trees on the bank fall over and expose more soil, the streams become more incised, and adverse effects to channel integrity would continue and water quality would be at risk. Aquatic habitat quality directly downstream of these sites would continue to be degraded. These areas currently do not support habitat for the five sensitive aquatic species. No sensitive aquatic species were located during previous surveys. There would be no direct impacts upon these 5 species however there would be no beneficial indirect impacts once the sites are restored and suitable habitat improves within the five streams.

Table 4. Determination of each alternative on the evaluated federally threatened and endangered species.

Species	Alternative 1 – No Action Alternative	Alternative 2 – Action Alternative
None present	Not applicable N/A	N/A

Six terrestrial wildlife species may occur within the action alternative project areas. Table 5 lists the potential impacts with implementation of the No Action Alternative to the six terrestrial wildlife species that may occur within the activity areas. With the exception of the Southern water shrew (*Sorex palustris puntulatus*), the No Action Alternative should have no impact on the wildlife species. The anticipated continued degradation of the streambank habitat without active restoration, may eventually impact the Southern water shrew individuals, if present.

Table 5. Summary of potential effects from the No Action and Proposed Action alternatives on known and potential sensitive species that may occur within the project area.

Species	Group	Alternative 1 – No Action Alternative	Action Alternatives
Northern bush katydid *Scudderia septentrionalis*	Insect	No impact	Short term: May impact individuals, Long term: beneficial habitat impacts (indirect)
Diana fritillary butterfly *Speyeria diana*	Butterfly	No impact	Short term: May impact individuals, Long term: beneficial habitat impacts (indirect)
S. Appalachian salamander *Plethodon teyahalee*	Amphibian	No impact	Short term: May impact individuals Long term:
Eastern small-footed bat *Myotis leibii*	Mammal	No impact	Short term: May impact individuals Long term:
Rafinesque's big-eared bat *Myotis rafinesquii rafinesquii*	Mammal	No impact	Short term: May impact individuals Long term:
Southern water shrew *Sorex palustris puntulatus*	Mammal	Long term: May impact individuals	Short term: May impact individuals Long term:

Action Alternatives - Alternative 2 (Proposed Action) and Alternative 3 - Analysis of Effects by Species

Direct and Indirect Effects

Northern bush katydid (*Scudderia septentrionalis).* A recent survey for this species within mature Oak-Hickory Forest communities in western North Carolina has been completed by Dr. Forrest of the University of North Carolina - Asheville. Individual katydids were located across a wide range of elevations, from 1500 to 3600 feet above sea level. One of the new records for the species was within the Bent Creek watershed along the Hard Times Trail. The species may occur within the activity areas on or adjacent to the four streams in Bent Creek as well as the Stony Fork site. If the species is present, project activities could impact individuals through direct crushing. The species has also been located within the edge of grass/forbs openings by Dr. Forrest. Some edge habitat would be created with the access roads to both Boyd Branch and Laurel Branch sites, and the stream bank restoration at the Stony Fork site. This may result in an indirect beneficial impact to this katydid.

Cumulative Effects

Past ground disturbance for projects within the Bent Creek and Stony Fork watersheds may have crushed individual katydids. The greatest lasting impact to any populations would be from those projects with more disturbance and that have occurred during the past five years. The hurricane damage created slightly more edge habitat within the watershed. Most of the edge habitat created with the previous storm events during the 1990s will have aged and may no longer provide suitable habitat for the grasshopper. Some edge habitat has been created during the past few years with the on-going Bent Creek Experimental Forest Research timber sale. Edge habitat may be created with the residential home development west of the Stony Fork site. Thus, the cumulative beneficial effect of more edge creation versus potential individuals crushed with past, ongoing, and foreseeable projects should be beneficial for the species.

Summary

Forest-wide, this species has probably benefited from past forest management, which created new forest edge to offset the concurrent maturation of other forest stands. This project may impact individuals of this species, but could benefit katydid habitat (Table 5). The adverse effects to individuals would be minor considering the status and distribution of potential habitat on the Forest. The species may be more common than presently known since the life cycle is short and calling sporadic. Therefore, this project is not likely to cause a trend to federal listing or a loss of viability across the Forest.

Diana fritillary butterfly *(Speyeria diana)*

Direct and Indirect Effects

There is a site occurrence for the Diana fritillary, *Speyeria diana*, in the lower slopes of the Bent Creek watershed. This species utilizes nectar species found along roadsides, streams, and linear grass/forbs areas. Diana fritillary occurs in different forest types but seems to prefer roadsides through cove forests. Potential habitat for this butterfly is present both within the Bent Creek watershed sites and the single Stony Fork site. Eggs and larvae are typically found on violets (*Viola* spp.). If watershed restoration activities are carried out during the egg or larval season, individual eggs or larvae may be eliminated by equipment that tramples existing violets. Project activities could impact individuals through direct crushing. A small amount of existing stream edge habitat would be negatively impacted following project activities and may no longer provide suitable habitat until riparian vegetation is re-established and matures. Conversely some potentially suitable edge habitat through an existing forested landscape would be created from the access roads to Boyd Branch and Laurel Branch and the streambank restoration on Stony Fork.

Cumulative Effects

Past activities resulted in similar effects to Diana fritillary as the effects described above for the Proposed Action. Specifically, some activities could have crushed vegetation containing eggs, caterpillars, overwintering caterpillars. Eggs on the ground could have been run over. Opening the forest following blow downs may have decreased habitat for Diana fritillary. However, constructing road or edge habitat may have increased habitat for this species. Although watershed restoration and other past and ongoing disturbance activities may directly impact Diana fritillary individuals, the construction/reconstruction of roads and edge has or would increase habitat and mitigate any loss of individuals in activity areas.

Summary

Forest-wide this species has probably benefited from past forest management, which created new forest roadside habitat. This project may impact individuals of this species, but could benefit Diana fritillary habitat (Table 5). The adverse effects to individuals would be minor considering the status and distribution of the habitat on the Forest. Therefore, this project is not likely to cause a trend to federal listing or a loss of viability across the Forest.

Southern Appalachian salamander *(Plethodon teyahalee)*

Direct and Indirect Effects

This species is found in moist forests in the southwestern Appalachian mountains at all elevations. Several populations have recently been located within the Bent Creek watershed. This species may occur under the leaf litter and downed wood debris in all the activity areas. Project activities could directly impact individuals through direct crushing. Habitat may be temporarily decreased in the road and access areas and where trees are removed to access the streams and/or lay back the stream bank if the action results in drying of the leaf litter.

Cumulative Effects

Habitat has been lost in the past and with the ongoing timber sale due to road construction activities, storm events, regeneration cuts, and other disturbance activities. The habitat loss is probably of a temporary duration (i.e., 10 years or less). Neither the activities surrounding the dredging of Lake Powhatan or the Arboretum canopy walk are anticipated to affect this species or its habitat. Residential home development within the Stony Fork watershed may lead to direct and indirect impacts to this species. The proposed project would add to the cumulative loss of individuals or habitat for southern Appalachian salamanders within the Bent Creek watershed.

This species is thought to be fairly common across the Forest. Dr. Richard Highton's collection at the Smithsonian lists 1007 records for this species from 10 counties in North Carolina, at elevations ranging from 1160 feet to 6000 feet above sea level. This includes 267 records on the Forest, distributed across the same 10 counties and four ranger districts. Because the species is widely distributed, current management is unlikely to affect the availability of suitable habitat.

Summary

Forest-wide this species has lost habitat due to wildlife opening construction, road construction/reconstruction, and regeneration activities. The concurrent maturation of younger stands into suitable habitat has offset this loss because the forest plan standards that limit the amount of regeneration allowed in any compartment, management area, and analysis area prevent cumulative effects to this species. Because the species is widely distributed and occurs in non-specialized mesic sites, current management practices are unlikely to affect the availability of suitable habitat. These watershed restoration activities may impact individuals of this species and cause a loss of habitat (Table 5). The adverse effects to individuals and habitat would be minor considering the status and distribution of this species on the Forest. Therefore, these projects are not likely to cause a trend to federal listing or a loss of viability across the Forest.

Eastern small-footed bat (*Myotis leibii*) and **Rafinesque's big-eared bat** (*Myotis rafinesquii rafinesquii*).

Both of these species are thought to roost in hemlock forests, rock crevices, caves, mines, bridges or buildings, usually near water. The species uses other habitats for feeding. Little is known regarding summer nursery sites, summer foraging, or roosting habitat. Suitable maternity habitat may be lacking across the Forest, if otherwise appropriate sites are not exposed to the sun. The likelihood that a Rafinesque's big-eared bat exists within either watershed is remote, though not completely dismissible. The last recorded sighting of a Rafinesque's big-eared bat in Buncombe County is 111 years old. Small-footed bats were last observed in Buncombe County in 1999, so there is a greater likelihood that this species could exist within the Bent Creek or Stony Fork watersheds and the activity area.

Direct and Indirect Effects

If these bats are roosting in trees during watershed improvement activities, the bats could be disturbed or die as a result of trees being cut or knocked down. No snags would be removed with this project; however, some hollow trees, which are possible roosting habitat, may be removed in order to access the stream banks. The removal could indirectly affect these bats by eliminating roost trees. Creating small openings in the canopy, particularly with the access routes may temporarily improve feeding habitat for forest bats, which are attracted to the insects supported by grassy/brushy habitat areas.

Cumulative Effects

The ongoing timber sale in the Bent Creek watershed or the residential home development within the Stony Fork watershed may affect bats by disturbing or killing them by felling trees they are roosting in, or possible roost trees would be removed from use. Habitat has been created in the past due to storm blowdown events. However, these areas have matured and are probably no longer desirable feeding habitat. The on-going timber sale has created some foraging habitat for the species. Cumulatively, the past projects, ongoing projects, and the current proposal, could impact local populations of bats that roost in trees. Viability across the forest for these two bat species would be unaffected because the total cumulative effect of past actions, the Proposed Action, and activities on private land would only occur in a localized area.

Summary

Eastern small-footed bats have been collected from most counties in western North Carolina, although the species is rarely trapped during mist-netting surveys. The species has probably benefited from past forest management, which created new forest openings to offset the concurrent maturation of other forest stands. This project may impact individuals of this species, but benefits the habitat (Table 5). The adverse effects to individuals would be minor considering the status and distribution of this species on the Forest. Therefore, these projects are not likely to cause a trend to federal listing or a loss of viability across the Forest.

Rafinesque's big-eared bat is less likely to occur within the proposed project area. This species has not been collected as often as eastern small-footed bat. The proposed activities would not affect snags to access the activity areas or rock outcrops, which are the optimal habitats for this species within the project area. This project may impact individuals of this species but the adverse affects to potential habitat would be minor considering the habitat present for this species, both within these watersheds, and across the Forest (Table 5).

Southern water shrew *(Sorex palustris punctulatus).*

Direct and Indirect Effects

This species is known to occur on and adjacent to small first-order streams up to 12 to 15 feet wide, with rhododendron cover, across seven counties in North Carolina. Creation of the access routes to Boyd Branch and Laurel Branch could adversely affect individuals through direct crushing and sedimentation. The large disturbance needed to lay back the eroded stream banks on Stony Fork could result in the same impacts. There will be a temporary increase in suspended sediments from the streambank restoration activities but the effects should diminish as the stream banks are re-vegetated.

Cumulative Effects

The existing condition of the aquatic resources is the result of all past effects. Roads were constructed and culverts were installed from past projects and an ongoing timber sale. For the Stony Fork area, residential homes have been previously constructed adjacent to the stream and are anticipated to be constructed near the stream in the foreseeable future. The impacts of the former projects are temporary in nature to the aquatic resource (less than one year) and the adjacent streamside habitat (5 to 10 years). The dredging of Lake Powhatan should not affect any habitat for this species. The proposed project would add to the cumulative loss of individuals or habitat for southern Appalachian salamanders within both watersheds.

Summary

The Southern water shrew has been recorded from seven counties across western North Carolina. The species is thought to be widespread, but occurs in low densities and is difficult to capture. Habitat for this species, which includes riparian areas embedded within either Acidic Cove or Rich Cove Forest, is not limited within either watershed or across the Forest. These restoration activities may impact individuals of this species and may adversely affect their habitat (Table 5). The adverse effects would be minor considering the status and distribution of this species on the Forest. Therefore, these restoration projects are not likely to cause a trend to federal listing or a loss of viability across the Forest.

Summary for All Sensitive Species

This project would have no effect on any proposed, endangered, and threatened species. Consultation with the USFWS is not required. The project may impact individuals of the northern bush katydid (*Scudderia septentrionalis*), Diana fritillary butterfly (*Speyeria diana)*, southern Appalachian salamander (*Plethodon teyahalee)*, eastern small-footed bat (*Myotis leibii*)*,* Rafinesque's big-eared bat *(Myotis rafinesquii rafinesquii)*, and southern water shrew (*Sorex palustris puntulatus),* but would not impact their viability of these sensitive species across the Forest. This project would not impact any other sensitive species. No cumulative effects on species viability across the Forest would result from this project, as disclosed in the following effects determination.

Forest Concern Species

Forest concern species occur at the periphery of their range or are disjunctive from their primary range and are considered rare in North Carolina.

Table 6. Habitat for Forest concern rare species likely to occur within the activity area affected by the Bent Creek and Stony Fork watersheds improvement projects.

Species	Type	Habitat	Occurrence
Micrasema burksi (a caddisfly)	A caddisfly	Lotic- streams	May occur in the activity area and downstream.
Gomphus consanguis *(Cherokee clubtail)*	Dragonfly	Lotic – Depositional Lentic - Littoral	May occur in the activity area and downstream.
Macdunnoa brunnea (a mayfly)	Mayfly	Lotic- French Broad River	May occur in the activity area and downstream.
Barbaetis benfieldi (Benfield's bearded small minnow mayfly)	Mayfly	Lotic – clean Substrate Streams	May occur in the activity area and downstream.
Ephemerella berneri (a mayfly)	Mayfly	Lotic- clean streams and rivers	May occur in the activity area and downstream.
Serratella spicilosa (Spicilose serratellan mayfly)	Mayfly	Lotic- rivers and streams	May occur in the activity area and downstream.
Vireo gilvus *(Warbling Vireo)*	Bird	Deciduous hardwoods along rivers and streams	Likely to occur in the activity area.

The Nantahala and Pisgah national forests list of Forest Concern species includes 262 plants, 56 terrestrial animals, and 87 aquatic animals. These species are either known or could occur on the Forests. All of these species were initially considered for this analysis. Six aquatic and one avian species are likely to occur within the project area (Table 9).

There would be no direct, indirect, or cumulative effects to any Forest concern plant species with implementation of these proposed watershed restoration projects, as previous surveys within the Bent Creek Experimental Forest and Stony Fork area have not located any Forest concern plant species.

Aquatic Insect Assemblage

Alternative 1 – No Action

Direct and Indirect Effects

With the No Action Alternative, there would be no activities to stabilize the existing stream banks that are currently contributing sediments into the two watersheds. Given the lack of any streambank restoration, the six aquatic invertebrate species, if they occur downstream of the proposed activity areas, would continue to be directly impacted by periodic sedimentation following rain events. Suitable habitat for these species would not be increased with the No Action Alternative.

Cumulative Effects

The chronic long-term effects of sedimentation may lead to localized extirpation of subpopulations. This would not result in a loss of viability for any of the six aquatic invertebrate species across the Forest since habitat is not believed to be limiting for any of these species. The No Action Alternative will have no direct or indirect impact on *Vireo gilvus* since potential habitat for this species within the forest adjacent to the stream would not change.

Alternative 2 - Proposed Action and Alternative 3

Direct and Indirect Effects

Forest concern species *Micrasema burksi, Gomphus consanguis, Macdunnoa brunnea, Barbaetis benfieldi, Ephemerella berneri*, and *Serratella spicilosa* may occur downstream of the activity area for all five stream areas. The implementation of this project may result in short-term increases in sedimentation within all of the activity areas. The increase in sedimentation may stress individuals of these six species, if they occur. This increased risk can be greatly reduced with implementation of proper erosion control measures however can not be completely eliminated. The negative impacts are expected to be short-term, less than one year up to when the planted vegetation becomes established. In the long-term, there should be a positive indirect impact on all six species because the proposed project is designed to stabilize existing chronic erosion problems.

Cumulative Effects

The existing condition of the aquatic resource is the result of all past and on-going activities. Roads were constructed and culverts were installed from past projects and an ongoing timber sale within the Bent Creek area. Box Turtle Road, on the western edge of the USFS tract on Stony Fork, was constructed two years ago. The impacts of the former projects are temporary (less than one year) in nature. All six species have been negatively impacted by the increased silt and sedimentation resulting from the hurricane storm events in September and October of 2004. The dredging of Lake Powhatan project should not affect any habitat for these species since the lake is not suitable habitat for the aquatic assemblage species analyzed in this docment. Given the short-term nature of impacts on the aquatic resource from previous and on-going projects, the proposed project should not add to the cumulative loss of individuals or habitat for these six

species within the Bent Creek or Stony Fork watersheds.

Summary

None of the above species were found during previous field surveys within the Bent Creek or the Stony Fork watersheds; however, due to variable life-cycles of aquatic insects and present suitable habitat they may occur here. The proposed watershed activities may temporarily negatively impact individuals of all six species while long-term benefits to the species include improved suitable habitat. The habitats for these benthic macroinvertebrate species are believed to be common across their range within western North Carolina. The proposed activities should result in an increase in suitable habitat for all six species within localized areas within the Bent Creek or Stony Fork watersheds.

Vireo gilvus *(Warbling Vireo).*

Direct and Indirect Effects

This bird is known to utilize the upper canopy, typically 40 feet above the forest floor within a riparian forest. The species may occur within the activity areas on or adjacent to the five streams. If the species is nesting within some of the trees that may have to be removed to access the streams in the Bent Creek watershed, or to lay back the slope in the Stony Fork site, there could be an indirect effect in loss of habitat for the species. If eggs are present within the nest, there could be a direct affect on potential recruitment.

Cumulative Effects

Forest riparian regulations would have reduced impacts to warbling vireo from past and on-going projects within the Bent Creek and Stony Fork watersheds. Disturbance from past storm events during the mid-1990s may have affected riparian canopy trees and indirectly affected this species. Future projects within either watershed should not affect this species on public land. Continued development adjacent private lands along Stony Fork may reduce suitable habitat as well as impact any existing populations. The cumulative negative impact to warbling vireos from the proposed project should be minimal and localized primarily to the activity area.

Summary

Warbling vireos have been documented within seven western North Carolina counties. In Buncombe County, the bird has been documented at Beaver Lake, Fletcher Park, and French Broad River Park within portions of the French Broad River drainage near Asheville. The activities reducing erosion potential within the two watersheds may impact individual warbling vireos, primarily by affecting nesting habitat. The habitat affected would be minimal in comparison to the availability of riparian habitat both within the Bent Creek and the Stony Fork watersheds and across the Forest. Therefore, these watershed restoration projects are not likely to cause a loss of viability across the Forest for this species.

Summary for All Forest Concern Species

Six Forest concern species, *Micrasema burksi, Gomphus consanguis, Macdunnoa brunnea, Barbaetis benfieldi, Ephemerella berneri,* and *Serratella spicilosa,* aquatic species are likely to occur within the waters downstream of the stream activity areas. One forest concern bird, *Vireo gilvus*, may occur within the riparian forest adjacent to the activity areas. The proposed watershed improvement projects may impact individuals of these seven species if they occur; however, the impacts should be minimal and not result in the loss of a single potential animal population. Project activities may beneficially impact *Micrasema burksi, Gomphus consanguis, Macdunnoa brunnea, Barbaetis benfieldi, Ephemerella berneri,* and *Serratella spicilosa* in the future by improving aquatic habitat for these species. For the remaining forest concern rare species, there would be no impact from the activities associated with this project.

Management Indicator Species

Management Indicator Species (MIS) serve as the system to monitor Forest Plan implementation and effects on diversity and population viability of all native and desirable non-native plants and animals. At the project scale, MIS are used to focus the effects of proposed activities on habitat types. When these effects are evaluated within a forest-wide context, it is determined whether or not any trends for MIS would change. An assessment of habitat changes linked to MIS is documented in this section. The assessment provides an evaluation of project level activities, the change in habitat used by MIS, and the likely contribution to forest wide trends.

The amount of habitat changed by the project is checked for consistency with the Forest Plan and the recent trends in activities. If inconsistencies are uncovered, further investigation should be made to determine effects on MIS. However, if project activities are consistent with recent trends, then effects of habitat changes to MIS should remain constant. Tables 6 and 7 list each MIS species and the biological communities and special habitats they are indicating. For the Bent Creek and Stony Fork restoration projects five separate species were selected to represent the two habitats that potentially could be impacted. Acadian flycatchers will represent riparian forests. Brook trout, brown trout, rainbow trout, and blacknose dace will represent the coldwater stream component.

Most of the biological communities and special habitats in the project area are not affected by management activities proposed by the preferred alternative. What changes that are anticipated to occur, and discussed above, are consistent with the Forest Plan. Most of the projected habitat changes are needed to accomplish the multiple-use goals of the Forest Plan. The cumulative effect of the implementation of this project, along with other similar projects, would change habitats in amounts close to/consistent with forest-wide averages of the recent past. Therefore, population trends of MIS related to habitat changes on the Forest would continue as cited in the most recent update of the MIS assessment.

For coldwater streams, the forest-wide trend is increasing quality, due to improved efforts at erosion control and a reduction in new road construction. The proposed project would add to this trend but would not significantly change the forest-wide trend. Riparian forests are protected by standards in the Forest Plan. These forests currently are static—i.e., they are not expanding or being reduced in extent. As a result there is no reduction in the quantity of habitat and a gradual increase in quality as the forests are aging and developing more characteristics of high-quality riparian forests and only activities that enhance riparian benefits are permitted forest-wide.

Table 7. Biological communities and associated MIS.

Biological Community	MIS	Analyzed Further/ Evaluation Criteria*
Fir dominated high elevation forests	Fraser fir	No/1
Northern hardwood forests	Ramps	No/1
Carolina hemlock bluff forests	Carolina hemlock	No/1
Rich Cove forests	Ginseng	No/1
Xeric yellow pine forests	Pine warbler	No/1
Reservoirs	Largemouth bass	No/1
Riparian forests	Acadian flycatcher	Yes
Coldwater streams	Brook, brown, and rainbow trout; blacknose dace	Yes
Coolwater streams	Smallmouth bass	No/1
Warmwater streams	Smallmouth bass	No/1

Table 8. Special Habitats and associated MIS.

Habitat Components	MIS	Analyzed Further/ Evaluation Criteria*
Old Forest Communities (100+ years old)	Black bear	No/1
Early successional (0-10 years old)	Rufous-sided (eastern) towhee	No/1
Early successional (11-20)	Ruffed grouse	No/1
Soft mast producing species	Ruffed grouse	No/1
Hard mast-producing species (>40 yrs)	Black bear	No/1
Large contiguous areas with low levels of human disturbance	Black bear	No/2
Large contiguous areas of mature deciduous forest	Ovenbird	No/1
Permanent grass/forb openings	White-tailed deer	No/1
Downed woody debris	Ruffed Grouse	No/1
Snags	Pileated woodpecker	No/2

*1 Biological community and its represented species do not occur in the project area; therefore, this biological community will not be affected. Given no effects to the community, the alternatives will not cause changes to forest-wide trends or changes in population trends of species associated with this community.

*2 Special Habitat and its represented species will be protected in accordance with LRMP standards and guidelines (open road density will not change, snags and den trees will be retained); therefore, this special habitat will not be affected by any of the alternatives. Given no effects to the habitat, this project will not cause changes to forest-wide trends or changes in population trends of species associated with this habitat.

Table 9. Biological communities and special habitats, and estimated change in each alternative.

Biological Community	**No Action**	*Action Alternative*
Fraser fir forests	None affected.	None affected.
Northern hardwood forests	None affected.	None affected.
Carolina hemlock bluff forests	None affected.	None affected.
Rich cove forests	None affected.	None affected.
Yellow pine successional communities	None affected.	None affected.
Reservoirs	None affected.	None affected.
Riparian forests	None affected.	Minor affect, < 0.05 acres
Cold water streams	Short and long-term effects, ~ 0.5 stream mile.	Short and long-term effects, ~ 0.5 stream miles
Warm water streams	None affected.	None affected.
Special Habitats		
Old forest communities (more than 100 years old)	None affected.	None affected.
Early successional communities (0 to 10 years old)	Absent.	None affected.
Early successional communities (11 to 20 years old)	None affected.	None affected.
Soft mast-producing species	None affected.	None affected.
Hard mast-producing species (more than 40 years old)	None affected.	None affected.
Contiguous areas with low disturbance (less than 1 mile of open road per 4 square miles)	No change.	No change.
Large contiguous forest	None affected.	None affected.
Permanent grass/forb openings	No change.	None affected.
Snags and dens (less than 22" dbh)	Retained.	Retained.
Down woody material	None affected.	None affected.

Species Evaluated and Rationale

The proposed project involves watershed improvement work at three sites on Boyd Creek, three sites on Laurel Branch, at one site on Rich Branch, one site on Bent Creek. All sites are within the Bent Creek watershed and Stony Fork, a tributary to South Hominy Creek. All MIS whose habitat is potentially affected by project activities were evaluated (see Tables 6, 7, and 8), including brook, brown, and rainbow trout; blacknose dace; and Acadian flycatcher. Information about forest-wide MIS habitats and population trends is contained in the Forest MIS report, "Management Indicator Species Habitat and Population Trends," which is available for review by contacting the Pisgah Ranger District, Pisgah National Forest.

Acadian Flycatcher

The preferred habitat for Acadian flycatcher is moist, deciduous forests with a moderate understory, most commonly near streams. Nests are built on the down-hanging branches

of deciduous trees, usually over a stream. The flycatcher forages on flying insects 10 to 40 feet above the ground. The Breeding Bird Survey (BBS) trend data for this region shows a downward trend in the population. However, the majority of BBS survey routes are along private land on roads. The Region 8 bird surveys completed on the Nantahala and Pisgah national forests for the past 5+ years indicate a static population trend for the Acadian flycatcher (Tables 6 and 7).

Alternative 1 – No Action

The No Action Alternative would have no direct or indirect impact on Acadian flycatchers because potential habitat for this species within the forest adjacent to the stream would not change. There would be no cumulative effect with implementation of the activities associated with this project.

Action Alternatives -Alternative 2 (Proposed Action) and Alternative 3

Direct/Indirect Effects

The proposed watershed improvement activity areas are within the Bent Creek and Stony Fork watersheds. All of the Bear Creek streams are dominated by relatively uninterrupted riparian vegetation, Acidic Cove Forest. Direct impacts to any canopy trees would be primarily limited to Laurel Branch and Boyd Branch where a narrow access road to the streams would need to be created. The Acadian flycatcher may occur within the activity areas on or adjacent to the four streams in the Bent Creek watershed. If eggs are present within the nest, there could be a direct effect on potential recruitment. If the species is nesting within some of the trees that may have to be removed to access the streams, there could be an indirect effect in loss of habitat for the species.

Cumulative Effects

Forest riparian regulations would have reduced any impacts to Acadian flycatchers from past and on-going projects within the Bent Creek watershed and at Stony Fork (South Hominy watershed). Disturbance from past storm events during the mid-1990s may have affected riparian canopy trees and indirectly affected this species. Future projects within the watershed should not affect this species on public land. However, in the Stony Fork watershed private land activities may be affecting the species because this riparian area is intermixed with federal and private land. The cumulative negative impact to Acadian flycatchers from the proposed project should be minimal and localized primarily to the activity area. While the project may impact a small amount of habitat for Acadian flycatchers along a small portion of the riparian forests for the streams, the project would not change the overall static population trend for Acadian flycatchers across the Forest.

Brook Trout, Brown Trout, Rainbow Trout, and Blacknose Dace

Changes in the presence and absence of brook trout, brown trout, rainbow trout, and blacknose dace are being used to indicate the effectiveness of management of coldwater streams across the Nantahala and Pisgah national forest. Any of these four species are sensitive to subtle changes within water quality.

Alternative 1 – No Action

With the No Action Alternative, there would be no activities to stabilize the existing stream banks that are currently contributing sediment into the Bent Creek and Stony Fork watersheds. Given the lack of any streambank restoration, the four aquatic species, if they occur downstream of the proposed activity areas, would continue to be directly impacted by periodic sedimentation following rain events. Suitable habitat for these species would not be increased with the No Action Alternative. The chronic long-term effects of sedimentation may lead to localized extirpation of subpopulations. Given the small amount of stream reach that could be negatively impacted without implementation of this watershed restoration project, the lack of action would not change the overall static population trend for these four species across the Forest.

Action Alternatives -Alternative 2 (Proposed Action) and Alternative 3

All four species of fish are known in the analysis area waters and could be affected by project activities within the streams. Management activities most likely to impact coldwater habitat would be ground-disturbing activities such as the re-contouring of the river banks and the removal of the road culvert in Boyd Branch.

This disturbance within the stream or on the stream bank may result in direct, short-term sedimentation influx into the stream. Long-term benefits of stabilizing the existing erosion problems within the activity area of the streams and for the other storm restoration projects within adjoining roads should indirectly enhance suitable habitat for all four species in the Bent Creek and Stony Fork watersheds.

The existing condition of the aquatic resource is the result of all past and on-going activities. Roads were constructed and culverts were installed from past projects and an on-going timber sale within the Bent Creek area (Table 2). The impacts of these former projects are temporary (less than one year) in nature. All four species have been negatively impacted by the increased silt and sedimentation resulting from the hurricane storm events in September and October of 2004. The dredging of Lake Powhatan should not affect any habitat for these species within both watersheds. The long-term beneficial impacts to habitat for all four species versus the short-term direct impacts to any individuals near the activity area should result in a localized increase in populations within the immediate vicinity of the activity area within the streams. All four species have a static population trend on the Forest. The beneficial impact to habitat within this small area of the Forest would not change the overall Forest-wide trend for any of these four species.

Invasive Species

Non-native Invasive Plant Species

Exotic plants are species that have been introduced into an ecosystem outside their natural range as a result of direct or indirect human action. Typically exotic plants come from other countries or continents, although they can be from another state or region within the United States. Once introduced, an exotic plant may remain noninvasive for a number of years until some unknown environmental factor triggers a change. Exotic species are known to be a problem throughout the southern Appalachians (Bowen 1996), the southeast (Miller 1997), and a major ecological problem worldwide. They are considered a major threat to the integrity of native communities (White and Bratton 1980). Over 180 non-native species have been recorded in an ongoing inventory of the Pisgah and Nantahala national forests (Danley & Kauffman 2002). This represents more than 12 percent of the recorded flora. However, only a few of these species have been found to be highly invasive within western North Carolina. A systematic exotic plant survey was conducted across the Nantahala and Pisgah national forests in 2002 and 2003 to identify species that currently have dense invasions and exotic species area hotspots. The following invasive species are known to pose the greatest risk of infestations across the Pisgah and Nantahala national forests (Table 10).

Table 10. Potential invasive species at risk of invading the Pisgah and Nantahala National Forests.

Scientific Name	Common Name
Ailanthus altissima	Tree-of-heaven
Albizia julbrissin	Silk Tree
Celastrus orbiculata	Oriental Bittersweet
Centaurea biebersteinii	Spotted Knapweed
Dioscorea oppositifolia	Chinese Yam
Ligustrum sinense	Privet
Lonicera japonica	Japanese Honeysuckle
Microstegium vimineum	Japanese Stilt Grass
Miscanthus sinensis	Chinese Silver Grass
Paulownia tomentosa	Princess Tree
Polygonum cuspidatum	Japanese Knotweed
Pueraria Montana	Kudzu
Rosa multiflora	Multiflora Rose
Spiraea japonica	Japanese Meadowsweet

The degree of infestation by any of these species varies by the associated plant community and prior land use history. Many species are more prevalent during the initial stages of succession and decrease with age. A temporary increase in the abundance and diversity of ruderal[8] plant species is expected within recently disturbed areas. Within the Bent Creek watershed restoration sites, many species have been documented. *Microstegium vimineum* dominates with *Celastrus orbiculata* also quite common. Other

[8] *Ruderal* refers to a plant that grows on rubbish, poor land, or waste.

non-native plant species observed within the surrounding area, particularly the old field, include *Lonicera japonica, Rosa multiflora, Ligustrum sinense,* and *Albizia julbrissin.* Of these six species, all except *Rosa multiflora* and *Albizia julbrissin* were located under the closed canopy. *Paulownia tomentosa*, *Miscanthus sinensis*, *Dioscorea oppositifolia*, and *Ailanthus altissima* were also recorded along roads within other portions of the Bent Creek watershed. This watershed is known to have a diversity of invasive plant species.

No invasive plant species were located at the Stony Fork site on public land. *Microstegium vimineum* was observed on a point bar on private land adjacent to the USFS tract. There is no information on the presence of other invasive exotic plant species on other private lands surrounding the Stony Fork site.

Alternative 1 – No Action

Direct/Indirect Effects

Under the No Action Alternative, streambank erosion would not be addressed within the four Bent Creek watershed streams or the site on Stony Fork. The proposed activity areas would continue to erode and be susceptible to invasion by non-native plant species. *Microstegium vimineum, Lonicera japonica, Celastrus orbiculata,* and *Ligustrum sinense* currently exist on portions of the stream banks. The selection of the No Action Alternative may slightly increase the likelihood of spread of the four species present along the stream banks. Within the Stony Fork site the existing scoured banks on the left side of the stream are currently too steep, almost vertical, to support any vegetation. Future storms would result in continued erosion on these stream banks. Continued erosion may result in a less vertical bank and provide suitable habitat for plant invasion. *Microstegium vimineum* would probably invade the stream bank at that time.

Cumulative Effects

The cumulative effects analysis area is the same as described for the rare species analysis in the biological evaluation. Past, present, and reasonably foreseeable management actions are also the same. Past actions have increased the spread of the six invasive plant species located in the Bent Creek watershed. In particular, the previous storm events increased local abundance of *Celastrus orbiculata* within blow-down areas. Control of this vine has been implemented for the on-going Bent Creek timber sale project. A housing development project is currently under construction west of the Stony Fork site. No invasive plant control projects are known within the Stony Fork area.

The proposed vegetation management project in the Bent Creek watershed includes maintenance of the existing system roads, reconstruction of roads and skid trails, and timber harvest (Table 2). All of these activities have the potential to increase the spread of the four dominant invasive species as well as the other three invasive plant species identified within the area, *Paulownia tomentosa*, *Miscanthus sinensis*, and *Ailanthus altissima*. The targeted control of *Celastrus orbiculata* is expected to decrease the rapid spread of this species but not completely eliminate it from the targeted areas.
High winds associated with previous hurricanes resulted in variable-sized canopy gaps that increased all four species within the Bent Creek watershed. The four shade-tolerant invasive species (*Microstegium vimineum, Lonicera japonica, Celastrus orbiculata,* and

Ligustrum sinense), if present adjacent to or within a gap, responded favorably to the previous disturbance. All four species are well established in the mesic portions of Bent Creek watershed. For these four species, systematic control by any currently known method is considered impractical. Other disturbance projects within the Bent Creek watershed and USFS lands south of the Stony Fork activity area have only resulted in small disturbances and may have resulted in the localized abundance of the four shade tolerant species as well as *Rosa multiflora, Albizia julbrissin, Paulownia tomentosa*, *Miscanthus sinensis*, *Dioscorea oppositifolia*, and *Ailanthus altissima.* Recent construction and anticipated small home construction near the Stony Fork activity area may also have resulted in localized outbreaks of these 10 species.

The selection of the No Action Alternative slightly increases the likelihood of the spread of *Microstegium vimineum, Lonicera japonica, Celastrus orbiculata,* and *Ligustrum sinense* within the activity areas, which might add to possible other outbreaks on other adjacent USFS and private lands in the two watersheds. The extent of these species on private lands on the eastern edge of the analysis area is unknown.

Alternative 2 - Proposed Action and Alternative 3

Direct/Indirect Effects

The Proposed Action alternative reduces the risk of invasion from exotic plant species on the eroding riverbanks by re-vegetating the banks with native shrubs and trees. This would not eliminate the risk of spread of invasive non-native species while the grasses, trees, and shrubs are becoming established. The potential area of spread is less than if the No Action Alternative were selected for the four Bent Creek watershed sites. At the Stony Fork site, there currently is no suitable habitat for invasion by plant species, native or non-native. However, by laying back the eroded riverbank to a 1:1 grade there would be a large expanse of suitable habitat for aggressive exotic species to invade. While the native plantings proposed for this site would reduce the likelihood of invasive exotic spread, the risk of invasion, particularly by the nearby *Microstegium vimineum* population, would be greater than the No Action Alternative. For both watersheds the risk of invasion would be greater in the short-term (less than one year) while the native plantings are getting established. After the woody species completely shade the re-vegetated slope (in 5 to 10 years), there would be less likelihood of invasion of invasive plant species as well as persistence of any previously established species.

Cumulative Effects

The cumulative effects analysis area and the past, present, and reasonably foreseeable management actions are the same for this alternative as the No Action Alternative. Within the Bent Creek watershed *Microstegium vimineum, Lonicera japonica, Celastrus orbiculata,* and *Ligustrum sinense* are known to be prevalent across USFS land. The selection of this action alternative does not completely eliminate the risk of invasion from these four invasive exotic species. The risk is less in comparison to the No Action Alternative and therefore would not contribute dramatically in the density of all four for the long-term on the public lands in the Bent Creek watershed.

The selection of the action alternatives increases the likelihood of the spread of *Microstegium vimineum* within the Stony Fork activity area, which might add to possible other outbreaks on other adjacent USFS and private lands in the this watershed.

3.4 Heritage Resources

Existing Condition

The Bent Creek Area of the Pisgah Ranger District has a high probability for heritage sites. The area has a long history of use by prehistoric and historic peoples. There are approximately 30 known sites in the Bent Creek Experimental Forest project area, with many of them in close proximity to waterways. These sites consist of eligible, not eligible, and unevaluated sites. For this particular set of projects, there are two identified unevaluated historic properties within the proposed planning areas for the Boyd Branch and Stony Fork projects. The two historic properties are located within or near identified planning units and have the potential to be affected.

Past management practices have not always evaluated these properties for eligibility to the National Register of Historic Places (NRHP). Historic properties that are unevaluated are managed as if eligible, and mitigations for these properties would follow management prescriptions as specified in the next section. Currently, the Heritage Program management attempts to relocate sites, monitor the sites for damage and deterioration, evaluate the sites for NRHP eligibility, and preserve and protect the sites.

Alternative 1 – No Action

Direct/Indirect Effects

The project would not be implemented under the No Action Alternative. There would be no direct immediate adverse effect to heritage resources in the project area. However, heritage sites located adjacent to the project area may continue to be affected by increased erosion and sedimentation over time if the No Action Alternative is selected. Specifically, the historic site at the Stony Fork project area, which is currently sloughing into the creek, would continue to be negatively impacted under this alternative.

Cumulative Effects

Under the No Action Alternative, historic properties within the planning area would experience moderate cumulative effects from known concurrent, planned, and/or completed projects. Effects may include, but are not limited to, damage caused by timber sale activities and negative impacts from escalating recreation and private land development. Proper buffering and maintenance of confidentiality of historic properties would effectively reduce these possible impacts. The Forest archaeologist or qualified heritage program representative would provide guidance on appropriate mitigations to protect the sites.

Action Alternatives –Alternative 2 (Proposed Action) and Alternative 3

Direct/Indirect Effects

Under the National Historic Preservation Act (NHPA), a significant, or adverse effect is one which may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or associations (36 CFR 800.9[b]). The project area was surveyed for cultural resources. Heritage resource sites were found within or adjacent to Boyd Branch (UID #3304) and Stony Fork (UID #1828). These heritage sites would be avoided and no adverse effects are expected under either action alternative.

Cumulative Effects

There are 15 identified concurrent, planned, or completed projects within the project area (Table 2). These 15 projects individually have varying effects on heritage resources, ranging from adverse effects to no effect. However, when the projects are considered as a whole, they have a moderate cumulative effect on heritage resources.

Under all action alternatives, historic properties within the planning area would experience moderate cumulative effects from this project. Effects may include, but are not limited to, damage caused by timber sale activities and negative impacts from escalating recreation and private land development. Proper buffering and maintenance of confidentiality of historic properties would effectively reduce these possible impacts. The Forest archaeologist or qualified heritage program representative would provide guidance on appropriate mitigations to protect the sites.

3.5 Other Resources

Restoring channels in the project area may impact park lands; prime farmlands; wetlands; wild and scenic rivers; ecologically critical areas; local laws; socio-economics; local geology; public health and safety; recreation; and visual and air quality.

Indicator: Presence of park lands, prime farmlands, wetlands, wild and scenic rivers, ecologically critical areas, or local law or requirements imposed for the protection of the environment.

Alternative 1 – No Action

Since no action is proposed under this alternative, there would be no direct, indirect, or cumulative effects to park lands; prime farmlands; wetlands; wild and scenic rivers; ecologically critical areas; socio-economics; local geology; public health and safety; recreation; and visual and air quality.

Action Alternatives – Alternative 2 (Proposed Action) and Alternative 3

There would be no measurable direct, indirect, or cumulative effects from any of these alternatives because none of the action alternatives occur within park lands, prime farmlands, wetlands (as per 1977 Executive Orders 11988 and 11990), wild and scenic rivers, or ecologically critical areas. The action alternatives also would not violate local law or requirements imposed for the protection of the environment. There is a subdivision being developed within a mile of Stony Fork. The potential for cumulative effects of the proposal in relation to this development is expected to be minimal and immeasurable. There are no other known or foreseeable actions in the project area.

Additionally there is no potential or an immeasurable effect of the Proposed Action on socio-economics, local geology, public health and safety, recreation, visual and air quality due to the following:

- The project would be undertaken within Forest boundaries generally away from populated areas.
- Activities would be limited to disturbance of the top layer of soil along stream banks.
- Recreational access to the project areas would be restricted during active work periods. However, the duration of the project would be short (approximately one month total for all projects) and would improve conditions of the stream banks and channels.
- Vehicle traffic and operation of heavy machinery at all project sites would contribute only small amounts of particulate matter and gaseous exhaust emissions containing regulated air pollutants in the near vicinity of project activities. Emissions would be very localized, sporadic, and short-term in duration.

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The Forest Service consulted the following individuals and agency personnel during the development of this environmental assessment.

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U.S. Fish and Wildlife Service
Tennessee Valley Authority
USDA Forest Service, Southern Research Station, Bent Creek Experimental Forest

STATE AGENCIES

North Carolina State Historic Preservation Office
North Carolina Wildlife Resources Commission
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