Tennessee Reference Stream Morphology and Large Woody Debris Assessment

Report and Guidebook

Prepared for:

Tennessee Department of Environment and Conservation

Prepared by:

Jennings Environmental, LLC

December 2017

EXECUTIVE SUMMARY

This report includes reference stream morphology and large woody debris data collected throughout Tennessee in 2015-2017. Hydraulic geometry data are presented as regional curves for Ecoregions 66, 67, 68/69, 71, and 65/74 to support stream assessment and restoration planning. Morphology relationships describe bankfull channel dimensions, pattern, and profile measurements in relation to channel-forming discharge and watershed drainage area. Large woody debris (LWD) data collected at reference streams serve as an indicator of natural stream conditions in forested floodplains. These databases and relationships are valuable for assessing disturbed streams to evaluate degree of departure from equilibrium, selecting and planning restoration projects to improve natural stream functions, and monitoring changes in stream conditions in undisturbed and restored stream systems. These databases should be supplemented with additional information collected during site assessment and restoration planning to improve understanding of local stream conditions throughout Tennessee.

The morphology data collection included 114 undisturbed streams ranging in width from 3 to 132 feet with watershed drainage areas ranging from 0.02 to 117 square miles. Wherever available, United States Geological Survey (USGS) gage station sites were surveyed to provide long-term hydrologic information close to the reference stream. Bankfull stage indicators at a USGS gage provided the opportunity to quantify the channel-forming discharge and exceedance probability of this flow event. For reference streams with no gages, natural equilibrium stream segments with clearly identifiable incipient-floodplain bankfull stage indicators were surveyed to determine morphology parameters. These ungaged reference streams were mostly located in forested, protected lands such as parks, State Forests, and Wildlife Management Areas. Some reference stream locations coincided with biological monitoring sites used by the Tennessee Department of Environment and Conservation (TDEC).

For all 114 Tennessee streams surveyed statewide, the regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 21.0\ DA^{0.695}$ $\quad R^2 = 0.951$
$W_{bkf} = 17.2\ DA^{0.379}$ $\quad R^2 = 0.908$
$d_{bkf} = 1.22\ DA^{0.317}$ $\quad R^2 = 0.895$
$Q_{bkf} = 68.2\ DA^{0.781}$ $\quad R^2 = 0.883$

Results of this study should be considered an initial database of reference stream morphology. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters. Long-term monitoring data for restoration projects should be evaluated to understand natural channel evolution toward geomorphic equilibrium.

Ecoregion 66 (Blue Ridge)

Stream morphology data were collected at 21 reference and gaged streams in the Blue Ridge Ecoregion of Tennessee (EPA Level III Ecoregion 66), with drainage areas ranging from 0.28 to 106 square miles. One of these streams was at a USGS gage station. The study included 13 B, 5 C, and 3 E Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. The entrenchment ratios ranged from 1.3 to 4.8. Width/depth ratios ranged from just under 10 for one of the E streams to greater than 20 for many of the wide and shallow B streams. Reach channel slopes ranged from 0.0025 ft/ft for one of the larger rivers to 0.0604 ft/ft for the steepest stream channel. The median streambed particle size (D_{50}) was classified as gravel at 9 sites and cobble at 12 sites.

Based on field measurements from the 21 reference and gaged streams, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 18.2\ DA^{0.725}$ $R^2 = 0.981$
$W_{bkf} = 16.2\ DA^{0.442}$ $R^2 = 0.972$
$d_{bkf} = 1.10\ DA^{0.289}$ $R^2 = 0.941$
$Q_{bkf} = 91.7\ DA^{0.774}$ $R^2 = 0.924$

Longitudinal profiles from ten selected step-pool reference streams with drainage areas ranging from 0.18 to 8.96 square miles were used to evaluate step heights, riffle and pool lengths, pool spacings, and riffle slopes. Each of these ten streams contained both step and riffle features, along with pools. The ratios of riffle lengths to bankfull widths ranged from 0.4 to 1.9, with a median of 0.8. Pool length ratios ranged from 0.4 to 1.4, with a median of 0.8. Pool spacing ratios ranged from 0.8 to 2.8, with a median of 1.8. The ratios of riffle slopes to channel slopes ranged from 0.7 to 1.8, with a median of 1.0. The ratios of step heights to bankfull width ranged from 0.01 to 0.09, with a median of 0.05.

Ecoregion 67 (Ridge and Valley)

Stream morphology data were collected at 18 reference and gaged streams in the Ridge and Valley Ecoregion of Tennessee (EPA Level III Ecoregion 67), with drainage areas ranging from 0.04 to 117 square miles. Five of these streams were at USGS gage stations. The study included 3 B, 12 C, and 3 E Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. The entrenchment ratios ranged from 1.4 for the narrow-valley B streams to greater than 5 for some of the alluvial C and E streams. Width/depth ratios ranged from just under 10 for some E streams to 40 for a wide and shallow B channel. Reach channel slopes ranged from 0.0010 ft/ft for the largest river to 0.0331 ft/ft for the steepest stream channel. The median streambed particle size (D_{50}) was classified as sand at 1 site, gravel at 15 sites, cobble at 1 site, and bedrock at 1 site.

Based on field measurements from the 18 reference and gaged streams, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel

bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 18.8\ DA^{0.684}$ $R^2 = 0.935$
$W_{bkf} = 16.2\ DA^{0.370}$ $R^2 = 0.897$
$d_{bkf} = 1.16\ DA^{0.315}$ $R^2 = 0.886$
$Q_{bkf} = 58.7\ DA^{0.728}$ $R^2 = 0.883$

Based on field measurements from selected reference streams with drainage areas ranging from 0.33 to 2.6 square miles, the riffle and pool lengths and pool spacing distances were generally not found to correlate with watershed drainage area. Additionally, riffle slopes were generally independent of drainage area. The ratio of riffle lengths to bankfull width ranged from 1.1 to 2.7, with a median of 1.2. Pool length ratios ranged from 1.4 to 2.7, with a median of 1.8. Pool spacing ratios ranged from 1.5 to 4.1, with a median of 3.5. The ratios of riffle slopes to channel slopes ranged from 1.4 to 2.7, with a median of 2.5.

Ecoregions 68/69 (Southwestern Appalachians and Central Appalachians)

Stream morphology data were collected at 22 reference and gaged streams in the Southwestern Appalachians and Central Appalachians Ecoregions of Tennessee (EPA Level III Ecoregions 68 and 69, respectively), with drainage areas ranging from 0.02 to 92 square miles. Three of these streams were at USGS gage stations. The study included 1 A, 4 B, 6 C, 10 E, and 1 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. The entrenchment ratios ranged from 1.3 for the narrow-valley A, B, and F streams to greater than 5 for some of the alluvial C and E streams. Width/depth ratios ranged from less than 10 for the E streams to greater than 20 for some of the wide and shallow B and C streams. Reach channel slopes ranged from 0.0006 ft/ft for the largest river to 0.1420 ft/ft for the smallest, steepest stream channel. The median streambed particle size (D_{50}) was classified as sand at 6 sites, gravel at 9 sites, cobble at 6 sites, and boulder at 1 site.

Based on field measurements from the 22 reference and gaged streams, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 20.7\ DA^{0.761}$ $R^2 = 0.975$
$W_{bkf} = 15.9\ DA^{0.411}$ $R^2 = 0.961$
$d_{bkf} = 1.30\ DA^{0.348}$ $R^2 = 0.873$
$Q_{bkf} = 57.6\ DA^{0.869}$ $R^2 = 0.918$

Based on field measurements from selected reference streams with drainage areas ranging from 0.05 to 3.1 square miles, the riffle and pool lengths and pool spacing distances were found to be correlated to watershed drainage area. Riffle slopes were generally independent of drainage area. The ratio of riffle lengths to bankfull width ranged from 0.6 to 2.0, with a median of 1.1. Pool length ratios ranged from 1.6 to 2.5, with a median of 2.0. Pool spacing ratios ranged from 2.5 to 4.1, with a median of 2.6. The ratios of riffle slopes to channel slopes ranged from 0.9 to 5.3, with a median of 2.4.

Ecoregion 71 (Interior Plateau)

Stream morphology data were collected at 36 reference and gaged streams in Interior Plateau Ecoregion of Tennessee (EPA Level III Ecoregion 71), with drainage areas ranging from 0.02 to 107 square miles. Twelve of these streams were at USGS gage stations. The study included 6 B, 21 C, 7 E, and 2 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. The entrenchment ratios ranged from just over 1 for the narrow-valley B and F streams to greater than 6 for some of the alluvial C and E streams. Width/depth ratios ranged from less than 10 for the E streams to greater than 20 for the wide and shallow C streams. Reach channel slopes ranged from 0.0014 ft/ft for the larger rivers to 0.0814 ft/ft for the steepest stream channel. The median streambed particle size (D_{50}) was classified as gravel at 23 sites, cobble at 6 sites, and bedrock at 7 sites.

Based on field measurements from the 36 reference and gaged streams, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 24.6\ DA^{0.658}$ $\quad R^2 = 0.976$
$W_{bkf} = 19.8\ DA^{0.349}$ $\quad R^2 = 0.934$
$d_{bkf} = 1.25\ DA^{0.307}$ $\quad R^2 = 0.931$
$Q_{bkf} = 91.2\ DA^{0.687}$ $\quad R^2 = 0.925$

Based on field measurements from selected reference streams with drainage areas ranging from 0.03 to 2.3 square miles, the riffle and pool lengths, pool spacing distances, and slopes of the riffles and channels were found to be correlated to watershed drainage area. The ratio of riffle lengths to bankfull width ranged from 0.7 to 3.5, with a median of 1.4. Pool length ratios ranged from 0.8 to 6.2, with a median of 1.7. Pool spacing ratios ranged from 1.8 to 9.0, with a median of 3.6. The ratios of riffle slopes to channel slopes ranged from 0.8 to 3.9, with a median of 2.1.

Ecoregions 65/74 (Southeastern Plains and Mississippi Valley Loess Plains)

Stream morphology data were collected at 17 reference and gaged streams in the Southeastern Plains and Mississippi Valley Loess Plains Ecoregions of Tennessee (EPA Level III Ecoregions 65 and 74, respectively), with drainage areas ranging from 0.09 to 68 square miles. Three of these streams were at USGS gage stations. The study included 4 B, 3 C, 9 E, and 1 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. The entrenchment ratios ranged from 1.3 for the narrow-valley F stream to greater than 10 for many of the alluvial C and E streams. Width/depth ratios ranged from less than 10 for many of the E streams to greater than 14 for some of the wide and shallow C and E streams. Reach channel slopes ranged from 0.0011 ft/ft for two of the larger rivers to 0.0126 ft/ft for one of the smallest stream channels. The median streambed particle size (D_{50}) was classified as sand at 15 sites and gravel at 2 sites.

Based on field measurements from 17 reference and gaged streams with drainage areas ranging from 0.09 to 68 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in

square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 21.5\ DA^{0.696}$ $R^2 = 0.921$
$W_{bkf} = 16.1\ DA^{0.342}$ $R^2 = 0.844$
$d_{bkf} = 1.34\ DA^{0.354}$ $R^2 = 0.945$
$Q_{bkf} = 46.2\ DA^{0.818}$ $R^2 = 0.875$

Field measurements of longitudinal profiles from selected small reference streams with drainage areas ranging from 0.09 to 0.16 square miles were used to evaluate riffle and pool lengths, pool spacings, and riffle slopes. The ratios of riffle lengths to bankfull widths ranged from 1.2 to 2.3, with a median of 1.3. Pool length ratios ranged from 2.0 to 3.2, with a median of 2.7. Pool spacing ratios ranged from 3.3 to 5.1, with a median of 4.5. The ratios of riffle slopes to channel slopes ranged from 2.1 to 3.5, with a median of 3.4. The narrow range of drainage areas represented in this study precludes strong conclusions from the regression equations for this data set.

Large Woody Debris (LWD)

Large Woody Debris (LWD) data were collected and analyzed at 92 of the reference streams surveyed for morphology throughout Tennessee. LWD is defined as dead wood over 1 meter in length and at least 10 cm in diameter. The LWD Index (LWDI) score was calculated for each stream to represent the relative function of the LWD pieces or debris dams in retaining organic matter, providing fish habitat, and affecting channel/substratum stability depending on LWD size, location, orientation, and stability.

The median LWDI score for the 92 reference streams was approximately 200, with higher scores typically found in the Blue Ridge and Plains Ecoregions due to increased numbers of fallen trees and broken limbs. Stream systems with recent disturbance due to wind storms, ice, or floods seemed to have more LWD pieces and debris dams. LWDI scores were highly variable by stream site and were not correlated to watershed drainage area or reach slope.

The LWDI results for these 92 forested reference streams may be used to compare with disturbed or restored stream systems to evaluate the relative prevalence of LWD in supporting natural stream functions. It should be noted that some disturbed streams are expected to have high LWDI scores due to unstable streambanks and resulting fallen trees or due to recent storms. In a stream restoration project, LWDI may be enhanced by the strategic addition of logs and woody debris to the restoration channel in the form of vanes, revetments, riffle wood, or other habitat structures.

Results of this study should be considered an initial database of reference stream large woody debris information. The database developed in this study should be supplemented with additional data collected on reference, disturbed, and restored streams using the same quantification method to support future analyses of LWD in Tennessee streams.

TABLE OF CONTENTS

APPENDICES

I. INTRODUCTION

Reference stream morphology relationships are valuable tools for assessing stream condition and estimating design ranges for channel morphology in restoration projects. Bankfull regional curves that relate bankfull discharge and channel cross-sectional area, width, and mean depth to drainage area are practical tools for identifying target channel bankfull dimensions (Cinotto, 2003; Keaton *et al.*, 2005; Brockman *et al.*, 2012). Bankfull regional curves are valuable when assessing incised systems where incipient-flooding bankfull indicators are difficult to identify in the field. Other valuable reference stream morphology relationships for assessment and restoration planning describe channel profile and pattern parameters including riffle, pool, step, and meander features (Zink *et al.*, 2012; Helms *et al.*, 2016).

Leopold and Maddock (1953) developed the concept of hydraulic geometry relationships to describe how channel dimensions depend on discharge. They described channel width, depth, and velocity as power functions of average annual discharge for 20 large rivers in the Great Plains and Southwestern United States (Dingman, 2007). Leopold *et al.* (1964) described the application of bankfull hydraulic geometry relationships based on bankfull discharge, the highest flow a channel conveys before accessing its floodplain. Dunne and Leopold (1978) introduced the application of drainage area as a surrogate for discharge where flow data are not available. They developed these relationships on a regional level where geology, soil, climate, and hydrology factors are relatively uniform.

Bieger *et al.* (2015) compiled bankfull regional curve data from over 50 publications to compare relationships for physiographic regions at different spatial levels and to assess the performance of drainage area as a surrogate for bankfull discharge. They determined that data derived from smaller regions produce more reliable regression equations and that bankfull discharge is a better predictor of channel dimensions than drainage area. The regional curves for physiographic divisions of the United States presented by Bieger *et al.* (2015) are valuable for comparing local curves for smaller regions.

Tennessee contains the following eight EPA Level III Ecoregions, shown in Figure 1-1:

66: Blue Ridge
67: Ridge and Valley
68: Southwestern Appalachians
69: Central Appalachians
71: Interior Plateau
65: Southeastern Plains
74: Mississippi Valley Loess Plains
73: Mississippi Alluvial Plain

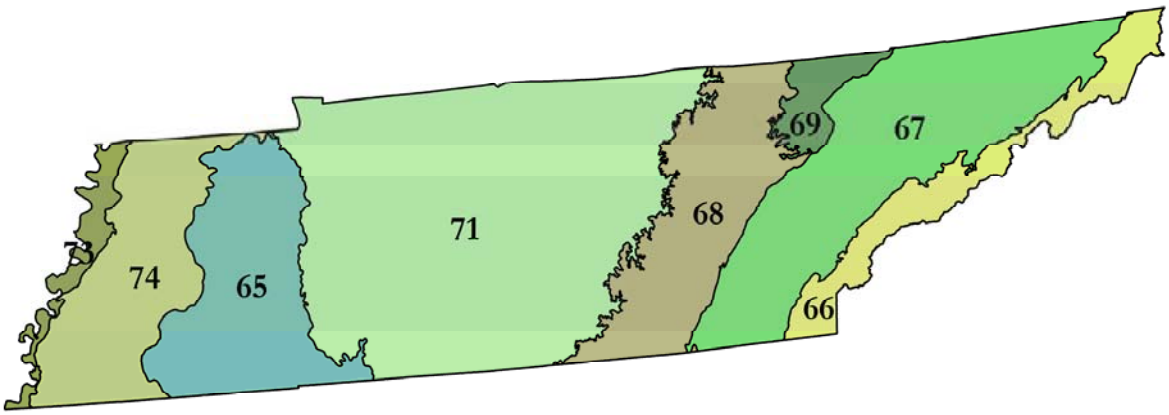


Figure 1-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

For Ecoregions 66, 67, 68/69, 71, and 65/74, the project team developed design and assessment tools based on reference stream conditions to improve restoration effectiveness. This includes reference stream hydraulic geometry relationships (i.e. regional curves) for predicting stable stream morphology (dimension, pattern, and profile) related to channel-forming discharge and drainage area. These tools may be used in site assessment, project selection, restoration design and implementation, determining ecological goals, and follow-up monitoring for evaluating the success of ecosystem restoration projects in Tennessee.

The team identified 114 stable streams across the state ranging in size from 3 to 132 feet wide with drainage areas ranging in size from 0.02 to 117 square miles (Figures 1-2 and 1-3).

Figure 1-2. Example of a small stream included in the study (0.03 square miles), Ecoregion 71.

Figure 1-3. Example of a large stream included in the study (91.8 square miles), Ecoregion 68.

When possible, watersheds with USGS gage stations were surveyed to provide long-term hydrologic information. Finding bankfull stage at or near a USGS gage provided the opportunity to quantify the specific channel-forming discharge for respective bankfull conditions. Where no gages were found, the team identified stable stream segments with clearly identifiable bankfull stage indicators. These ungaged streams were often located on public land (e.g., State Parks, Wildlife Management Areas). Some stream locations coincided with biological monitoring sites used by TDEC.

The objectives of this study were to: (1) develop bankfull regional curves for Ecoregions 66, 67, 68/69, 71, and 65/74 in Tennessee, (2) describe other reference stream morphology relationships for these ecoregions to be used in stream assessment and natural channel design parameter estimation, and (3) collect and analyze large woody debris (LWD) data from reference streams across the ecoregions.

For sites studied in this project, the following morphology data were collected and analyzed, when available:

- drainage area
- bankfull discharge
- bankfull channel cross-section area
- bankfull channel width
- bankfull channel mean depth
- width-to-depth ratio
- entrenchment ratio
- bank height ratio
- valley slope
- channel thalweg slope
- riffle slopes

- pool spacings
- riffle lengths
- pool lengths
- meander lengths
- belt widths
- radius of curvature of meander bends
- sinuosity

Predictive models were developed relating these parameters to each other so that practitioners can understand the typical ranges of morphological data expected in stable stream systems.

II. MORPHOLOGY FIELD DATA COLLECTION

Site Selection

Reference streams and gaged streams were identified using mapping and field evaluations based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had freely-formed meander patterns and discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

At each site, the stream reach upstream and downstream of the morphological study location was inspected to ensure that the reach generally met the stated guidelines and to assist with identifying consistent bankfull indicators.

Bankfull Identification

There is general agreement that channel size is related to the channel-forming discharge, defined as the discharge that, if maintained indefinitely, would produce the same channel form as the actually long-term hydrograph (Biedenharn and Copeland, 2000). Bankfull measurements, when they can be determined, provide a common method of comparing design parameters and expressing hydraulic geometry. Toward that end, researchers typically identify the bankfull elevation throughout a stream, which may or may not be the same elevation as the top of the streambank. This results in the use of uniform terminology to allow for temporal and spatial comparisons among streams. Practically, a monitoring professional needs to be able to identify the bankfull elevation while in the stream channel. This bankfull elevation is frequently identical to that of the adjoining floodplain (Wolman and Leopold, 1957) (Figure 2-1). When an obvious floodplain break does not exist, the bankfull elevation can be identified using other topographic changes in the bank and changes in sediment size (Dunne and Leopold, 1978). In cases where these bankfull indicators did not exist at cross-sections, one can use indicators from elsewhere in the stream reach to identify the approximate bankfull elevation at a cross-section (Leopold, 1994). The presence of bankfull indicators can be dependent on stream type, climate, vegetation, and physiographic region, and may not be universally applicable. Identifying a specific bankfull elevation that represents a stream requires considerable experience.

Figure 2-1. Example of bankfull elevation identical to adjoining floodplain, Ecoregion 71.

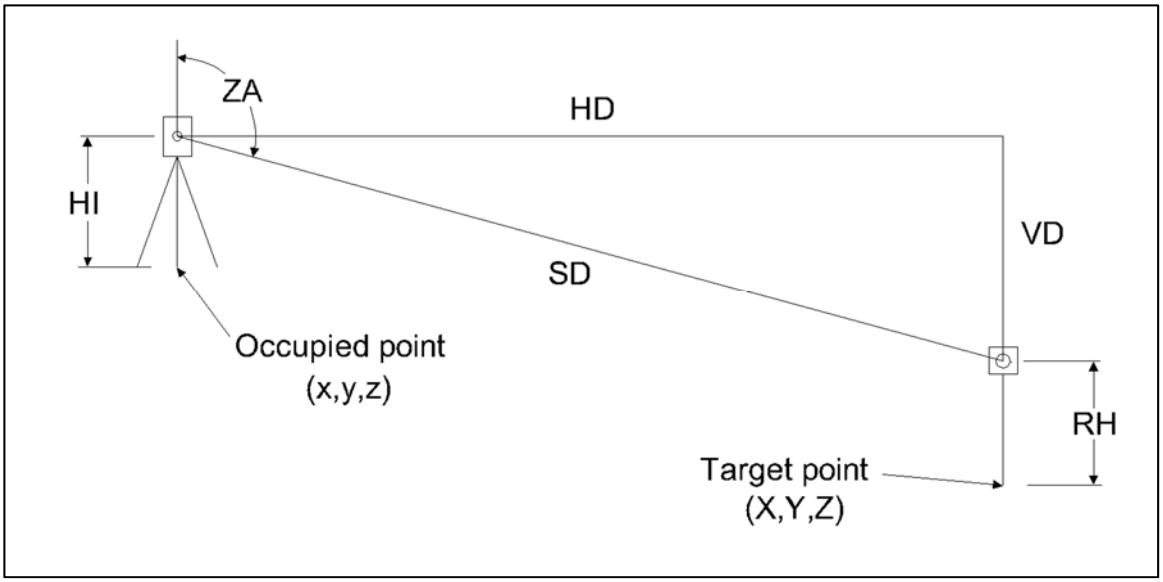
Survey Overview and Procedures

Historically, geomorphic data was collected in streams using a measuring tape and level (Harrelson *et al.*, 1994). This method could be used to produce two-dimensional data (i.e., cross-sections and longitudinal profiles), but not three-dimensional data (i.e., plan views). Data collected with a tape and level could be subject to inaccuracies from tape sag, manual recording error, and limitations with line of sight. Additionally, challenges could exist with the replication of measurements in future years. More recently, three-dimensional surveying technology has been applied to stream monitoring. These methods allow for the collection of three-dimensional data (i.e., x, y, and z coordinates for any point of interest) while avoiding the aforementioned limitations. These data can then be processed with software, such as AutoCAD, to represent the stream as a plan view, longitudinal profile, and cross-sections.

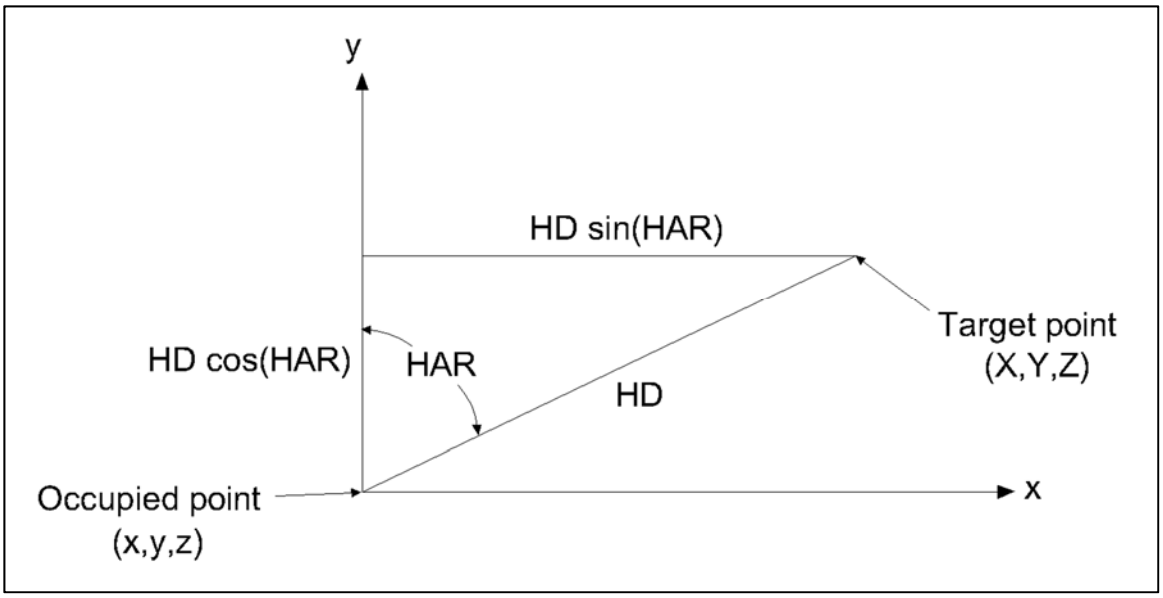
Several technologies can be used to conduct three-dimensional surveys: ground-based LIDAR, GPS, and total station. The methods do have different advantages and disadvantages, with regards to cost, time in the field, data processing time, reliability, and the ability to survey any point of interest (Resop and Hession, 2010). For example, GPS technology relies on communication with satellites, which can be limited in areas of dense tree cover. Also, LIDAR has limitations with line of sight, as it cannot capture features obscured by rocks or vegetation (Heritage and Hetherington, 2007). Until recently, LIDAR was also limited by the inability to collect data below the water surface. However, advances in technology now allow for the use of LIDAR to survey streambed features (McKean *et al.*, 2009). Due to the combination of cost, availability, and ease of use, the total station is currently the predominant method used for geomorphic stream monitoring (Figure 2-2).

Figure 2-2. Using a total station to survey a stream.

A total station combines a theodolite with an electronic distance meter (EDM). The theodolite is a mechanical instrument used to measure the horizontal angle of rotation (HAR) and zenith (i.e., vertical) angle (ZA). The EDM transmits a laser beam to a prism, then receives the reflection of the laser. Based on the time required for this reflection, the EDM calculates a slope (i.e., straight-line) distance (SD) between the total station and prism. An electronic data collector records the HAR, ZA, and SD, which can be combined with the height of instrument over the occupied point (HI) and rod height over the target point (RH), to calculate coordinates for any point of interest (Figure 2-3).



(a)



(b)

Figure 2-3. Total station geometry in a) profile view, and b) plan view.

The horizontal (HD) and vertical (VD) components of the SD are:

$$HD = SD \sin(ZA)$$
$$VD = SD \cos(ZA)$$

Assuming the occupied point has coordinates (x, y, z), and the target point has coordinates (X, Y, Z), then:

$$X = x + HD \sin(HAR)$$
$$Y = y + HD \cos(HAR)$$
$$Z = z + HI + VD - RH$$

Surveys should be done during low-flow conditions. The use of a standard set of abbreviations can increase efficiency while surveying (Table 2-1).

Table 2-1. Common abbreviations used in stream surveying.

T	Thalweg
R	Thalweg at head of riffle
U	Thalweg at head of run
M	Thalweg at maximum pool
P	Thalweg at head of pool
G	Thalweg at head of glide
S	Thalweg at top of step
W	Water surface
B	Bankfull indicator
TOB	Top of bank
TTRIB	Thalweg of tributary
TCONF	Common thalweg at confluence

X1	Cross-section 1 point
X1W	Water surface at cross-section 1
BM	Benchmark
TBM	Temporary benchmark
CULV36	Invert of 36" diameter culvert

At sites in this study, a total station was used to survey points as required to represent the cross-sections, longitudinal profile, and plan view of the channel. Additionally, points were collected to document other features of interest (e.g., stormwater conveyances, crossings, and bridges). During the survey of each cross-section, points were recorded at breaks in slope between the left and right endpoints. The water surface elevation at the cross-section was also noted. The use of a measuring tape or rope pulled taut between cross-section pins can help the data collector remain in a straight line between the left and right endpoints.

III. MORPHOLOGY DATA ANALYSIS

Cross-sections

Cross-section dimensions (e.g., area, width, and mean depth) are frequently reported in geomorphic assessment and monitoring studies. With the bankfull elevation as a reference, area (A), width (W), and maximum depth (d_{max}) can be directly measured for a cross-section (Figure 3-1). Mean depth (d) can then be calculated as A/W. Additionally, the width of the flood-prone area (W_{fpa}) can be measured as the width of the floodplain at an elevation of two times maximum depth above the thalweg. Measurement of W_{fpa} requires surveying points beyond the endpoints of the bankfull cross-section.

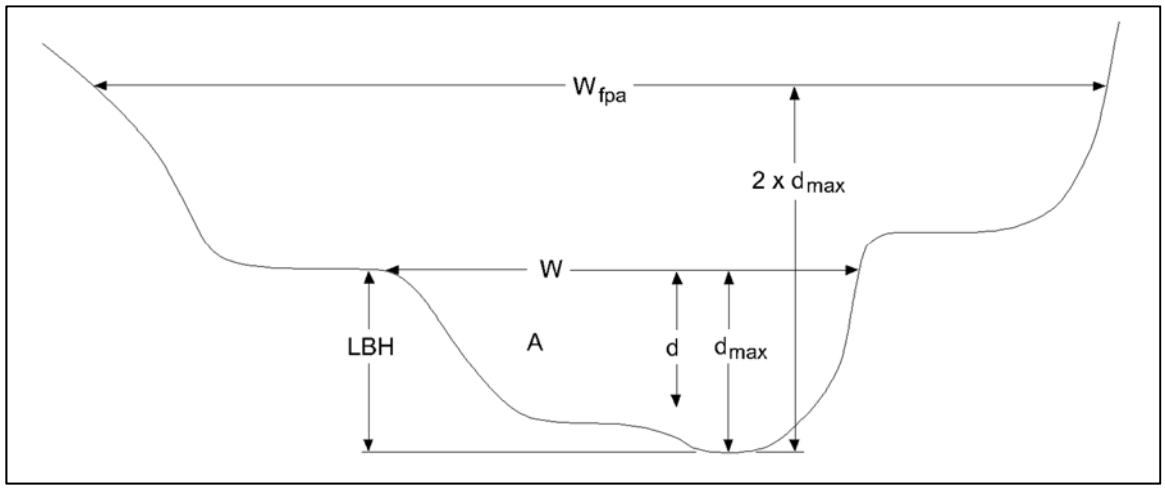


Figure 3-1. Typical cross-section measurements.

Four dimensionless ratios are typically calculated for riffle cross-sections:

Maximum depth (d_{max}) *ratio* = d_{max}/d

Width/depth (W/d) *ratio* = W/d; The W/d ratio serves as a relative index of channel shape

Entrenchment ratio (ER) = W_{fpa}/W; Along with W/d ratio, the ER has implications for stream classification (Rosgen, 1994)

Bank height ratio (BHR) = LBH/d_{max}; LBH is the low bank height, measured as the vertical distance between the thalweg and top of the lower bank

Longitudinal Profile

The longitudinal profile is used to document channel elevation, and slopes and lengths of streambed features. The bed profile of an alluvial stream frequently includes the geomorphic units of riffles, runs, pools, and glides. Additionally, some streams may have step features. Identifying these features is best done using a combination of field observations and a plotted longitudinal profile of the streambed and water surface (Figures 3-2 and 3-3).

Figure 3-2. Example of streambed with riffles and pools, Ecoregion 71.

The longitudinal profile survey should include points along the channel thalweg, water surface, and top of bank. Thalweg points should be recorded at the start and end of observed bed features, as well as other breaks in longitudinal slope, in order to accurately characterize the bed profile (Zimmerman *et al.*, 2008). If there is flow in the channel, a point should be surveyed on the water surface immediately above every point surveyed on the thalweg. The beginning and ending points of a longitudinal profile should be at features of the same type (typically the head of a riffle), to allow for an accurate computation of average water surface slope ($S_{average}$).

Horizontal and vertical dimensions, and therefore slope, can be measured from the water surface profile for every bed feature (Figure 3-3). The most commonly reported of these are:

Riffle length (L_{riffle}); The horizontal distance between the beginning and end of each riffle

Pool length (L_{pool}); The horizontal distance between the beginning and end of each pool

Riffle slope (S_{riffle}); The slope, measured at the low-flow water surface profile, for each riffle

Pool spacing: The horizontal distance between deepest point in one pool and the deepest point in the subsequent pool

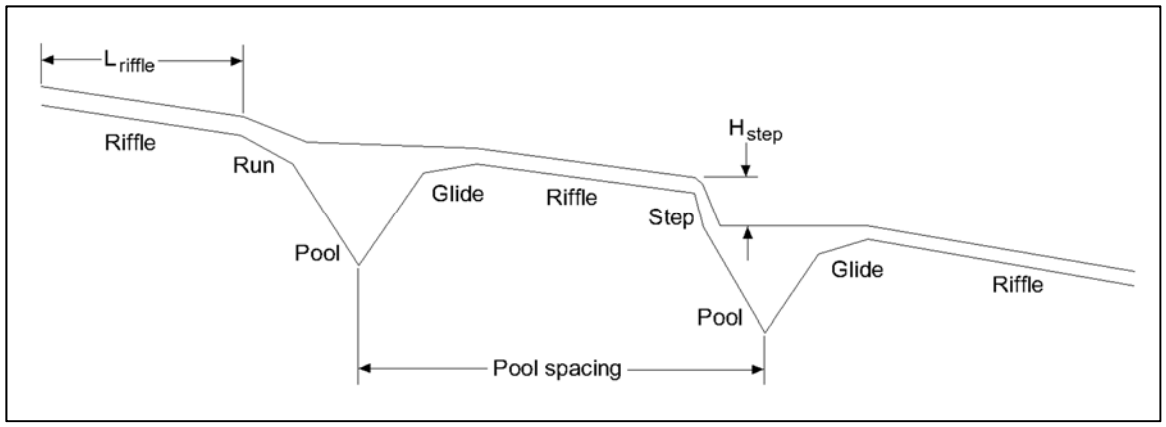


Figure 3-3. Typical longitudinal profile measurements.

These four measurements yield another set of dimensionless ratios:

Riffle length ratio = L_{riffle}/W

Pool length ratio = L_{pool}/W

Riffle slope ratio = $S_{riffle}/S_{average}$

Pool spacing ratio = Pool spacing divided by W; Pool spacing ratio has been documented to be a function of stream slope (Chin *et al.*, 2009), with ratios reported between 3 and 9 (Beschta and Platts, 1986) and between 5 and 7 (Leopold *et al.*, 1964) for riffle-pool systems

Pattern

The pattern of a stream channel can be described by three types of measurements made from a plan view (Figure 3-4): meander wavelength (L_m), belt width (W_{blt}), and radius of curvature (R_c).

Figure 3-4. Typical pattern measurements.

Each of the three types of pattern measurements can be divided by W to calculate dimensionless ratios: belt width (W_{blt}) ratio, meander wavelength (L_m) ratio, and radius of curvature (R_c) ratio. When multiple meanders exist on a stream, the range and median are typically used to describe these values. Each stream reach will have just one value for sinuosity, the ratio of total stream length to the straight-line distance between the beginning and end of the channel.

Discharge Estimation

A common method for estimating velocity and discharge is Manning equation, developed in the 19th century to describe energy losses in open channels. As the field of hydraulic engineering expanded, this equation has been applied to studies of watershed processes and natural channels. The Manning equation, in English units, is:

$$v = \frac{1.486 * \left(R^{2/3}\right) * \left(S^{1/2}\right)}{n}$$

v is velocity (feet/second), R is the hydraulic radius (feet), S is water surface slope (feet/feet), and n is a dimensionless coefficient describing channel roughness, known as Manning's n.

With n values ranging from 0.033 to 0.150 for natural channels (Chow, 1959), practitioners benefit from experience in choosing the most appropriate value. Familiarity with values for n is perhaps best gained by observing photos of different roughness conditions, such as those presented by Barnes (1967). For an analytical estimation of n, at least ten methods exist, summarized by Marcus *et al.* (1992). One of the more commonly-used methods is from Cowan (1956), which segregates the channel into characteristics that can be assessed visually: sediment size (n_0), irregularity within a cross-section (n_1), variation among cross-sections (n_2), obstructions (n_3), vegetation (n_4), and sinuosity (m):

$$n = (n_0 + n_1 + n_2 + n_3 + n_4) * m$$

Suggested values for these factors are in Table 3-1. Detailed guidance for choosing each of these values is provided by many sources, including Arcement and Schneider (1989).

Table 3-1. Values for Cowan equation (Cowan, 1956; Benson and Dalrymple, 1967).

n_0: sediment type	sand	0.026 – 0.035
	gravel	0.028 – 0.035
	cobble	0.030 – 0.050
	boulder	0.040 – 0.070
n_1: irregularity within cross-section	smooth	0.000
	minor	0.005
	moderate	0.010
	severe	0.015
n_2: changes in cross-section area and shape	gradual	0.000
	alternating occasionally	0.005
	alternating frequently	0.010 – 0.015
n_3: effect of obstructions	negligible	0.000
	minor	0.010 – 0.015
	appreciable	0.020 – 0.050
	severe	0.040 – 0.060
n_4: effect of vegetation	low	0.005 – 0.010
	medium	0.010 – 0.025
	high	0.025 – 0.050
	very high	0.050 – 0.100
m: degree of meandering (sinuosity)	minor (1.0 – 1.2)	1.00
	appreciable (1.2 – 1.5)	1.15
	severe (>1.5)	1.30

The need to estimate roughness coefficients is eliminated when a long-term streamflow record exists for a site (Figure 3-5). The USGS stage-discharge relationship can be combined with hydraulic geometry at a cross-section to estimate discharge at the bankfull stage.

(a)

(b)

Figure 3-5. Example of USGS gage station components: a) data recorder/transmitter and b) staff gage and pressure transducer.

As a result, two methods were used to estimate bankfull discharge for the streams in this study. When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method. Power functions were then used to correlate bankfull discharge, cross-sectional area, width, and mean depth with drainage area (Leopold *et al.*, 1964; Leopold, 1994). In addition to bankfull discharge, the 100-year discharge (USGS, 2017) and average floodplain shear stress for the 100-year discharge were estimated.

IV. ECOREGION 66

Morphological Stream Design and Assessment Tools for the Blue Ridge (Ecoregion 66) of Tennessee

Executive Summary

Reference stream morphology measurements represent tools that may be used to verify field bankfull stage determinations and to plan and evaluate design ranges for channel morphology in restoration projects. This study documents alluvial stream morphology measurements from 20 reference streams and one USGS-gaged stream in the Blue Ridge (EPA Level III Ecoregion 66) of Tennessee. The reference streams included in this study were selected based upon their natural equilibrium conditions indicated by floodplain connectivity, bedform diversity, and well-vegetated stable streambanks. The gaged stream was included to document bankfull dimensions and estimated discharges of larger stable streams in this region.

Based on field measurements from 21 reference and gaged streams with drainage areas ranging from 0.28 to 106 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 18.2\ DA^{0.725}$ $R^2 = 0.981$
$W_{bkf} = 16.2\ DA^{0.442}$ $R^2 = 0.972$
$d_{bkf} = 1.10\ DA^{0.289}$ $R^2 = 0.941$
$Q_{bkf} = 91.7\ DA^{0.774}$ $R^2 = 0.924$

Longitudinal profiles from ten selected step-pool reference streams with drainage areas ranging from 0.18 to 8.96 square miles were used to evaluate step heights, riffle and pool lengths, pool spacings, and riffle slopes. Each of these ten streams contained both step and riffle features, along with pools. The ratios of riffle lengths to bankfull widths ranged from 0.4 to 1.9, with a median of 0.8. Pool length ratios ranged from 0.4 to 1.4, with a median of 0.8. Pool spacing ratios ranged from 0.8 to 2.8, with a median of 1.8. The ratios of riffle slopes to channel slopes ranged from 0.7 to 1.8, with a median of 1.0. The ratios of step heights to bankfull width ranged from 0.01 to 0.09, with a median of 0.05.

Results of this study should be considered an initial database of reference stream morphology for this region. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

Stream Morphology Measurements and Analysis

Stream morphology data were collected at 21 reference and gaged streams in the Blue Ridge ecoregion of Tennessee (EPA Level III Ecoregion 66), with drainage areas ranging from 0.28 to 106 square miles (Figures 4-1 and 4-2, Table 4-1). One of these streams was at a United States Geological Survey (USGS) gage station.

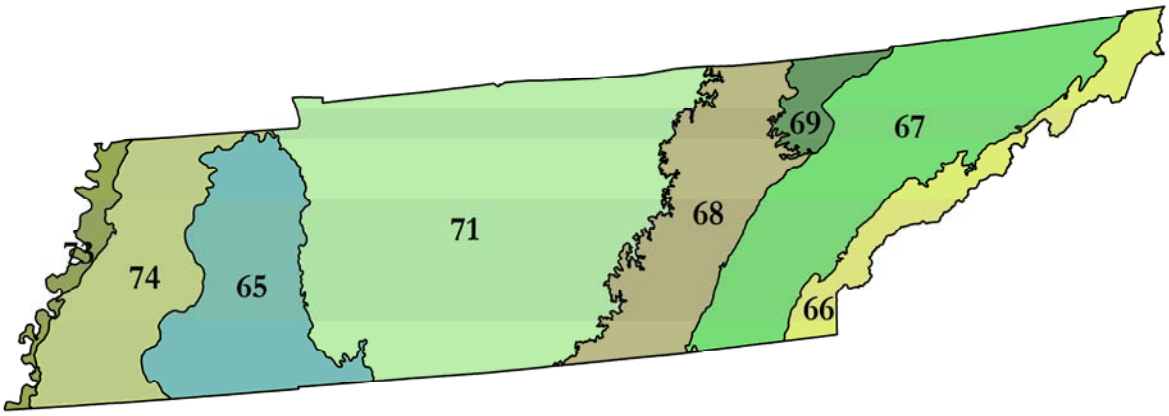


Figure 4-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Reference stream sites were selected based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

Reference streams were surveyed using a total station to measure longitudinal profiles and riffle cross-sections. Streams were classified using the Rosgen stream classification system (Rosgen, 1994). The study included 13 B, 5 C, and 3 E Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes listed in Table 4-2. The entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from 1.3 to 4.8. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from 9.7 for one of the E streams to greater than 20 for many of the wide and shallow B streams. Reach channel slopes, measured using water surface elevation differences from the first step or riffle to the last step or riffle surveyed, ranged from 0.0025 ft/ft for one of the larger rivers to 0.0604 ft/ft for one of the smaller stream channels.

The streambed substrate was characterized through observations of dominant channel material. Of the 21 reference streams, the median streambed particle size (D_{50}) was classified as gravel at 9 sites and cobble at 12 sites.

Appendix A contains detailed information about each of the 21 streams, including photographs, longitudinal profile plots, and cross-section plots.

Figure 4-2. Representative stream in Ecoregion 66 (Site 5, Mids Branch).

Bankfull Channel Dimensions

The measured bankfull riffle cross-sectional areas ranged from 5.9 to 612 square feet (Table 4-2), with the relationship between cross-sectional area (A_{bkf}) and drainage area (DA) shown in Figure 4-3. Similarly, the bankfull channel riffle widths (W_{bkf}) and mean depths (d_{bkf}) related to drainage area are shown in Figures 4-4 and 4-5. Two methods were used to estimate bankfull discharge for the streams. When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method (Arcement and Schneider, 1989) (Table 4-3). The resulting bankfull discharge estimates are shown in relation to drainage area in Figure 4-6. The regression equations for the hydraulic geometry regional curves for the Blue Ridge ecoregion of Tennessee are summarized as follows:

$A_{bkf} = 18.2\ DA^{0.725}$ $R^2 = 0.981$
$W_{bkf} = 16.2\ DA^{0.442}$ $R^2 = 0.972$
$d_{bkf} = 1.10\ DA^{0.289}$ $R^2 = 0.941$
$Q_{bkf} = 91.7\ DA^{0.774}$ $R^2 = 0.924$

This set of regional curves for bankfull channel dimensions provides a tool for verifying bankfull stage in field surveys and for estimating dimensions in stream restoration projects in this ecoregion.

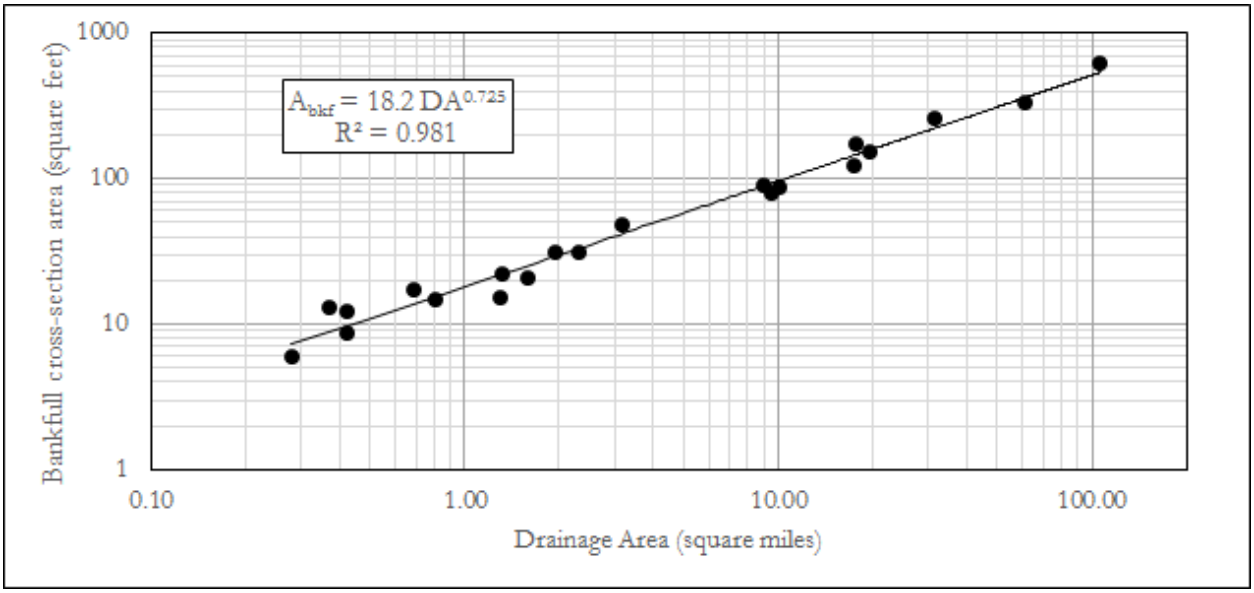


Figure 4-3. Bankfull riffle cross-section area related to drainage area for 21 Blue Ridge streams.

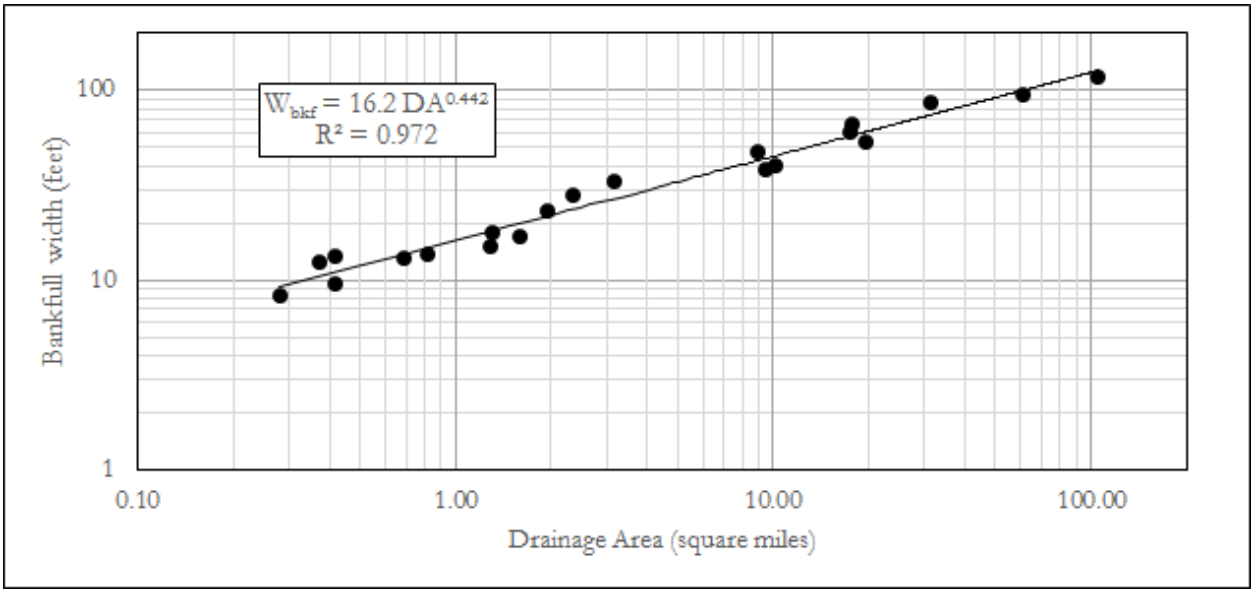


Figure 4-4. Bankfull riffle width related to drainage area for 21 Blue Ridge streams.

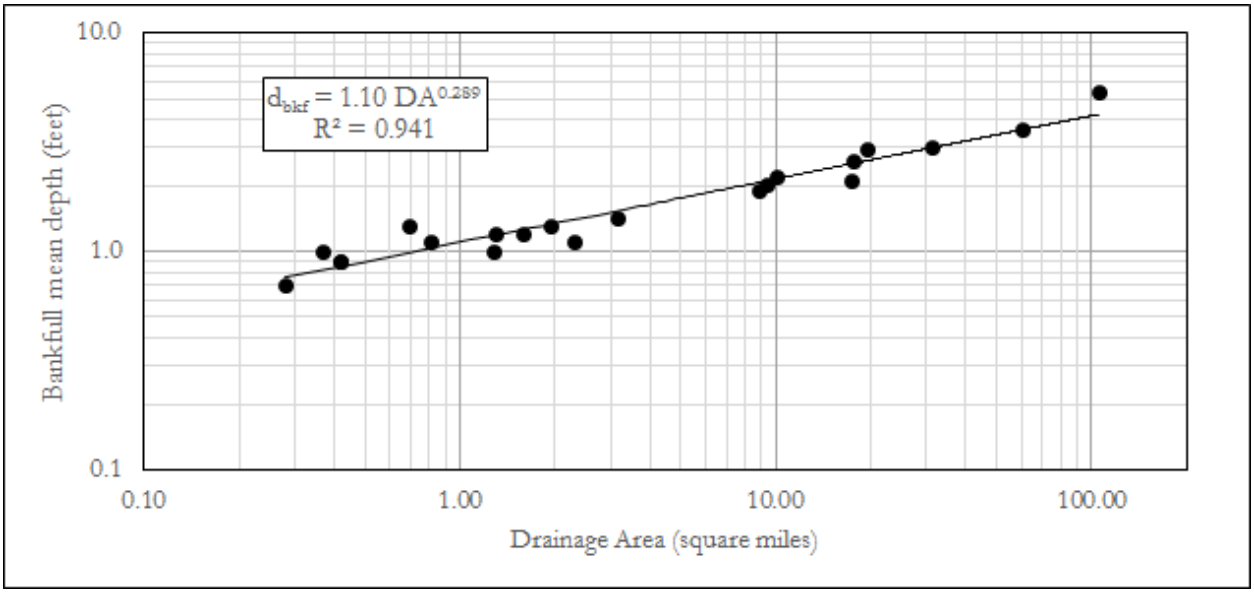


Figure 4-5. Bankfull riffle mean depth related to drainage area for 21 Blue Ridge streams.

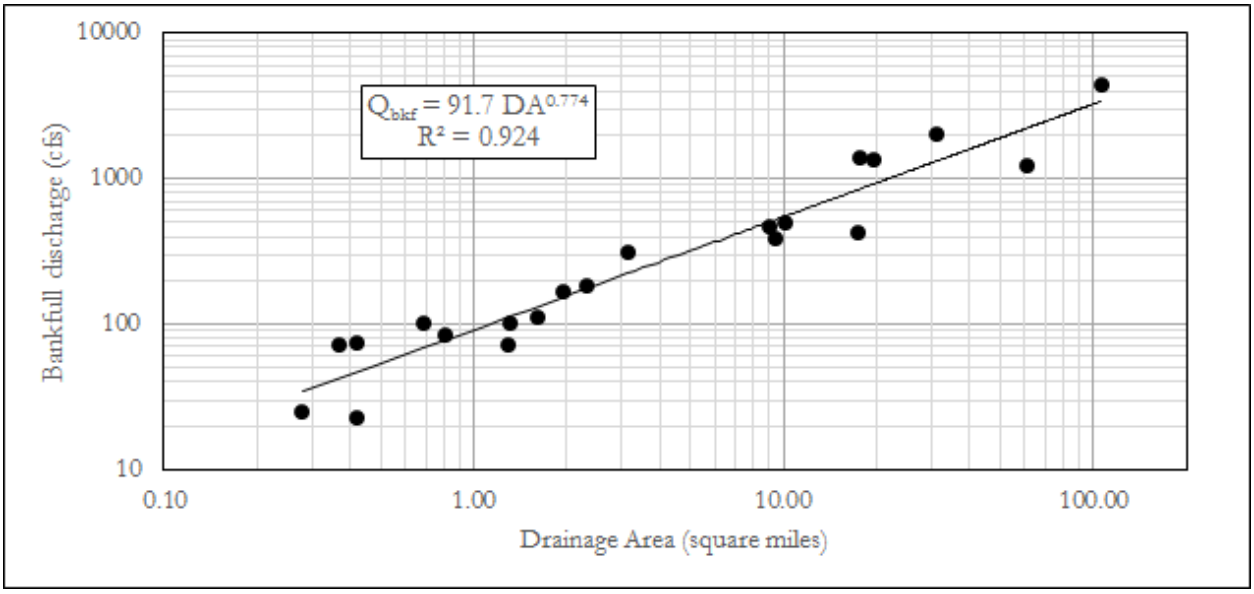


Figure 4-6. Estimated bankfull discharge related to drainage area for 21 Blue Ridge streams.

The following seven EPA Level IV Ecoregions are found within the Blue Ridge of Tennessee (Figure 4-7):

66d: Southern Igneous Ridges and Mountains
66e: Southern Sedimentary Ridges
66f: Limestone Valleys and Coves
66g: Southern Metasedimentary Mountains
66i: High Mountains
66j: Broad Basins
66k: Amphibolite Mountains

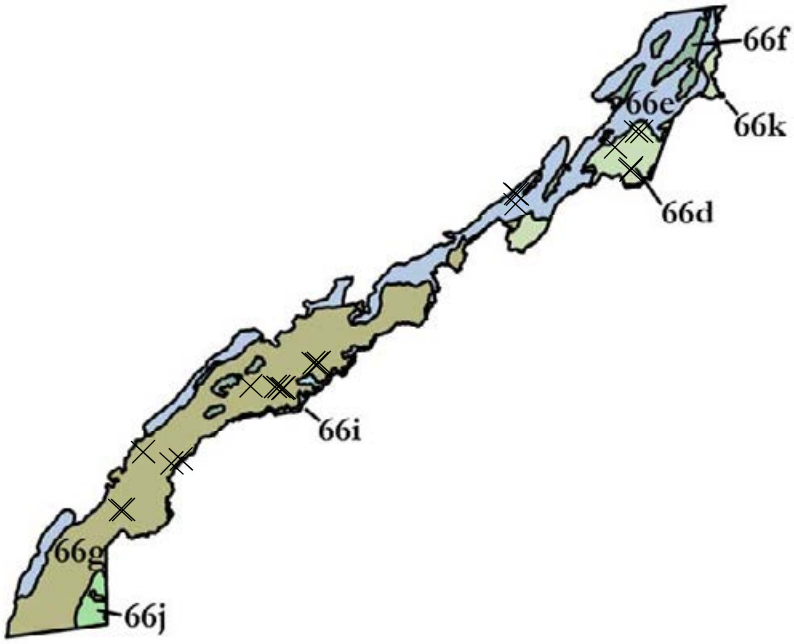


Figure 4-7. EPA Level IV Ecoregions within the Blue Ridge of Tennessee (USEPA, 2013), with reference stream sites marked.

Bedform Dimensions

Table 4-4 lists measured dimensions and slopes for bedform features (e.g., steps, riffles, pools) for ten selected reference streams. Six of these streams are a subset of the 21 aforementioned streams in the Blue Ridge ecoregion of Tennessee. Data from an additional four reference streams in the Joyce Kilmer/Slickrock Wilderness Area were added to enhance the bedform database. These additional sites are in the Blue Ridge ecoregion of North Carolina, within a short distance of the border with Tennessee (Zink *et al*., 2012). All ten streams contain step features, so riffle and pool measurements should be interpreted in that context.

The mean riffle and pool lengths listed in Table 4-4 represent the means of the measured longitudinal lengths of all the riffles and pools in each reference reach. These bedform lengths are shown in relation to drainage area in Figure 4-8, and in relation to bankfull channel width in Figure 4-9. Riffle length ratios ranged from 0.4 to 1.9, with a median of 0.8. Pool length ratios ranged from 0.4 to 1.4, with a median of 0.8. Step heights, along with step height ratios, are included in Table 4-4. Figure 4-10 shows mean step heights in relation to average reach slope. The ratios of step heights to bankfull width ranged from 0.01 to 0.09, with a median of 0.05. Table 4-4 also lists the mean spacing of pools found in each reference stream and the ratios of pool spacing to bankfull channel width. Values of pool spacing ratio ranged from 0.8 to 2.8, with a median of 1.8. Pool spacing values are shown in relation to bankfull channel width in Figure 4-11. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

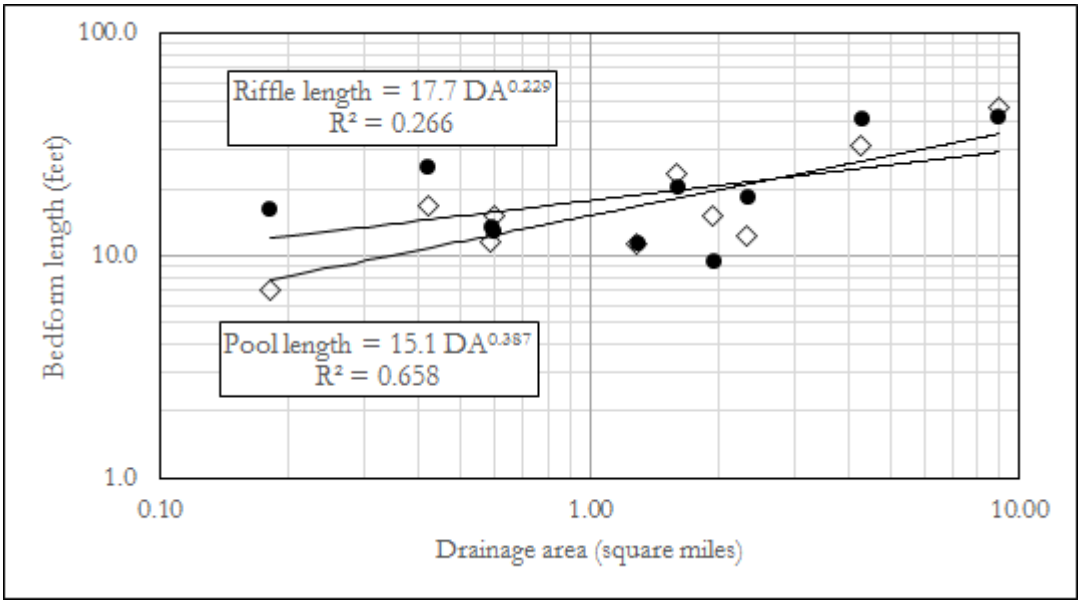


Figure 4-8. Mean riffle and pool length related to drainage area for Blue Ridge streams.

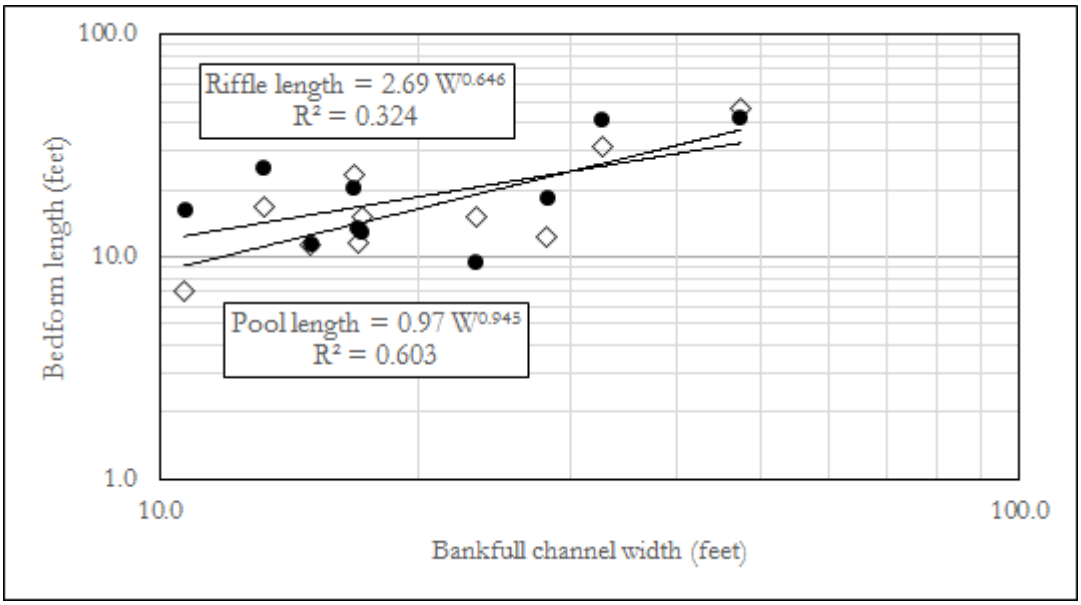


Figure 4-9. Mean riffle and pool length related to bankfull channel width for Blue Ridge streams.

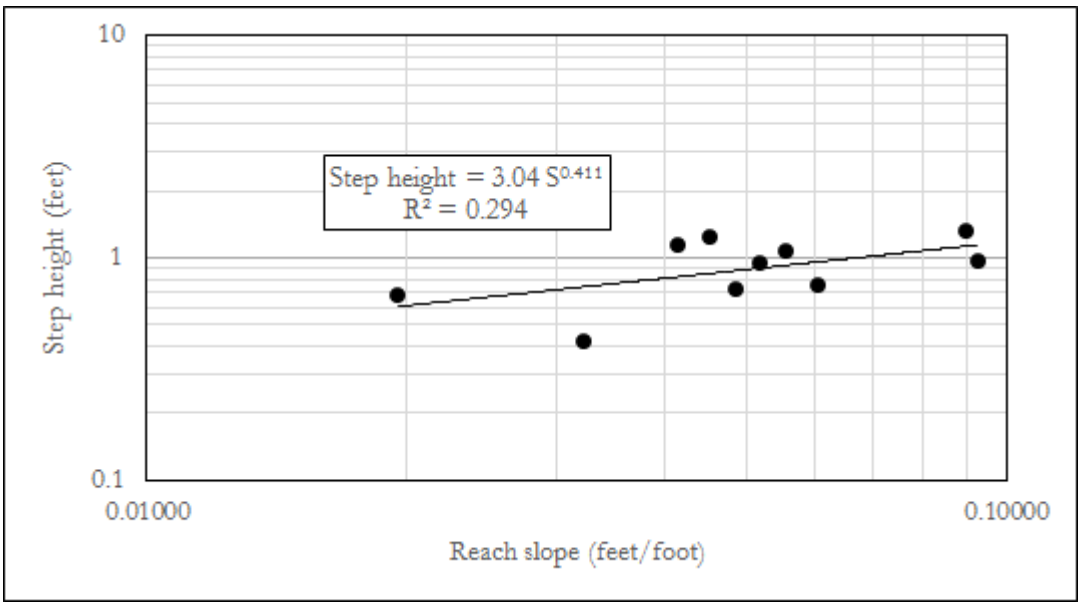


Figure 4-10. Mean step height related to average reach slope for Blue Ridge streams.

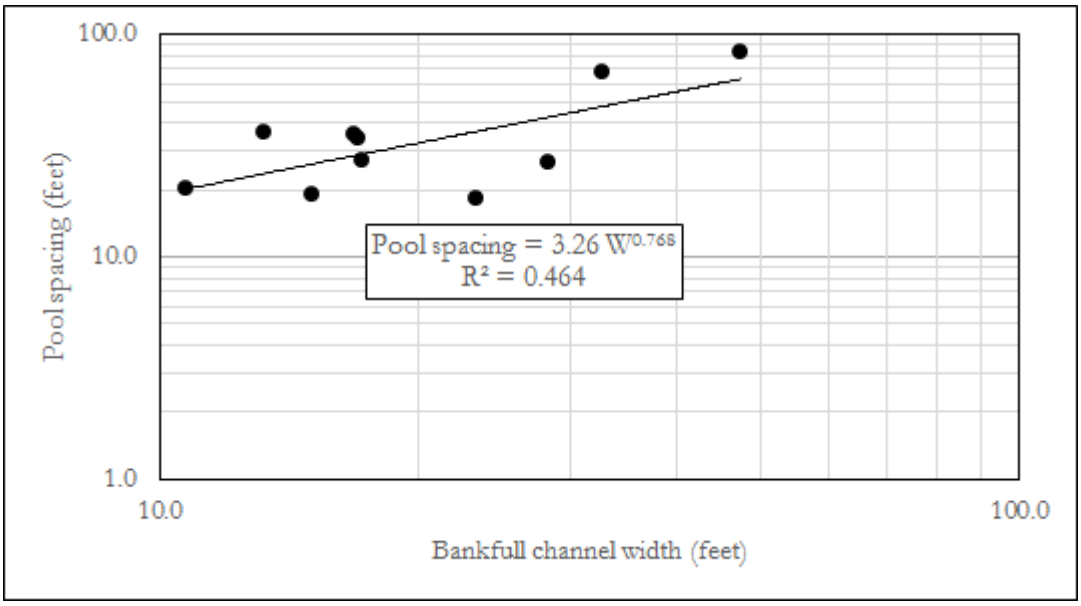


Figure 4-11. Mean pool spacing related to bankfull channel width for Blue Ridge streams.

Bedform Slopes

Table 4-4 includes the mean measured riffle slopes and ratios of riffle slope to overall reach slope. The values of riffle slope ratios ranged from 0.7 to 1.8, with a median of 1.0. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 4-12. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

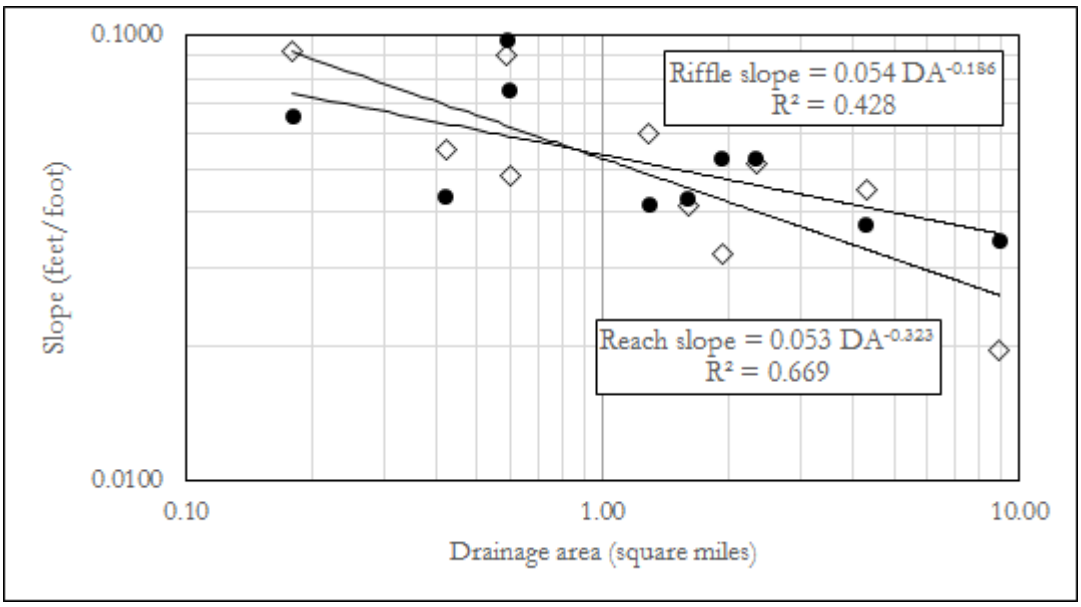


Figure 4-12. Reach channel slope and mean riffle slope related to drainage area for Blue Ridge streams.

Table 4-1. Morphology Reference Stream Summary, Blue Ridge Ecoregion.

Site	Stream name	Source/Location	Latitude	Longitude	EPA Level IV Ecoregion	Drainage area (mile^2)
1	False Gap Prong	GSMNP	35.706581	-83.382170	66g	0.28
2	Catron Branch	GSMNP	35.663774	-83.587464	66g	0.37
3	Bearwallow Branch	GSMNP	35.652274	-83.574728	66g	0.42
4	UT Laurel Creek	Cherokee National Forest	35.345191	-84.193323	66g	0.42
5	Mids Branch	GSMNP	35.657787	-83.579546	66g	0.69
6	Bearwallow Creek	Roan Mountain State Park	36.158204	-82.103407	66d	0.81
7	Sill Branch	Cherokee National Forest	36.127883	-82.533143	66e	1.29
8	Laurel Creek	Cherokee National Forest	35.345255	-84.194284	66g	1.31
9	UT Little Stony Creek	Cherokee National Forest	36.283843	-82.067919	66d	1.60
10	Little Slickrock Creek	Joyce Kilmer/Slickrock Wilderness	35.448456	-83.982228	66g	1.94
11	Little Stony Creek	TDEC FECO66D07	36.286460	-82.066313	66d	2.33
12	Lower Higgins Creek	TDEC ECO66E11	36.086343	-82.522528	66e	3.16
13	Slickrock Creek	Joyce Kilmer/Slickrock Wilderness	35.431553	-83.999251	66g	8.96
14	Clark Creek	TDEC ECO66E09	36.147859	-82.528400	66e	9.48
15	Doe River	TDEC ECO66D05	36.157320	-82.100600	66d	10.1
16	Laurel Fork	TDEC ECO66D03	36.255862	-82.109877	66d	17.4
17	Porters Creek	GSMNP	35.706229	-83.383259	66g	17.7
18	Middle Prong Pigeon	TDEC ECO66G04	35.707277	-83.380050	66g	19.5
19	Little River	TDEC ECO66G05	35.652767	-83.573211	66g	31.3
20	Citico Creek	TDEC ECO66G07	35.506607	-84.106280	66g	61.1
21	Little River	USGS gage 03497300	35.664700	-83.711392	66g	106

Table 4-2. Morphology Dimensions for Reference Streams, Blue Ridge Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Bankfull width (ft)	Bankfull mean depth (ft)	Width/ depth ratio	Entrenchment ratio	Sinuosity	Stream classification
1	0.28	0.04738	5.9	8.3	0.7	11.6	2.5	1.05	E4a
2	0.37	0.05047	12.9	12.3	1.0	11.7	2.4	1.04	B3a
3	0.42	0.01414	8.6	9.6	0.9	10.8	2.7	1.08	E4
4	0.42	0.05530	12.2	13.2	0.9	14.2	1.7	1.06	B4a
5	0.69	0.02677	17.5	13.0	1.3	9.7	3.4	1.06	E4b
6	0.81	0.05765	14.8	13.6	1.1	12.6	1.8	1.05	B4a
7	1.29	0.06041	15.1	15.0	1.0	14.9	1.8	1.07	B3a
8	1.31	0.01706	22.1	17.8	1.2	14.4	4.8	1.04	C4
9	1.60	0.04156	20.9	16.8	1.2	13.4	3.8	1.05	C3a
10	1.94	0.03222	30.7	23.3	1.3	17.6	2.8	1.10	C4b
11	2.33	0.05175	31.4	28.2	1.1	25.3	2.2	1.10	B3a
12	3.16	0.04818	47.8	33.0	1.4	22.8	1.3	1.05	B3a
13	8.96	0.01961	91.2	47.4	1.9	24.7	2.2	1.09	B3c
14	9.48	0.01676	79.2	38.6	2.0	18.9	2.1	1.08	C3
15	10.1	0.01514	86.6	40.0	2.2	18.5	3.1	1.07	C3
16	17.4	0.00470	122.6	59.6	2.1	28.9	1.6	1.09	B4c
17	17.7	0.03043	175.4	66.4	2.6	25.1	2.3	1.09	B3
18	19.5	0.04168	151.9	52.9	2.9	18.4	2.3	1.05	B3a
19	31.3	0.02903	259.8	86.3	3.0	28.6	1.5	1.05	B3
20	61.1	0.00251	335.2	94.3	3.6	26.5	1.6	1.04	B4c
21	106	0.00534	611.5	116.1	5.3	22.1	1.4	1.13	B3c

Table 4-3. Discharge Estimates for Reference Streams, Blue Ridge Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Manning's n	Bankfull mean velocity (ft/sec)	Bankfull discharge (cfs)
1	0.28	0.04738	5.9	0.055	4.22	25
2	0.37	0.05047	12.9	0.055	5.67	73
3	0.42	0.01414	8.6	0.055	2.66	23
4	0.42	0.05530	12.2	0.050	6.09	74
5	0.69	0.02677	17.5	0.045	5.83	102
6	0.81	0.05765	14.8	0.060	5.69	84
7	1.29	0.06041	15.1	0.070	4.82	73
8	1.31	0.01706	22.1	0.045	4.58	101
9	1.60	0.04156	20.9	0.060	5.34	112
10	1.94	0.03222	30.7	0.055	5.43	167
11	2.33	0.05175	31.4	0.060	5.76	181
12	3.16	0.04818	47.8	0.060	6.59	315
13	8.96	0.01961	91.2	0.060	5.10	465
14	9.48	0.01676	79.2	0.060	4.85	384
15	10.1	0.01514	86.6	0.050	5.71	495
16	17.4	0.00470	122.6	0.045	3.50	429
17	17.7	0.03043	175.4	0.060	7.85	1377
18	19.5	0.04168	151.9	0.065	8.80	1337
19	31.3	0.02903	259.8	0.065	7.77	2018
20	61.1	0.00251	335.2	0.045	3.67	1231
21	106	0.00534	611.5	--	7.28	4450

Note: Absence of Manning's n in table indicates that bankfull discharge was derived from the long-term flow record at a USGS gage station.

Table 4-4. Stream Morphology Bedform Measurements for Reference Streams, Blue Ridge Ecoregion.

Site	Site name	Drainage area (mile^2)	Mean riffle length [ratio to bankfull width] (ft [none])	Mean pool length [ratio to bankfull width] (ft [none])	Mean pool spacing [ratio to bankfull width] (ft [none])	Mean riffle slope [ratio to channel slope] (ft/ft [none])	Mean step height [ratio to bankfull width] (ft [none])
--	Nichols Cove	0.18	16.3 [1.5]	7.0 [0.7]	20.3 [1.9]	0.0658 [0.7]	0.96 [0.09]
4	UT Laurel Creek	0.42	25.0 [1.9]	16.9 [1.3]	36.4 [2.8]	0.0434 [0.8]	1.08 [0.08]
--	Adams Camp Branch	0.59	13.5 [0.8]	11.5 [0.7]	34.3 [2.0]	0.0976 [1.1]	1.32 [0.08]
--	Big Fat Branch	0.60	12.9 [0.8]	15.3 [0.9]	27.3 [1.6]	0.0753 [1.6]	0.72 [0.04]
7	Sill Branch	1.29	11.4 [0.8]	11.3 [0.8]	19.3 [1.3]	0.0418 [0.7]	0.75 [0.05]
9	UT Little Stony Creek	1.60	20.3 [1.2]	23.4 [1.4]	36.1 [2.1]	0.0428 [1.0]	1.14 [0.07]
10	Little Slickrock Creek	1.94	9.4 [0.4]	15.0 [0.6]	18.4 [0.8]	0.0529 [1.6]	0.42 [0.02]
11	Little Stony Creek	2.33	18.5 [0.7]	12.3 [0.4]	26.6 [0.9]	0.0528 [1.0]	0.94 [0.03]
--	Little Santeetlah Creek	4.29	41.6 [1.3]	31.6 [1.0]	68.0 [2.1]	0.0375 [0.8]	1.24 [0.04]
13	Slickrock Creek	8.96	42.6 [0.9]	47.0 [1.0]	84.0 [1.8]	0.0345 [1.8]	0.68 [0.01]

Note: Lack of site number indicates that measurements were taken from Zink *et al.*, 2012 to enhance the bedform measurement database for the Blue Ridge Ecoregion.

V. ECOREGION 67

Morphological Stream Design and Assessment Tools for the Ridge and Valley (Ecoregion 67) of Tennessee

Executive Summary

Reference stream morphology measurements represent tools that may be used to verify field bankfull determinations and to estimate design ranges for channel morphology in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

Based on field measurements from 18 reference streams with drainage areas ranging from 0.04 to 117 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 18.8\ DA^{0.684}$ $R^2 = 0.935$
$W_{bkf} = 16.2\ DA^{0.370}$ $R^2 = 0.897$
$d_{bkf} = 1.16\ DA^{0.315}$ $R^2 = 0.886$
$Q_{bkf} = 58.7\ DA^{0.728}$ $R^2 = 0.883$

Based on field measurements from selected reference streams with drainage areas ranging from 0.33 to 2.6 square miles, the riffle and pool lengths and pool spacing distances were generally not found to correlate with watershed drainage area. Additionally, riffle slopes were generally independent of drainage area. The ratio of riffle lengths to bankfull width ranged from 1.1 to 2.7, with a median of 1.2. Pool length ratios ranged from 1.4 to 2.7, with a median of 1.8. Pool spacing ratios ranged from 1.5 to 4.1, with a median of 3.5. The ratios of riffle slopes to channel slopes ranged from 1.4 to 2.7, with a median of 2.5.

Results of this study should be considered an initial database of reference stream morphology for this region. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

Stream Morphology Measurements and Analysis

Stream morphology data were collected at 18 reference streams in the Ridge and Valley ecoregion of Tennessee (EPA Level III Ecoregion 67), with drainage areas ranging from 0.04 to 117 square miles (Figures 5-1 and 5-2, Table 5-1). Five of these streams were at United States Geological Survey (USGS) gage stations.

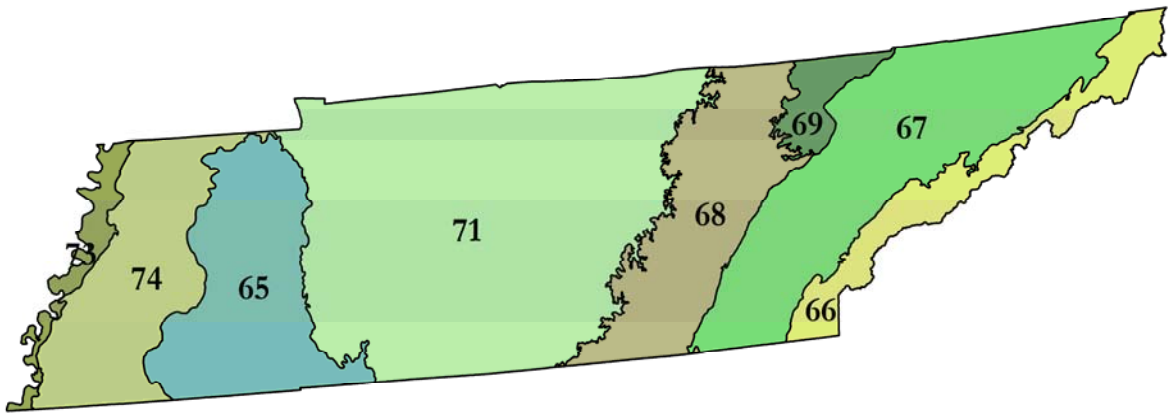


Figure 5-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Reference stream sites were selected based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had freely-formed meander patterns and discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

Reference streams were surveyed using total station and laser level survey equipment to measure longitudinal profiles and riffle cross-sections. Streams were classified using the Rosgen stream classification system (Rosgen, 1994). The study included 3 B, 12 C, and 3 E Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes listed in Table 5-2. The entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from 1.4 for the narrow-valley B streams to greater than 5 for some of the alluvial C and E streams. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from just under 10 for some E streams to 40 for a wide and shallow B channel. Reach channel slopes, measured using water surface elevation differences from the first riffle to the last riffle surveyed, ranged from 0.0010 ft/ft for the largest river to 0.0331 ft/ft for the steepest stream channel.

The streambed substrate was characterized through pebble counts and observations of dominant channel material. Of the 18 reference streams, the median streambed particle size (D_{50}) was classified as sand at 1 site, gravel at 15 sites, cobble at 1 site, and bedrock at 1 site. Appendix B contains detailed information about each of the 18 reference streams, including: photographs, longitudinal profile plots, and cross-section plots.

Figure 5-2. Representative stream in Ecoregion 67 (Site 12, Clear Creek).

Bankfull Channel Dimensions

The measured bankfull riffle cross-sectional areas ranged from 1.7 to 498 square feet (Table 5-2), with the relationship between cross-sectional area (A_{bkf}) and drainage area (DA) shown in Figure 5-3. Similarly, the bankfull channel riffle widths (W_{bkf}) and mean depths (d_{bkf}) related to drainage area are shown in Figures 5-4 and 5-5. Two methods were used to estimate bankfull discharge for the streams. When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method (Arcement and Schneider, 1989) (Table 5-3). The resulting bankfull discharge estimates are shown in relation to drainage area in Figure 5-6. In addition to bankfull discharge, Table 5-3 contains estimates of the 100-year discharge (USGS StreamStats, 2017) and estimates of average floodplain shear stress for the 100-year discharge. The regression equations for the hydraulic geometry regional curves for the Ridge and Valley of Tennessee are summarized as follows:

$A_{bkf} = 18.8\ DA^{0.684}$ $R^2 = 0.935$
$W_{bkf} = 16.2\ DA^{0.370}$ $R^2 = 0.897$
$d_{bkf} = 1.16\ DA^{0.315}$ $R^2 = 0.886$
$Q_{bkf} = 58.7\ DA^{0.728}$ $R^2 = 0.883$

This set of regional curves for bankfull channel dimensions provides a tool for verifying bankfull stage in field surveys and for estimating dimensions in stream restoration projects in this region.

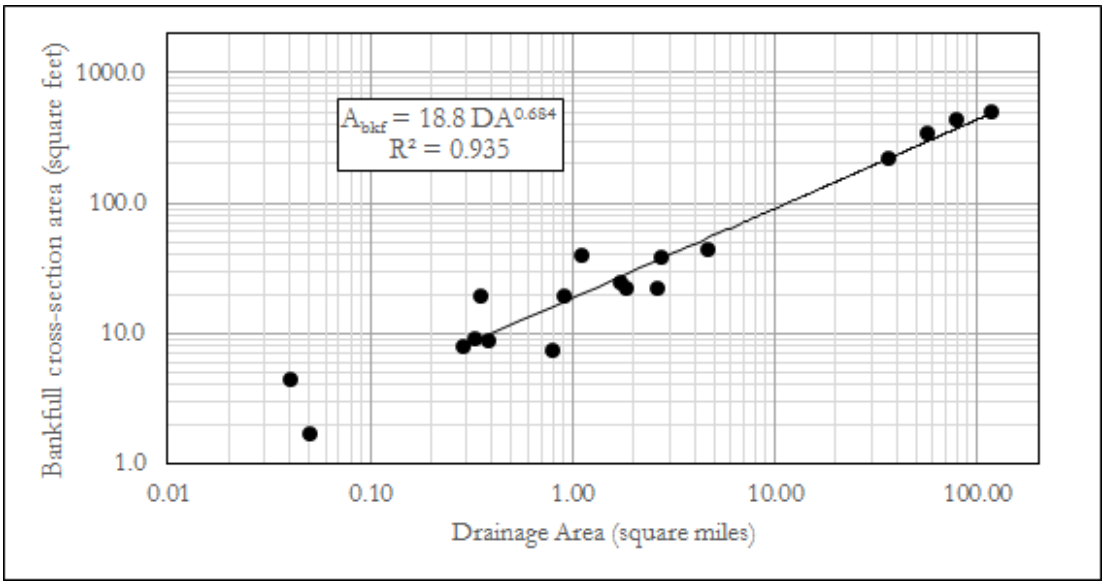


Figure 5-3. Bankfull riffle cross-section area related to drainage area for 18 Ridge and Valley streams.

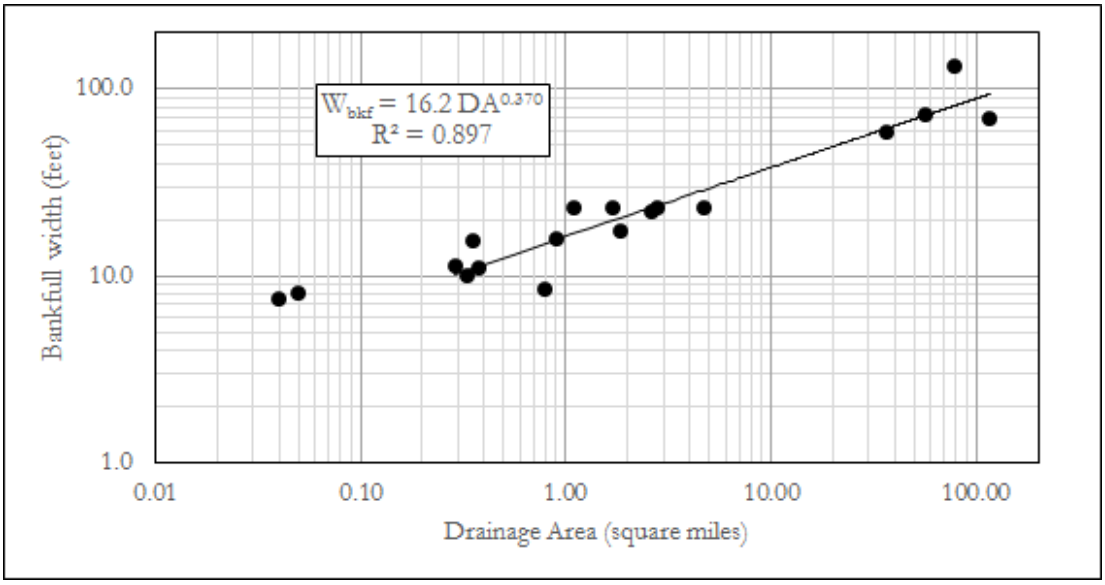


Figure 5-4. Bankfull riffle width related to drainage area for 18 Ridge and Valley streams.

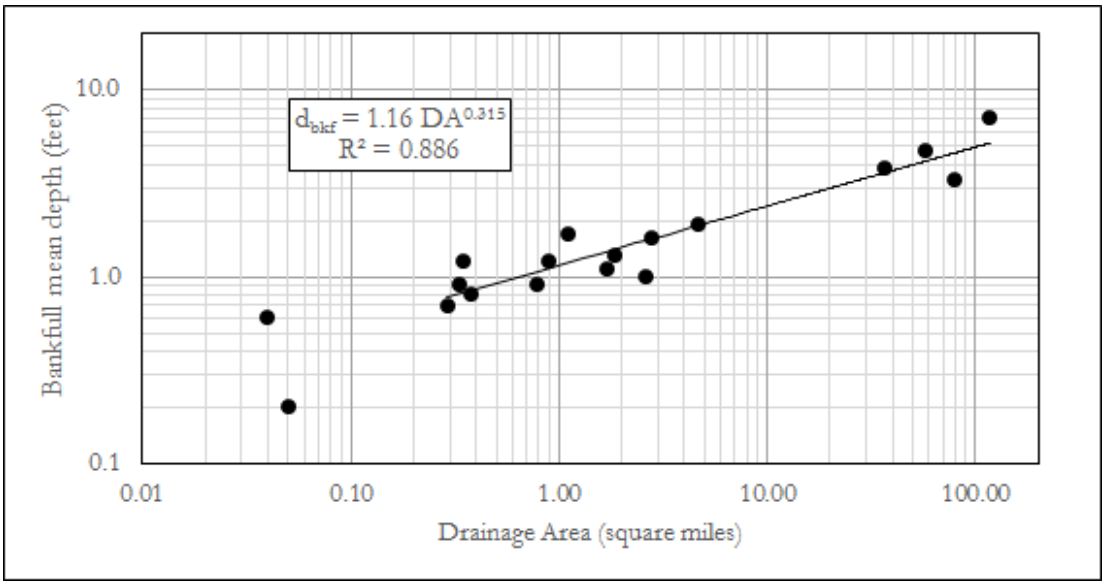


Figure 5-5. Bankfull riffle mean depth related to drainage area for 18 Ridge and Valley streams.

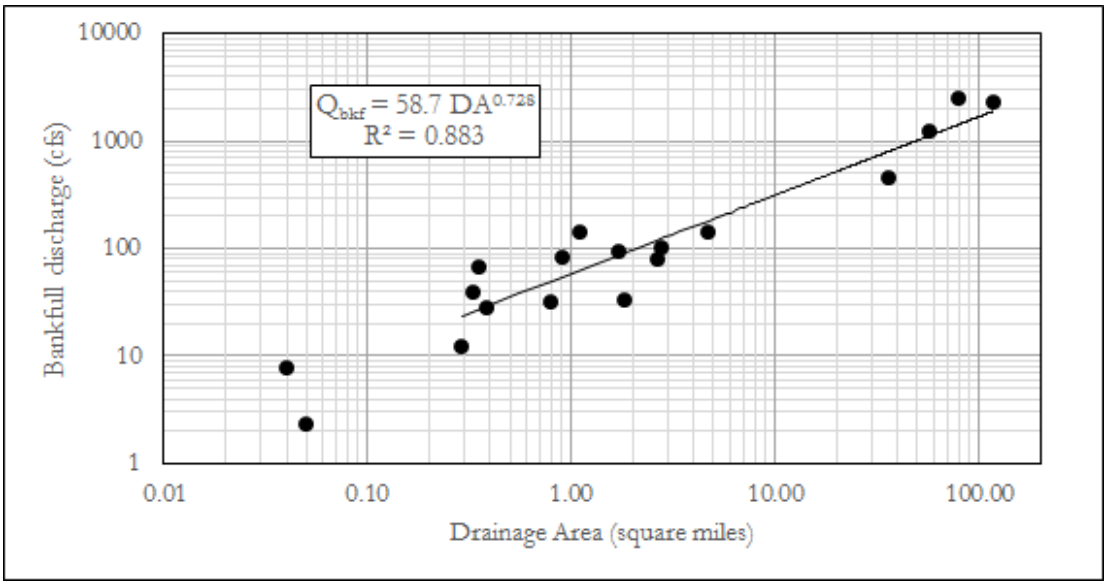


Figure 5-6. Estimated bankfull discharge related to drainage area for 18 Ridge and Valley streams.

The following four EPA Level IV Ecoregions are found within the Ridge and Valley of Tennessee (Figure 5-7):

67f: Southern Limestone/Dolomite Valleys and Low Rolling Hills
67g: Southern Shale Valleys
67h: Southern Sandstone Ridges
67i: Southern Dissected Ridges and Knobs

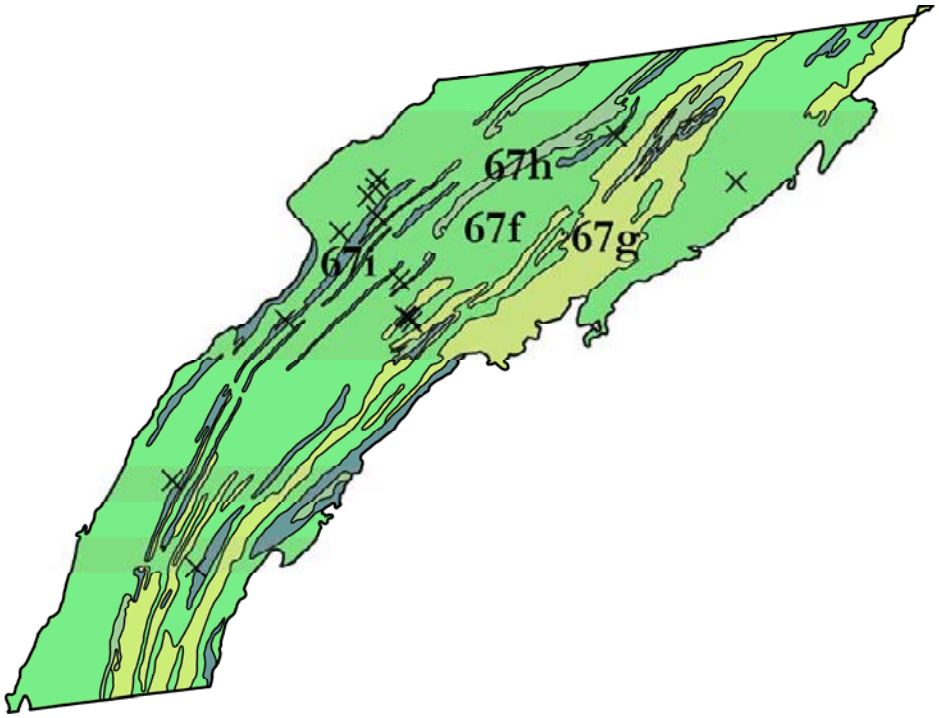


Figure 5-7. EPA Level IV Ecoregions within the Ridge and Valley of Tennessee (USEPA, 2013), with reference stream sites marked.

Bedform Dimensions

Table 5-4 lists measured dimensions and slopes for bedform features (i.e., riffles, pools) for the reference streams that contained these features. The mean riffle and pool lengths listed in Table 5-4 represent the means of the measured longitudinal lengths of all the riffles and pools existing in each reference reach. These bedform lengths are shown in relation to drainage area in Figure 5-8. Pool and riffle bedforms within the Ridge and Valley ecoregion generally do not correlate with drainage area, suggesting that, for the selected streams, pool and riffle lengths are not dependent on drainage area. These same values are shown in relation to bankfull channel width in Figure 5-9. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

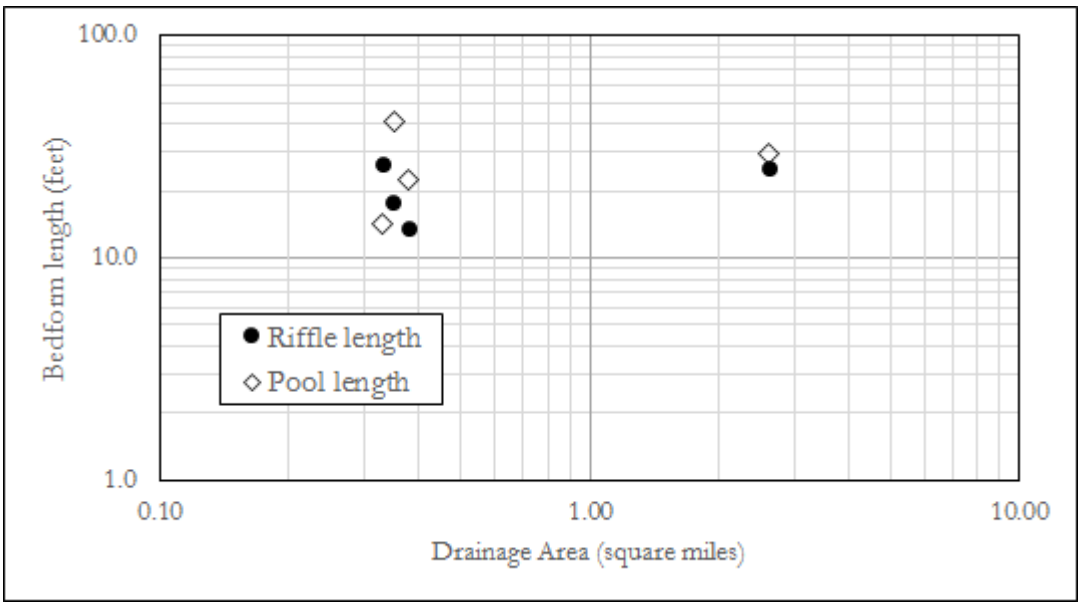


Figure 5-8. Mean riffle and pool length related to drainage area for Ridge and Valley streams.

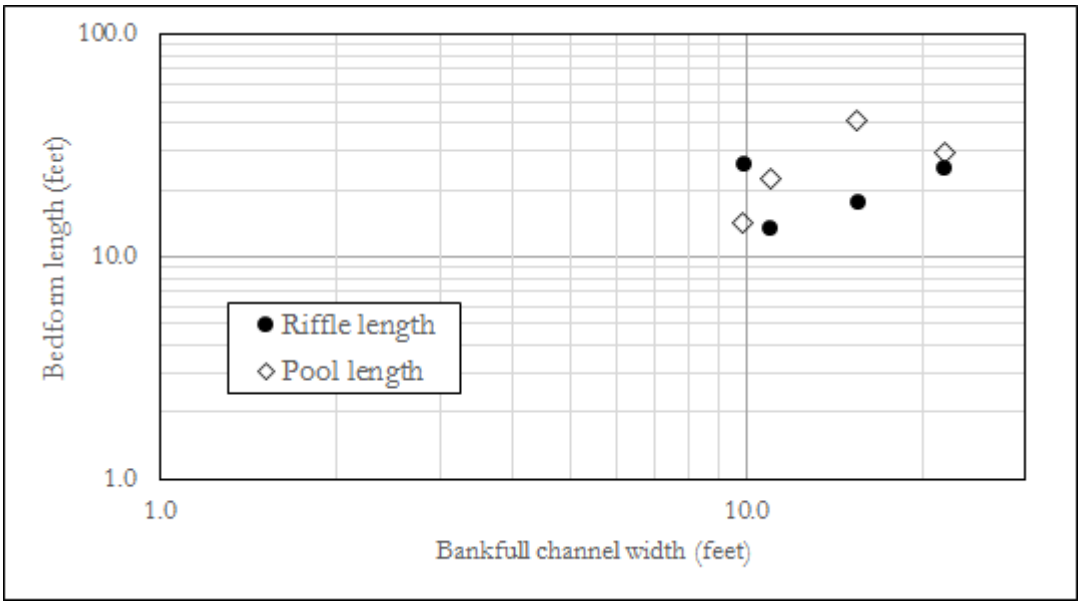


Figure 5-9. Mean riffle and pool length related to bankfull channel width for Ridge and Valley streams.

Table 5-4 lists the ratios of riffle and pool length to bankfull width for each stream. Riffle length ratios ranged from 1.1 to 2.7, with a median of 1.2. Pool length ratios ranged from 1.4 to 2.7, with a median of 1.8. Table 5-4 also lists the mean spacing of pools found in each reference stream and the ratios of pool spacing to bankfull channel width. Values of pool spacing ratio ranged from 1.5 to 4.1, with a median of 3.5. Pool spacing values are shown in relation to bankfull channel width in Figure 5-10.

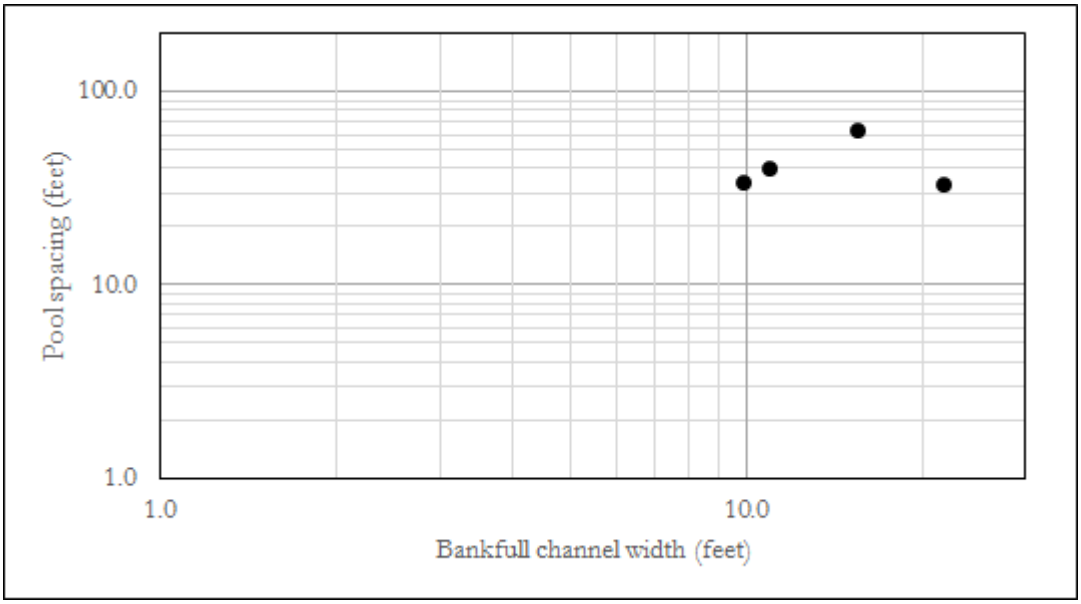


Figure 5-10. Mean pool spacing related to bankfull channel width for Ridge and Valley streams.

Bedform Slopes

Table 5-4 lists the mean measured riffle slopes and ratios of riffle slope to overall reach slope. The values of riffle slope ratios ranged from 1.4 to 2.7, with a median of 2.5. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 5-11. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

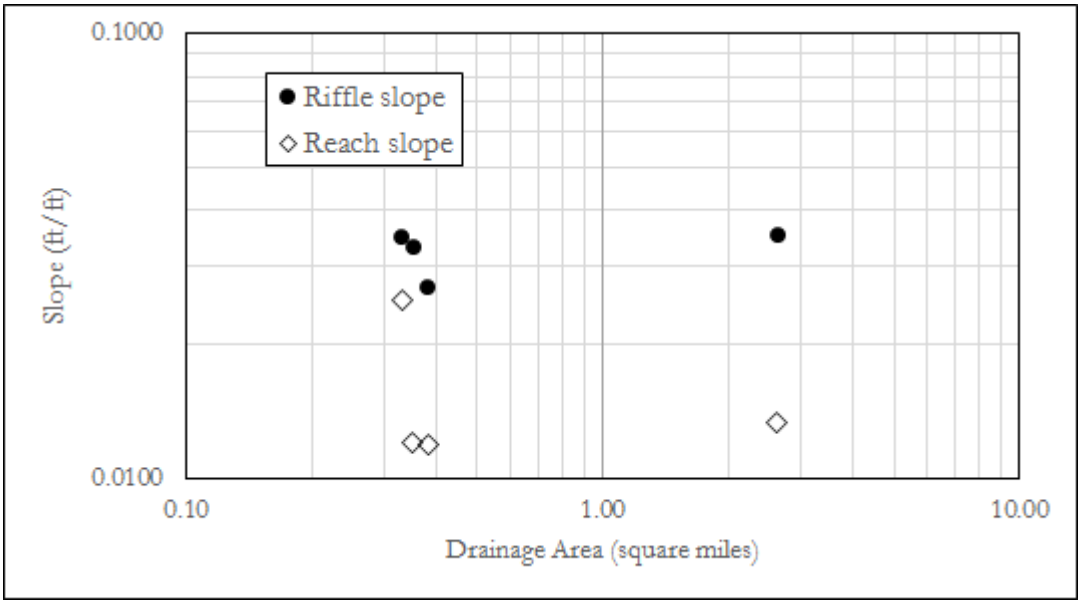


Figure 5-11. Reach channel slope and mean riffle slope related to drainage area for Ridge and Valley streams.

Pattern

Pattern measurements (i.e., meander lengths, belt widths, and radii of curvature) are reported in Table 5-5 for sites in unconfined valleys with sinuosity greater than 1.10. These measurements were collected in the field for those sites with drainage area less than 10 square miles. Aerial photography was used for sites with drainage area greater than 10 square miles. Reported measurements for these larger rivers should be carefully evaluated, as anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred.

For the sites with drainage area less than 10 square miles, meander length ratios (meander length divided by bankfull width) range from 4.0 to 6.3, with a median of 4.8. Beltwidth ratios range from 1.4 to 2.0, with a median of 1.7. Radius of curvature ratios range from 1.2 to 1.8, with a median of 1.6.

Table 5-1. Morphology Reference Stream Summary, Ridge and Valley Ecoregion.

Site	Stream name	Source/Location	Latitude	Longitude	EPA Level IV Ecoregion	Drainage area (mile^2)
1	Forks Creek (3)	Forks of the River WMA	35.937514	-83.848191	67f	0.04
2	Ijams Creek	Ijams Nature Center	35.956553	-83.868685	67g	0.05
3	Forks Creek (2)	Forks of the River WMA	35.949691	-83.853727	67f	0.29
4	UT White Creek	Chuck Swan State Forest	36.349005	-83.899726	67f	0.33
5	Forks Creek (1)	Forks of the River WMA	35.936921	-83.849549	67f	0.35
6	Big Ridge Creek	Big Ridge State Park	36.246175	-83.921839	67i	0.38
7	Big Spring Creek	Chuck Swan State Forest	36.303581	-83.944898	67f	0.79
8	White Creek	TDEC ECO67F13	36.348095	-83.901602	67f	0.90
9	Mill Creek	TDEC FECO67I12	35.988330	-84.288880	67i	1.10
10	Toll Creek	Ijams Nature Center	35.952161	-83.864656	67f	1.71
11	Forks Creek (4)	Forks of the River WMA	35.937082	-83.848372	67f	1.84
12	Clear Creek (1)	Chuck Swan State Forest	36.322751	-83.913806	67f	2.62
13	Clear Creek (2)	TDEC ECO67F06	36.213589	-84.059333	67f	2.77
14	Crockett Creek	USGS Gage 3491544	36.379817	-83.046554	67f	4.67
15	Beaver Creek	USGS Gage 3535187	36.059269	-83.972218	67f	36.4
16	Oostanaula Creek	USGS Gage 3565500	35.327517	-84.705082	67f	57.0
17	Big Limestone Creek	USGS Gage 3466208	36.205938	-82.650427	67f	79.0
18	Sewee Creek	USGS Gage 3543500	35.577894	-84.749564	67f	117

Table 5-2. Morphology Dimensions for Reference Streams, Ridge and Valley Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Bankfull width (ft)	Bankfull mean depth (ft)	Width/ depth ratio	Entrenchment ratio	Sinuosity	Stream classification
1	0.04	0.0071	4.4	7.6	0.6	13.1	10.9	1.06	C4
2	0.05	0.0085	1.7	8.0	0.2	37.3	1.6	1.02	B5c
3	0.29	0.0041	7.9	11.4	0.7	16.5	6.4	1.01	C4
4	0.33	0.0253	9.0	9.9	0.9	10.9	5.6	1.05	E4b
5	0.35	0.0121	19.1	15.5	1.2	12.6	2.3	1.05	C3
6	0.38	0.0119	8.8	11.0	0.8	13.7	5.3	1.10	C4
7	0.79	0.0331	7.3	8.4	0.9	9.6	2.5	1.02	E4b
8	0.90	0.0187	19.5	15.9	1.2	13.0	3.6	1.05	C4
9	1.10	0.0039	40.3	23.3	1.7	13.4	3.4	1.06	C4
10	1.71	0.0174	24.5	23.3	1.1	22.1	3.9	1.06	C4
11	1.84	0.0018	22.4	17.2	1.3	13.2	4.0	1.03	C4
12	2.62	0.0133	22.3	21.8	1.0	21.2	2.3	1.02	C4
13	2.77	0.0048	37.9	23.3	1.6	14.3	3.1	1.14	C4
14	4.67	0.0025	44.6	23.2	1.9	12.1	2.0	1.02	B4c
15	36.4	0.0010	220.9	58.9	3.8	15.7	3.7	1.32	C3
16	57.0	0.0015	344.9	73.3	4.7	15.6	3.0	1.28	C4
17	79.0	0.0023	431.5	131.7	3.3	40.2	1.4	1.21	B1c
18	117	0.0010	497.5	69.8	7.1	9.8	2.9	1.55	E4

Table 5-3. Discharge Estimates for Reference Streams, Ridge and Valley Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Manning's n	Bankfull mean velocity (ft/sec)	Bankfull discharge (cfs)	100-year discharge (cfs)	100-year floodplain shear stress (lbs/ft^2)
1	0.04	0.0071	4.4	0.045	1.75	7.7	46.7	0.3
2	0.05	0.0085	1.7	0.035	1.35	2.3	59.2	1.1
3	0.29	0.0041	7.9	0.045	1.53	12.0	175	0.4
4	0.33	0.0253	9.0	0.045	4.41	39.7	219	2.2
5	0.35	0.0121	19.1	0.048	3.55	67.9	209	1.7
6	0.38	0.0119	8.8	0.040	3.19	28.1	239	1.4
7	0.79	0.0331	7.3	0.050	4.32	31.6	410	6.9
8	0.90	0.0187	19.5	0.050	4.24	82.6	455	2.8
9	1.10	0.0039	40.3	0.035	3.51	141.3	510	0.8
10	1.71	0.0174	24.5	0.050	3.82	93.6	635	2.4
11	1.84	0.0018	22.4	0.045	1.51	33.8	689	0.6
12	2.62	0.0133	22.3	0.045	3.64	81.3	957	3.6
13	2.77	0.0048	37.9	0.048	2.71	103	992	1.5
14	4.67	0.0025	44.6	--	3.21	143	1280	1.4
15	36.4	0.0010	220.9	0.052	2.04	451	5390	0.8
16	57.0	0.0015	344.9	--	3.52	1215	7870	1.3
17	79.0	0.0023	431.5	--	5.92	2556	9070	2.1
18	117	0.0010	497.5	--	4.66	2317	14200	1.7

Note: Absence of Manning's n in table indicates that bankfull discharge was derived from the long-term flow record at a USGS gage station.

Table 5-4. Stream Morphology Bedform Measurements for Reference Streams, Ridge and Valley Ecoregion.

Site	Drainage area (mile^2)	Mean riffle length [ratio to bankfull width] (ft [none])	Mean pool length [ratio to bankfull width] (ft [none])	Mean pool spacing [ratio to bankfull width] (ft [none])	Mean riffle slope [ratio to channel slope] (ft/ft [none])
4	0.33	26.4 [2.7]	14.4 [1.5]	34.0 [3.4]	0.0351 [1.4]
5	0.35	17.7 [1.1]	41.3 [2.7]	62.9 [4.1]	0.0331 [2.7]
6	0.38	13.5 [1.2]	22.7 [2.1]	39.8 [3.6]	0.0268 [2.3]
12	2.62	25.2 [1.2]	29.5 [1.4]	33.0 [1.5]	0.0353 [2.7]

Table 5-5. Stream Morphology Pattern Measurements for Reference Streams, Ridge and Valley Ecoregion.

Site	Drainage area (mile^2)	Mean meander length [ratio to bankfull width] (ft [none])	Mean beltwidth [ratio to bankfull width] (ft [none])	Mean radius of curvature [ratio to bankfull width] (ft [none])
4	0.33	62 [6.3]	20 [2.0]	13 [1.3]
5	0.35	62 [4.0]	25 [1.6]	28 [1.8]
6	0.38	50 [4.5]	19 [1.7]	20 [1.8]
12	2.62	110 [5.0]	31 [1.4]	27 [1.2]
15*	36.4	526 [8.9]	299 [5.1]	167 [2.8]
16*	57.0	1031 [14.1]	664 [9.1]	203 [2.8]
17*	79.0	1575 [12.0]	837 [6.4]	577 [4.4]
18*	117	2729 [39.1]	1372 [19.7]	383 [5.5]

Note: * after site name indicates that pattern measurements were obtained from aerial photography due to the size of the river. Anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred within these larger rivers.

VI. ECOREGIONS 68/69

Morphological Stream Design and Assessment Tools for the Southwestern and Central Appalachians (Ecoregions 68/69) of Tennessee

Executive Summary

Reference stream morphology measurements represent tools that may be used to verify field bankfull determinations and to estimate design ranges for channel morphology in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

Based on field measurements from 22 reference streams with drainage areas ranging from 0.02 to 92 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 20.7\ DA^{0.761}$ $R^2 = 0.975$
$W_{bkf} = 15.9\ DA^{0.411}$ $R^2 = 0.961$
$d_{bkf} = 1.30\ DA^{0.348}$ $R^2 = 0.873$
$Q_{bkf} = 57.6\ DA^{0.869}$ $R^2 = 0.918$

Based on field measurements from selected reference streams with drainage areas ranging from 0.05 to 3.1 square miles, the riffle and pool lengths and pool spacing distances were found to be correlated to watershed drainage area. Riffle slopes were generally independent of drainage area. The ratio of riffle lengths to bankfull width ranged from 0.6 to 2.0, with a median of 1.1. Pool length ratios ranged from 1.6 to 2.5, with a median of 2.0. Pool spacing ratios ranged from 2.5 to 4.1, with a median of 2.6. The ratios of riffle slopes to channel slopes ranged from 0.9 to 5.3, with a median of 2.4.

Results of this study should be considered an initial database of reference stream morphology for this region. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

Stream Morphology Measurements and Analysis

Stream morphology data were collected at 22 reference streams in the Southwestern Appalachians and Central Appalachians ecoregions of Tennessee (EPA Level III Ecoregions 68 and 69, respectively), with drainage areas ranging from 0.02 to 92 square miles (Figures 6-1, 6-2, and 6-3, Table 6-1). Three of these streams were at United States Geological Survey (USGS) gage stations.

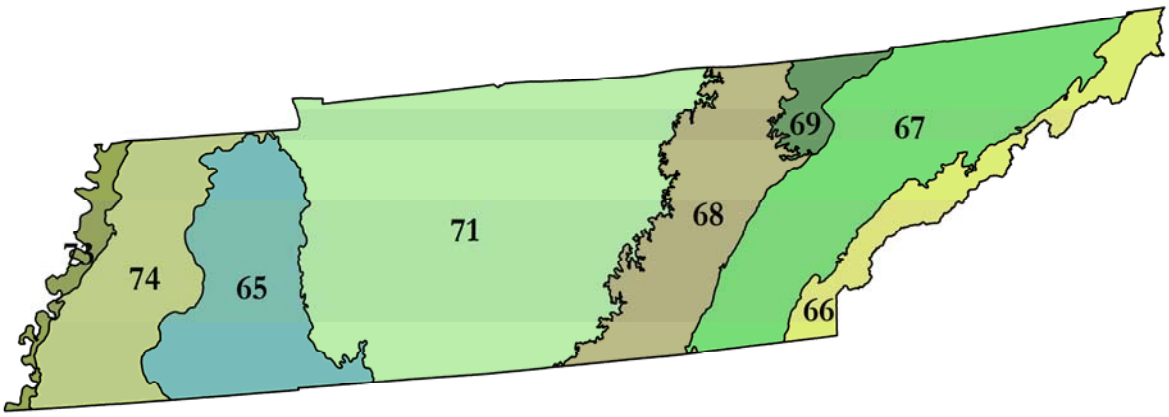


Figure 6-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Reference stream sites were selected based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had freely-formed meander patterns and discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

Reference streams were surveyed using total station and laser level survey equipment to measure longitudinal profiles and riffle cross-sections. Streams were classified using the Rosgen stream classification system (Rosgen, 1994). The study included 1 A, 4 B, 6 C, 10 E, and 1 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes listed in Table 6-2. The entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from 1.3 for the narrow-valley A, B, and F streams to greater than 5 for some of the alluvial C and E streams. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from less than 10 for the E streams to greater than 20 for some of the wide and shallow B and C streams. Reach channel slopes, measured using water surface elevation differences from the first riffle to the last riffle surveyed, ranged from 0.0006 ft/ft for the largest river to 0.1420 ft/ft for the smallest, steepest stream channel.

The streambed substrate was characterized through pebble counts and observations of dominant channel material. Of the 22 reference streams, the median streambed particle size (D_{50}) was classified as sand at 6 sites, gravel at 9 sites, cobble at 6 sites, and boulder at 1 site.

Appendix C contains detailed information about each of the 22 reference streams, including: photographs, longitudinal profile plots, and cross-section plots.

Figure 6-2. Representative stream in Ecoregion 68 (Site 7, UT Slave Falls).

Figure 6-3. Representative stream in Ecoregion 69 (Site 17, New River).

Bankfull Channel Dimensions

The measured bankfull riffle cross-sectional areas ranged from 2.8 to 835 square feet (Table 6-2), with the relationship between cross-sectional area (A_{bkf}) and drainage area (DA) shown in Figure 6-4. Similarly, the bankfull channel riffle widths (W_{bkf}) and mean depths (d_{bkf}) related to drainage area are shown in Figures 6-5 and 6-6. Two methods were used to estimate bankfull discharge for the streams.

When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method (Arcement and Schneider, 1989) (Table 6-3). The resulting bankfull discharge estimates are shown in relation to drainage area in Figure 6-7. In addition to bankfull discharge, Table 6-3 contains estimates of the 100-year discharge (USGS StreamStats, 2017) and estimates of average floodplain shear stress for the 100-year discharge. The regression equations for the hydraulic geometry regional curves for the Southwestern and Central Appalachians of Tennessee are summarized as follows:

$A_{bkf} = 20.7\ DA^{0.761}$ $R^2 = 0.975$
$W_{bkf} = 15.9\ DA^{0.411}$ $R^2 = 0.961$
$d_{bkf} = 1.30\ DA^{0.348}$ $R^2 = 0.873$
$Q_{bkf} = 57.6\ DA^{0.869}$ $R^2 = 0.918$

This set of regional curves for bankfull channel dimensions provides a tool for verifying bankfull stage in field surveys and for estimating dimensions in stream restoration projects in this region of Tennessee.

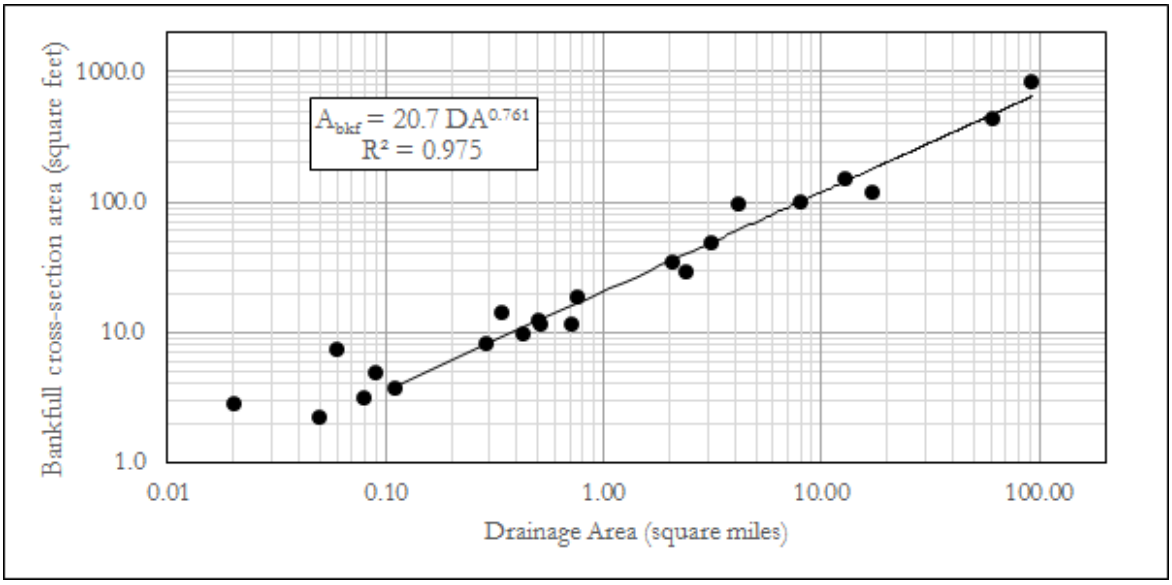


Figure 6-4. Bankfull riffle cross-section area related to drainage area for 22 Southwestern and Central Appalachians streams.

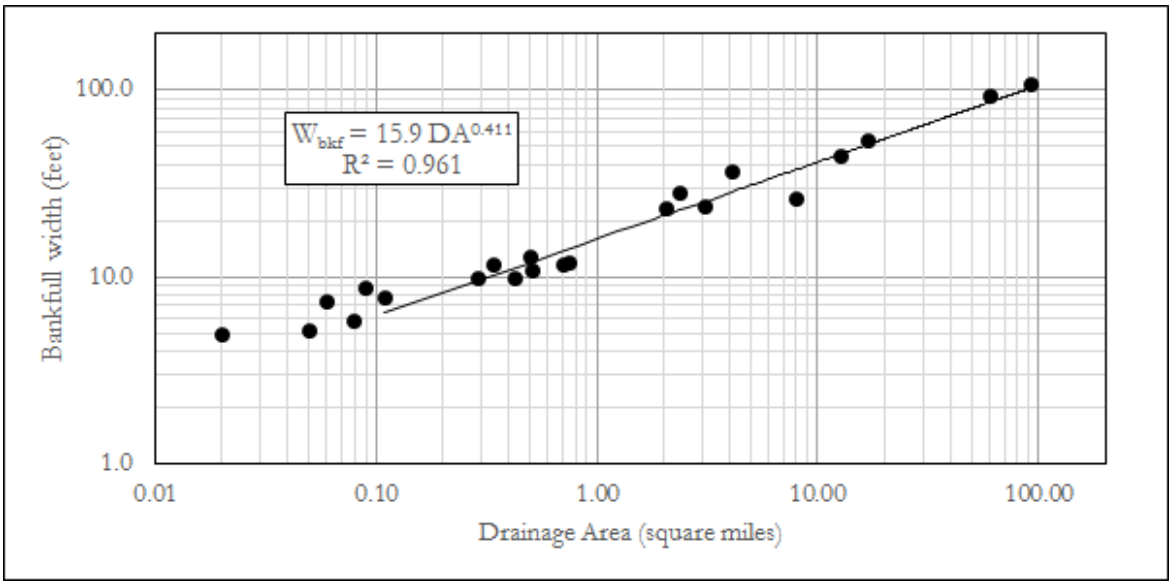


Figure 6-5. Bankfull riffle width related to drainage area for 22 Southwestern and Central Appalachians streams.

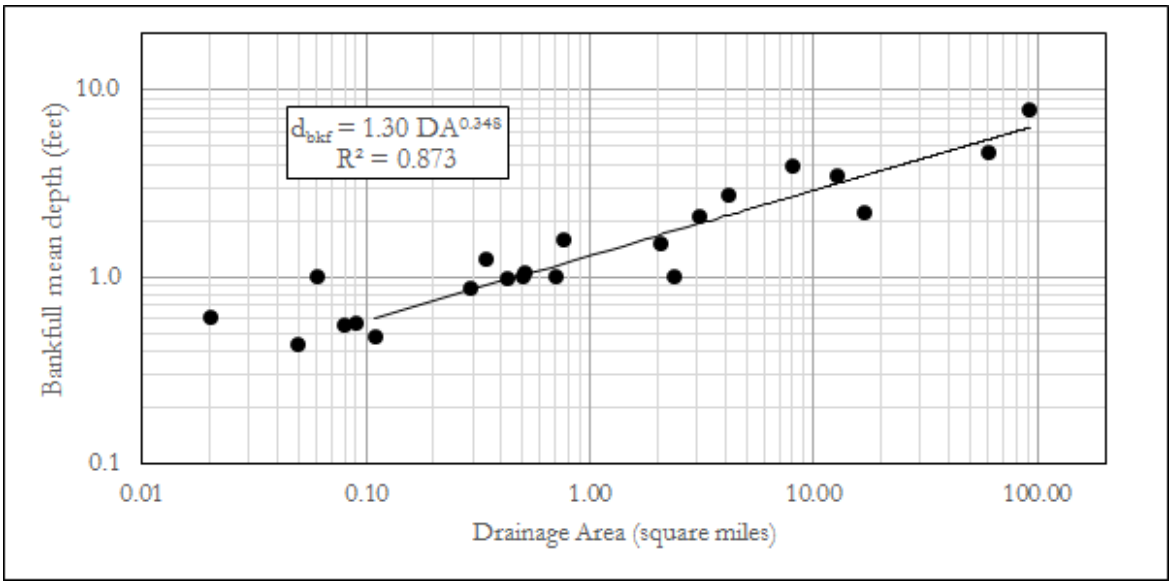


Figure 6-6. Bankfull riffle mean depth related to drainage area for 22 Southwestern and Central Appalachians streams.

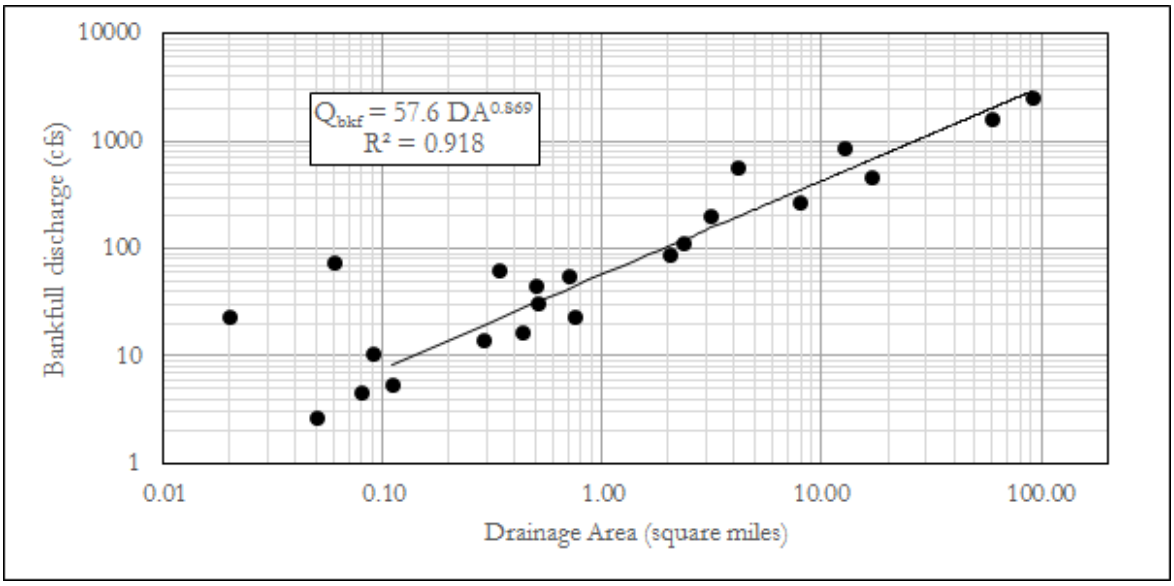


Figure 6-7. Estimated bankfull discharge related to drainage area for 22 Southwestern and Central Appalachians streams.

The following five EPA Level IV Ecoregions are found within the Southwestern and Central Appalachians of Tennessee (Figure 6-8):

68a: Cumberland Plateau
68b: Sequatchie Valley
68c: Plateau Escarpment
69d: Dissected Appalachian Plateau
69e: Cumberland Mountain Thrust Block

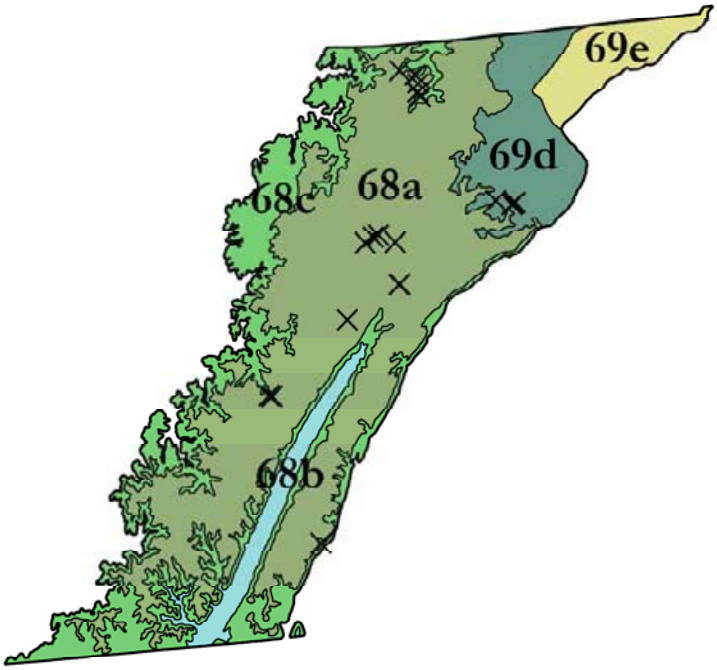


Figure 6-8. EPA Level IV Ecoregions within the Southwestern and Central Appalachians of Tennessee (USEPA, 2013), with reference stream sites marked.

Bedform Dimensions

Table 6-4 lists measured dimensions and slopes for bedform features (i.e., riffles, pools) for the reference streams that contained these features. The mean riffle and pool lengths listed in Table 6-4 represent the means of the measured longitudinal lengths of all the riffles and pools existing in each reference reach. These bedform lengths are shown in relation to drainage area in Figure 6-9. These same values are shown in relation to bankfull channel width in Figure 6-10. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

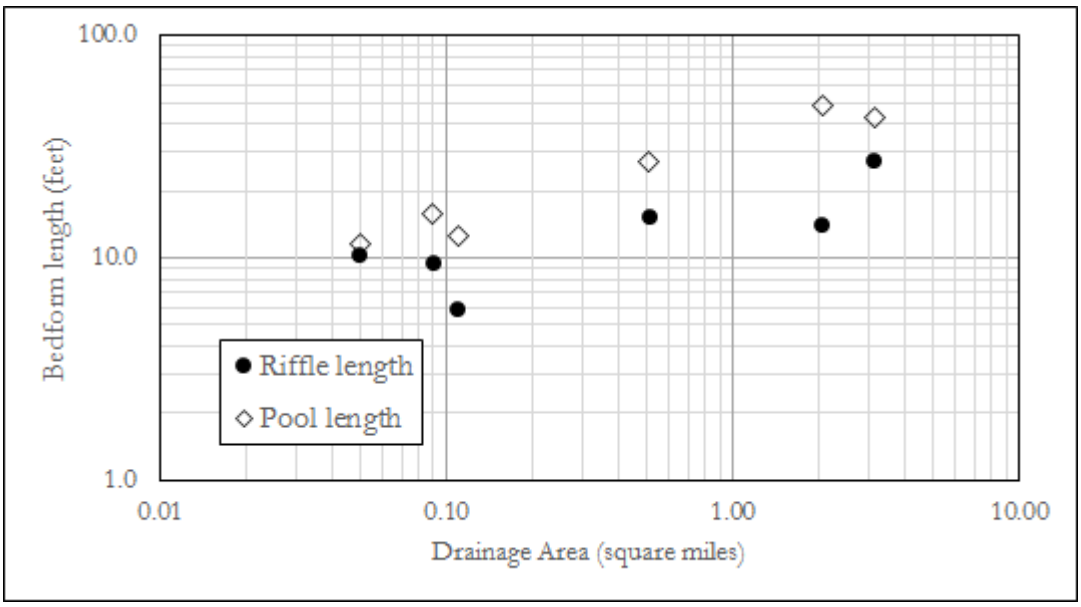


Figure 6-9. Mean riffle and pool length related to drainage area for Southwestern and Central Appalachians streams.

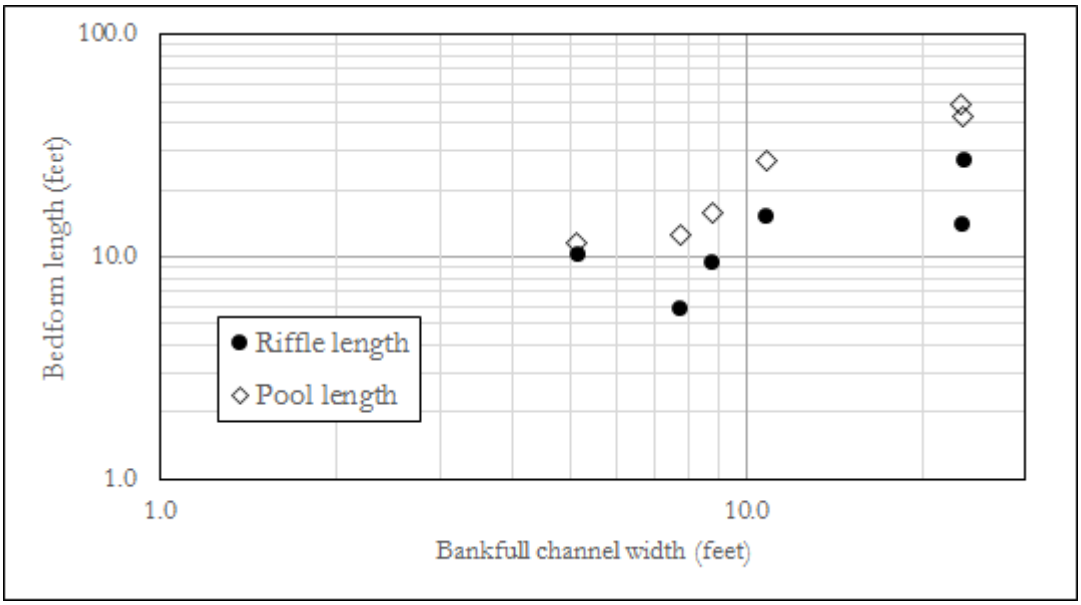


Figure 6-10. Mean riffle and pool length related to bankfull channel width for Southwestern and Central Appalachians streams.

Table 6-4 lists the ratios of riffle and pool length to bankfull width for each stream. Riffle length ratios ranged from 0.6 to 2.0, with a median of 1.1. Pool length ratios ranged from 1.6 to 2.5, with a median of 2.0. Table 6-4 also lists the mean spacing of pools found in each reference stream and the ratios of pool spacing to bankfull channel width. Values of pool spacing ratio ranged from 2.5 to 4.1, with a median of 2.6. Pool spacing values are shown in relation to bankfull channel width in Figure 6-11.

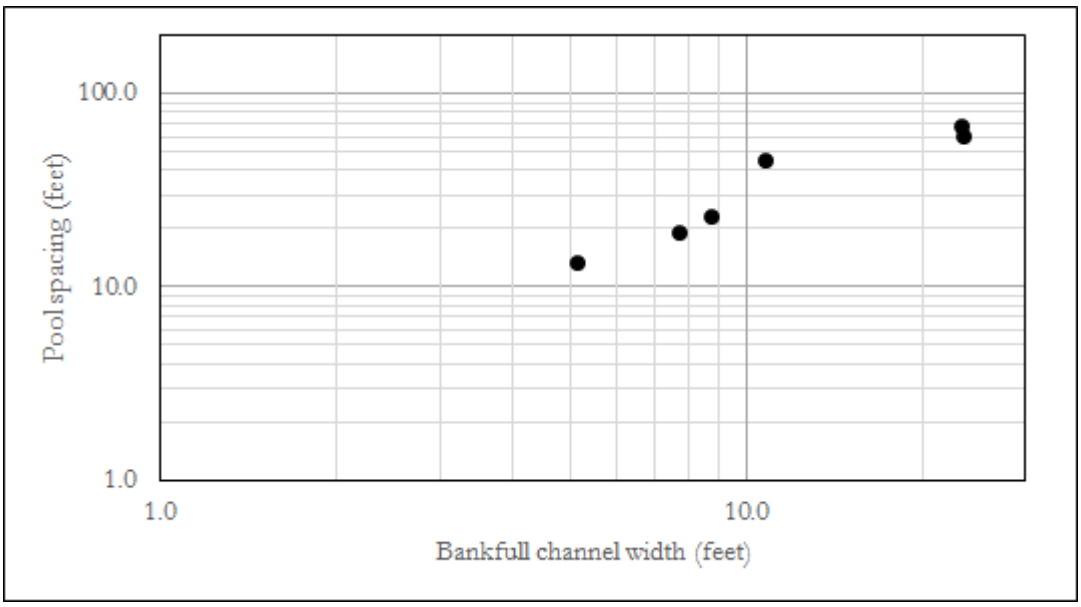


Figure 6-11. Mean pool spacing related to bankfull channel width for Southwestern and Central Appalachians streams.

Bedform Slopes

Table 6-4 lists the mean measured riffle slopes and ratios of riffle slope to overall reach slope. The values of riffle slope ratios ranged from 0.9 to 5.3, with a median of 2.4. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 6-12. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

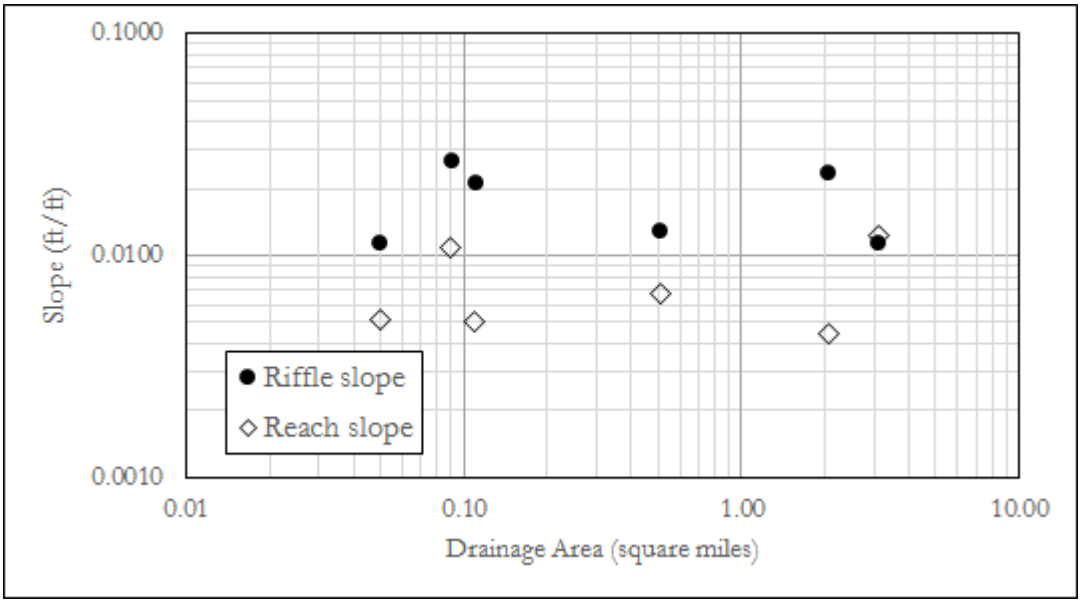


Figure 6-12. Reach channel slope and mean riffle slope related to drainage area for Southwestern and Central Appalachians streams.

Pattern

Pattern measurements (i.e., meander lengths, belt widths, and radii of curvature) are reported in Table 6-5 for sites in unconfined valleys with sinuosity greater than 1.10. These measurements were collected in the field for those sites with drainage area less than 8 square miles. Aerial photography was used for sites with drainage area greater than 8 square miles. Reported measurements for these larger rivers should be carefully evaluated, as anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred.

For the sites with drainage area less than 8 square miles, meander length ratios (meander length divided by bankfull width) range from 3.9 to 5.9, with a median of 4.3. Beltwidth ratios range from 1.7 to 3.8, with a median of 2.3. Radius of curvature ratios range from 1.5 to 2.7, with a median of 1.6.

Table 6-1. Morphology Reference Stream Summary, Southwestern and Central Appalachians Ecoregions.

Site	Stream name	Source/Location	Latitude	Longitude	EPA Level IV Ecoregion	Drainage area (mile^2)
1	UT1 New River	TDEC FECO69D01	36.120713	-84.432341	69d	0.02
2	UT Groom Branch	Big South Fork NRRA	36.450189	-84.708111	68a	0.05
3	UT2 New River	Frozen Head State Park	36.121060	-84.430431	69d	0.06
4	UT West Fork Coyte Branch	Big South Fork NRRA	36.463306	-84.714556	68a	0.08
5	UT Weaver Branch	Cumberland County	35.934432	-84.859921	68a	0.09
6	UT Bee Ridge Creek	Catoosa WMA	36.075083	-84.931611	68a	0.11
7	UT Slave Falls	Big South Fork NRRA	36.531368	-84.769519	68c	0.29
8	Underwood Branch	Catoosa WMA	36.079056	-84.911972	68a	0.34
9	West Fork Coyte Branch	Big South Fork NRRA	36.463139	-84.714583	68a	0.43
10	Coon Creek	Fall Creek Falls State Park	35.666057	-85.356841	68c	0.50
11	Weaver Branch	Cumberland County	35.936126	-84.857636	68a	0.51
12	Flatrock Branch	Frozen Head State Park	36.123561	-84.424819	69d	0.71
13	Bandy Creek	Big South Fork NRRA	36.489056	-84.710028	68a	0.76
14	Black House Branch	Big South Fork NRRA	36.515389	-84.716944	68c	2.05
15	Flat Fork	Frozen Head State Park	36.136792	-84.487200	69d	2.37
16	Rockhouse Creek	Fall Creek Falls State Park	35.663490	-85.346584	68a	3.11
17	New River	Frozen Head State Park	36.125320	-84.420904	69d	4.15
18	Basses Creek	USGS Gage 3538970	35.850888	-85.055245	68a	8.07
19	Laurel Fork	Big South Fork NRRA	36.513783	-84.715431	68c	12.7
20	Otter Creek	Catoosa WMA	36.053528	-84.856222	68a	16.9
21	North Chickamauga Creek	USGS Gage 3566525	35.237027	-85.234943	68c	60.6
22	Obed River	USGS Gage 3538830	36.061667	-84.961389	68a	91.8

Table 6-2. Morphology Dimensions for Reference Streams, Southwestern and Central Appalachians Ecoregions.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Bankfull width (ft)	Bankfull mean depth (ft)	Width/ depth ratio	Entrenchment ratio	Sinuosity	Stream classification
1	0.02	0.1420	2.8	4.9	0.6	8.5	1.4	1.01	A4a+
2	0.05	0.0051	2.2	5.1	0.4	12.0	5.2	1.07	E5
3	0.06	0.0928	7.4	7.3	1.0	7.3	4.7	1.02	E4a
4	0.08	0.0071	3.2	5.7	0.6	10.4	5.2	1.28	E5
5	0.09	0.0108	5.0	8.7	0.6	15.5	3.3	1.32	C4
6	0.11	0.0050	3.7	7.7	0.5	16.4	4.9	1.10	C5
7	0.29	0.0038	8.3	9.7	0.9	11.3	6.6	1.03	E5
8	0.34	0.0282	14.4	11.6	1.2	9.4	2.8	1.01	E3b
9	0.43	0.0040	9.6	9.8	1.0	10.0	4.8	1.14	E5
10	0.50	0.0272	12.5	12.8	1.0	13.2	2.0	1.04	B3
11	0.51	0.0067	11.4	10.8	1.1	10.4	1.5	1.10	B4c
12	0.71	0.0262	11.5	11.6	1.0	11.7	3.1	1.06	E4b
13	0.76	0.0018	18.4	11.8	1.6	7.5	3.5	1.20	E5
14	2.05	0.0044	35.0	23.3	1.5	15.9	5.2	1.78	C4
15	2.37	0.0165	29.3	28.1	1.0	27.0	1.3	1.05	B3c
16	3.11	0.0124	49.3	23.5	2.1	11.4	6.9	1.02	E3b
17	4.15	0.0080	96.8	36.0	2.7	13.4	5.2	1.02	C4
18	8.07	0.0012	101.2	26.0	3.9	6.7	6.4	1.10	E4
19	12.7	0.0047	150.5	43.6	3.4	12.6	2.6	1.02	C4
20	16.9	0.0065	117.5	53.0	2.2	23.9	2.9	1.01	C3
21	60.6	0.0311	432.9	93.3	4.6	20.1	1.4	1.02	B2
22	91.8	0.0006	835.4	107.8	7.8	13.9	1.8	1.12	F3

Table 6-3. Discharge Estimates for Reference Streams, Southwestern and Central Appalachians Ecoregions.

Site	Drainage area ($mile^2$)	Channel slope (ft/ft)	Cross-section area (ft^2)	Manning's n	Bankfull mean velocity (ft/sec)	Bankfull discharge (cfs)	100-year discharge (cfs)	100-year floodplain shear stress (lbs/ft^2)
1	0.02	0.1420	2.8	0.040	8.33	23.3	42.5	9.3
2	0.05	0.0051	2.2	0.045	1.21	2.7	75.8	0.6
3	0.06	0.0928	7.4	0.040	9.72	71.9	133	5.3
4	0.08	0.0071	3.2	0.052	1.45	4.6	139	1.2
5	0.09	0.0108	5.0	0.047	2.07	10.3	109	1.4
6	0.11	0.0050	3.7	0.040	1.48	5.4	104	0.6
7	0.29	0.0038	8.3	0.045	1.65	13.8	330	0.7
8	0.34	0.0282	14.4	0.058	4.37	63.0	235	3.3
9	0.43	0.0040	9.6	0.048	1.71	16.4	447	1.1
10	0.50	0.0272	12.5	0.060	3.64	45.3	315	4.6
11	0.51	0.0067	11.4	0.041	2.73	31.1	352	2.5
12	0.71	0.0262	11.5	0.045	4.78	55.0	929	7.1
13	0.76	0.0018	18.4	0.059	1.24	22.7	636	0.9
14	2.05	0.0044	35.0	0.048	2.48	86.7	1490	1.9
15	2.37	0.0165	29.3	0.050	3.75	110	1100	5.5
16	3.11	0.0124	49.3	0.060	4.05	199	1190	1.9
17	4.15	0.0080	96.8	0.040	5.84	566	2990	2.3
18	8.07	0.0012	101.2	0.040	2.68	271	2090	0.5
19	12.7	0.0047	150.5	0.038	5.55	836	5030	2.9
20	16.9	0.0065	117.5	0.050	3.86	454	3650	2.5
21	60.6	0.0311	432.9	--	3.70	1600	11300	15.9
22	91.8	0.0006	835.4	0.043	3.03	2534	12300	0.9

Note: Absence of Manning's n in table indicates that bankfull discharge was derived from the long-term flow record at a USGS gage station.

Table 6-4. Stream Morphology Bedform Measurements for Reference Streams, Southwestern and Central Appalachians Ecoregions.

Site	Drainage area (mile^2)	Mean riffle length [ratio to bankfull width] (ft [none])	Mean pool length [ratio to bankfull width] (ft [none])	Mean pool spacing [ratio to bankfull width] (ft [none])	Mean riffle slope [ratio to channel slope] (ft/ft [none])
2	0.05	10.3 [2.0]	11.5 [2.2]	13.3 [2.6]	0.0115 [2.3]
5	0.09	9.5 [1.1]	16.0 [1.8]	23.1 [2.6]	0.0266 [2.5]
6	0.11	5.9 [0.8]	12.5 [1.6]	19.2 [2.5]	0.0212 [4.2]
11	0.51	15.2 [1.4]	27.0 [2.5]	44.8 [4.1]	0.0129 [1.9]
14	2.05	14.2 [0.6]	48.3 [2.1]	67.1 [2.9]	0.0235 [5.3]
16	3.11	27.4 [1.2]	43.2 [1.8]	59.8 [2.5]	0.0115 [0.9]

Table 6-5. Stream Morphology Pattern Measurements for Reference Streams, Southwestern and Central Appalachians Ecoregions.

Site	Drainage area (mile^2)	Mean meander length [ratio to bankfull width] (ft [none])	Mean beltwidth [ratio to bankfull width] (ft [none])	Mean radius of curvature [ratio to bankfull width] (ft [none])
5	0.09	37 [4.2]	21 [2.4]	13 [1.5]
6	0.11	30 [3.9]	13 [1.7]	12 [1.6]
9	0.43	49 [5.0]	23 [2.3]	18 [1.8]
11	0.51	64 [5.9]	24 [2.2]	29 [2.7]
14	2.05	100 [4.3]	88 [3.8]	36 [1.5]
18*	8.07	933 [35.9]	306 [11.8]	366 [14.1]
22*	91.8	2618 [24.3]	522 [4.8]	855 [7.9]

Note: * after site name indicates that pattern measurements were obtained from aerial photography due to the size of the river. Anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred within these larger rivers.

VII. ECOREGION 71

Morphological Stream Design and Assessment Tools for the Interior Plateau (Ecoregion 71) of Tennessee

Executive Summary

Reference stream morphology measurements represent tools that may be used to verify field bankfull determinations and to estimate design ranges for channel morphology in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

Based on field measurements from 36 reference streams with drainage areas ranging from 0.02 to 107 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 24.6\ DA^{0.658}$ $R^2 = 0.976$
$W_{bkf} = 19.8\ DA^{0.349}$ $R^2 = 0.934$
$d_{bkf} = 1.25\ DA^{0.307}$ $R^2 = 0.931$
$Q_{bkf} = 91.2\ DA^{0.687}$ $R^2 = 0.925$

Based on field measurements from selected reference streams with drainage areas ranging from 0.03 to 2.3 square miles, the riffle and pool lengths, pool spacing distances, and slopes of the riffles and channels were found to be correlated to watershed drainage area. The ratio of riffle lengths to bankfull width ranged from 0.7 to 3.5, with a median of 1.4. Pool length ratios ranged from 0.8 to 6.2, with a median of 1.7. Pool spacing ratios ranged from 1.8 to 9.0, with a median of 3.6. The ratios of riffle slopes to channel slopes ranged from 0.8 to 3.9, with a median of 2.1.

Results of this study should be considered an initial database of reference stream morphology for this region. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

Stream Morphology Measurements and Analysis

Stream morphology data were collected at 36 reference streams in Interior Plateau ecoregion of Tennessee (EPA Level III Ecoregion 71), with drainage areas ranging from 0.02 to 107 square miles (Figures 7-1 and 7-2, Table 7-1). Twelve of these streams were at United States Geological Survey (USGS) gage stations.

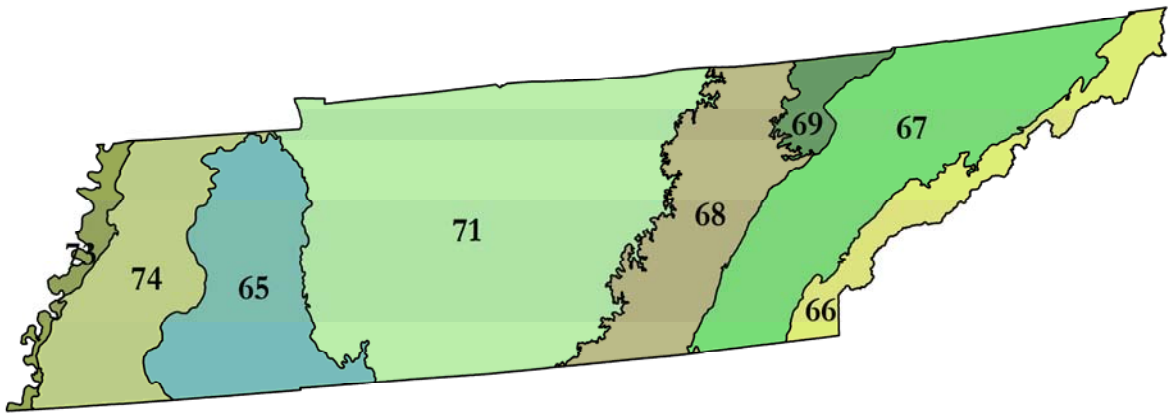


Figure 7-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Reference stream sites were selected based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had freely-formed meander patterns and discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

Reference streams were surveyed using total station and laser level survey equipment to measure longitudinal profiles and riffle cross-sections. Streams were classified using the Rosgen stream classification system (Rosgen, 1994). The study included 6 B, 21 C, 7 E, and 2 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes listed in Table 7-2. The entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from just over 1 for the narrow-valley B and F streams to greater than 6 for some of the alluvial C and E streams. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from less than 10 for the E streams to greater than 20 for the wide and shallow C streams. Reach channel slopes, measured using water surface elevation differences from the first riffle to the last riffle surveyed, ranged from 0.0014 ft/ft for the larger rivers to 0.0814 ft/ft for the steepest stream channel.

The streambed substrate was characterized through pebble counts and observations of dominant channel material. Of the 36 reference streams, the median streambed particle size (D_{50}) was classified as gravel at 23 sites, cobble at 6 sites, and bedrock at 7 sites.

Appendix D contains detailed information about each of the 36 reference streams, including: photographs, longitudinal profile plots, and cross-section plots.

Figure 7-2. Representative stream in Ecoregion 71 (Site 13, UT1 Woodhaven Lake).

Bankfull Channel Dimensions

The measured bankfull riffle cross-sectional areas ranged from 0.8 to 675 square feet (Table 7-2), with the relationship between cross-sectional area (A_{bkf}) and drainage area (DA) shown in Figure 7-3. Similarly, the bankfull channel riffle widths (W_{bkf}) and mean depths (d_{bkf}) related to drainage area are shown in Figures 7-4 and 7-5. Two methods were used to estimate bankfull discharge for the streams. When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method (Arcement and Schneider, 1989) (Table 7-3). The resulting bankfull discharge estimates are shown in relation to drainage area in Figure 7-6. In addition to bankfull discharge, Table 7-3 contains estimates of the 100-year discharge (USGS StreamStats, 2017) and estimates of average floodplain shear stress for the 100-year discharge. The regression equations for the hydraulic geometry regional curves for the Interior Plateau Tennessee are summarized as follows (Note: sites with DA less than 0.10 square miles were excluded from the following regression equations, due to high variability in channel dimensions):

$A_{bkf} = 24.6\ DA^{0.658}$ $R^2 = 0.976$
$W_{bkf} = 19.8\ DA^{0.349}$ $R^2 = 0.934$
$d_{bkf} = 1.25\ DA^{0.307}$ $R^2 = 0.931$
$Q_{bkf} = 91.2\ DA^{0.687}$ $R^2 = 0.925$

This set of regional curves for bankfull channel dimensions provides a tool for verifying bankfull stage in field surveys and for estimating dimensions in stream restoration projects in this region of Tennessee.

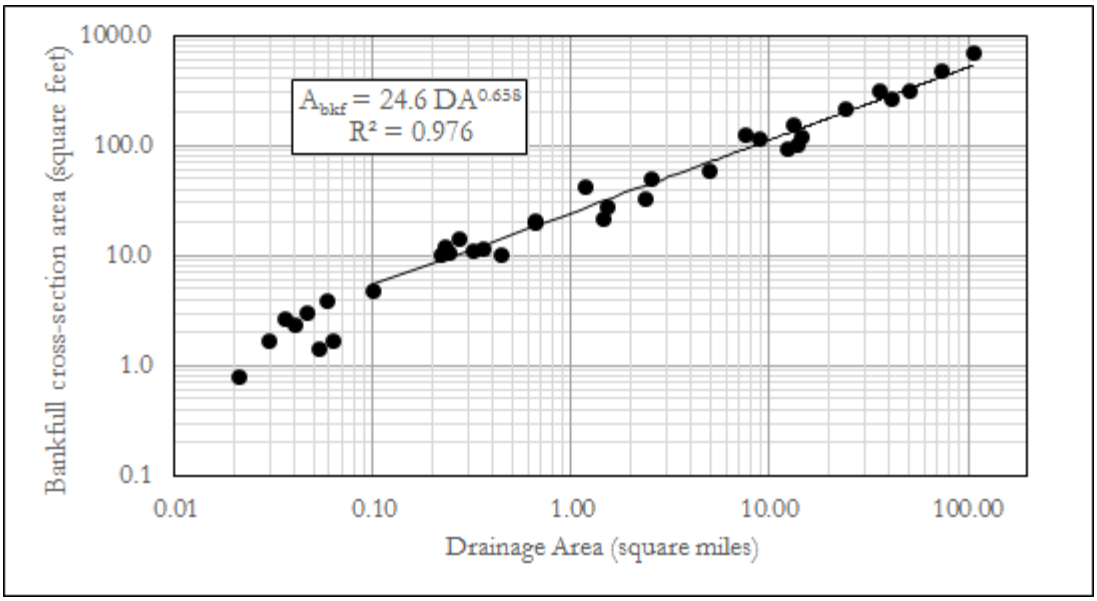


Figure 7-3. Bankfull riffle cross-section area related to drainage area for 36 Interior Plateau streams.

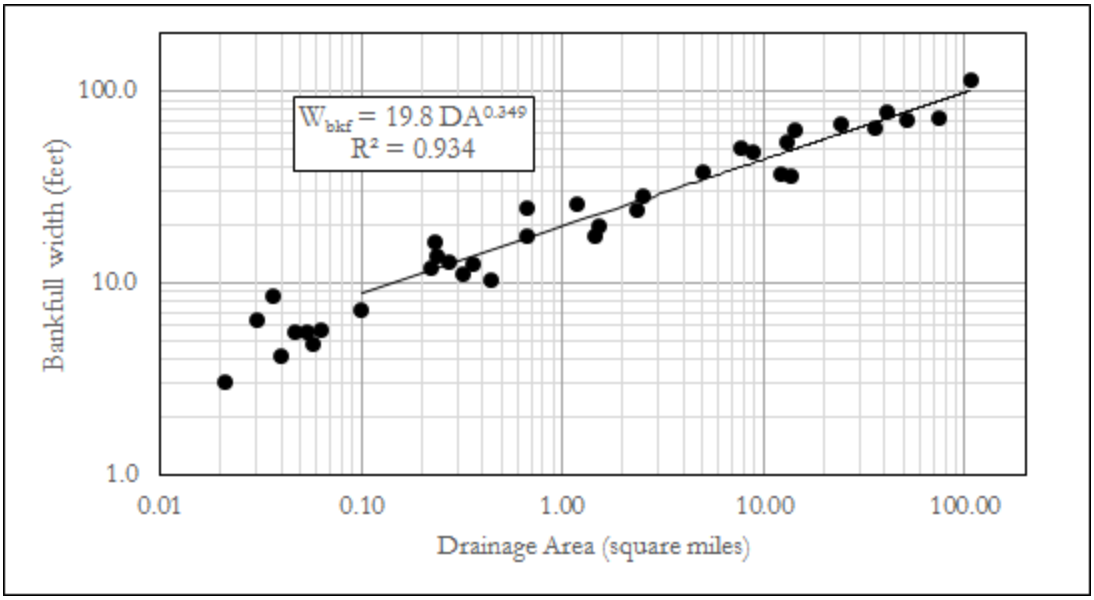


Figure 7-4. Bankfull riffle width related to drainage area for 36 Interior Plateau streams.

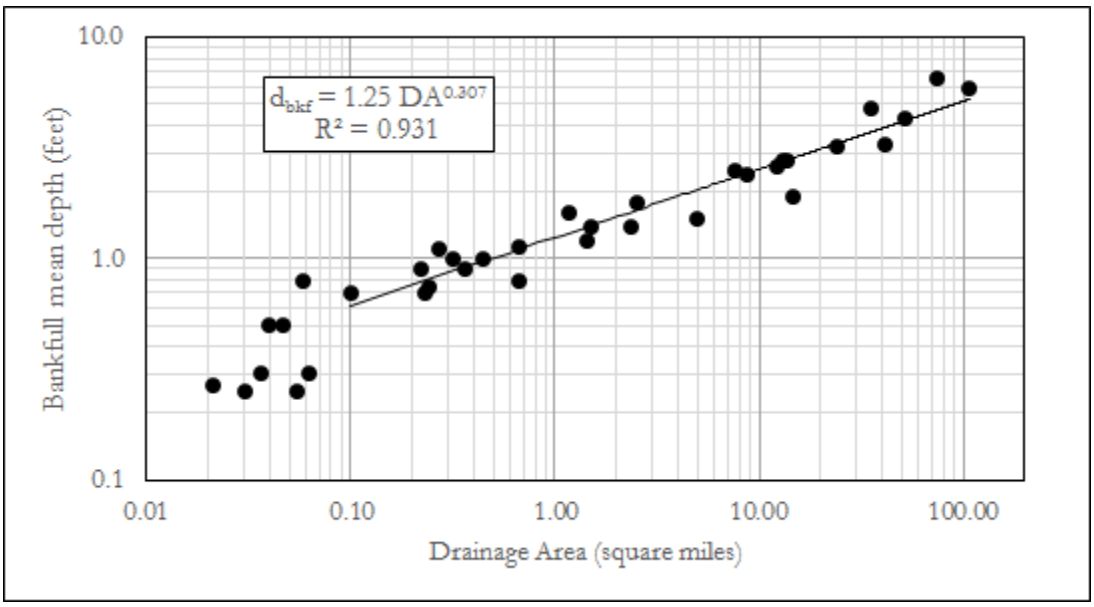


Figure 7-5. Bankfull riffle mean depth related to drainage area for 36 Interior Plateau streams.

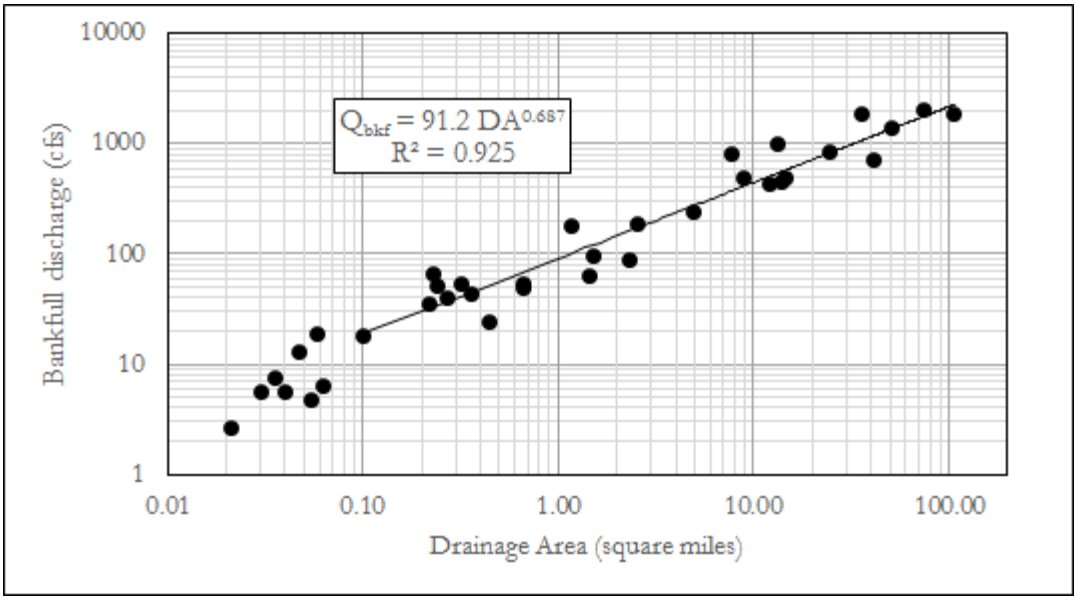


Figure 7-6. Estimated bankfull discharge related to drainage area for 36 Interior Plateau streams.

The following five EPA Level IV Ecoregions are found within the Interior Plateau of Tennessee (Figure 7-7):

71e: Western Pennyroyal Karst
71f: Western Highland Rim
71g: Eastern Highland Rim
71h: Outer Nashville Basin
71i: Inner Nashville Basin

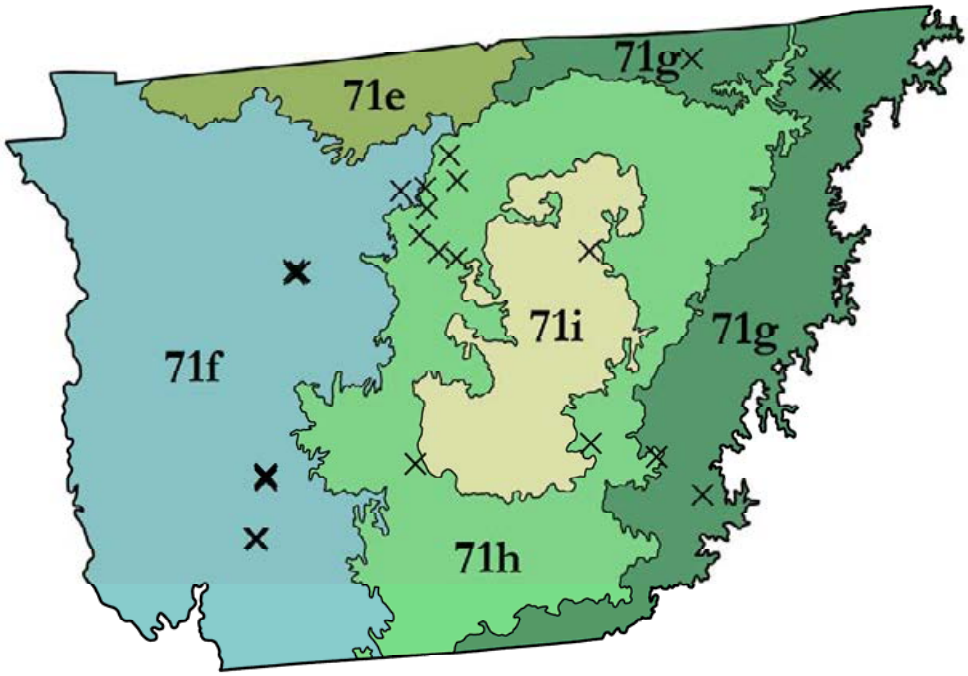


Figure 7-7. EPA Level IV Ecoregions within the Interior Plateau of Tennessee (USEPA, 2013), with reference stream sites marked.

Study sites were located within EPA Level IV Ecoregions 71f, 71g, 71h, and 71i. Figure 7-8 shows the regional curve for channel cross-section area, with data symbols corresponding to the appropriate EPA Level IV ecoregion. There was very little difference in cross-section dimensions among EPA Level IV ecoregions, suggesting that the composite regional curves for the Interior Plateau (Figures 7-3 through 7-6) could be applied throughout Ecoregion 71.

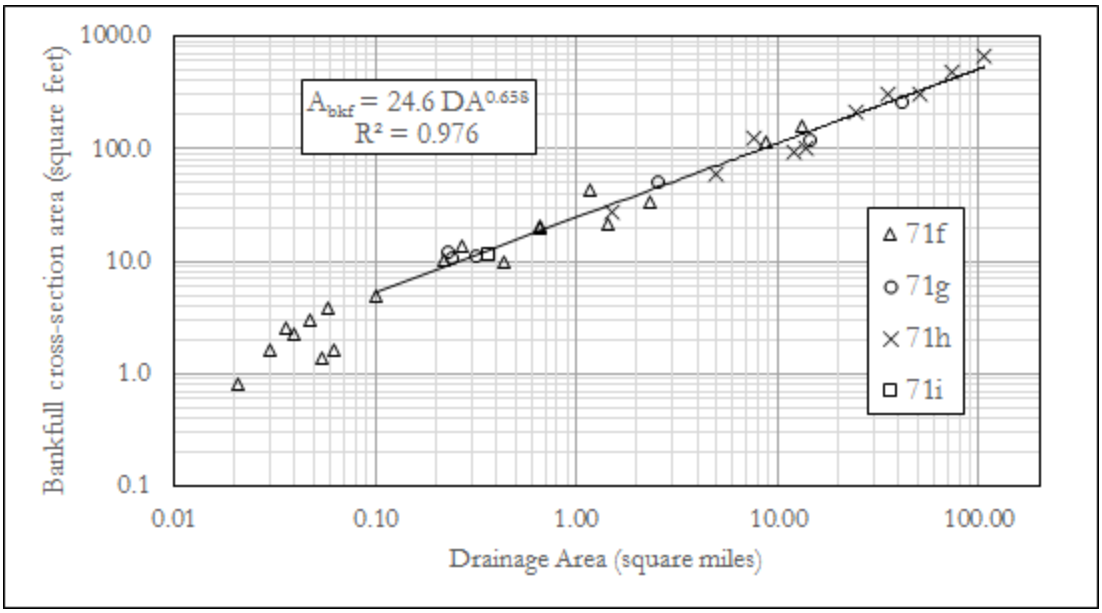


Figure 7-8. Bankfull riffle cross-section area related to drainage area for 36 Interior Plateau streams, with different symbols for each EPA Level IV Ecoregion.

Bedform Dimensions

Table 7-4 lists measured dimensions and slopes for bedform features (i.e., riffles, pools) for the reference streams that contained these features. The mean riffle and pool lengths listed in Table 7-4 represent the means of the measured longitudinal lengths of all the riffles and pools existing in each reference reach. These bedform lengths are shown in relation to drainage area in Figure 7-9. The regression lines are not parallel for pool and riffle bedforms, indicating that, as drainage area increases, the rate of change in pool lengths is greater than that for riffle lengths. These same values are shown in relation to bankfull channel width in Figure 7-10. The power function exponents shown on these figures indicate the degree of non-linearity in these relationships. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

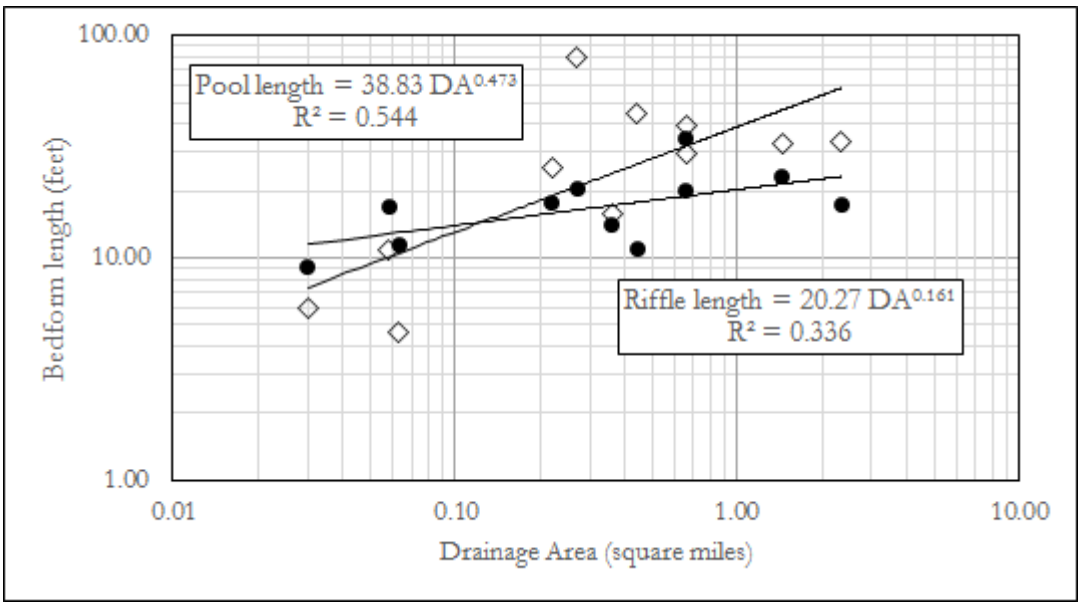


Figure 7-9. Mean riffle and pool length related to drainage area for Interior Plateau streams.

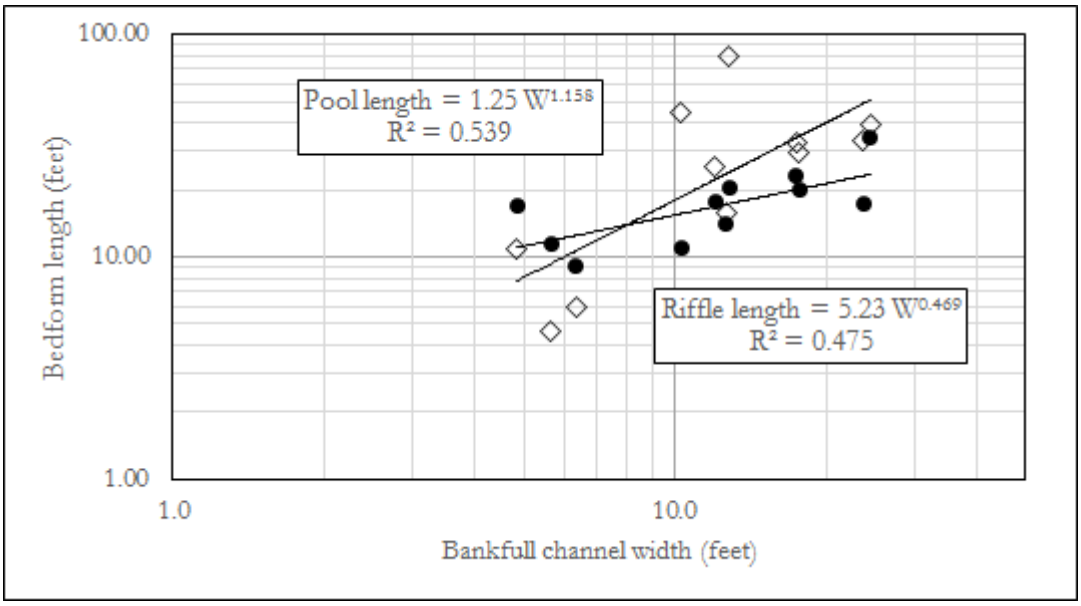


Figure 7-10. Mean riffle and pool length related to bankfull channel width for Interior Plateau streams.

Table 7-4 lists the ratios of riffle and pool length to bankfull width for each stream. Riffle length ratios ranged from 0.7 to 3.5, with a median of 1.4. Pool length ratios ranged from 0.8 to 6.2, with a median of 1.7. Table 7-4 also lists the mean spacing of pools found in each reference stream and the ratios of pool spacing to bankfull channel width. Values of pool spacing ratio ranged from 1.8 to 9.0, with a median of 3.6. Most pool spacing ratios were between 3 and 5 times riffle bankfull width, regardless of channel slope. Pool spacing values are shown in relation to bankfull channel width in Figure 7-11.

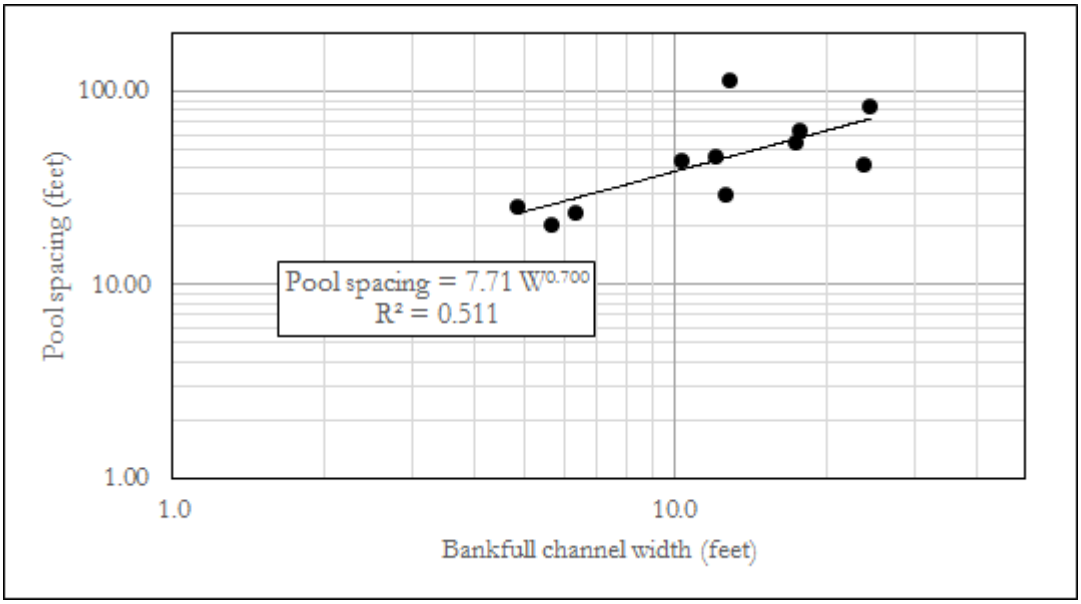


Figure 7-11. Mean pool spacing related to bankfull channel width for Interior Plateau streams.

Bedform Slopes

Table 7-4 lists the mean measured riffle slopes and ratios of riffle slope to overall reach slope. The values of riffle slope ratios ranged from 0.8 to 3.9, with a median of 2.1. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 7-12. The regression lines are not parallel for the two slopes, indicating that smaller, steeper channels contain riffles with slopes approximating the overall channel slope. In the larger, flatter streams, the riffle slopes are generally 2 to 4 times as steep as the overall channel slope. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

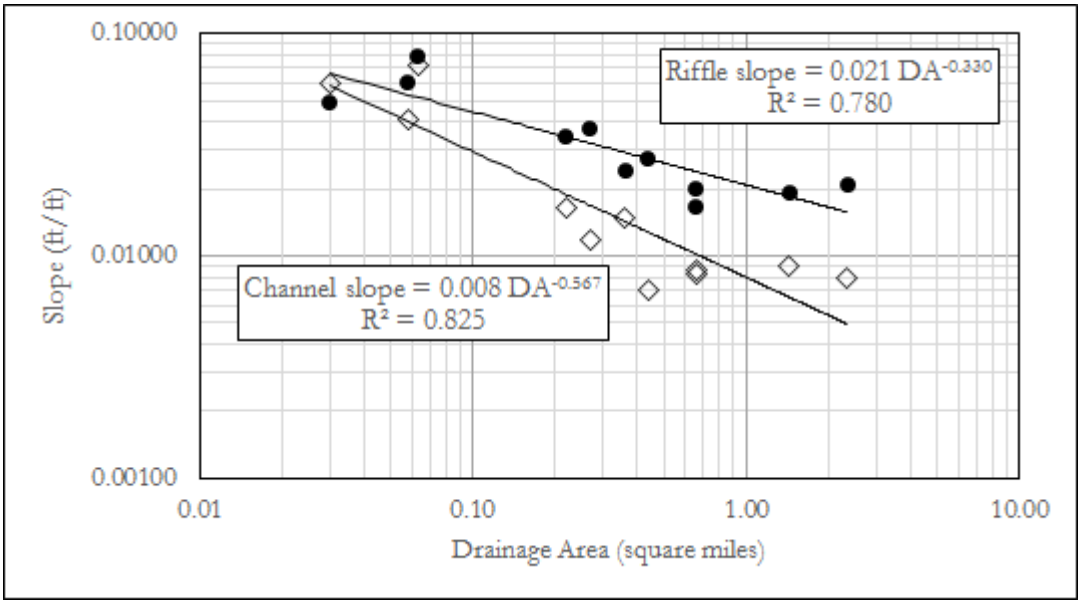


Figure 7-12. Reach channel slope and mean riffle slope related to drainage area for Interior Plateau streams.

Pattern

Pattern measurements (i.e., meander lengths, belt widths, and radii of curvature) are reported in Table 7-5 for sites in unconfined valleys with sinuosity greater than 1.10. These measurements were collected in the field for those sites with drainage area less than 10 square miles. Aerial photography was used for sites with drainage area greater than 10 square miles. Reported measurements for these larger rivers should be carefully evaluated, as anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred.

For the sites with drainage area less than 10 square miles, meander length ratios (meander length divided by bankfull width) ranged from 3.1 to 10.0, with a median of 6.9. Beltwidth ratios ranged from 1.7 to 3.4, with a median of 2.7. Radius of curvature ratios ranged from 1.5 to 4.2, with a median of 2.5.

Table 7-1. Morphology Reference Stream Summary, Interior Plateau Ecoregion.

Site	Stream name	Source/Location	Latitude	Longitude	EPA Level IV Ecoregion	Drainage area (mile^2)
1	UT6 Little Swan Creek	Natchez Trace Parkway	35.522566	-87.451521	71f	0.02
2	UT2 Little Swan Creek	Natchez Trace Parkway	35.519570	-87.456770	71f	0.03
3	UT3 Little Swan Creek	Natchez Trace Parkway	35.512135	-87.455704	71f	0.04
4	UT UT2 Woodhaven Lake	Montgomery Bell State Park	36.073430	-87.283140	71f	0.04
5	UT Little Buffalo River	Laurel Hill WMA	35.352084	-87.505361	71f	0.05
6	UT7 Little Swan Creek	Natchez Trace Parkway	35.517061	-87.456661	71f	0.05
7	UT5 Little Swan Creek	Natchez Trace Parkway	35.525536	-87.457892	71f	0.06
8	UT4 Little Swan Creek	Natchez Trace Parkway	35.513963	-87.455846	71f	0.06
9	UT UT1 Woodhaven Lake	Montgomery Bell State Park	36.076054	-87.275324	71f	0.10
10	Ham Branch	Laurel Hill WMA	35.356584	-87.512692	71f	0.22
11	UT2 Bryans Fork	Standing Stone State Park	36.456187	-85.420767	71g	0.23
12	UT1 Bryans Fork	Standing Stone State Park	36.458705	-85.426768	71g	0.24
13	UT1 Woodhaven Lake	Montgomery Bell State Park	36.076194	-87.275732	71f	0.27
14	UT Morgan Creek	Standing Stone State Park	36.449308	-85.392042	71g	0.32
15	East Fork Hurricane Creek	TDEC FECO71I04	36.055688	-86.277492	71i	0.36
16	UT2 Woodhaven Lake	Montgomery Bell State Park	36.073827	-87.283168	71f	0.44
17	UT Little Marrowbone Creek	TDEC FECO71F04	36.272148	-86.902682	71f	0.66
18	UT3 Woodhaven Lake	Montgomery Bell State Park	36.081146	-87.294231	71f	0.66
19	UT1 Little Swan Creek	Natchez Trace Parkway	35.527900	-87.456635	71f	1.18
20	Weaver Branch	Laurel Hill WMA	35.355438	-87.502046	71f	1.44
21	West Fork Brown Creek	USGS Gage 3431100	36.093543	-86.793250	71h	1.51
22	Will Hall Creek	Montgomery Bell State Park	36.071609	-87.294206	71f	2.34
23	Bryans Fork	Standing Stone State Park	36.457484	-85.425834	71g	2.53
24	Mansker Creek	USGS Gage 3426387	36.355880	-86.724127	71h	4.97
25	Dry Creek	USGS Gage 3426470	36.284345	-86.705335	71h	7.64
26	Little Swan Creek	TDEC ECO71F28	35.529466	-87.453971	71f	8.82
27	Sevenmile Creek	USGS Gage 3431040	36.072007	-86.733542	71h	12.2
28	Little Buffalo River	Laurel Hill WMA	35.352696	-87.503928	71f	13.2
29	Whites Creek	USGS Gage 3431530	36.273604	-86.817171	71h	13.8
30	Salt Lick Creek	USGS Gage 3312259	36.551887	-85.857300	71g	14.5
31	Richland Creek	USGS Gage 3431700	36.144459	-86.852688	71h	24.3
32	Wartrace Creek	USGS Gage 3597590	35.526917	-86.340099	71h	35.7

33	Bradley Creek	USGS Gage 3578500	35.356352	-85.978926	71g	41.3
34	Whites Creek	USGS Gage 3431599	36.216224	-86.819321	71h	51.3
35	Fountain Creek	USGS Gage 3599450	35.518370	-86.942251	71h	74.0
36	Duck River	USGS Gage 3596000	35.471141	-86.121514	71h	107

Table 7-2. Morphology Dimensions for Reference Streams, Interior Plateau Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Bankfull width (ft)	Bankfull mean depth (ft)	Width/ depth ratio	Entrenchment ratio	Sinuosity	Stream classification
1	0.02	0.0814	0.8	3.0	0.3	11.8	4.9	1.05	C4a
2	0.03	0.0597	1.7	6.4	0.3	23.8	2.8	1.06	C4a
3	0.04	0.0440	2.6	8.6	0.3	27.8	4.3	1.03	C4a
4	0.04	0.0108	2.3	4.2	0.5	7.8	13.1	1.05	E4
5	0.05	0.0419	3.0	5.5	0.5	10.1	3.7	1.02	E4a
6	0.05	0.0623	1.4	5.5	0.3	22.3	4.4	1.08	C4a
7	0.06	0.0406	3.8	4.9	0.8	6.2	2.7	1.13	E4a
8	0.06	0.0714	1.7	5.7	0.3	19.0	2.3	1.01	B4a
9	0.10	0.0310	4.9	7.3	0.7	11.3	4.2	1.02	E4b
10	0.22	0.0166	10.3	12.0	0.9	14.0	4.2	1.03	C4
11	0.23	0.0455	12.1	16.3	0.7	21.9	1.6	1.03	B3a
12	0.24	0.0339	10.6	13.9	0.8	18.6	2.3	1.06	C3b
13	0.27	0.0117	13.9	12.8	1.1	11.8	2.6	1.46	E4
14	0.32	0.0260	11.0	11.0	1.0	11.0	1.7	1.03	B3
15	0.36	0.0147	11.6	12.7	0.9	13.8	5.9	1.04	C4
16	0.44	0.0070	10.0	10.3	1.0	10.7	3.1	1.15	E4
17	0.66	0.0084	19.6	24.5	0.8	30.7	1.4	1.02	B4c
18	0.66	0.0086	20.3	17.7	1.1	15.5	5.0	1.27	C4
19	1.18	0.0090	42.2	25.8	1.6	15.8	3.7	1.02	C4
20	1.44	0.0090	21.3	17.4	1.2	14.3	6.3	1.12	C4
21	1.51	0.0178	27.2	20.0	1.4	14.8	1.7	1.09	B3c
22	2.34	0.0079	33.2	23.8	1.4	17.0	4.0	1.37	C4
23	2.53	0.0046	50.1	28.4	1.8	16.1	5.1	1.05	C4
24	4.97	0.0056	58.9	38.0	1.5	24.6	1.2	1.05	F1
25	7.64	0.0073	126.1	50.5	2.5	20.2	2.4	1.05	C1
26	8.82	0.0055	113.3	48.1	2.4	20.4	3.1	1.30	C4
27	12.2	0.0039	94.3	36.7	2.6	14.3	3.1	1.03	C1
28	13.2	0.0072	155.5	54.9	2.8	19.4	3.5	1.02	C4
29	13.8	0.0031	102.4	36.0	2.8	12.6	1.2	1.02	F1
30	14.5	0.0024	118.7	62.3	1.9	32.7	2.4	1.25	C1
31	24.3	0.0074	215.5	66.8	3.2	20.7	3.5	1.06	C4

32	35.7	0.0030	311.4	65.0	4.8	13.6	3.7	1.14	C1
33	41.3	0.0014	260.0	78.6	3.3	23.8	2.4	1.15	C4
34	51.3	0.0022	305.1	70.4	4.3	16.3	1.5	1.04	B1c
35	74.0	0.0022	472.0	72.6	6.5	11.2	2.2	1.55	E3
36	107	0.0014	675.1	114.2	5.9	19.3	5.6	1.78	C3

Table 7-3. Discharge Estimates for Reference Streams, Interior Plateau Ecoregion.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Manning's n	Bankfull mean velocity (ft/sec)	Bankfull discharge (cfs)	100-year discharge (cfs)	100-year floodplain shear stress (lbs/ft^2)
1	0.02	0.0814	0.8	0.047	3.33	2.7	58.7	5.09
2	0.03	0.0597	1.7	0.042	3.35	5.5	72.1	4.28
3	0.04	0.0440	2.6	0.047	2.86	7.4	75.7	2.17
4	0.04	0.0108	2.3	0.037	2.42	5.6	258	1.36
5	0.05	0.0419	3.0	0.042	4.32	13.0	97.5	3.45
6	0.05	0.0623	1.4	0.042	3.35	4.7	117	5.01
7	0.06	0.0406	3.8	0.042	5.01	19.0	112	5.26
8	0.06	0.0714	1.7	0.042	3.89	6.4	116	7.40
9	0.10	0.0310	4.9	0.047	3.77	18.3	147	2.84
10	0.22	0.0166	10.3	0.047	3.35	34.5	271	1.96
11	0.23	0.0455	12.1	0.045	5.47	66.1	353	6.92
12	0.24	0.0339	10.6	0.045	4.74	50.3	352	5.04
13	0.27	0.0117	13.9	0.054	2.83	39.3	325	2.78
14	0.32	0.0260	11.0	0.045	4.76	52.3	443	6.46
15	0.36	0.0147	11.6	0.042	3.70	43.0	445	1.91
16	0.44	0.0070	10.0	0.045	2.41	23.9	469	2.14
17	0.66	0.0084	19.6	0.042	2.67	52.5	643	2.50
18	0.66	0.0086	20.3	0.058	2.42	49.2	584	1.63
19	1.18	0.0090	42.2	0.042	4.31	182	951	1.85
20	1.44	0.0090	21.3	0.050	2.95	62.9	1060	1.92
21	1.51	0.0178	27.2	--	3.46	94.0	1310	6.99
22	2.34	0.0079	33.2	0.058	2.66	88.4	1430	2.64
23	2.53	0.0046	50.1	0.037	3.68	184	1900	1.39
24	4.97	0.0056	58.9	0.035	4.03	237	3180	4.24
25	7.64	0.0073	126.1	--	6.46	814	4480	3.53
26	8.82	0.0055	113.3	0.043	4.28	485	3930	2.75
27	12.2	0.0039	94.3	0.035	4.56	430	7528	3.20
28	13.2	0.0072	155.5	0.037	6.41	996	4860	2.78
29	13.8	0.0031	102.4	0.035	4.31	441	7110	4.64
30	14.5	0.0024	118.7	--	4.04	480	5140	1.73
31	24.3	0.0074	215.5	--	3.85	829	11066	4.22

32	35.7	0.0030	311.4	0.035	6.04	1881	15453	2.84
33	41.3	0.0014	260.0	--	2.69	700	7624	1.29
34	51.3	0.0022	305.1	0.038	4.56	1391	16500	3.67
35	74.0	0.0022	472.0	0.052	4.20	1980	19500	4.12
36	107	0.0014	675.1	--	2.78	1880	46121	2.42

Note: Absence of Manning's n in table indicates that bankfull discharge was derived from the long-term flow record at a USGS gage station.

Table 7-4. Stream Morphology Bedform Measurements for Reference Streams, Interior Plateau Ecoregion.

Site	Drainage area (mile^2)	Mean riffle length [ratio to bankfull width] (ft [none])	Mean pool length [ratio to bankfull width] (ft [none])	Mean pool spacing [ratio to bankfull width] (ft [none])	Mean riffle slope [ratio to channel slope] (ft/ft [none])
2	0.03	9.1 [1.4]	5.9 [0.9]	23.8 [3.7]	0.0493 [0.8]
7	0.06	17.1 [3.5]	10.8 [2.2]	25.2 [5.2]	0.0598 [1.5]
8	0.06	11.4 [2.0]	4.6 [0.8]	20.6 [3.6]	0.0791 [1.1]
10	0.22	17.8 [1.5]	25.5 [2.1]	45.9 [3.8]	0.0341 [2.1]
13	0.27	20.7 [1.6]	79.3 [6.2]	115.8 [9.0]	0.0376 [3.2]
15	0.36	14.0 [1.1]	15.8 [1.2]	29.5 [2.3]	0.0244 [1.7]
16	0.44	10.9 [1.1]	44.3 [4.3]	44.2 [4.3]	0.0272 [3.9]
17	0.66	34.4 [1.4]	39.5 [1.6]	84.4 [3.4]	0.0167 [2.0]
18	0.66	20.1 [1.1]	29.4 [1.7]	62.7 [3.5]	0.0200 [2.3]
20	1.44	23.0 [1.3]	32.6 [1.9]	54.1 [3.1]	0.0193 [2.2]
22	2.34	17.3 [0.7]	33.7 [1.4]	42.3 [1.8]	0.0208 [2.6]

Table 7-5. Stream Morphology Pattern Measurements for Reference Streams, Interior Plateau Ecoregion.

Site	Drainage area (mile^2)	Mean meander length [ratio to bankfull width] (ft [none])	Mean beltwidth [ratio to bankfull width] (ft [none])	Mean radius of curvature [ratio to bankfull width] (ft [none])
7	0.06	49 [10.0]	15 [3.0]	14 [2.8]
13	0.27	95 [7.4]	44 [3.4]	34 [2.7]
16	0.44	81 [7.9]	23 [2.3]	43 [4.2]
18	0.66	94 [5.3]	52 [2.9]	30 [1.7]
20	1.44	109 [6.3]	41 [2.4]	41 [2.3]
22	2.34	73 [3.1]	41 [1.7]	36 [1.5]
30*	14.5	2084 [33.5]	411 [6.6]	593 [9.5]
32*	35.7	1170 [18.0]	233 [3.6]	233 [3.6]
33*	41.3	781 [9.9]	235 [3.0]	289 [3.7]
35*	74.0	1630 [22.5]	721 [9.9]	332 [4.6]
36*	107	2644 [23.2]	1025 [9.0]	407 [3.6]

Note: * after site name indicates that pattern measurements were obtained from aerial photography due to the size of the river. Anthropomorphic impacts to pattern (e.g., straightening, channel realignment) have likely occurred within these larger rivers.

VIII. ECOREGIONS 65/74

Morphological Stream Design and Assessment Tools for the Southeastern and Mississippi Valley Loess Plains (Ecoregions 65/74) of Tennessee

Executive Summary

Reference stream morphology measurements represent tools that may be used to verify field bankfull stage determinations and to plan and evaluate design ranges for channel morphology in restoration projects. This study documents alluvial stream morphology measurements from 14 reference streams and 3 USGS-gaged streams in the Southeastern and Mississippi Valley Loess Plains (EPA Level III Ecoregions 65 and 74). The reference streams included in this study were selected based upon their natural equilibrium conditions indicated by floodplain connectivity, freely-formed meander pattern, bedform diversity, and well-vegetated stable streambanks. The gaged streams were included to document bankfull dimensions and estimated discharges of larger stable streams in this region.

Based on field measurements from 17 reference and gaged streams with drainage areas ranging from 0.09 to 68 square miles, bankfull channel cross-section area, width, mean depth, and estimated discharge were found to be strongly correlated to watershed drainage area. The regression hydraulic geometry regional curve relationships are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf}) in cubic feet per second:

$A_{bkf} = 21.5\ DA^{0.696}$ $R^2 = 0.921$
$W_{bkf} = 16.1\ DA^{0.342}$ $R^2 = 0.844$
$d_{bkf} = 1.34\ DA^{0.354}$ $R^2 = 0.945$
$Q_{bkf} = 46.2\ DA^{0.818}$ $R^2 = 0.875$

Field measurements of longitudinal profiles from selected small reference streams with drainage areas ranging from 0.09 to 0.16 square miles were used to evaluate riffle and pool lengths, pool spacings, and riffle slopes. The ratios of riffle lengths to bankfull widths ranged from 1.2 to 2.3, with a median of 1.3. Pool length ratios ranged from 2.0 to 3.2, with a median of 2.7. Pool spacing ratios ranged from 3.3 to 5.1, with a median of 4.5. The ratios of riffle slopes to channel slopes ranged from 2.1 to 3.5, with a median of 3.4. The narrow range of drainage areas represented in this study precludes strong conclusions from the regression equations for this data set.

Results of this study should be considered an initial database of reference stream morphology for this region. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

Stream Morphology Measurements and Analysis

Stream morphology data were collected at 17 reference and gaged streams in the Southeastern Plains and Mississippi Valley Loess Plains ecoregions of Tennessee (EPA Level III Ecoregions 65 and 74, respectively), with drainage areas ranging from 0.09 to 68 square miles (Figures 8-1, 8-2, and 8-3, Table 8-1). Three of these streams were at United States Geological Survey (USGS) gage stations.

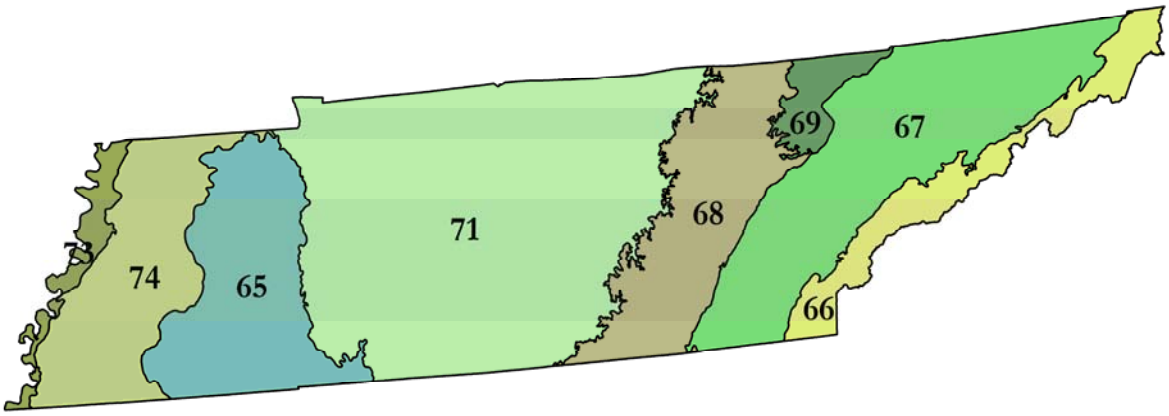


Figure 8-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Reference stream sites were selected based on the following guidelines:

1. Channels were well-connected to alluvial floodplains with little evidence of incision
2. Channels had freely-formed meander patterns and discernable bedform features including riffles and pools
3. Streambanks and floodplains were well-vegetated with little evidence of erosion
4. Upstream watersheds were rural with mostly forest and agricultural land uses
5. Reference reaches were stable and unconfined for a longitudinal length of at least 20 times bankfull width

Reference streams were surveyed using a total station to measure longitudinal profiles and riffle cross-sections. Streams were classified using the Rosgen stream classification system (Rosgen, 1994). The study included 4 B, 3 C, 9 E, and 1 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes listed in Table 8-2. The entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from 1.3 for the narrow-valley F stream to greater than 10 for many of the C and E streams. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from less than 10 for many of the E streams to greater than 14 for some of the wide and shallow B and C streams. Reach channel slopes, measured using water surface elevation differences from the first riffle to the last riffle surveyed, ranged from 0.0011 ft/ft for two of the larger rivers to 0.0126 ft/ft for one of the smallest stream channels. The streambed substrate was characterized through observations of dominant channel material. Of the 17 reference streams, the median streambed particle size (D_{50}) was classified as sand at 15 sites and gravel at 2 sites.

Appendix E contains detailed information about each of the 17 reference streams, including: photographs, longitudinal profile plots, and cross-section plots.

Figure 8-2. Representative stream in Ecoregion 65 (Site 3, UT Tuscumbia River).

Figure 8-3. Representative stream in Ecoregion 74 (Site 4, UT3 Barnishee Bayou).

Bankfull Channel Dimensions

The measured bankfull riffle cross-sectional areas ranged from 3.9 to 699 square feet (Table 8-2), with the relationship between cross-sectional area (A_{bkf}) and drainage area (DA) shown in Figure 8-4. Similarly, the bankfull channel riffle widths (W_{bkf}) and mean depths (d_{bkf}) related to drainage area are

shown in Figures 8-5 and 8-6. Two methods were used to estimate bankfull discharge for the streams. When available, the long-term USGS flow record was reviewed to determine the discharge associated with the bankfull stage identified in the field. For the ungaged streams, the Manning equation was applied using estimates for roughness (Manning's n) based on the Cowan method (Arcement and Schneider, 1989) (Table 8-3). The resulting bankfull discharge estimates are shown in relation to drainage area in Figure 8-7. The regression equations for the hydraulic geometry regional curves for the Southeastern and Mississippi Valley Loess Plains of Tennessee are summarized as follows:

$A_{bkf} = 21.5\ DA^{0.696}$ $R^2 = 0.921$
$W_{bkf} = 16.1\ DA^{0.342}$ $R^2 = 0.844$
$d_{bkf} = 1.34\ DA^{0.354}$ $R^2 = 0.945$
$Q_{bkf} = 46.2\ DA^{0.818}$ $R^2 = 0.875$

This set of regional curves for bankfull channel dimensions provides a tool for verifying bankfull stage in field surveys and for estimating dimensions in stream restoration projects in these regions of Tennessee.

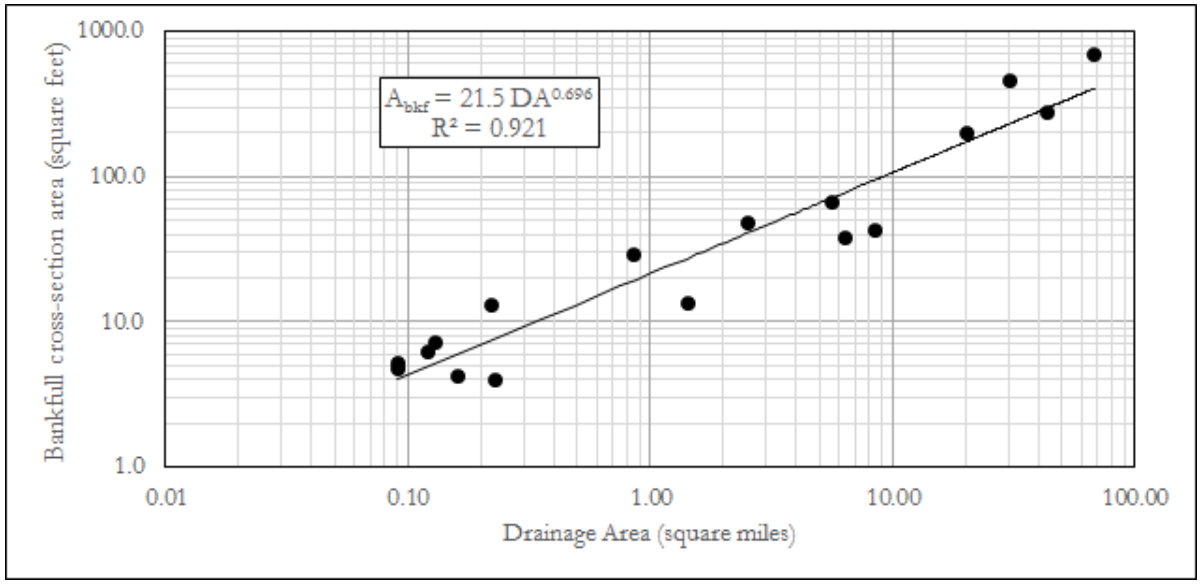


Figure 8-4. Bankfull riffle cross-section area related to drainage area for 17 Southeastern and Mississippi Valley Loess Plains streams.

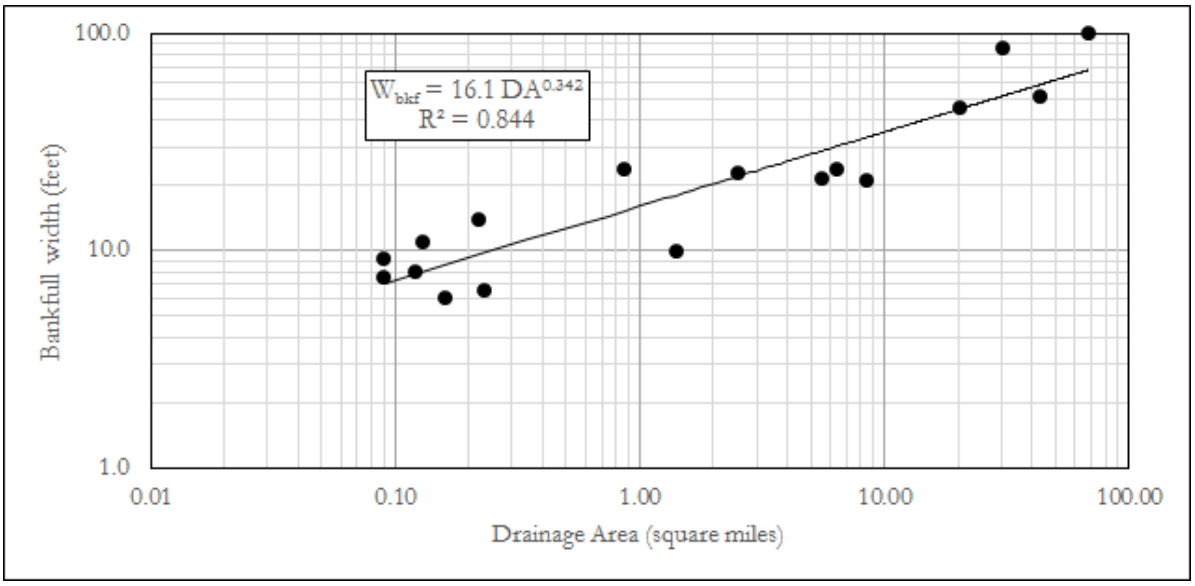


Figure 8-5. Bankfull riffle width related to drainage area for 17 Southeastern and Mississippi Valley Loess Plains streams.

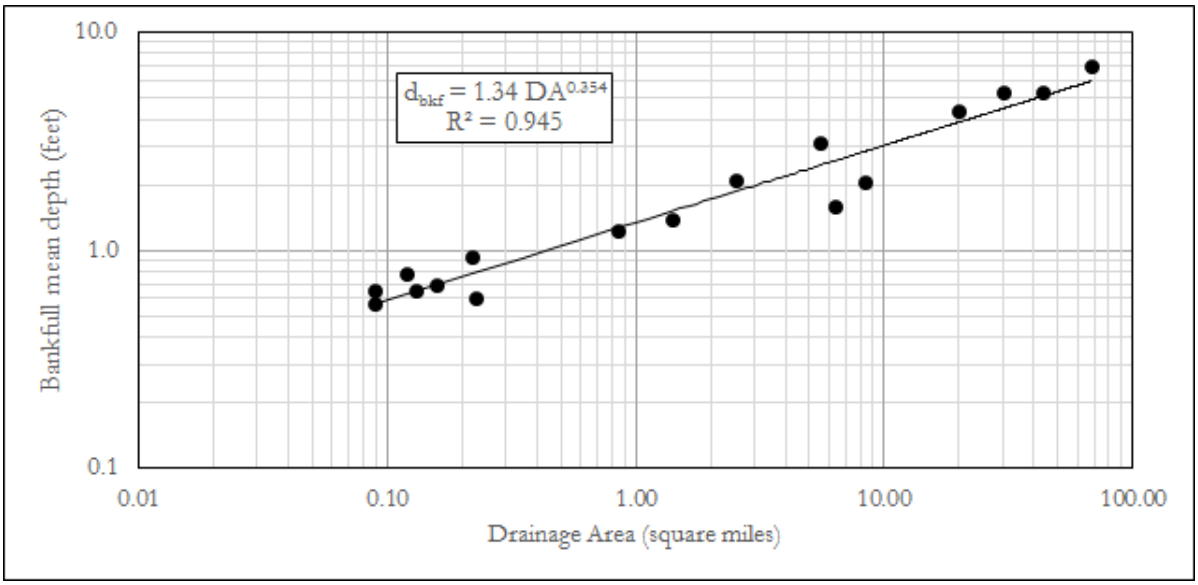


Figure 8-6. Bankfull riffle mean depth related to drainage area for 17 Southeastern and Mississippi Valley Loess Plains streams.

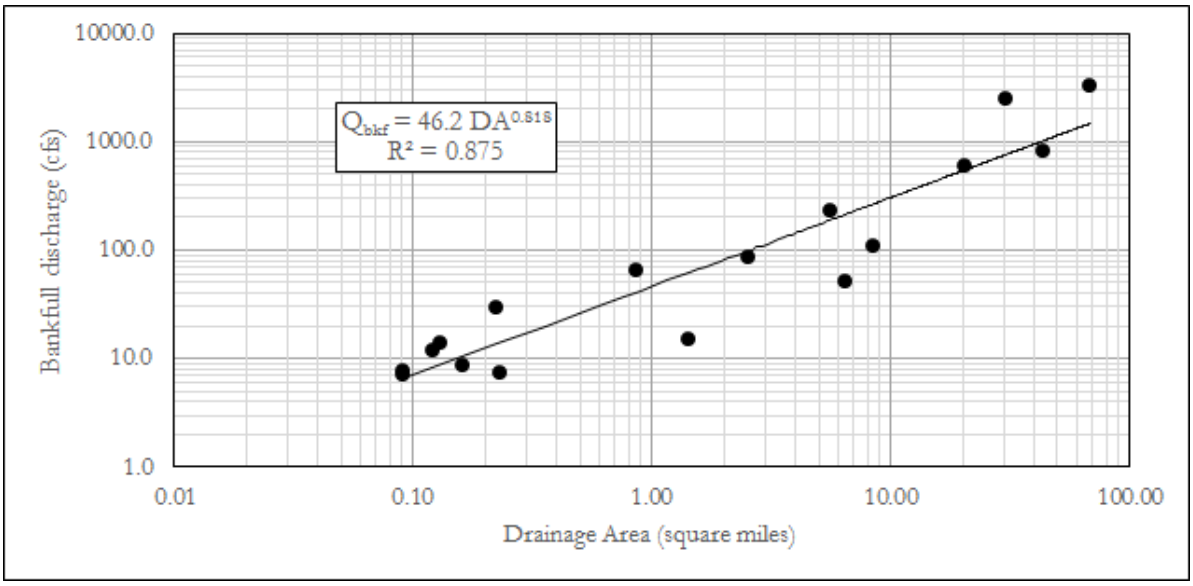


Figure 8-7. Estimated bankfull discharge related to drainage area for 17 Southeastern and Mississippi Valley Loess Plains streams.

The following seven EPA Level IV Ecoregions are found within the Southeastern and Mississippi Valley Loess Plains of Tennessee (Figure 8-8):

65a: Blackland Prairie
65b: Flatwoods/Blackland Prairie Margins
65e: Northern Hilly Gulf Coastal Plain
65i: Fall Line Hills
65j: Transition Hills
74a: Bluff Hills
74b: Loess Plains

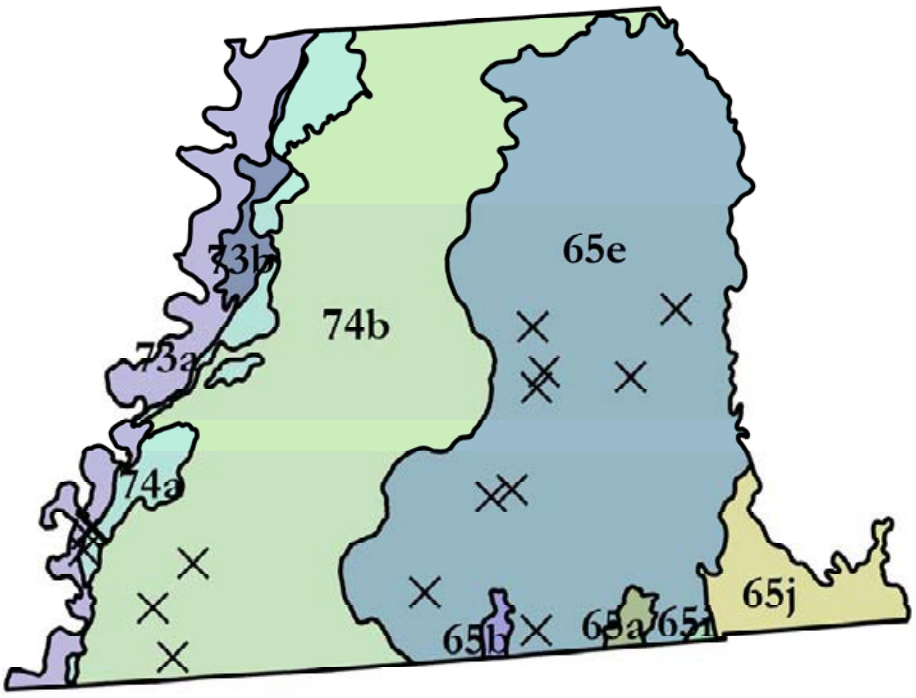


Figure 8-8. EPA Level IV Ecoregions within the Southeastern and Mississippi Valley Loess Plains of Tennessee (USEPA, 2013), with reference stream sites marked. (Note: Ecoregion 73, Northern Mississippi Alluvial Plain, is also shown for reference.)

Bedform Dimensions

Table 8-4 lists measured dimensions and slopes for bedform features (i.e., riffles, pools) for the reference streams that contained these features. The mean riffle and pool lengths listed in Table 8-4 represent the means of the measured longitudinal lengths of all the riffles and pools existing in each reference reach. These bedform lengths are shown in relation to drainage area in Figure 8-9, and in relation to bankfull channel width in Figure 8-10. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

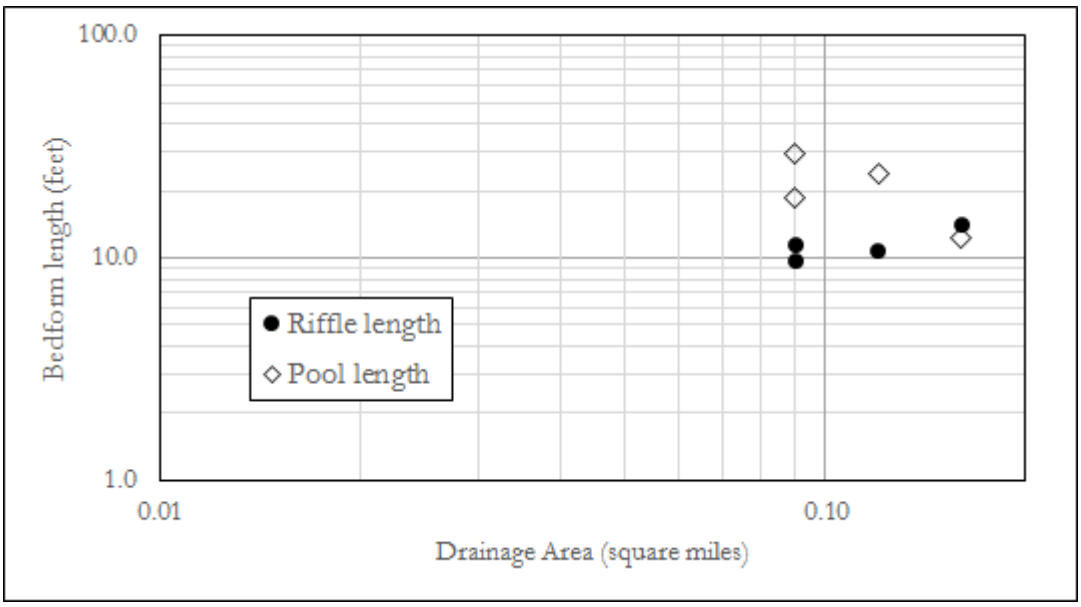


Figure 8-9. Mean riffle and pool length related to drainage area for Southeastern and Mississippi Valley Loess Plains streams.

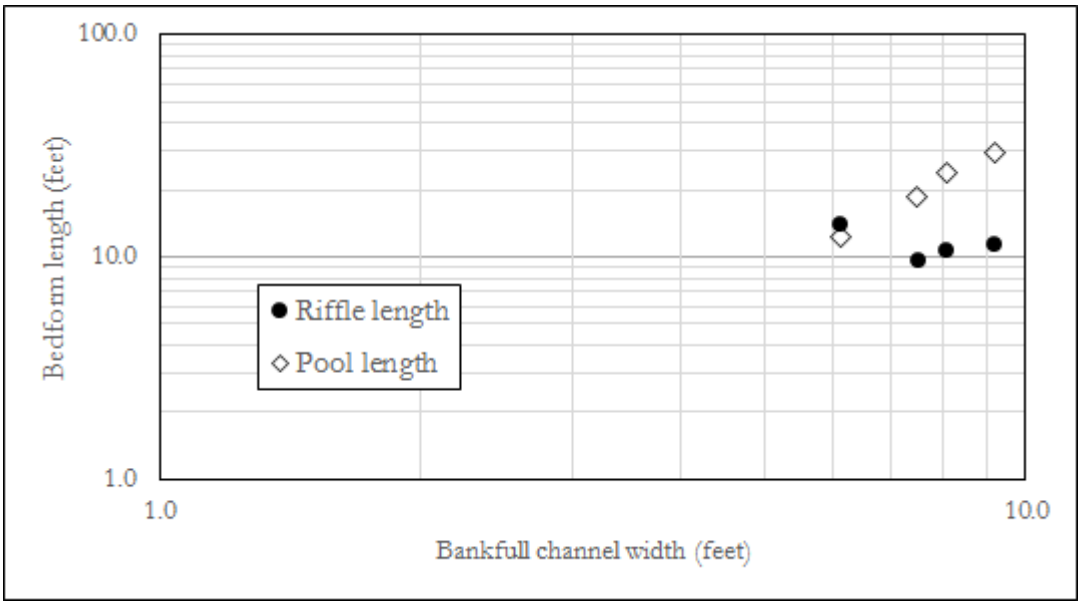


Figure 8-10. Mean riffle and pool length related to bankfull channel width for Southeastern and Mississippi Valley Loess Plains streams.

Table 8-4 lists the ratios of riffle and pool length to bankfull width for each stream. Riffle length ratios ranged from 1.2 to 2.3, with a median of 1.3. Pool length ratios ranged from 2.0 to 3.2, with a median of 2.7. Table 8-4 also lists the mean spacing of pools found in each reference stream and the ratios of pool spacing to bankfull channel width. Values of pool spacing ratio ranged from 3.3 to 5.1, with a median of 4.5. Pool spacing values are shown in relation to bankfull channel width in Figure 8-11.

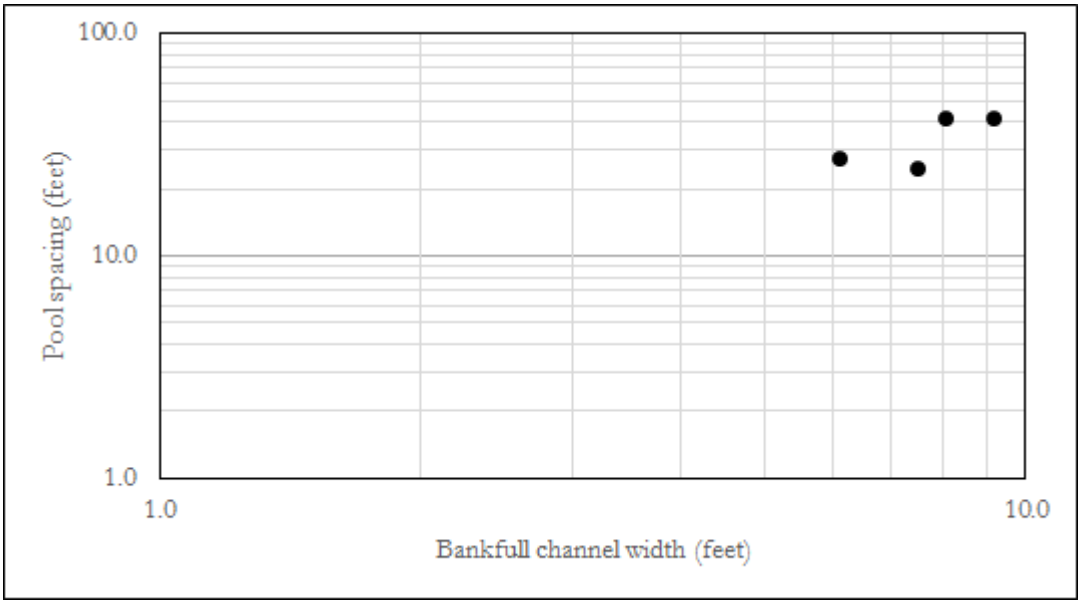


Figure 8-11. Mean pool spacing related to bankfull channel width for Southeastern and Mississippi Valley Loess Plains streams.

Bedform Slopes

Table 8-4 lists the mean measured riffle slopes and ratios of riffle slope to overall reach slope. The values of riffle slope ratios ranged from 2.1 to 3.5, with a median of 3.4. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 8-12. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

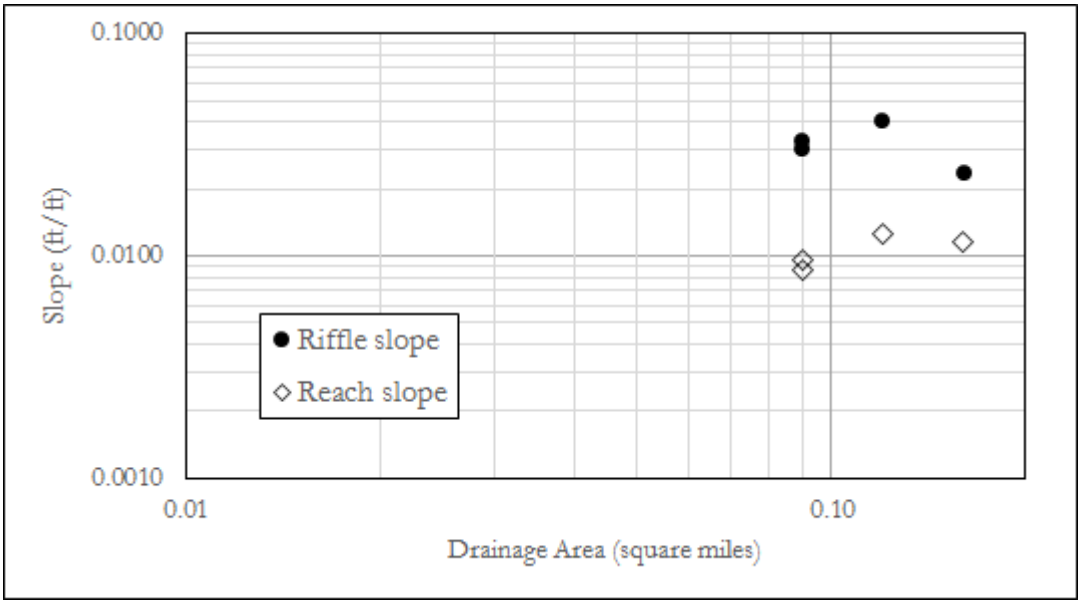


Figure 8-12. Reach channel slope and mean riffle slope related to drainage area for Southeastern and Mississippi Valley Loess Plains streams.

Pattern

Pattern measurements (i.e., meander lengths, belt widths, and radii of curvature) are reported in Table 8-5 for sites where these measurements were available (generally sites with sinuosity greater than 1.15). These measurements were collected in the field when possible. Aerial photography was used for two sites with larger drainage areas. Measurements for all sites should be carefully evaluated, as anthropomorphic impacts to pattern (e.g., straightening, channel realignment) may have occurred.

For the sites with field-collected pattern measurement, meander length ratios (meander length divided by bankfull width) ranged from 5.1 to 6.2, with a median of 5.9. Beltwidth ratios ranged from 2.5 to 8.4, with a median of 3.0. Radius of curvature ratios ranged from 1.6 to 3.1, with a median of 2.2.

Table 8-1. Morphology Reference Stream Summary, Southeastern Plains and Mississippi Valley Loess Plains Ecoregions.

Site	Stream name	Source/Location	Latitude	Longitude	EPA Level IV Ecoregion	Drainage area (mile^2)
1	UT1 Barnishee Bayou	Meeman-Shelby Forest State Park	35.351310	-90.046340	74a	0.09
2	UT Piney Creek	Chickasaw State Park	35.389989	-88.789536	65e	0.09
3	UT1 Tuscumbia River	Big Hill Pond State Park	35.051156	-88.750444	65e	0.12
4	UT3 Barnishee Bayou	Meeman-Shelby Forest State Park	35.371643	-90.026829	74a	0.13
5	UT N Fork Cub Creek	TDEC FECO65E04	35.785215	-88.264681	65e	0.16
6	UT Poplar Tree Lake	Meeman-Shelby Forest State Park	35.314997	-90.058076	74a	0.22
7	UT2 Barnishee Bayou	Meeman-Shelby Forest State Park	35.365364	-90.033687	74a	0.23
8	Barnishee Bayou	TDEC FECO74A04	35.352193	-90.046466	74a	0.86
9	Cypress Creek	Hardeman County	35.376401	-88.852283	65e	1.42
10	Scotts Creek	TDEC SCOTT001.7SH	35.267750	-89.740489	74b	2.53
11	Trace Creek	TDEC ECO65E19	35.662943	-88.668672	65e	5.57
12	Marshall Creek	TDEC ECO65E10	35.160921	-89.067608	65e	6.40
13	Spring Creek	Madison County	35.770129	-88.691930	65e	8.47
14	Harris Creek	TDEC ECO65E08	35.626065	-88.694443	65e	20.2
15	Fletcher Creek	USGS Gage 07031692	35.169307	-89.866455	74b	30.5
16	Beech River	USGS Gage 3594421	35.634167	-88.414722	65e	43.6
17	Nonconnah Creek	USGS Gage 7032200	35.049389	-89.818276	74b	68.2

Table 8-2. Morphology Dimensions for Reference Streams, Southeastern Plains and Mississippi Valley Loess Plains Ecoregions.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Bankfull width (ft)	Bankfull mean depth (ft)	Width/ depth ratio	Entrenchment ratio	Sinuosity	Stream classification
1	0.09	0.00966	5.2	9.2	0.6	16.2	1.8	1.85	B4c
2	0.09	0.00863	4.8	7.5	0.7	11.9	4.2	1.20	E5
3	0.10	0.01257	6.2	8.1	0.8	10.7	3.8	1.80	E5
4	0.13	0.00755	7.1	11.0	0.6	17.0	>10	1.06	C5
5	0.16	0.01164	4.2	6.1	0.7	8.7	>10	1.45	E5
6	0.22	0.00495	12.9	14.1	0.9	15.3	3.9	1.10	C5
7	0.23	0.01040	3.9	6.5	0.6	10.8	>10	1.21	E5
8	0.86	0.00560	28.8	23.5	1.2	19.2	1.3	1.39	F5
9	1.42	0.00111	13.5	9.9	1.4	7.2	>10	1.08	E5
10	2.50	0.00188	47.6	22.8	2.1	10.9	1.7	1.14	B4c
11	5.57	0.00341	67.4	21.7	3.1	7.0	>10	1.15	E5
12	6.40	0.00111	37.9	23.8	1.6	14.9	>10	1.14	C5
13	8.47	0.00283	43.1	21.2	2.0	10.4	>10	1.08	E5
14	20.2	0.00206	198.9	46.0	4.3	10.7	5.8	1.68	E5
15	30.5	0.00383	454.6	86.4	5.3	16.4	1.4	1.04	B5c
16	43.6	0.00110	272.7	51.7	5.3	9.8	4.0	1.55	E5
17	68.2	0.00390	698.8	99.7	7.0	14.2	1.7	1.03	B5c

Table 8-3. Discharge Estimates for Reference Streams, Southeastern Plains and Mississippi Valley Loess Plains Ecoregions.

Site	Drainage area (mile^2)	Channel slope (ft/ft)	Cross-section area (ft^2)	Manning's n	Bankfull mean velocity (ft/sec)	Bankfull discharge (cfs)
1	0.09	0.00966	5.2	0.068	1.37	7.1
2	0.09	0.00863	4.8	0.058	1.61	7.8
3	0.10	0.01257	6.2	0.065	1.91	11.8
4	0.13	0.00755	7.1	0.045	1.99	14.1
5	0.16	0.01164	4.2	0.052	2.12	8.9
6	0.22	0.00495	12.9	0.040	2.28	29.5
7	0.23	0.01040	3.9	0.052	1.87	7.4
8	0.86	0.00560	28.8	0.052	2.30	66.4
9	1.42	0.00111	13.5	0.045	1.15	15.5
10	2.50	0.00188	47.6	0.052	1.81	85.9
11	5.57	0.00341	67.4	0.045	3.47	234
12	6.40	0.00111	37.9	0.045	1.38	52.3
13	8.47	0.00283	43.1	0.045	2.51	108
14	20.2	0.00206	198.9	0.052	3.07	610
15	30.5	0.00383	454.6	--	5.57	2530
16	43.6	0.00110	272.7	--	3.09	843
17	68.2	0.00390	698.8	--	4.78	3340

Note: Absence of Manning's n in table indicates that bankfull discharge was derived from the long-term flow record at a USGS gage station.

Table 8-4. Stream Morphology Bedform Measurements for Reference Streams, Southeastern Plains and Mississippi Valley Loess Plains Ecoregions.

Site	Drainage area (mile^2)	Mean riffle length [ratio to bankfull width] (ft [none])	Mean pool length [ratio to bankfull width] (ft [none])	Mean pool spacing [ratio to bankfull width] (ft [none])	Mean riffle slope [ratio to channel slope] (ft/ft [none])
1	0.09	11.4 [1.2]	29.5 [3.2]	41.1 [4.5]	0.0329 [3.4]
2	0.09	9.6 [1.3]	18.7 [2.5]	24.9 [3.3]	0.0304 [3.5]
3	0.12	10.7 [1.3]	23.8 [2.9]	41.4 [5.1]	0.0410 [3.3]
5	0.16	14.0 [2.3]	12.3 [2.0]	27.3 [4.5]	0.0239 [2.1]

Table 8-5. Stream Morphology Pattern Measurements for Reference Streams, Southeastern Plains and Mississippi Valley Loess Plains Ecoregions.

Site	Drainage area (mile^2)	Mean meander length [ratio to bankfull width] (ft [none])	Mean beltwidth [ratio to bankfull width] (ft [none])	Mean radius of curvature [ratio to bankfull width] (ft [none])
1	0.09	57 [6.2]	77 [8.4]	22 [2.3]
2	0.09	42 [5.6]	19 [2.5]	15 [2.0]
3	0.12	41 [5.1]	28 [3.5]	13 [1.6]
5	0.16	37 [6.1]	15 [2.5]	19 [3.1]
8*	0.86	141 [6.0]	81 [3.4]	51 [2.2]
14*	20.2	544 [11.8]	324 [7.0]	171 [3.7]

Note: * after site name indicates that pattern measurements were obtained from aerial photography. Anthropomorphic impacts to pattern (e.g., straightening, channel realignment) may have occurred within sites.

IX. SUMMARY OF STATEWIDE MORPHOLOGY RESULTS

Morphology data were collected from 114 reference and gaged streams across Tennessee within Ecoregions 66, 67, 68/69, 71, and 65/74 (Figure 9-1). Across the state, study streams ranged from 3 to 132 feet wide with drainage areas ranging from 0.02 to 117 square miles. Twenty-four of the study sites were located at United States Geological Survey (USGS) gage stations.

Results of this study should be considered an initial database of reference stream morphology for the State of Tennessee. Additional stream data should be added as more reference streams are identified and measured during assessment and design projects. Stream assessment and restoration practitioners should carefully consider the natural variability demonstrated in these data. Designers should not use this information as the sole basis for planning restoration projects, but should evaluate evidence from hydrologic and hydraulic monitoring and modeling, nearby reference stream morphology, and existing stream conditions in order to determine appropriate restoration design parameters.

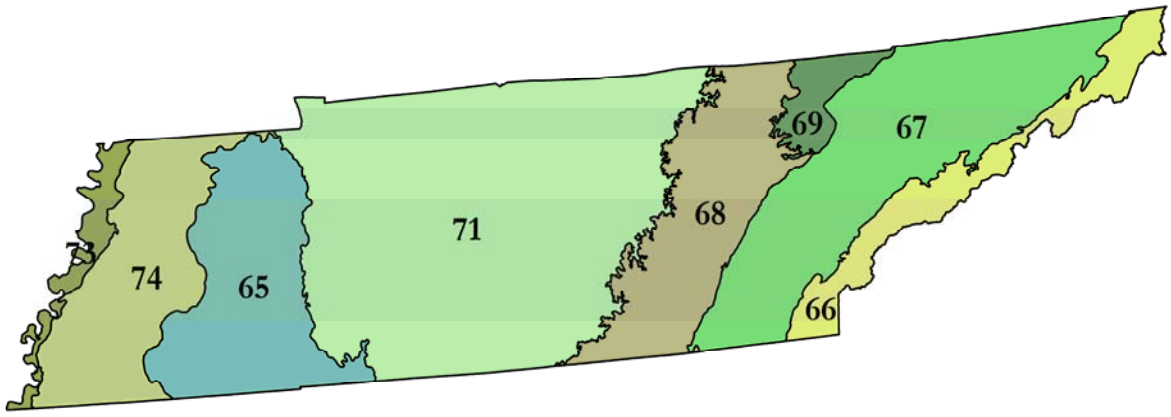


Figure 9-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

The study included 1 A, 30 B, 47 C, 32 E, and 4 F Rosgen type streams based on the measured entrenchment ratios, width/depth ratios, and slopes. Of the 114 streams, the median streambed particle size (D_{50}) was classified as sand at 22 sites, gravel at 58 sites, cobble at 25 sites, and bedrock at 9 sites.

For all study sites, the entrenchment ratios, calculated as the width of the floodprone area divided by the bankfull channel width, ranged from 1.2 to over 10. Width/depth ratios, calculated as the bankfull riffle channel width divided by the mean riffle bankfull depth, ranged from 6.2 to 40. Reach channel slopes, measured using water surface elevation differences from the first step or riffle to the last step or riffle surveyed, ranged from 0.0006 to 0.1420 ft/ft.

Bankfull Channel Dimensions

The resulting hydraulic geometry regional curve relationships for all Tennessee ecoregions combined are summarized below, with watershed drainage area (DA) in square miles, channel bankfull area (A_{bkf}) in square feet, channel bankfull width (W_{bkf}) and mean depth (d_{bkf}) in feet, and bankfull discharge (Q_{bkf})

in cubic feet per second. These relationships are also shown in Figures 9-2 through 9-5. An ecoregion-specific determination was made on the lower limit of drainage area to include in computation of the regional curves. This limit was generally 0.09 square miles, due to the high degree of variability observed in channels with drainage areas smaller than that. The composite regional curves were developed using data from the same sites used for the curves for individual ecoregions.

$A_{bkf} = 21.0\ DA^{0.695}$ $R^2 = 0.951$
$W_{bkf} = 17.2\ DA^{0.379}$ $R^2 = 0.908$
$d_{bkf} = 1.22\ DA^{0.317}$ $R^2 = 0.895$
$Q_{bkf} = 68.2\ DA^{0.781}$ $R^2 = 0.883$

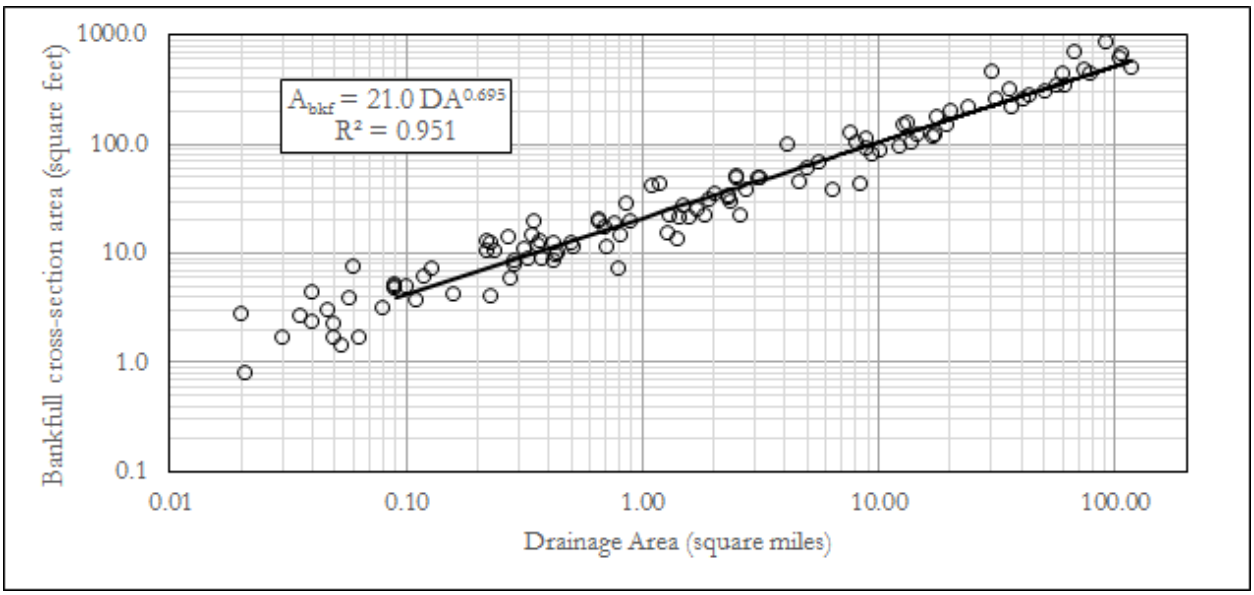


Figure 9-2. Bankfull riffle cross-section area related to drainage area for all Tennessee study streams.

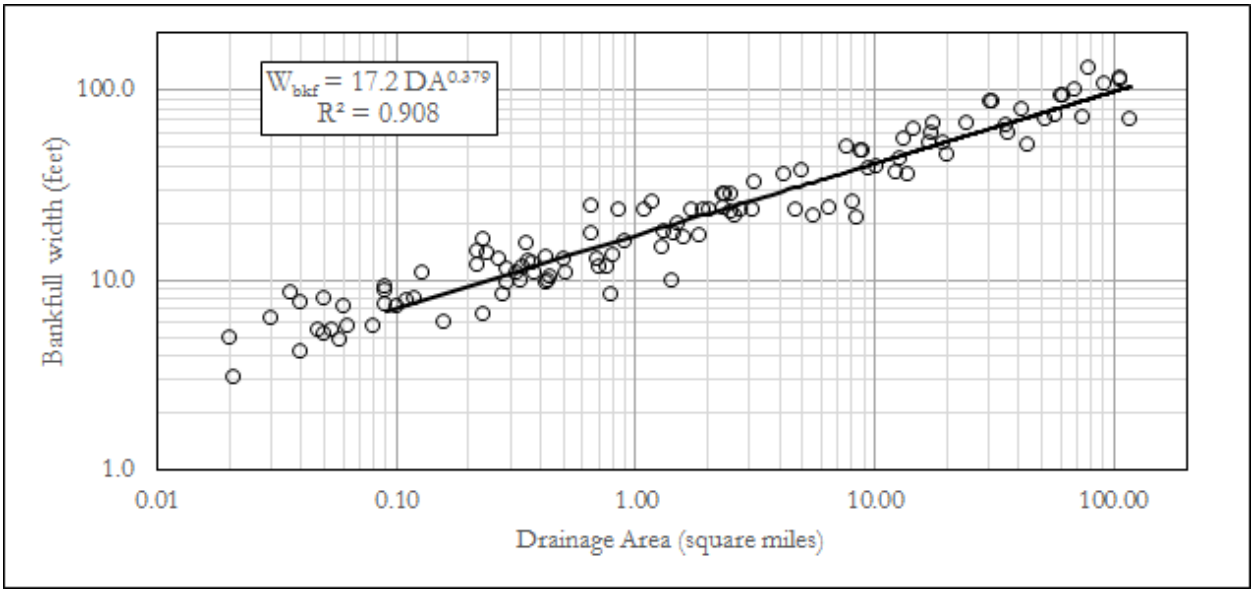


Figure 9-3. Bankfull riffle width related to drainage area for all Tennessee study streams.

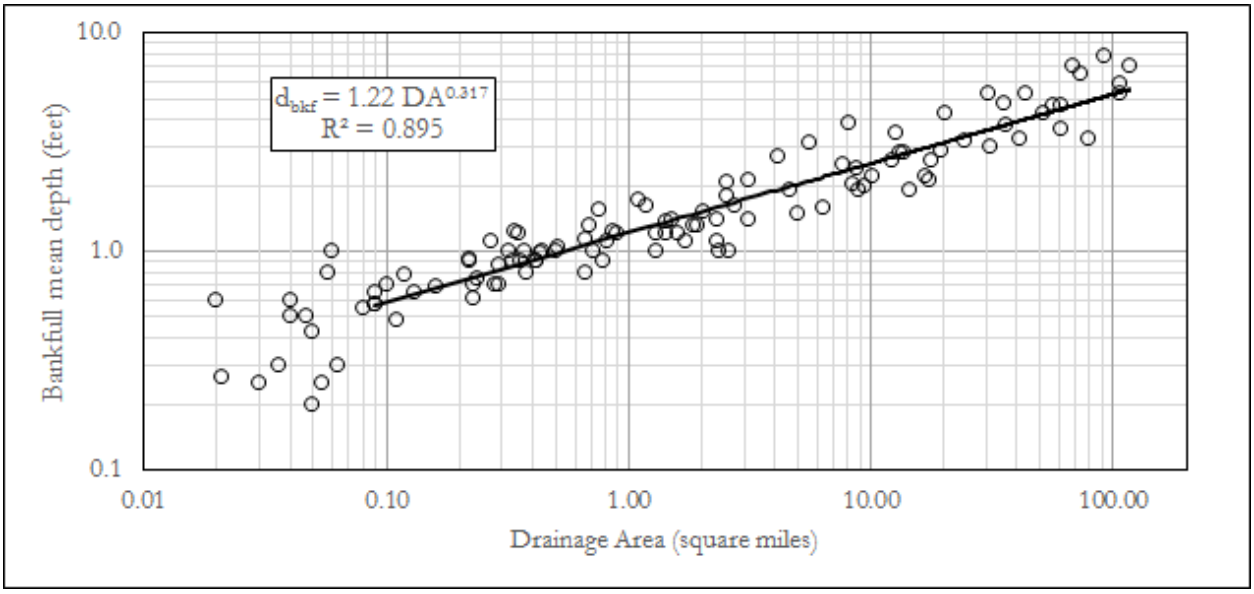


Figure 9-4. Bankfull riffle mean depth related to drainage area for all Tennessee study streams.

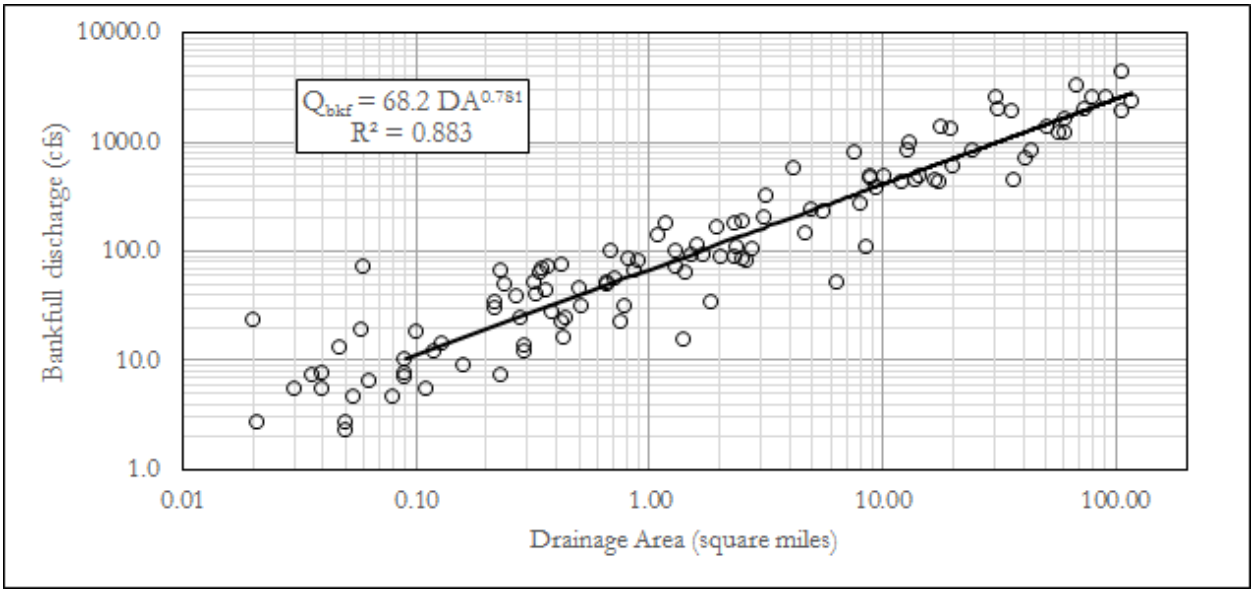


Figure 9-5. Estimated bankfull discharge related to drainage area for all Tennessee study streams.

Figures 9-6 through 9-9 compare the individual regional curves generated for the separate ecoregions. Differences among the regions are subtle, but do exist. For example, the comparisons suggest that width/depth ratios differ among the regions: larger streams in Ecoregion 66 tend to be wider and shallower, while large streams in Ecoregions 65/74 tend to be narrower and deeper.

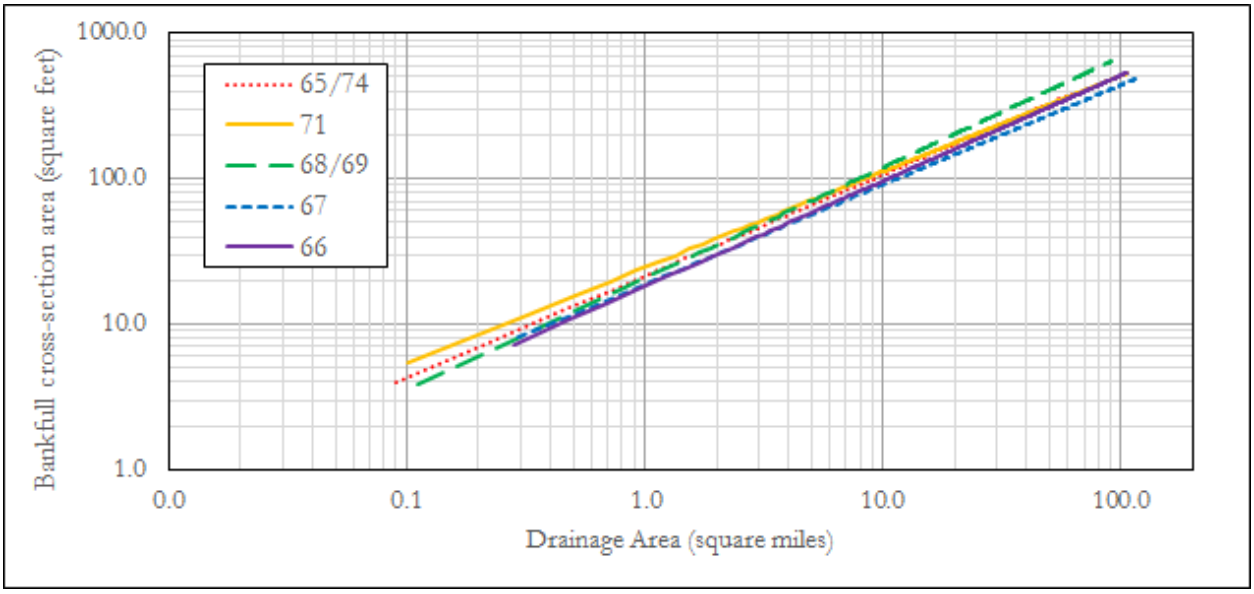


Figure 9-6. Comparison of bankfull riffle cross-section area related to drainage area for Tennessee ecoregions.

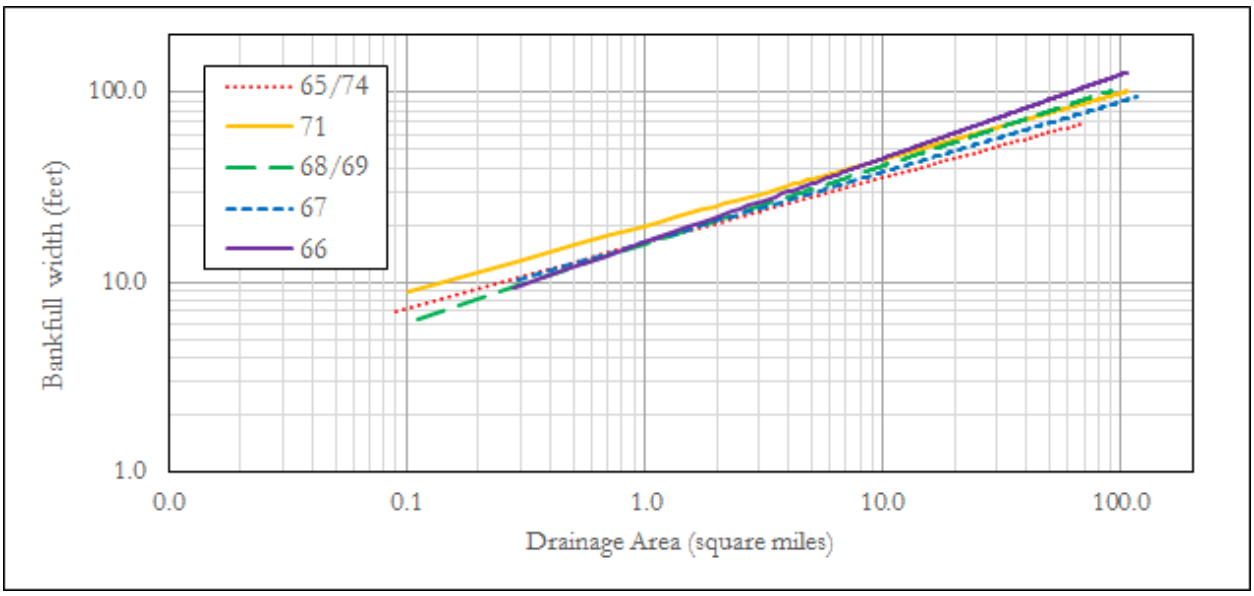


Figure 9-7. Comparison of bankfull riffle cross-section width related to drainage area for Tennessee ecoregions.

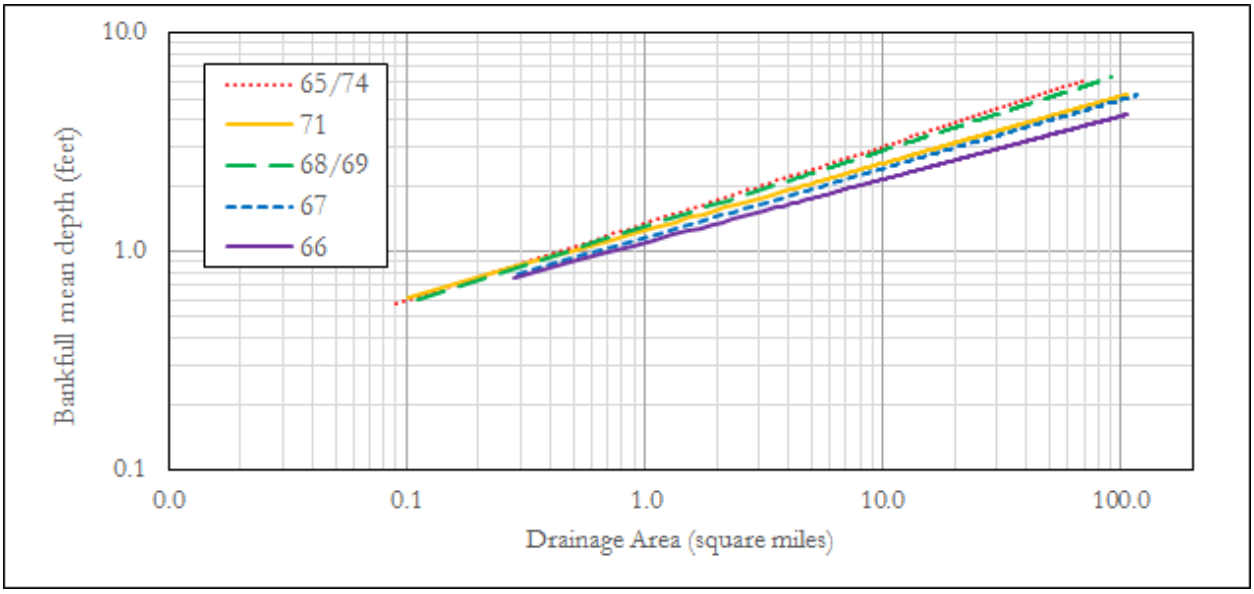


Figure 9-8. Comparison of bankfull riffle cross-section mean depth related to drainage area for Tennessee ecoregions.

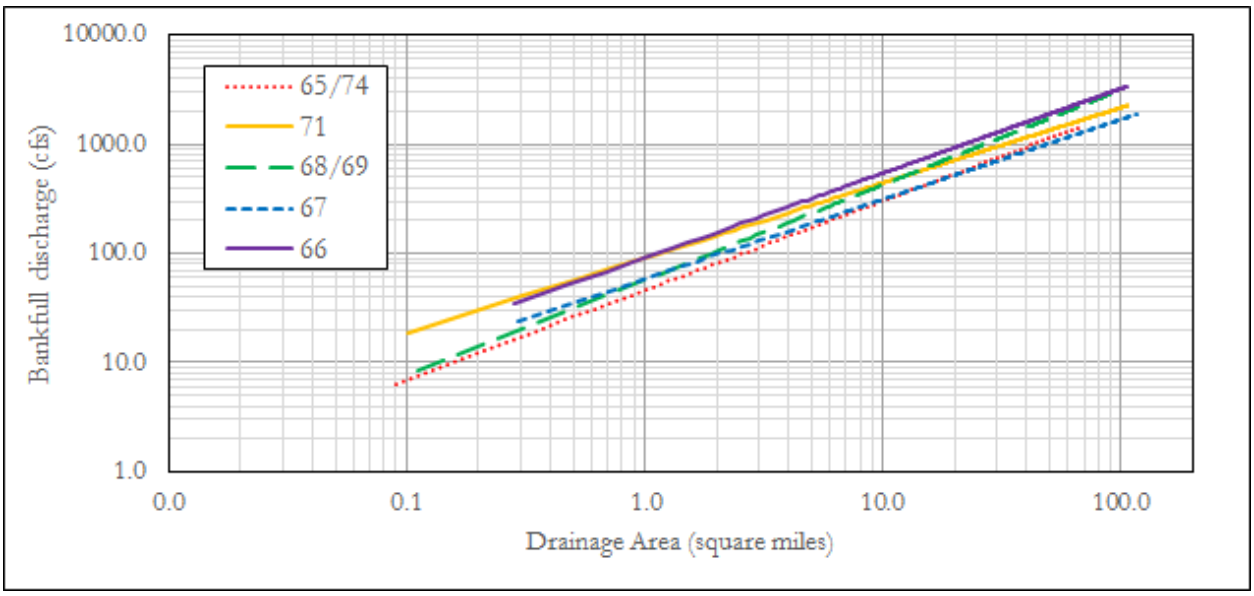


Figure 9-9. Comparison of estimated bankfull discharge related to drainage area for Tennessee ecoregions.

Bedform Dimensions

The mean riffle and pool lengths represent the means of the measured longitudinal lengths of all the riffles and pools in each reference reach. These bedform lengths were measured from a subset of 35 of study sites across the state (10 sites in Ecoregion 66, 4 in 67, 6 in 68/69, 11 in 71, and 4 in 65/74). All ten sites in Ecoregion 66 also contained step features, which should be considered when interpreting these results. The bedform lengths from the 35 sites are shown in relation to drainage areas in Figure 9-10, and in relation to bankfull channel widths in Figure 9-11. The trends show pool

lengths generally 20-40% longer than riffle lengths across the range of drainage areas and channel widths. Across the state, riffle length ratios ranged from 0.4 to 3.5, with a median of 1.2. Pool length ratios ranged from 0.4 to 6.2, with a median of 1.6. Values of pool spacing ratio ranged from 0.8 to 9.0, with a median of 2.9. Pool spacing values are shown in relation to bankfull channel width in Figure 9-12. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

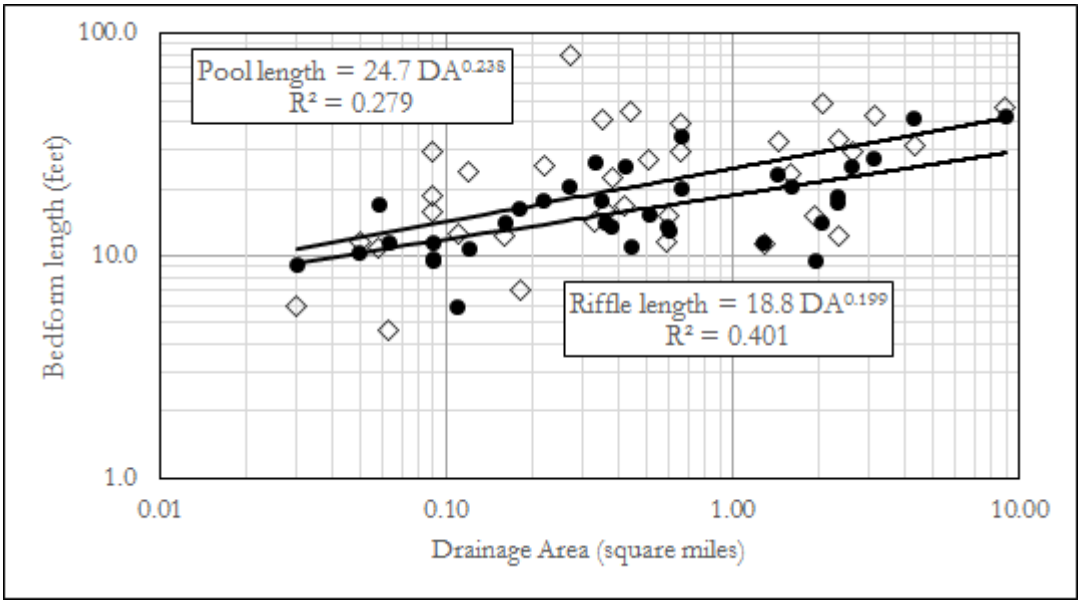


Figure 9-10. Mean riffle and pool length related to drainage area for all Tennessee study streams.

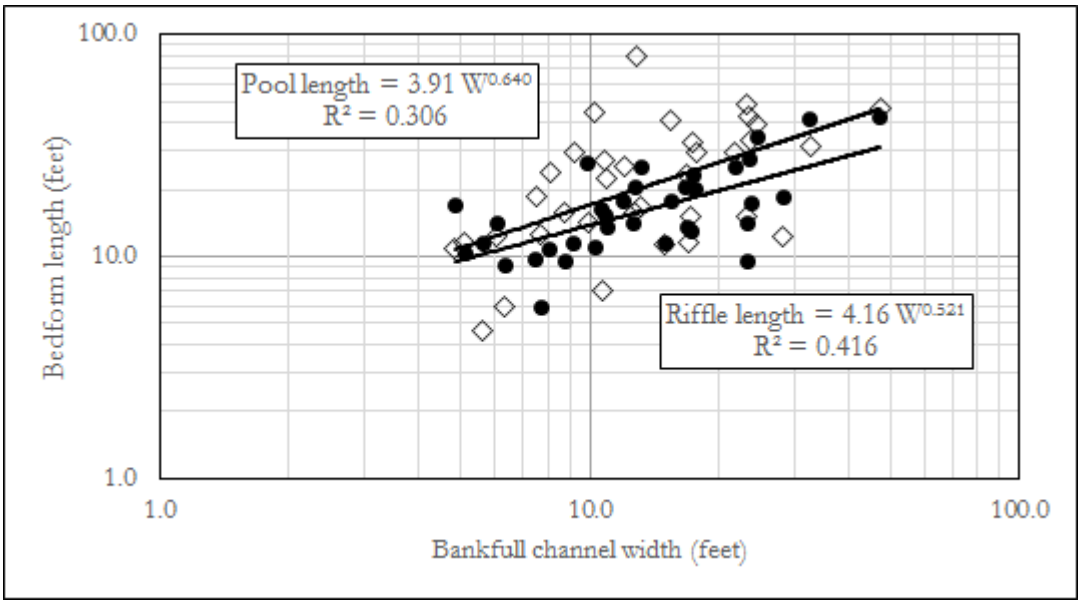


Figure 9-11. Mean riffle and pool length related to bankfull channel width for all Tennessee study streams.

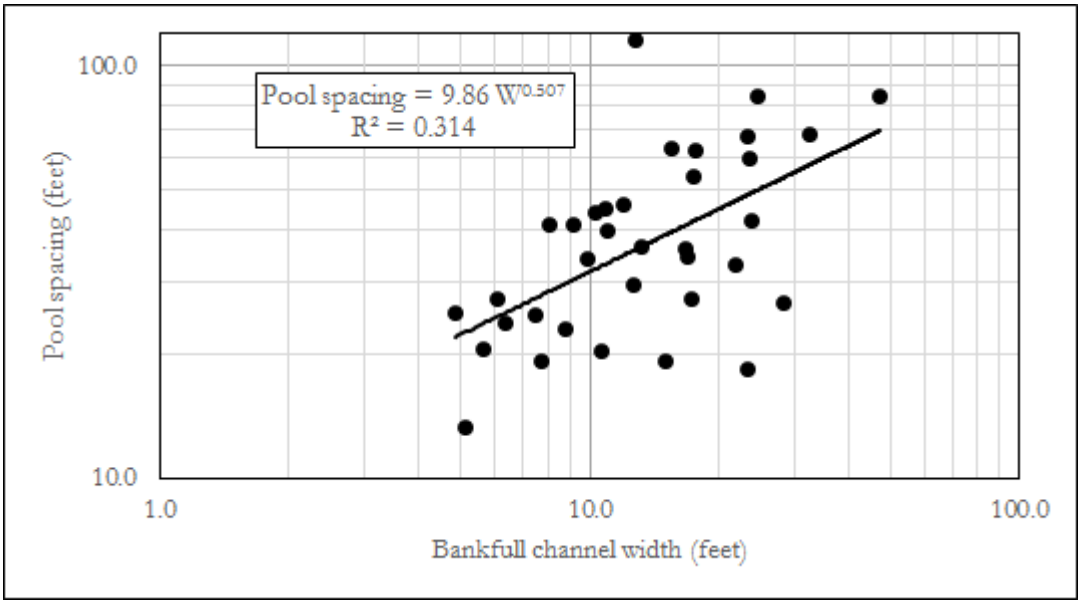


Figure 9-12. Mean pool spacing related to bankfull channel width for all Tennessee study streams.

Bedform Slopes

The values of riffle slope ratios ranged from 0.7 to 5.3, with a median of 2.0. The measured riffle slopes and overall reach slopes are shown in relation to drainage area in Figure 9-13. A strong correlation does not exist between drainage area and riffle and reach slopes. This figure is presented to compare trends between riffle slopes and reach slopes (i.e., riffle slope ratio). Comparing the trend lines shows a riffle slope ratio near 3 for smaller streams, then closer to 1.5 for the largest streams. These graphs represent design tools that may be used to estimate ranges of bedform dimensions in restoration projects. Designers should carefully consider the natural variability demonstrated in these datasets.

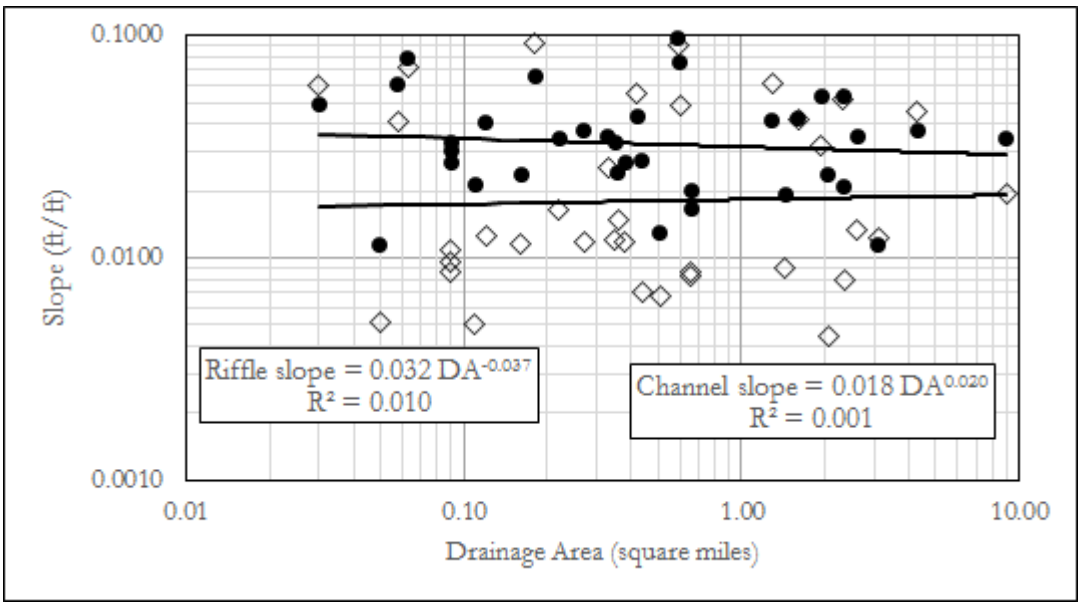


Figure 9-13. Reach channel slope and mean riffle slope related to drainage area for all Tennessee study streams.

X. LARGE WOODY DEBRIS IN REFERENCE STREAMS

Executive Summary

Large Woody Debris (LWD) data were collected and analyzed at 92 reference streams in ecoregions throughout Tennessee using the protocols described by Harman *et al.* (2017) and Davis *et al.* (2001). LWD is defined as dead wood over 1 meter in length and at least 10 cm in diameter. The LWD Index (LWDI) score was calculated for each stream to represent the relative function of the large woody debris pieces or debris dams in retaining organic matter, providing fish habitat, and affecting channel/substratum stability depending on LWD size, location, orientation, and stability.

The median LWDI score for the 92 reference streams was approximately 200, with higher scores typically found in the Blue Ridge and Plains Ecoregions due to increased numbers of fallen trees and broken limbs. Stream systems with recent disturbance due to wind storms, ice, or floods seemed to have more LWD pieces and debris dams. LWDI scores were highly variable and were not found to be correlated with watershed drainage area or reach slope.

The LWDI results for these 92 reference streams may be used to compare with disturbed or restored stream systems. It should be noted that some disturbed streams are expected to have high LWDI scores due to unstable streambanks and resulting fallen trees or recent storms. In a stream restoration project, LWDI may be enhanced by the strategic addition of logs and woody debris to the restoration channel in the form of vanes, revetments, riffle wood, or other habitat structures.

Results of this study should be considered an initial database of reference stream large woody debris information. The database developed in this study should be supplemented with additional data collected on reference, disturbed, and restored streams using the same quantification method to support future analyses of LWD in Tennessee streams.

Large Woody Debris Measurements and Analysis

Large Woody Debris (LWD) data were collected at 92 reference streams in ecoregions throughout Tennessee, with drainage areas ranging from 0.02 to 61 square miles and reach slopes ranging from 0.001 to 0.140 ft/ft (Figure 10-1, Table 10-1).

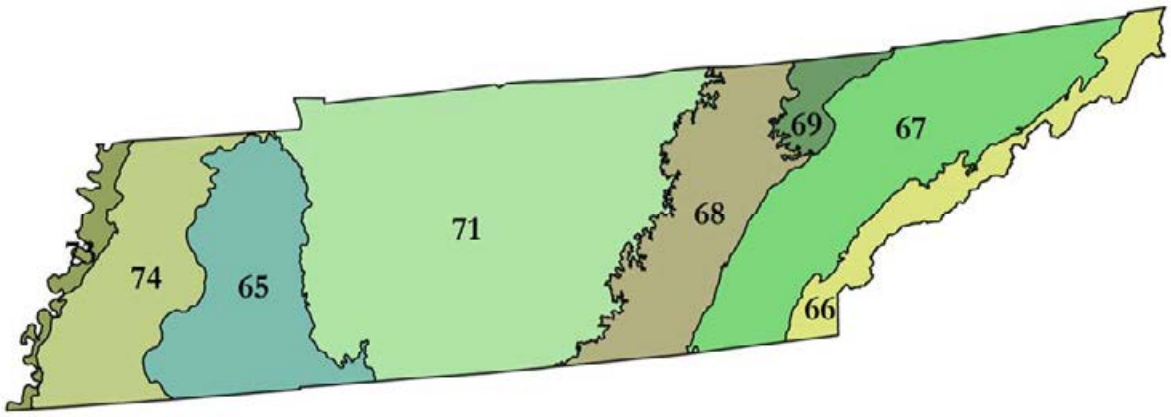


Figure 10-1. EPA Level III Ecoregions of Tennessee (USEPA, 2013).

Table 10-1. LWD reference stream characteristics for each ecoregion and statewide.

Ecoregion	Number of Reference Streams	Range of Drainage Areas (sq mi)	Range of Slopes (ft/ft)
66 (Blue Ridge)	20	0.28 to 61	0.003 to 0.060
67 (Ridge and Valley)	15	0.04 to 36	0.001 to 0.033
68/69 (SW and Central Appalachians)	20	0.02 to 17	0.001 to 0.140
71 (Interior Plateau)	21	0.03 to 13	0.005 to 0.071
65/74 (Plains)	16	0.05 to 20	0.001 to 0.013
Tennessee (Statewide)	92	0.02 to 61	0.001 to 0.140

LWD data were collected and analyzed using the protocol described by Harman *et al.* (2017), (stream-mechanics.com/wp-content/uploads/2017/12/LWDI-Manual_V1.pdf). The Large Woody Debris Index (LWDI) was calculated as outlined by the U.S. Forest Service (USFS) General Technical Report Monitoring Wilderness Stream Ecosystems (Davis *et al.*, 2001). Following this methodology, "Large woody debris is described as the organic matter over 1 meter in length and at least 10 cm in diameter at one end (sticks to logs). When multiple pieces of debris accumulate in the stream channel and retard water flow, a debris dam is formed" (Davis *et al.*, 2001). The LWDI score represents the relative function of the large woody debris pieces or debris dams in retaining organic matter, providing fish habitat, and affecting channel/substratum stability depending on LWD size, location, orientation, and stability of the wood piece or debris dam.

For each reference stream, a 100-meter reach was selected where it would produce the highest LWDI score based on observed density of LWD pieces and debris dams. Each LWD piece observed within the sampling reach was scored from 1 to 5 based on functionality in the categories of length, diameter, location, type, structure, stability, and orientation. Increasing scores indicated greater contributions to stream functions within each category. Each LWD debris dam consisting or 3 or more touching LWD pieces was scored from 1 to 5 in the categories of length, height, structure, location, and stability.

Within each score box on the LWD data sheet, the number of observed LWD pieces or debris dams fitting into that box was multiplied by the score for that box, and these values were summed across each category to produce a total category score. The total piece score and total dam score were calculated by summing the category scores for pieces and dams, respectively. Since debris dams are considered more important in contributing to stream functions, the total dam score was multiplied by a factor of 5 and added to the total piece score to determine the total LWDI score for each reference stream.

LWDI summary results for the 92 reference streams in the ecoregions are listed in Table 10-2, with individual site results for each ecoregion listed in Tables 10-3 through 10-7. The data for each site include reference stream latitude, longitude, drainage area, reach slope, numbers of pieces and debris dams observed within the 100-meter reach, piece and dam scores, and LWDI score.

Table 10-2. LWDI summary results for each ecoregion and for the 92 sites statewide.

Ecoregion	Median LWDI	25th Percentile LWDI	75th Percentile LWDI	Range of LWDI
66 (Blue Ridge)	241	157	322	109 to 946
67 (Ridge & Valley)	137	72	204	50 to 526
68 & 69 (SW App & Central App)	179	101	252	44 to 455
71 (Interior Plateau)	161	95	229	31 to 452
65 & 74 (Plains)	264	141	346	18 to 714
Tennessee (Statewide)	199	132	284	18 to 946

For each ecoregion, example reference stream photos and LWD data sheets are shown in Figures 10-2 through 10-11 below. All data sheets for the 92 reference streams are included in Appendix F of this report.

In Ecoregion 66, the Middle Prong Pigeon River TDEC reference stream ECO66G04 contained 13 LWD pieces and 1 debris dam in the sample reach with a drainage area of 19.5 square miles, slope of 0.0417 ft/ft, and bankfull dimensions of 53 ft wide and 2.9 ft deep (Figures 10-2 and 10-3). The piece score of 195 and dam score of 17 were used to calculate the LWDI score of 280 for this reference stream.

Figure 10-2. Middle Prong Pigeon River (Ecoregion 66) reference stream photos showing LWD pieces and debris dam.

LARGE WOODY DEBRIS FIELD FORM Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	6/16/17		County	Sevier	Forest Age (yrs)	30 to 50	
Stream Name	Middle Prong Pigeon		Phys. Province	66	Latitude (dd)	35.70728	
Reach ID	18		Drainage Area (mi^2)	19.5	Longitude (dd)	-83.38005	
Watershed Name	Pigeon		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	53	Slope (ft/ft)	0.04170	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.9	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	120	Rosgen Type	B3a	
Field Notes:							

SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *									**PIECE SCORES**
Length/BKF Width	0 to 0.4	6	0.4 to 0.6	7	0.6 to 0.8		0.8 to 1.0		> 1.0		20
Diameter (cm)	10 to 20	5	20 to 30	5	30 to 40		40 to 50	3	>50		27
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)		29
Type	Bridge				Ramp	11	Submersed		Buried		33
Structure	Plain	8	Plain/Int	2	Intermediate	1	Int/Sticky	2	Sticky		23
Stability	Moveable	5	Mov/Int	4	Intermediate	4	Int/Sec		Secured		25
Orientation (deg)	0 to 20	4	20 to 40	2	40 to 60	2	60 to 80	1	80 to 90	4	38
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	1	In low flow		4
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec		Secured		3
Additional Notes:											

Figure 10-3. LWD data sheet for Middle Prong Pigeon River.

In Ecoregion 67, Big Spring Creek in Chuck Swan State Forest contained 10 LWD pieces and 1 debris dam in the sample reach with a drainage area of 0.79 square miles, slope of 0.0331 ft/ft, and bankfull dimensions of 8 ft wide and 0.9 ft deep (Figures 10-4 and 10-5). The piece score of 195 and dam score of 16 were used to calculate the LWDI score of 275 for this reference stream.

Figure 10-4. Big Spring Creek (Ecoregion 67) reference stream photos showing LWD pieces and debris dam.

LARGE WOODY DEBRIS FIELD FORM Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous		
Date	11/13/17		County				Forest Age (yrs)	30 to 50		
Stream Name	Big Spring Creek		Phys. Province	67			Latitude (dd)	36.30358		
Reach ID	7		Drainage Area (mi^2)	0.79			Longitude (dd)	-83.94490		
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Beech						
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	8			Slope (ft/ft)	0.03310		
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9			Bed material	Gravel		
Stream Condition	Reference		Floodprone Width (ft)	50			Rosgen Type	E4b		
Field Notes:										

SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8	2	0.8 to 1.0	3	> 1.0	1	29
Diameter (cm)	10 to 20	5	20 to 30	3	30 to 40	2	40 to 50		>50		17
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	31
Type	Bridge	1			Ramp	6	Submersed	3	Buried		31
Structure	Plain	4	Plain/Int	2	Intermediate	3	Int/Sticky	1	Sticky		21
Stability	Moveable	2	Mov/Int	2	Intermediate	4	Int/Sec	1	Secured	1	27
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	3	60 to 80	2	80 to 90	4	39
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int	1	Intermediate		Int/Sec		Secured		2
Additional Notes:											

Figure 10-5. LWD data sheet for Big Spring Creek.

In Ecoregions 68/69, North Prong Flat Fork in Frozen Head State Park contained 13 LWD pieces and no debris dams in the sample reach with a drainage area of 2.4 square miles, slope of 0.0165 ft/ft, and bankfull dimensions of 28 ft wide and 1.0 ft deep (Figures 10-6 and 10-7). The piece score of 252 and dam score of 0 were used to calculate the LWDI score of 252 for this reference stream.

Figure 10-6. North Prong Flat Fork (Ecoregions 68/69) reference stream photos showing LWD pieces.

LARGE WOODY DEBRIS FIELD FORM Revised: 10/18/2016

Investigator(s)	GJ	State	TN	Forest Type	Deciduous		
Date	11/14/17	County		Forest Age (yrs)	30 to 50		
Stream Name	Flat Fork	Phys. Province	69	Latitude (dd)	36.13679		
Reach ID	15	Drainage Area (mi^2)	2.4	Longitude (dd)	-84.48720		
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	28	Slope (ft/ft)	0.01650	
Stream Classification	Perennial		BKF Mean Depth (ft)	1	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	40	Rosgen Type	B3c	
Field Notes:							

SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *									**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	3	> 1.0	4	43
Diameter (cm)	10 to 20	7	20 to 30	3	30 to 40	2	40 to 50	1	>50		23
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)	2	48
Type	Bridge				Ramp	8	Submersed	4	Buried	1	45
Structure	Plain	4	Plain/Int	5	Intermediate	4	Int/Sticky		Sticky		26
Stability	Moveable	5	Mov/Int	4	Intermediate	2	Int/Sec	2	Secured		27
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	3	60 to 80	4	80 to 90	2	40
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

Figure 10-7. LWD data sheet for North Prong Flat Fork.

In Ecoregion 71, UT1 Woodhaven Lake in Montgomery Bell State Park contained 6 LWD pieces and 2 debris dams in the sample reach with a drainage area of 0.27 square miles, slope of 0.0117 ft/ft, and bankfull dimensions of 12.8 ft wide and 1.1 ft deep (Figures 10-8 and 10-9). The piece score of 103 and dam score of 47 were used to calculate the LWDI score of 338 for this reference stream.

Figure 10-8. UT1 Woodhaven Lake in Montgomery Bell State Park (Ecoregion 71) reference stream photos showing LWD pieces and debris dam.

LARGE WOODY DEBRIS FIELD FORM Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN	Forest Type	Deciduous		
Date	12/14/17	County		Forest Age (yrs)	30 to 50		
Stream Name	UT1 Woodhaven Lake, MBSP	Phys. Province	71	Latitude (dd)	36.07619		
Reach ID	13	Drainage Area (mi^2)	0.27	Longitude (dd)	-87.27573		
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	12.8	Slope (ft/ft)	0.01170		
Stream Classification	Perennial	BKF Mean Depth (ft)	1.1	Bed material	Gravel		
Stream Condition	Reference	Floodprone Width (ft)	150	Rosgen Type	E4		
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	2	23
Diameter (cm)	10 to 20	3	20 to 30		30 to 40		40 to 50	3	>50		15
Location	**Zone 4** (Above BKF/Hanging into Ch)	5			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		8
Type	Bridge	1			Ramp	5	Submersed		Buried		16
Structure	Plain	5	Plain/Int	1	Intermediate		Int/Sticky		Sticky		7
Stability	Moveable	2	Mov/Int		Intermediate	4	Int/Sec		Secured		14
Orientation (deg)	0 to 20		20 to 40		40 to 60	4	60 to 80	2	80 to 90		20
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine	1	Fine		7
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	2	10
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	2	10
Additional Notes:											

Figure 10-9. UT1 Woodhaven Lake in Montgomery Bell State Park.

In Ecoregions 65/74, UT Poplar Tree Lake in Meeman-Shelby Forest State Park contained 13 LWD pieces and 1 debris dam in the sample reach with a drainage area of 0.22 square miles, slope of 0.00495 ft/ft, and bankfull dimensions of 14.1 ft wide and 0.9 ft deep (Figures 10-10 and 10-11). The piece score of 259 and dam score of 21 were used to calculate the LWDI score of 364 for this reference stream.

Figure 10-10. UT Poplar Tree Lake reference stream photos showing LWD pieces and debris dam.

LARGE WOODY DEBRIS FIELD FORM — Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN			Forest Type	Deciduous		
Date	3/24/17		County	Shelby			Forest Age (yrs)	30		
Stream Name	UT Poplar Tree Lake		Phys. Province	74			Latitude (dd)	35.31500		
Reach ID	72		Drainage Area (mi^2)	0.22			Longitude (dd)	-90.05808		
Watershed Name			Dominant Species	Oak, Beech, Maple, Holly						
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	14.1			Slope (ft/ft)	0.00495		
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9			Bed material	Sand		
Stream Condition	Reference		Floodprone Width (ft)	55			Rosgen Type	C5		
Field Notes:										

SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *									**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	6	47
Diameter (cm)	10 to 20	4	20 to 30	5	30 to 40	1	40 to 50		>50	3	32
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	2	35
Type	Bridge	4			Ramp	7	Submersed	1	Buried	1	34
Structure	Plain	5	Plain/Int		Intermediate	8	Int/Sticky		Sticky		29
Stability	Moveable	3	Mov/Int		Intermediate	1	Int/Sec		Secured	9	51
Orientation (deg)	0 to 20	6	20 to 40	2	40 to 60	1	60 to 80	2	80 to 90	2	31
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow	1	Partially low flow		Mid low flow		In low flow		2
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5
Additional Notes:											

Figure 10-11. LWD data sheet for UT Poplar Tree Lake in Meeman-Shelby Forest State Park.

The cumulative distributions of LWDI scores for the 92 sites statewide and for each ecoregion are shown graphically in Figures 10-12 and 10-13, respectively.

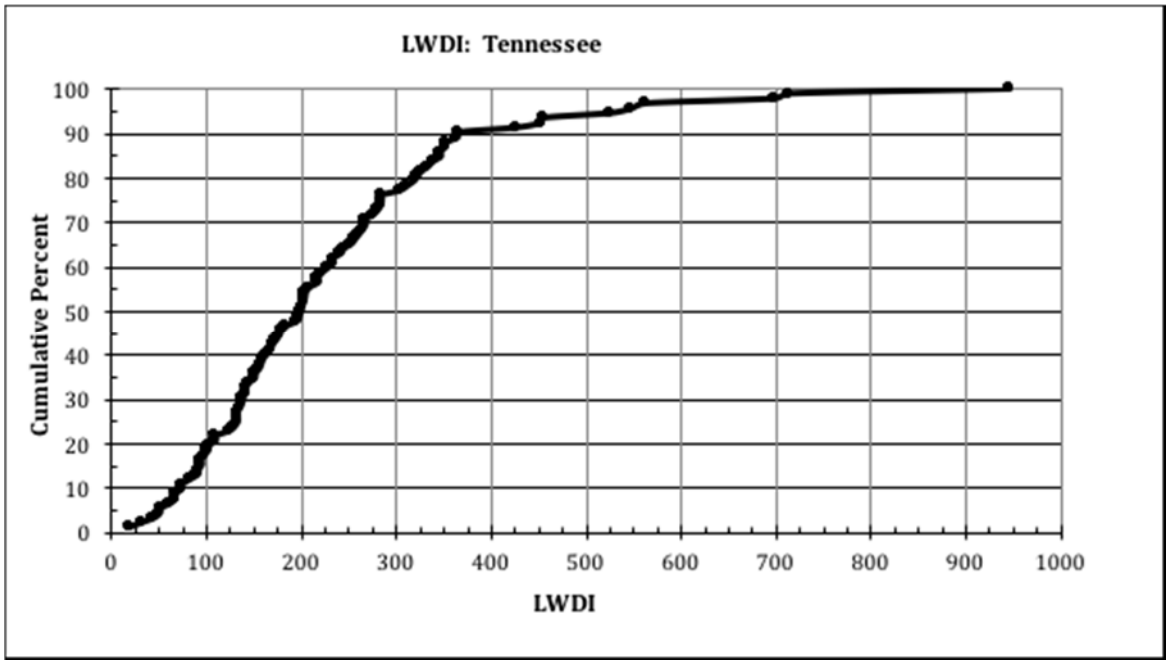


Figure 10-12. LWDI cumulative distribution for all 92 reference streams statewide.

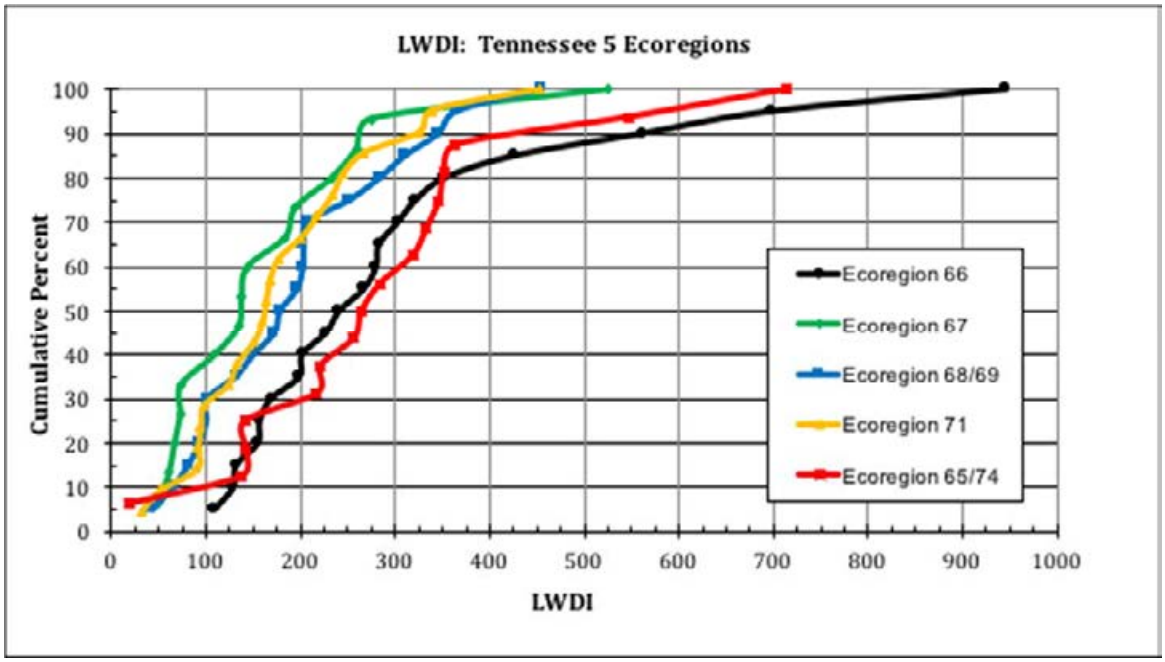


Figure 10-13. LWDI cumulative distributions for each ecoregion.

All reference streams in this study had forested floodplains with relatively stable streambanks and upstream watersheds. Typical vegetation included various native hardwood and some evergreen tree species ranging in age from less than 20 to greater than 50 years. Based on field observations, the variability in large woody debris density and functionality found in these reference streams is attributed largely to the natural randomness of fallen trees and broken limbs existing temporarily or long-term

within the 100-meter observation reach of each reference stream. Stream systems with recent disturbance due to wind storms, ice, or floods seemed to have more LWD pieces and debris dams.

In the Blue Ridge Ecoregion, the generally higher LWDI scores may be attributed to the prevalence of hemlocks and other evergreen species with broken limbs existing in many of the reference streams. In some cases, steeper slope streams with narrow floodplains had fallen trees and broken limbs from recent storms. In the Plains Ecoregions, the generally higher LWDI scores may be attributed to the prevalence of fallen trees found in low-slope wetland floodplains with meandering streams that have experienced natural planform adjustments.

The relationships of statewide LWDI scores to watershed drainage area and reach slope are shown in Figures 10-14 and 10-15, respectively. Neither of these two factors explains statistically the natural variability in LWDI observed statewide. Considering that the regression slopes are close to zero for both relationships, there is no observable trend in LWDI score for increasing drainage area or reach slope for the 92 reference streams statewide. The range of reference LWDI scores is consistent for all stream sizes in this study.

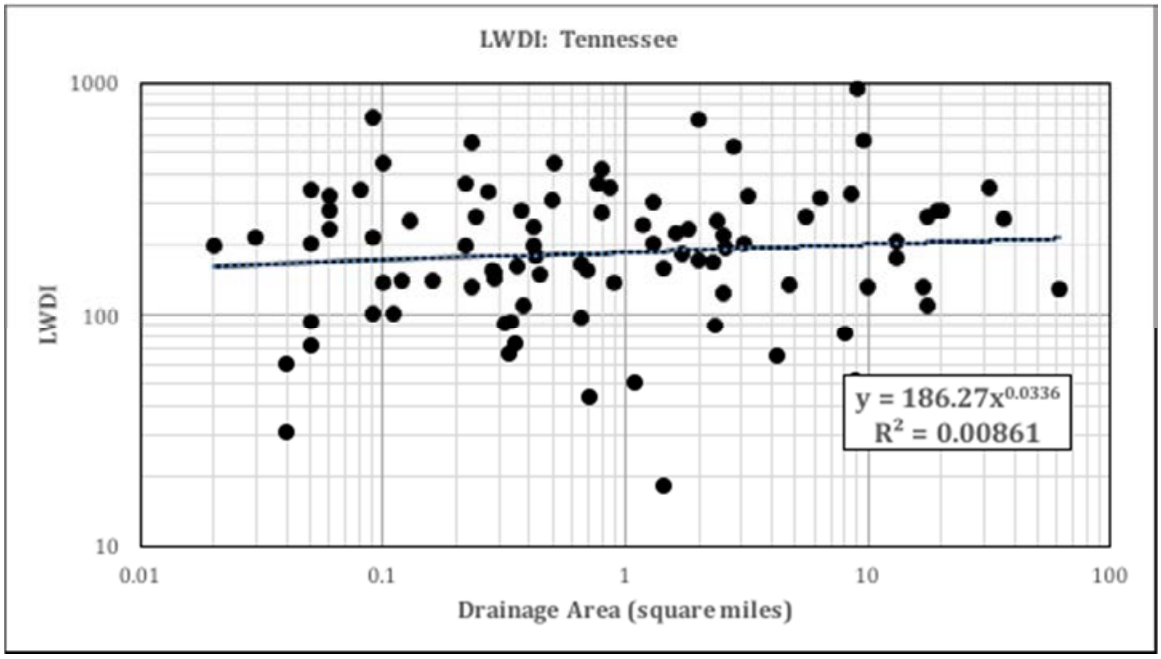


Figure 10-14. LWDI related to watershed drainage area for the 92 reference streams statewide.

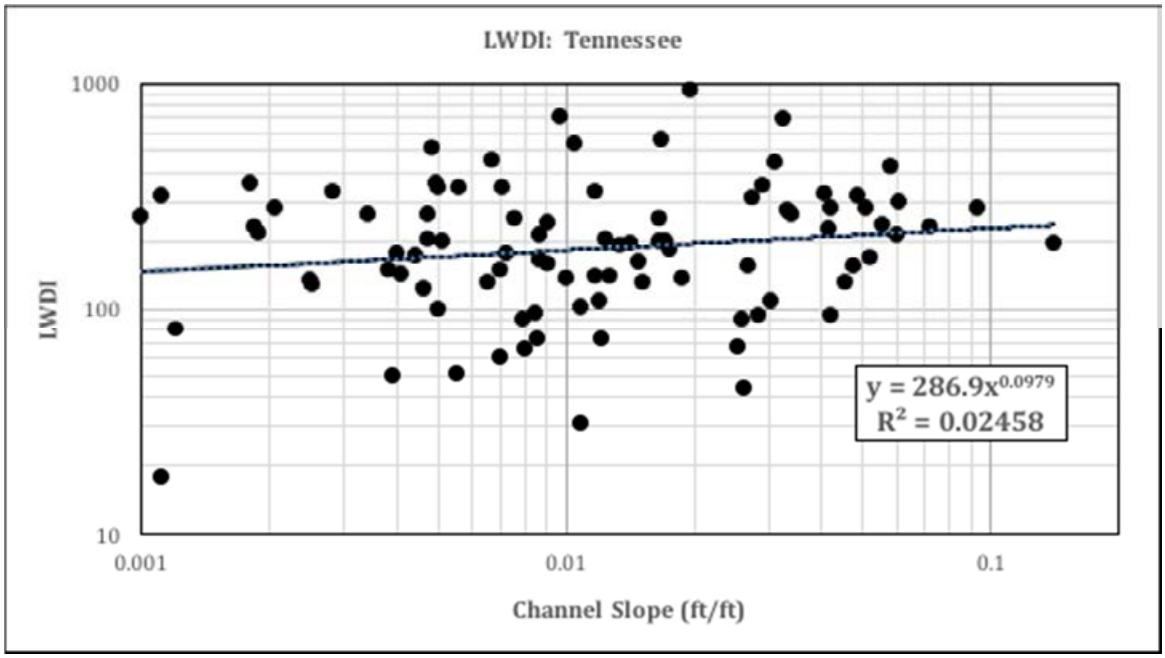


Figure 10-15. LWDI related to reach channel slope for the 92 reference streams statewide.

The LWDI results for these 92 reference streams may be used to compare with disturbed or restored stream systems. It should be noted that some disturbed streams are expected to have high LWDI scores due to unstable streambanks and resulting fallen trees or recent storms. In a stream restoration project, LWDI may be enhanced by the strategic addition of logs and woody debris to the restoration channel in the form of vanes, revetments, riffle wood, or other habitat structures. The database developed in this study should be supplemented with additional data collected on reference, disturbed, and restored streams using the same quantification method to support future analyses of LWD in Tennessee streams.

Table 10-3. LWD for Ecoregion 66 (Blue Ridge).

Stream Name	Latitude	Longitude	Drainage Area (sq mi)	Slope (ft/ft)	Pieces	Dams	Piece Score	Dam Score	LWDI
False Gap Prong	35.706581	-83.382170	0.28	0.0474	8	0	157	0	157
Catron Branch	35.663774	-83.587464	0.37	0.0505	13	0	283	0	283
Bearwallow Branch	35.652274	-83.574728	0.42	0.0141	8	0	199	0	199
UT Laurel Creek	35.345191	-84.193323	0.42	0.0553	8	1	151	18	241
Mids Branch	35.657787	-83.579546	0.69	0.0267	7	0	155	0	155
Bearwallow Creek	36.158204	-82.103407	0.80	0.0576	15	1	317	22	427
Sill Branch	36.127883	-82.533143	1.3	0.0604	6	2	128	35	303
Laurel Creek	35.345255	-84.194284	1.3	0.0170	4	1	77	25	202
UT Little Stony Creek	36.283843	-82.067919	1.6	0.0415	10	0	227	0	227
Little Slickrock Creek	35.448456	-83.982228	2.0	0.0322	14	4	349	70	699
Little Stony Creek	36.28646	-82.066313	2.3	0.0517	7	1	109	12	169
Lower Higgins Creek	36.086343	-82.522528	3.2	0.0482	10	1	222	20	322
Slickrock Creek	35.431553	-83.999251	9.0	0.0196	19	5	486	92	946
Clark Creek	36.147859	-82.528400	9.5	0.0167	15	2	367	39	562
Doe River	36.157320	-82.100600	10.0	0.0151	7	0	132	0	132
Laurel Fork	36.255862	-82.109877	17.4	0.0047	13	0	267	0	267
Porters Creek	35.706229	-83.383259	17.7	0.0304	7	0	109	0	109
Middle Prong Pigeon	35.707277	-83.380050	19.5	0.0417	13	1	195	17	280
Little River	35.652767	-83.573211	31.3	0.0290	9	2	148	41	353
Citico Creek	35.506607	-84.106280	61.0	0.0025	8	0	129	0	129

Table 10-4. LWD for Ecoregion 67 (Ridge and Valley).

Stream Name	Latitude	Longitude	Drainage Area (sq mi)	Slope (ft/ft)	Pieces	Dams	Piece Score	Dam Score	LWDI
Forks Creek (3)	35.937514	-83.848191	0.04	0.0070	3	0	61	0	61
Ijams Creek	35.956553	-83.868685	0.05	0.0085	4	0	73	0	73
Forks Creek (2)	35.949691	-83.853727	0.29	0.0041	7	0	144	0	144
UT White Creek	36.349005	-83.899726	0.33	0.0253	4	0	67	0	67
Forks Creek (1)	35.936921	-83.849549	0.35	0.0121	4	0	74	0	74
Big Ridge Creek	36.246175	-83.921839	0.38	0.0119	6	0	109	0	109
Big Spring Creek	36.303581	-83.944898	0.79	0.0331	10	1	195	16	275
White Creek	36.348095	-83.901602	0.90	0.0187	7	0	138	0	138
Mill Creek	35.988330	-84.288880	1.1	0.0039	3	0	50	0	50
Toll Creek	35.952161	-83.864656	1.7	0.0174	10	0	184	0	184
Forks Creek (4)	35.937082	-83.848372	1.8	0.0018	7	1	133	20	233
Clear Creek (1)	36.322751	-83.913806	2.6	0.0133	10	0	195	0	195
Clear Creek (2)	36.213589	-84.059333	2.8	0.0048	15	2	326	40	526
Crockett Creek	36.379817	-83.046554	4.7	0.0025	7	0	135	0	135
Beaver Creek	36.059269	-83.972218	36.4	0.0010	10	1	180	16	260

Table 10-5. LWD for Ecoregions 68/69 (Southwest and Central Appalachians).

Stream Name	Latitude	Longitude	Drainage Area (sq mi)	Slope (ft/ft)	Pieces	Dams	Piece Score	Dam Score	LWDI
UT1 New River	36.120713	-84.432341	0.02	0.1400	12	0	197	0	197
UT Groom Branch	36.450189	-84.708111	0.05	0.0051	12	0	203	0	203
UT2 New River	36.121060	-84.430431	0.06	0.0928	17	0	284	0	284
UT West Fork Coyte Branch	36.463306	-84.714556	0.08	0.0071	13	1	236	22	346
UT Weaver Branch	35.934432	-84.859921	0.09	0.0108	6	0	102	0	102
UT Bee Ridge Creek	36.075083	-84.931611	0.11	0.005	6	0	101	0	101
UT Slave Falls	36.531368	-84.769519	0.29	0.0038	8	0	151	0	151
Underwood Branch	36.079056	-84.911972	0.34	0.0282	5	0	94	0	94
West Fork Coyte Branch	36.463139	-84.714583	0.43	0.0040	9	0	179	0	179
Coon Creek	35.666057	-85.356841	0.50	0.0272	7	2	141	34	311
Weaver Branch	35.936126	-84.857636	0.51	0.0067	12	2	245	42	455
Flatrock Branch	36.123561	-84.424819	0.71	0.0262	3	0	44	0	44
Bandy Creek	36.489056	-84.710028	0.76	0.0018	13	1	265	20	365
Black House Branch	36.515389	-84.716944	2.0	0.0044	10	0	173	0	173
Flat Fork	36.136792	-84.4872	2.4	0.0165	13	0	252	0	252
Rockhouse Creek	35.663490	-85.346584	3.1	0.0124	5	1	119	17	204
New River	36.125320	-84.420904	4.2	0.0080	4	0	66	0	66
Basses Creek	35.850888	-85.055245	8.0	0.0012	4	0	82	0	82
Laurel Fork	36.513783	-84.715431	13	0.0047	12	0	208	0	208
Otter Creek	36.053528	-84.856222	17	0.0065	7	0	132	0	132

Table 10-6. LWD for Ecoregion 71 (Interior Plateau).

Stream Name	Latitude	Longitude	Drainage Area (sq mi)	Slope (ft/ft)	Pieces	Dams	Piece Score	Dam Score	LWDI
UT2 Little Swan	35.519570	-87.456770	0.03	0.0597	11	0	217	0	217
UT UT2 Woodhaven Lake	36.073430	-87.283140	0.04	0.0108	2	0	31	0	31
UT Little Buffalo	35.352084	-87.505361	0.05	0.0419	5	0	94	0	94
UT5 Little Swan	35.525536	-87.457892	0.06	0.0406	5	2	96	46	326
UT4 Little Swan	35.513963	-87.455846	0.06	0.0714	11	0	233	0	233
UT UT1 Woodhaven Lake	36.076050	-87.275320	0.10	0.0310	14	2	247	41	452
Hams Branch	35.356584	-87.512692	0.22	0.0166	11	0	200	0	200
UT2 Bryans Fork	36.456190	-85.420770	0.23	0.0455	7	0	132	0	132
UT1 Bryans Fork	36.458700	-85.426770	0.24	0.0339	13	0	267	0	267
UT1 Woodhaven Lake	36.076190	-87.275730	0.27	0.0117	6	2	103	47	338
UT Morgan Creek	36.449308	-85.392042	0.32	0.0260	5	0	91	0	91
East Fork Hurricane	36.055688	-86.277492	0.36	0.0147	9	0	163	0	163
UT2 Woodhaven Lake	36.073830	-87.283170	0.44	0.0070	2	1	30	24	150
UT3 Woodhaven Lake	36.081150	-87.294230	0.66	0.0086	6	1	77	18	167
UT Little Marrowbone	36.272148	-86.902682	0.66	0.0084	6	0	97	0	97
UT1 Little Swan	35.527900	-87.456635	1.2	0.0090	8	1	144	20	244
Weaver Branch	35.355438	-87.502046	1.4	0.0090	9	0	159	0	159
Will Hall Creek	36.071610	-87.294210	2.3	0.0079	6	0	90	0	90
Bryans Fork	36.457484	-85.425830	2.5	0.0046	8	0	123	0	123
Little Swan	35.529466	-87.453971	8.8	0.0055	4	0	51	0	51
Little Buffalo	35.352696	-87.503928	13.2	0.0072	10	0	176	0	176

Table 10-7. LWD for Ecoregions 65/74 (Southeastern Plains and Mississippi Valley Loess Plains).

Stream Name	Latitude	Longitude	Drainage Area (sq mi)	Slope (ft/ft)	Pieces	Dams	Piece Score	Dam Score	LWDI
UT2 Tuscumbia River	35.050330	-88.748937	0.05	0.00500	15	0	346	0	346
UT Piney Creek	35.389989	-88.789536	0.09	0.00863	10	0	217	0	217
UT1 Barnishee Bayou	35.351310	-90.046340	0.09	0.00966	19	4	329	77	714
UT Little Sugar Creek	35.376268	-88.747104	0.10	0.01000	7	0	137	0	137
UT1 Tuscumbia River	35.051156	-88.750444	0.12	0.01257	6	0	141	0	141
UT3 Barnishee Bayou	35.371643	-90.026829	0.13	0.00755	11	0	256	0	256
UT North Fork Cub	35.785215	-88.264681	0.16	0.01164	7	0	141	0	141
UT Poplar Tree Lake	35.314997	-90.058076	0.22	0.00495	13	1	259	21	364
UT2 Barnishee Bayou	35.365364	-90.033687	0.23	0.01040	15	2	328	44	548
Barnishee Bayou	35.352193	-90.046466	0.86	0.00560	17	0	351	0	351
Cypress Creek	35.376401	-88.852283	1.4	0.00111	1	0	18	0	18
Scotts Creek	35.267750	-89.740489	2.5	0.00188	5	1	126	19	221
Trace Creek	35.662943	-88.668672	5.6	0.00341	8	1	179	17	264
Marshall Creek	35.160921	-89.067608	6.4	0.00111	13	0	318	0	318
Spring Creek	35.770129	-88.691930	8.5	0.00283	9	2	173	32	333
Harris Creek	35.626065	-88.694443	20.2	0.00206	7	2	134	30	284

XI. LITERATURE CITED

Arcement, G.J. Jr., V.R. Schneider, 1989. Guide for selecting Manning's roughness coefficients for natural channels and flood plains. United States Geological Survey Water Supply Paper 2339. United States Geological Survey, Washington, DC.

Barnes, H.H., 1967. Roughness characteristics of natural channels. United States Geological Survey, Washington, DC.

Benson, M.A., T. Dalrymple, 1967. General field and office procedures for indirect discharge measurements. Chapter A1 in United States Geological Survey Techniques of Water-Resources Investigations, book 3. United States Geological Survey, Washington, DC.

Beschta, R.L., W.S. Platts, 1986. Morphological features of small streams: significance and function. *Water Resources Bulletin* 22, 369-379.

Biedenharn, D.S., R.R. Copeland, 2000. Effective discharge calculation. ERDC/CHL CHETN-VIII-4, United States Army Engineers Research and Development Center, Vicksburg, Mississippi.

Bieger, K., H. Rathjens, P.M. Allen, J.G. Arnold, 2015. Development and evaluation of bankfull hydraulic geometry relationships for the physiographic regions of the United States. Journal of the American Water Resources Association (JAWRA) 51(3): 842-858. DOI: 10.1111/jawr.12282.

Brockman, R. R., C.T. Agouridis, S.R. Workman, L.E. Ormsbee, and A.W. Fogle, 2012. Bankfull regional curves for the inner and outer bluegrass regions of Kentucky. Journal of the American Water Resources Association (JAWRA) 1-16. DOI: 10.1111/j.1752-1688.2011.00621.x

Chin, A., S. Anderson, A. Collison, B.J. Ellis-Sugai, J.P. Haltiner, J.B. Hogervorst, G.M. Kondolf, L.S. O'Hirok, A.H. Purcell, A.L. Riley, E. Wohl, 2009. Linking theory and practice for restoration of step-pool streams. *Environmental Management* 43: 645-661.

Chow, V.T., 1959. Open-channel hydraulics. McGraw-Hill, New York.

Cinotto, Peter J., 2003. Development of regional curves of bankfull-channel geometry and discharge for streams in the non-urban, Piedmont Physiographic Province, Pennsylvania and Maryland. United States Geological Survey Water Resources Investigations Report 2003-4014.

Cowan, W.L., 1956. Estimating hydraulic roughness coefficients. Agricultural Engineering 37, 473-475.

Davis, J.C., G.W. Minshall, C.T. Robinson, and P. Landres, 2001. Large woody debris. In Monitoring Wilderness Stream Ecosystems. General Technical Report RMRS-GTR-70, pp. 73 - 77. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado.

Dingman, S. L., 2007. Fluvial hydraulics. Oxford University Press, New York, New York, ISBN-13: 978-0195172867.

Dunne, T., L.B. Leopold, 1978. Water in environmental planning. W.H. Freeman Company, San Francisco, California, ISBN-13: 978-0716700791.

Harman, W.A., T.B. Barrett, C.J. Jones, A. James, and H.M. Peel. 2017. Application of the large woody debris index: A field user manual, Version 1. Stream Mechanics and Ecosystem Planning & Restoration, Raleigh, NC.

Harrelson, C.C., J.P. Potyondy, C.L. Rawlins, 1994. Stream channel reference sites: an illustrated guide to field technique. General Technical Report RM-245. United States Department of Agriculture, Forest Service.

Helms, B.; Zink, J.; Werneke, D.; Hess, T.; Price, Z.; Jennings, G.; Brantley, E., 2016. Development of Ecogeomorphological (EGM) Stream Design and Assessment Tools for the Piedmont of Alabama, USA. Water 8, 161.

Heritage, G., D. Hetherington, 2007. Toward a protocol for laser scanning in fluvial geomorphology. *Earth Surface Processes and Landforms* 32, 66-74.

Keaton, J.N., T. Messinger, E.J. Doheny, 2005. Development and analysis of regional curves for streams in the non-urban valley and ridge physiographic province, Maryland, Virginia, and West Virginia. United States Geological Survey Scientific Investigations Report 2005-5076.

Leopold, L.B., T. Maddock, Jr., 1953. The hydraulic geometry of stream channels and some physiographic implications. United States Geological Survey Professional Paper 252.

Leopold, L.B., M.G. Wolman, J.P. Miller, 1964. Fluvial processes in geomorphology. W.H. Freeman and Company, San Francisco, California, ISBN-13: 978-0486685885.

Leopold, L.B., 1994. A view of the river. Harvard University Press, Cambridge, Massachusetts, ISBN-13: 978-0674018457.

Marcus, W.A., K. Roberts, L. Harvey, G. Tackman, 1992. An evaluation of methods for estimating Manning's n in small mountain streams. Mountain Research and Development 12, 227-239.

McKean, J., D. Isaak, W. Wright, 2009. Improving stream studies with a small-footprint green lidar. *Transactions American Geophysical Union* 90, 341.

Resop, J.P., W.C. Hession, 2010. Terrestrial laser scanning for monitoring streambank retreat: comparison with traditional surveying techniques. *Journal of Hydraulic Engineering* 136, 794-798.

Rosgen, D.L., 1994. A classification of natural rivers. *Catena* 22, 169-199.

United States Environmental Protection Agency (USEPA), 2013. EPA Level III ecoregions of the continental United States. Corvallis, Oregon, USEPA National Health and Environmental Effects Research Laboratory, map scale 1:7,500,000, http://www.epa.gov/wed/pages/ecoregions /level_iii_iv.htm.

United States Geological Survey (USGS) StreamStats, 2017. http://water.usgs.gov/osw/streamstats

Wolman, M.G., L.B. Leopold, 1957. River floodplains: some observations on their formation. United States Geological Survey Professional Paper 282-C. United States Geological Survey, Washington, DC.

Zimmerman, A., M. Church, M.A. Hassan, 2008. Identification of steps and pools from stream longitudinal profile data. *Geomorphology* 102: 395-406.

Zink, J. M., G. D. Jennings, G. A. Price, 2012. Morphology characteristics of southern Appalachian wilderness streams. Journal of the American Water Resources Association (JAWRA), 48: 762–773. doi: 10.1111/j.1752-1688.2012.00647.x

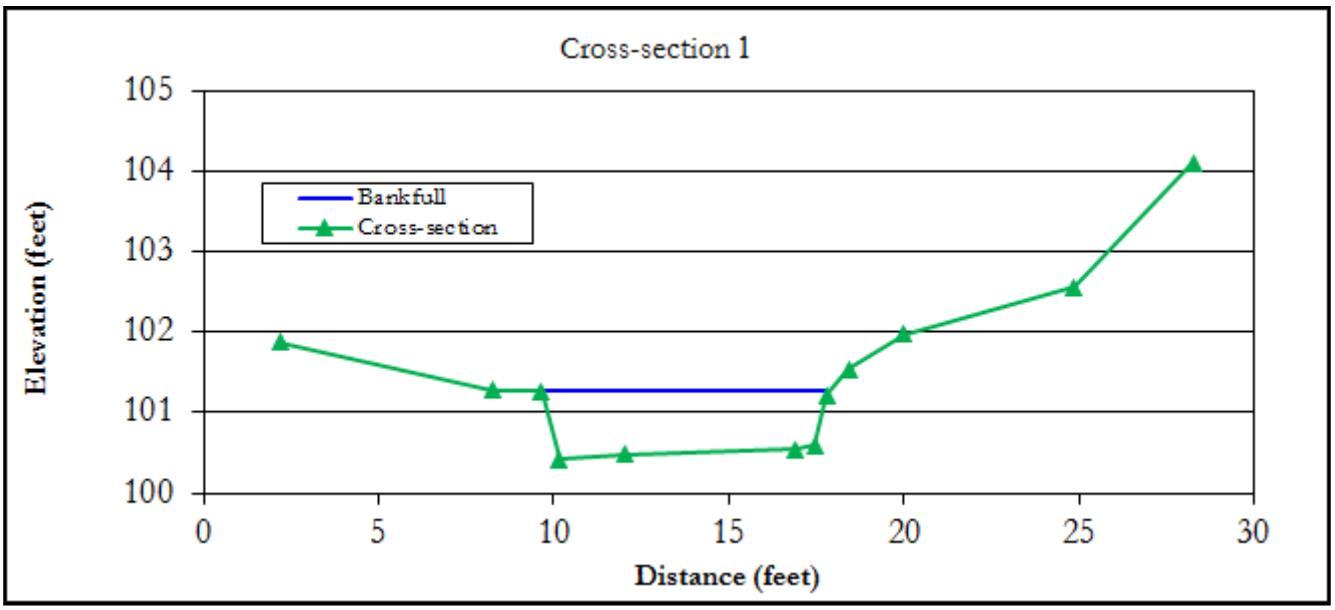
APPENDIX A

Ecoregion 66 Morphology Data

1. False Gap Prong
Ecoregion 66, Tennessee

Latitude: 35.706581
Longitude: -83.382170
Drainage area: 0.28 square miles
Median particle size: gravel
Longitudinal slope: 0.04738 feet/foot
Stream classification: E4a

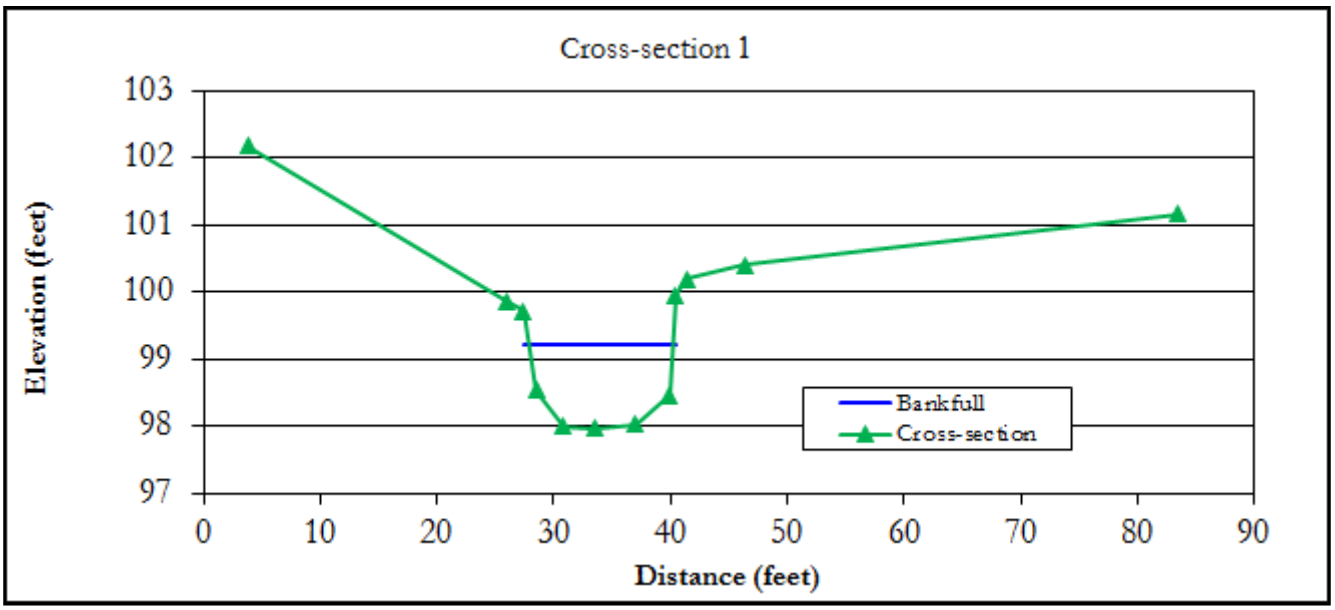
	X1
Area (square feet) =	5.9
Width (feet) =	8.3
Mean depth =	0.7
Max depth =	0.8
Width/depth ratio =	11.6
Entrenchment ratio =	2.5



2. Catron Branch
Ecoregion 66, Tennessee

Latitude: 35.663774
Longitude: -83.587464
Drainage area: 0.37 square miles
Median particle size: cobble
Longitudinal slope: 0.05047 feet/foot
Stream classification: B3a

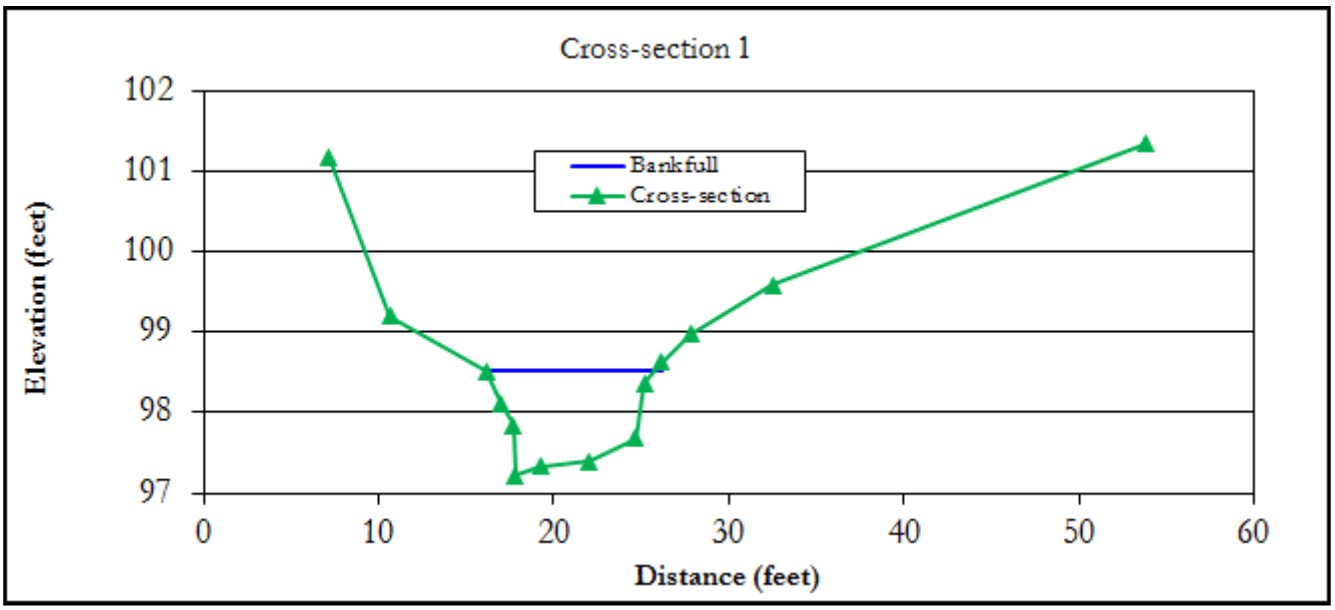
	X1
Area (square feet) =	12.9
Width (feet) =	12.3
Mean depth =	1.0
Max depth =	1.3
Width/depth ratio =	11.7
Entrenchment ratio =	2.4



3. Bearwallow Branch
Ecoregion 66, Tennessee

Latitude: 35.652274
Longitude: -83.574728
Drainage area: 0.42 square miles
Median particle size: gravel
Longitudinal slope: 0.01414 feet/foot
Stream classification: E4

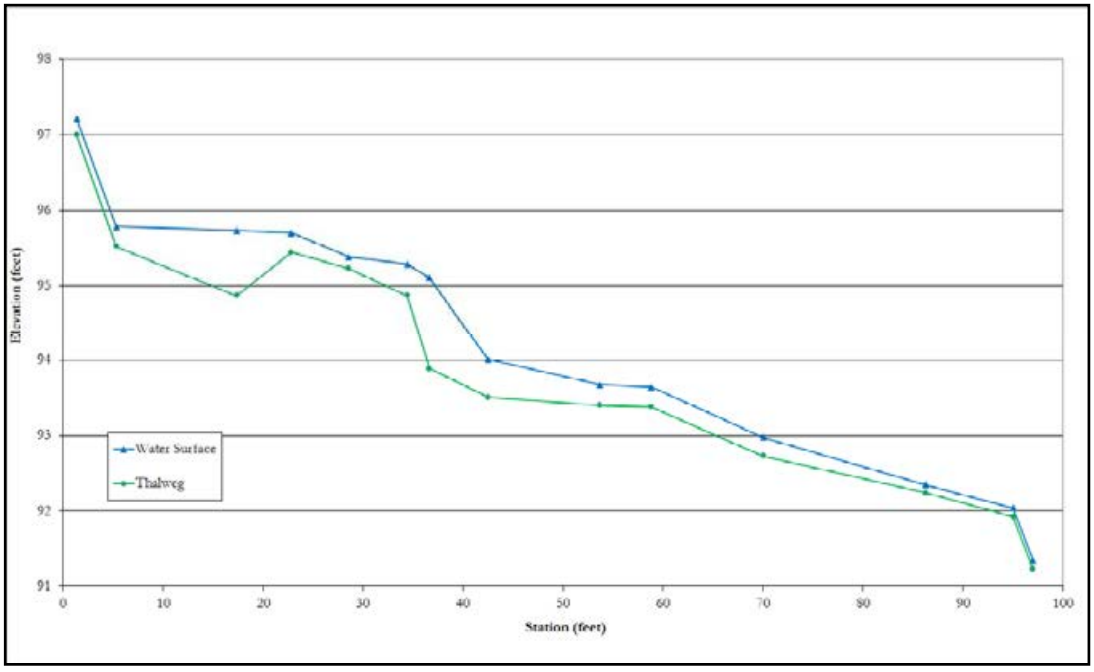
	X1
Area (square feet) =	8.6
Width (feet) =	9.6
Mean depth =	0.9
Max depth =	1.3
Width/depth ratio =	10.8
Entrenchment ratio =	2.7



4. UT Laurel Creek
Ecoregion 66, Tennessee

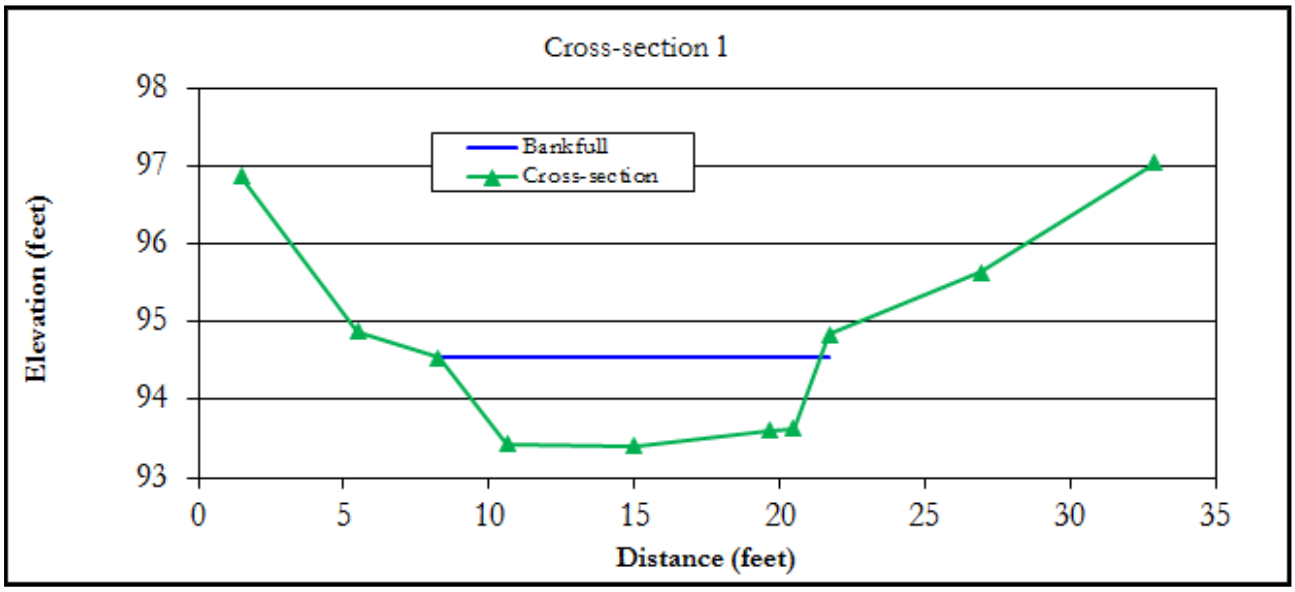
Latitude: 35.345191
Longitude: -84.193323
Drainage area: 0.42 square miles
Median particle size: gravel
Longitudinal slope: 0.05530 feet/foot
Stream classification: B4a

	X1
Area (square feet) =	12.2
Width (feet) =	13.2
Mean depth =	0.9
Max depth =	1.1
Width/depth ratio =	14.2
Entrenchment ratio =	1.7



Longitudinal Profile

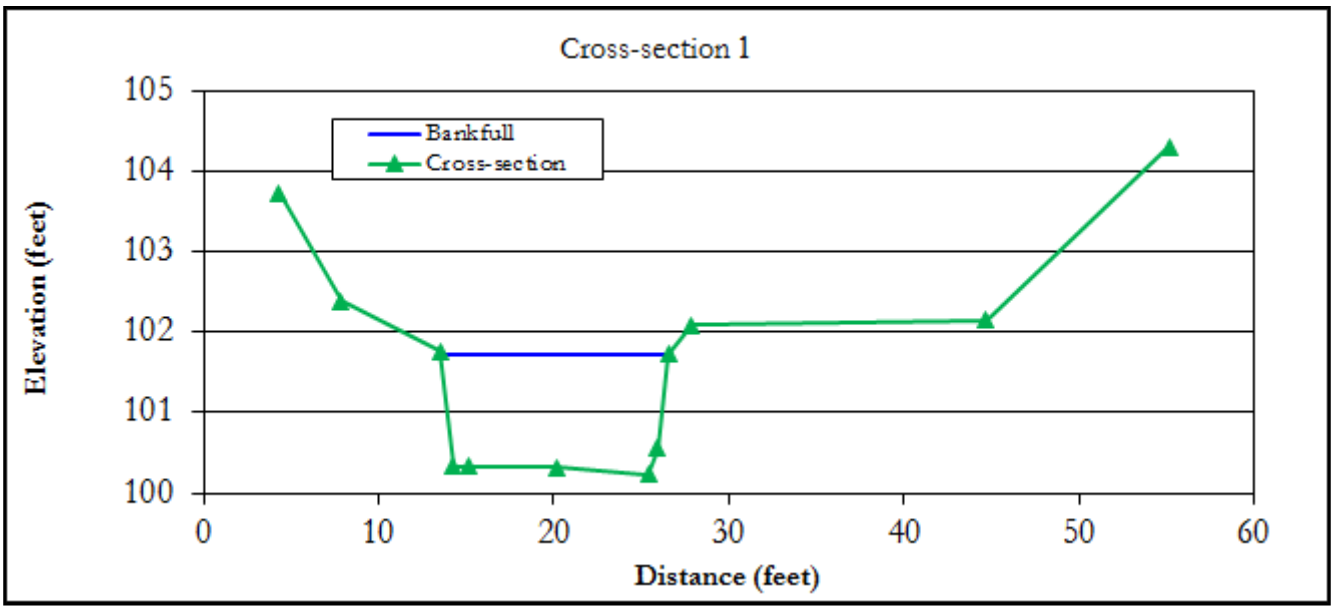
4. UT Laurel Creek
Ecoregion 66, Tennessee



5. Mids Branch
Ecoregion 66, Tennessee

Latitude: 35.657787
Longitude: -83.579546
Drainage area: 0.69 square miles
Median particle size: gravel
Longitudinal slope: 0.02677 feet/foot
Stream classification: E4b

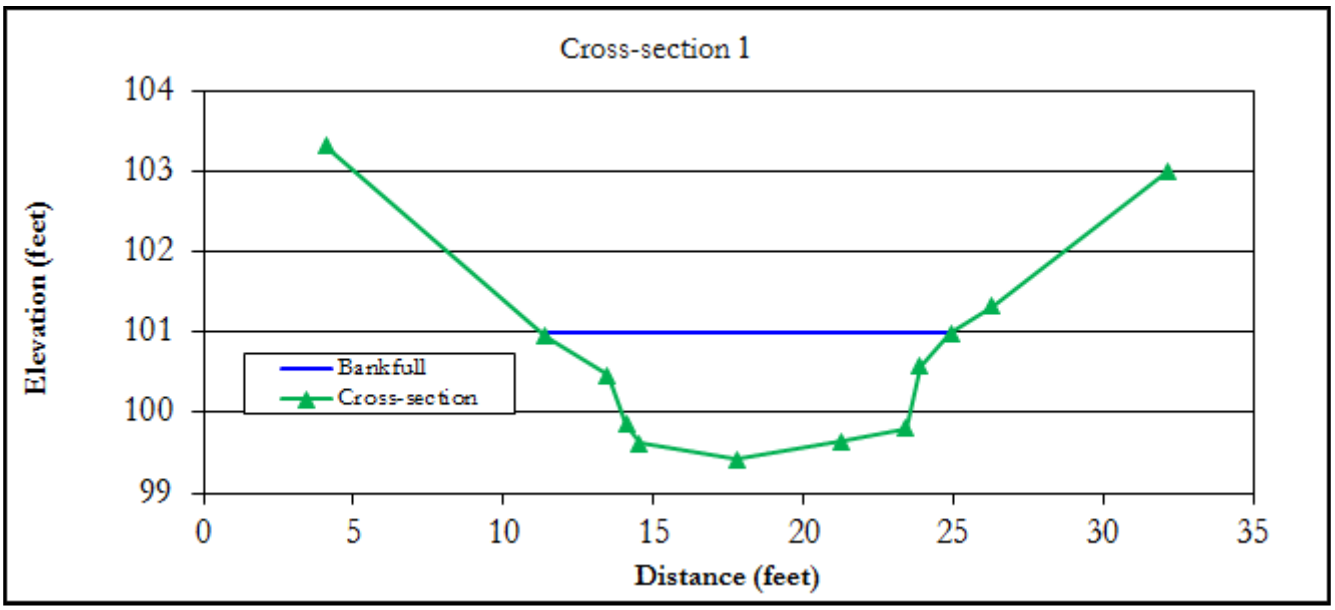
	X1
Area (square feet) =	17.5
Width (feet) =	13.0
Mean depth =	1.3
Max depth =	1.5
Width/depth ratio =	9.7
Entrenchment ratio =	3.4



6. Bearwallow Creek
Ecoregion 66, Tennessee

Latitude: 36.158204
Longitude: -82.103407
Drainage area: 0.81 square miles
Median particle size: gravel
Longitudinal slope: 0.05765 feet/foot
Stream classification: B4a

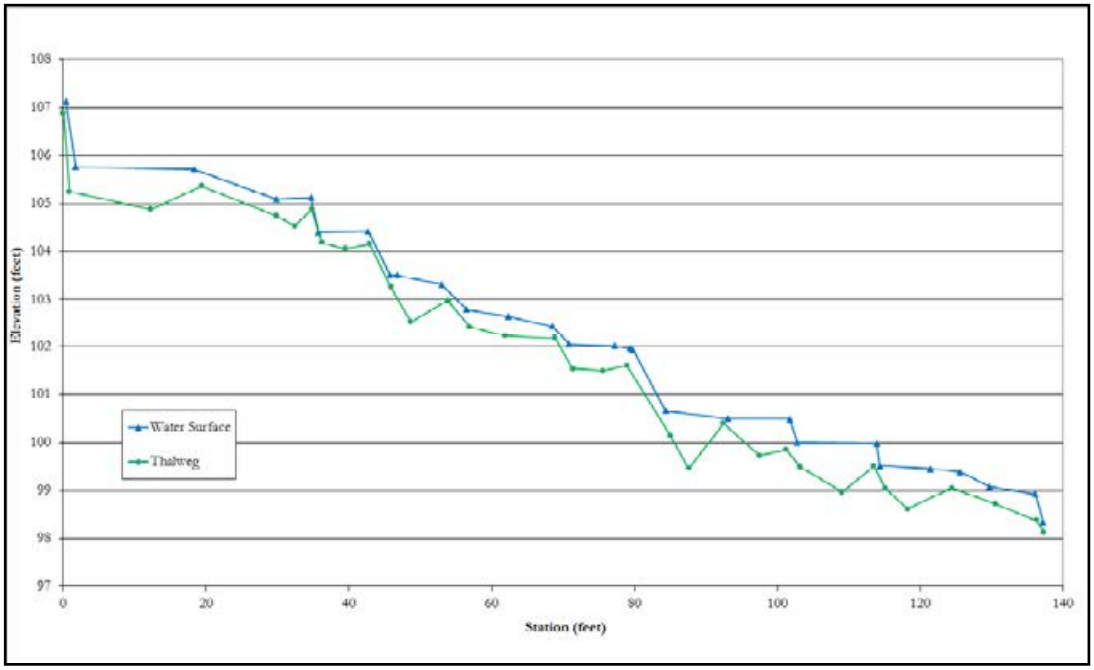
	X1
Area (square feet) =	14.8
Width (feet) =	13.6
Mean depth =	1.1
Max depth =	1.6
Width/depth ratio =	12.6
Entrenchment ratio =	1.8



7. Sill Branch
Ecoregion 66, Tennessee

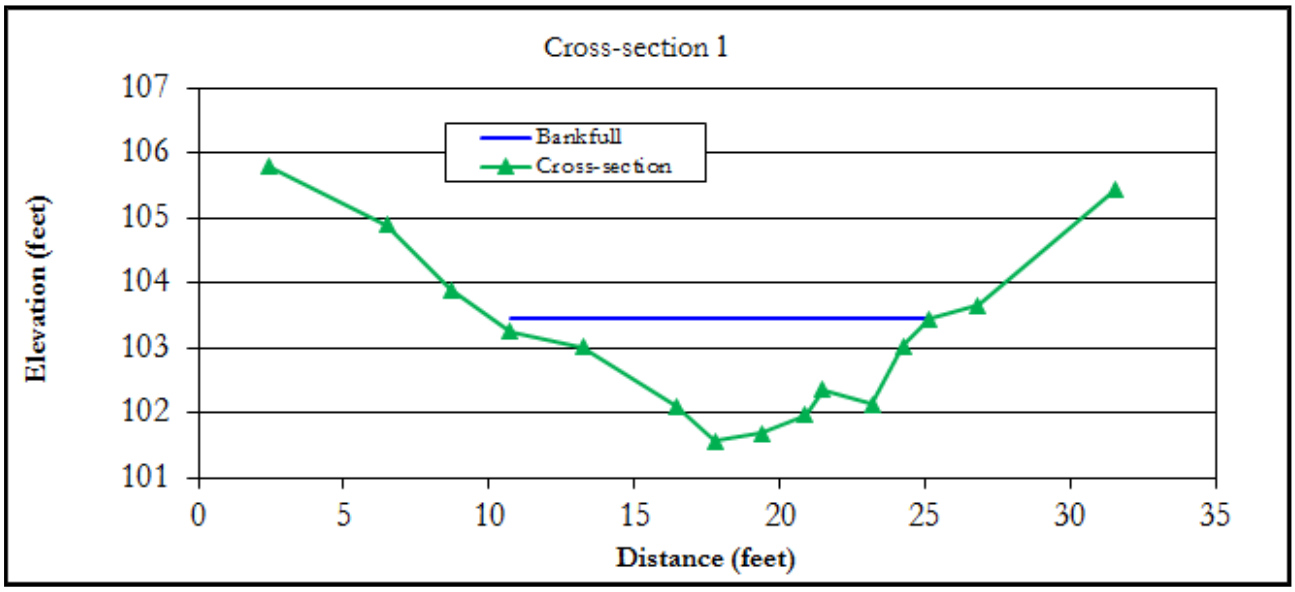
Latitude: 36.127883
Longitude: -82.533143
Drainage area: 1.29 square miles
Median particle size: cobble
Longitudinal slope: 0.06041 feet/foot
Stream classification: B3a

	X1
Area (square feet) =	15.1
Width (feet) =	15.0
Mean depth =	1.0
Max depth =	1.9
Width/depth ratio =	14.9
Entrenchment ratio =	1.8



Longitudinal Profile

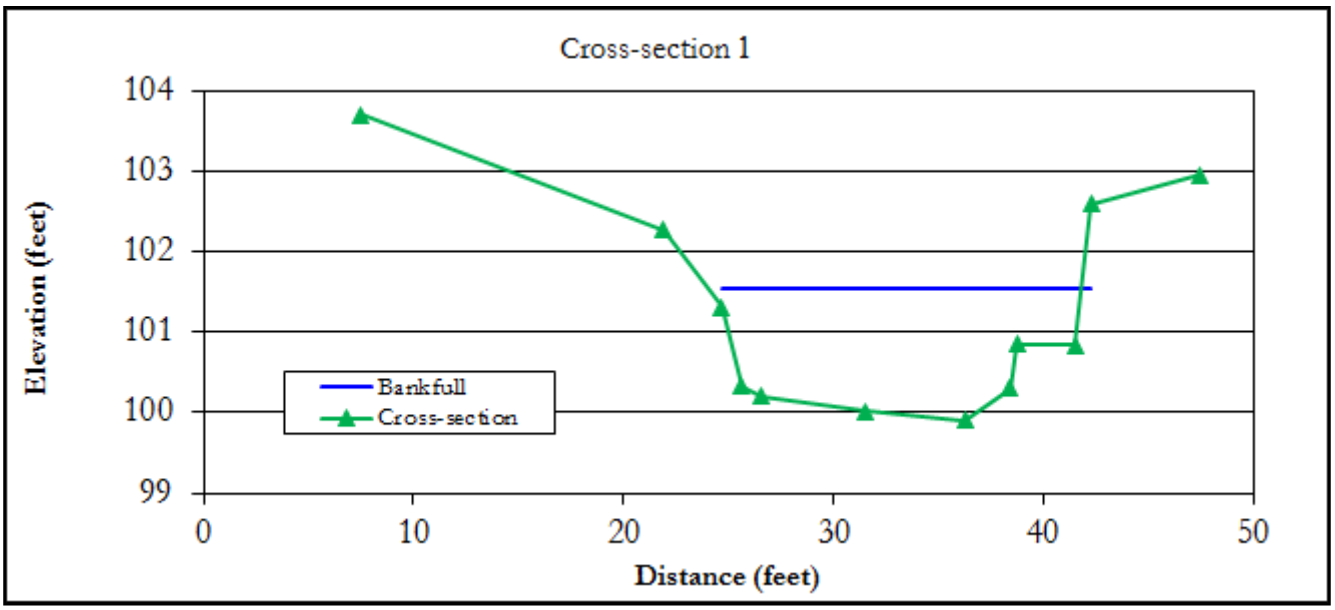
7. Sill Branch
Ecoregion 66, Tennessee



8. Laurel Creek
Ecoregion 66, Tennessee

Latitude: 35.345255
Longitude: -84.194284
Drainage area: 1.31 square miles
Median particle size: gravel
Longitudinal slope: 0.01706 feet/foot
Stream classification: C4

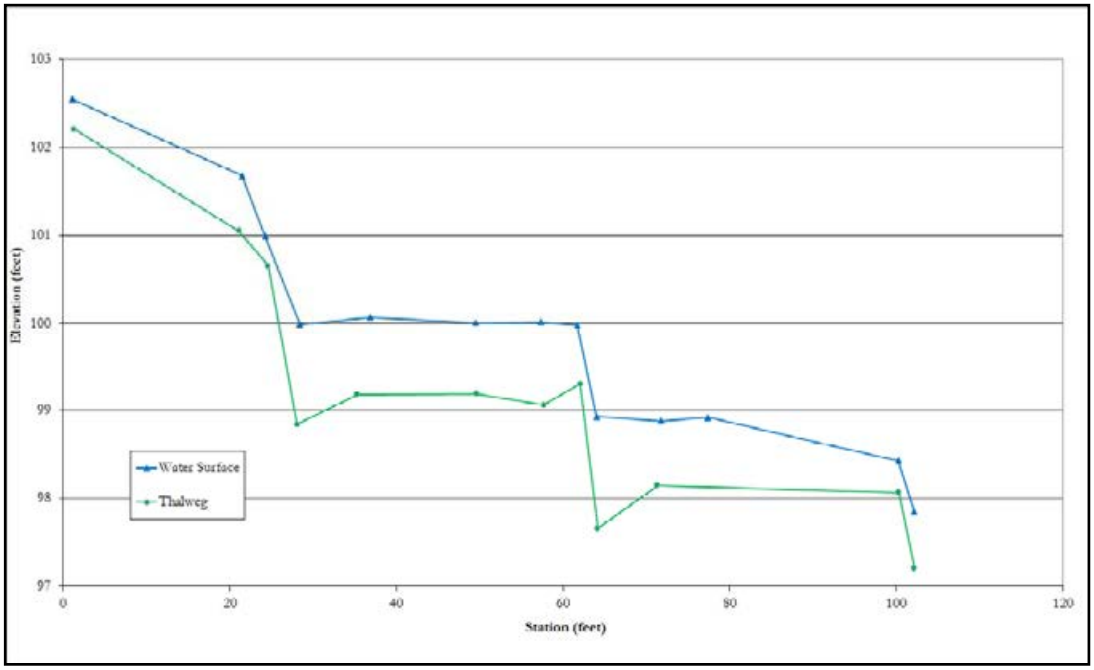
	X1
Area (square feet) =	22.1
Width (feet) =	17.8
Mean depth =	1.2
Max depth =	1.6
Width/depth ratio =	14.4
Entrenchment ratio =	4.8



9. UT Little Stony Creek
Ecoregion 66, Tennessee

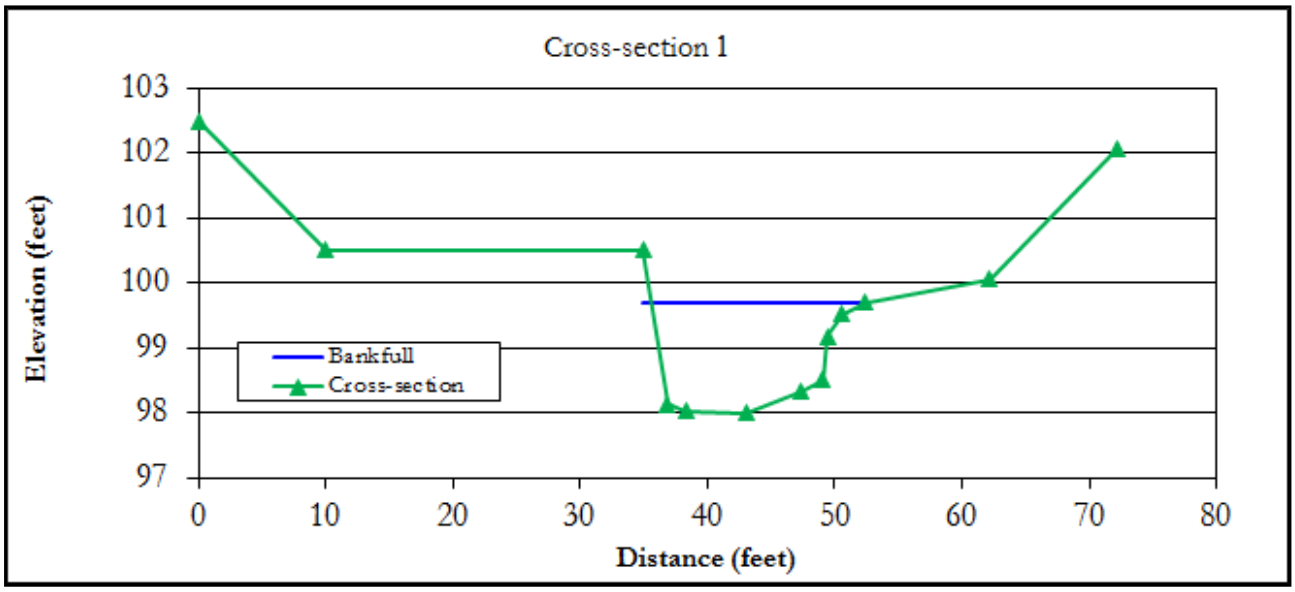
Latitude: 36.283843
Longitude: -82.067919
Drainage area: 1.60 square miles
Median particle size: cobble
Longitudinal slope: 0.04156 feet/foot
Stream classification: C3a

	X1
Area (square feet) =	20.9
Width (feet) =	16.8
Mean depth =	1.2
Max depth =	1.7
Width/depth ratio =	13.4
Entrenchment ratio =	3.8



Longitudinal Profile

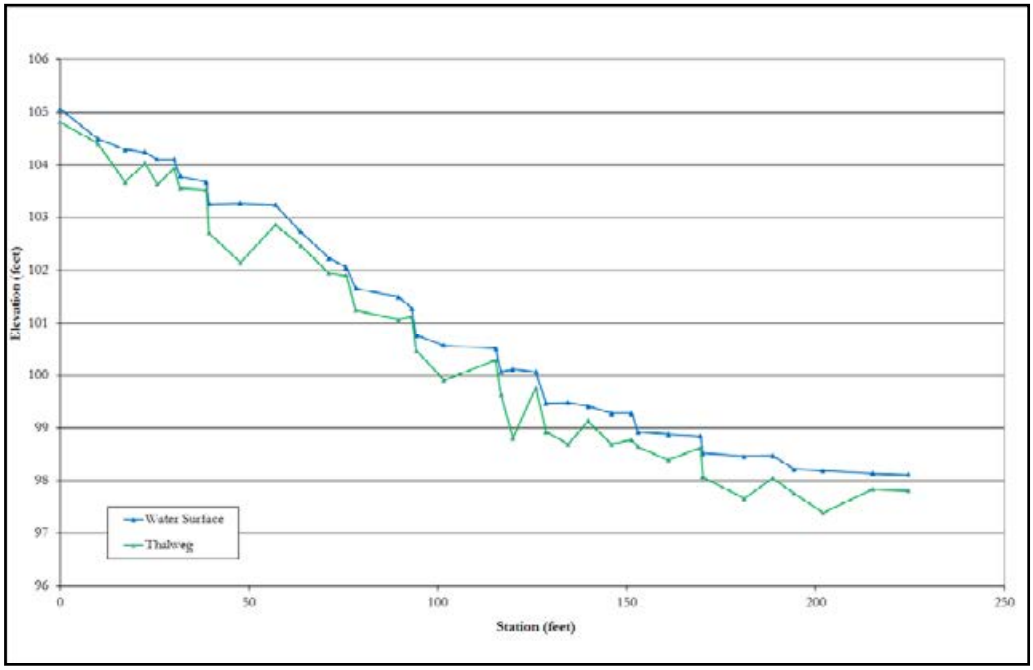
9. UT Little Stony Creek
Ecoregion 66, Tennessee



10. Little Slickrock Creek
Ecoregion 66, Tennessee

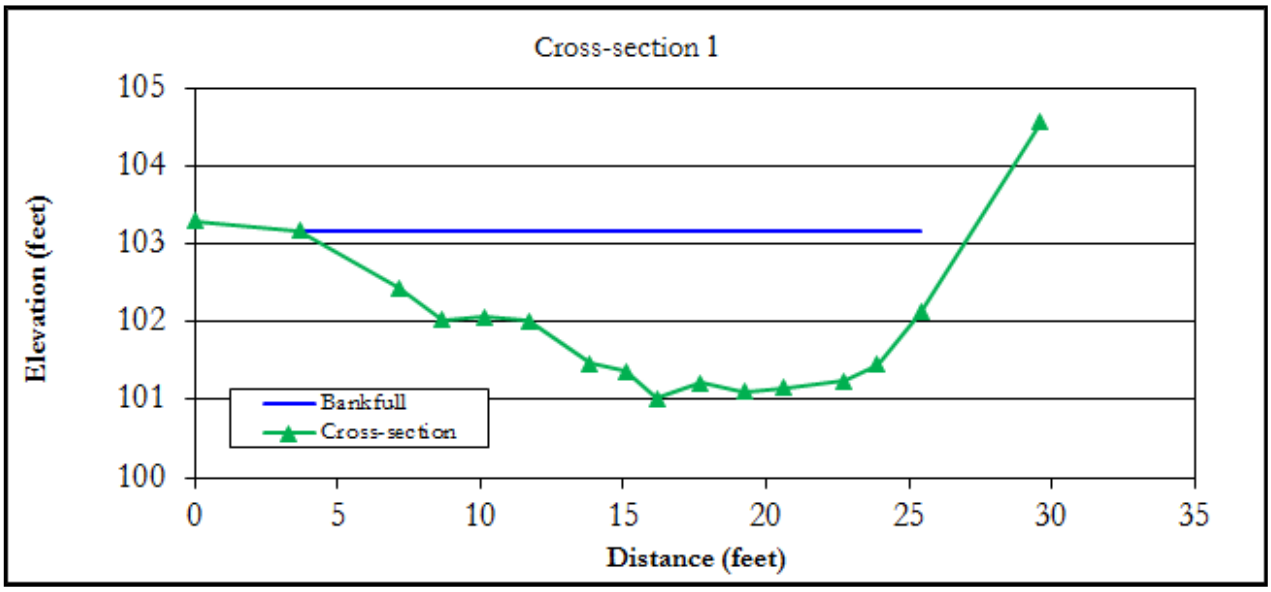
Latitude: 35.448456
Longitude: -83.982228
Drainage area: 1.94 square miles
Median particle size: gravel
Longitudinal slope: 0.03222 feet/foot
Stream classification: C4b

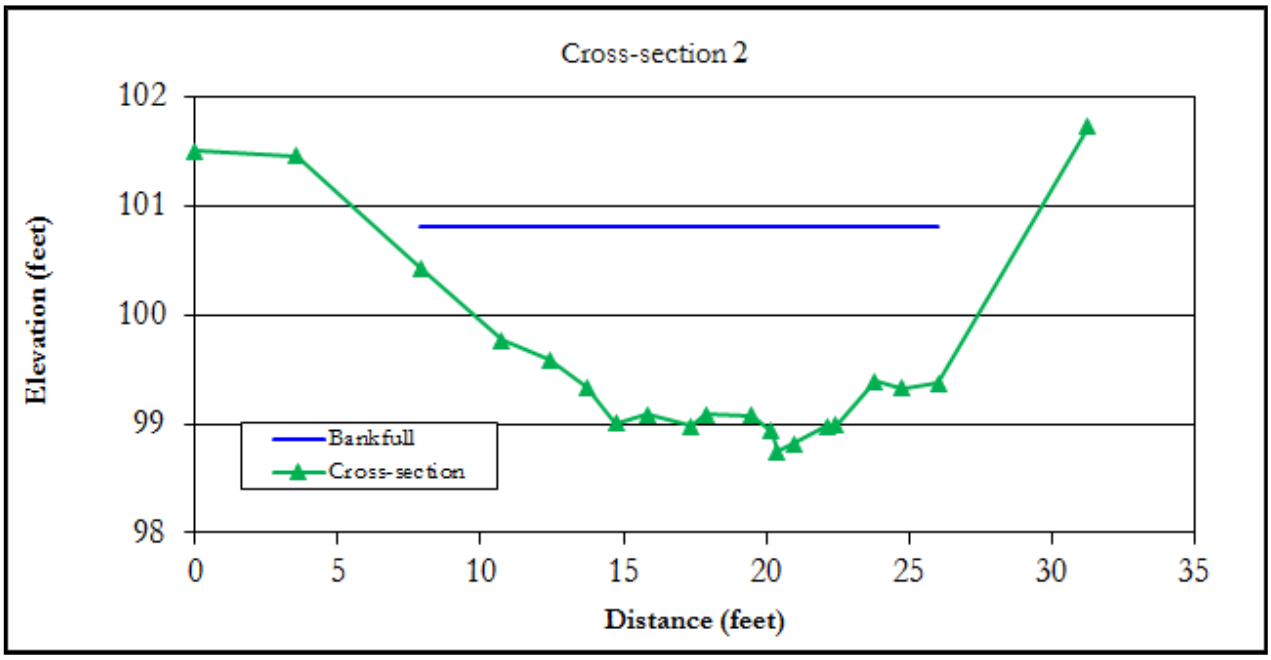
	X1	X2
Area (square feet) =	31.9	29.5
Width (feet) =	23.6	23.0
Mean depth =	1.4	1.3
Max depth =	2.2	2.1
Width/depth ratio =	17.4	17.9
Entrenchment ratio =	3.0	2.6



Longitudinal Profile

10. Little Slickrock Creek
Ecoregion 66, Tennessee

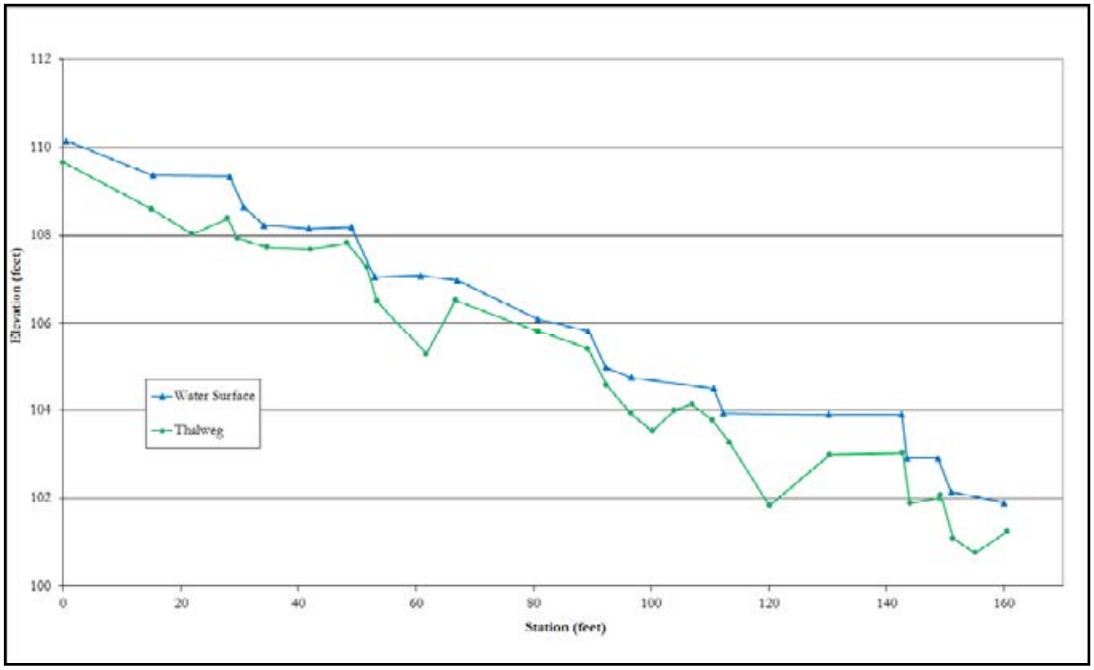




11. Little Stony Creek
Ecoregion 66, Tennessee

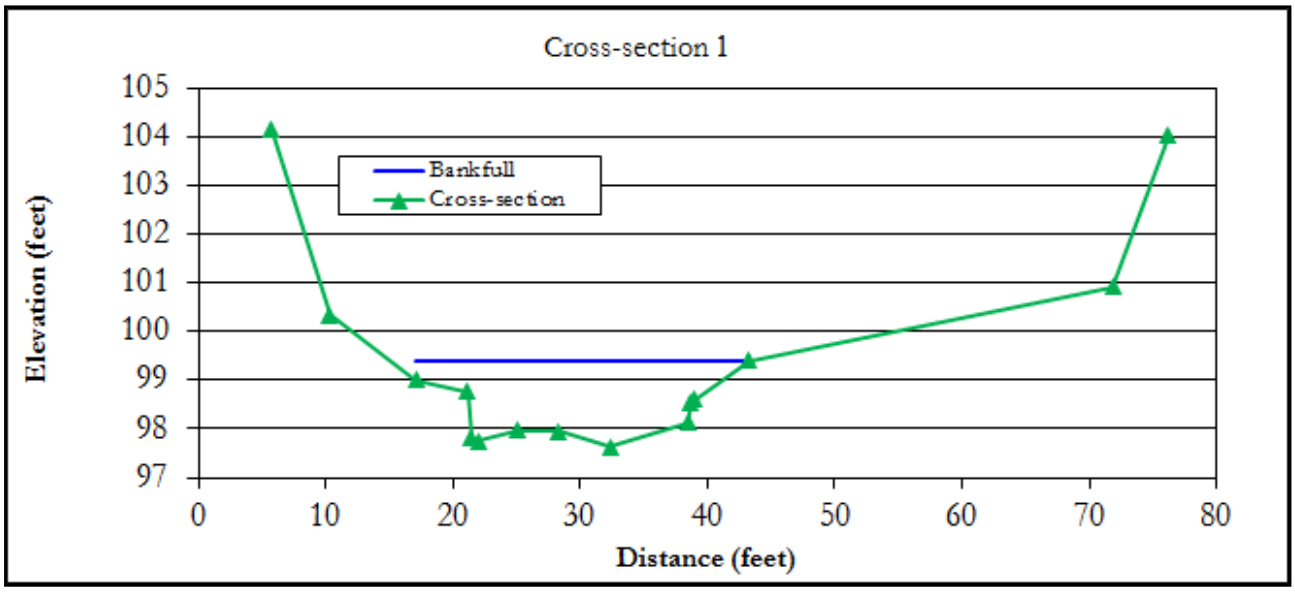
Latitude: 36.286460
Longitude: -82.066313
Drainage area: 2.33 square miles
Median particle size: cobble
Longitudinal slope: 0.05175 feet/foot
Stream classification: B3a

	X1
Area (square feet) =	31.4
Width (feet) =	28.2
Mean depth =	1.1
Max depth =	1.8
Width/depth ratio =	25.3
Entrenchment ratio =	2.2



Longitudinal Profile

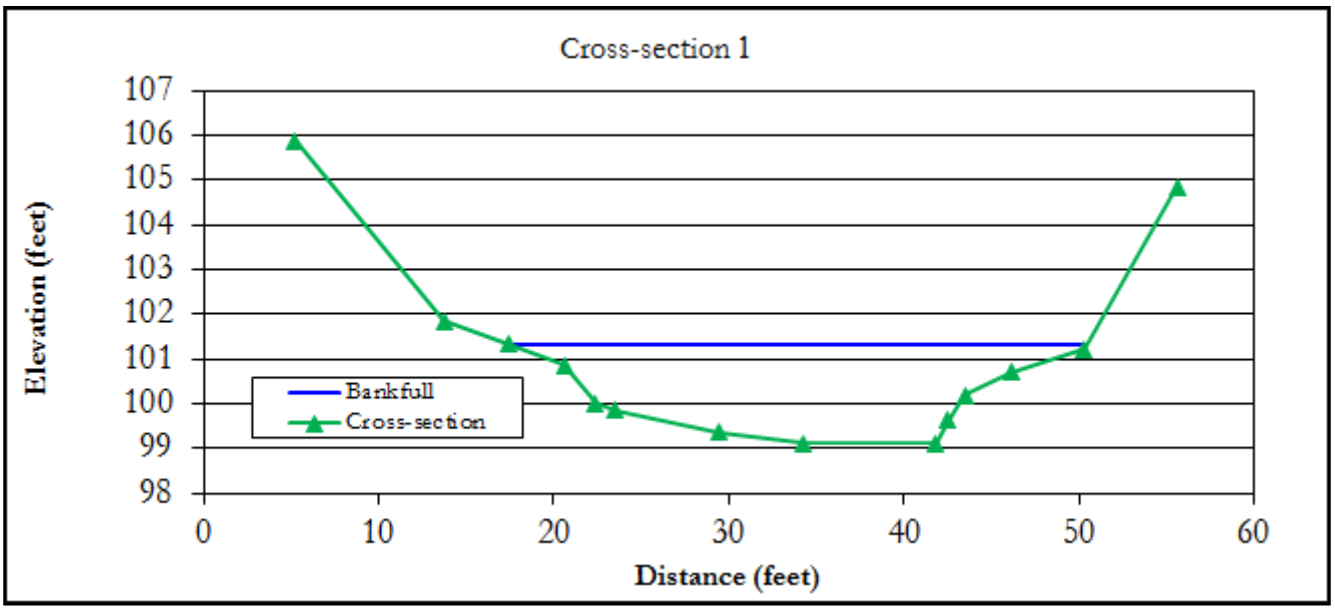
11. Little Stony Creek
Ecoregion 66, Tennessee



12. Lower Higgins Creek
Ecoregion 66, Tennessee

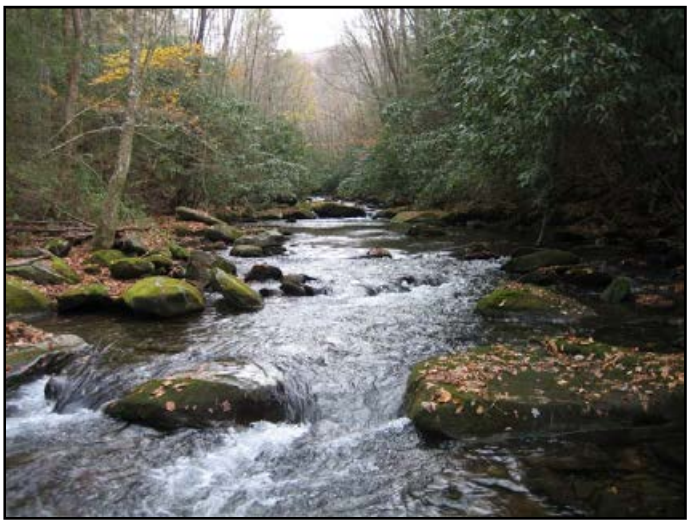
Latitude: 36.086343
Longitude: -82.522528
Drainage area: 3.16 square miles
Median particle size: cobble
Longitudinal slope: 0.04818 feet/foot
Stream classification: B3a

	X1
Area (square feet) =	47.8
Width (feet) =	33.0
Mean depth =	1.4
Max depth =	2.2
Width/depth ratio =	22.8
Entrenchment ratio =	1.3

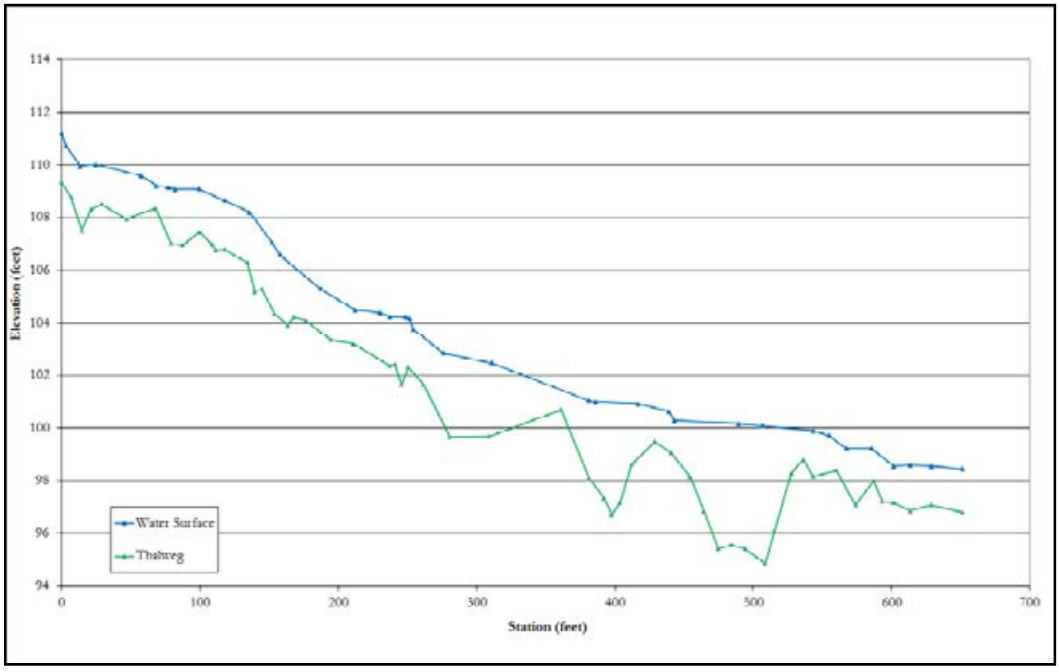


13. Slickrock Creek
Ecoregion 66, Tennessee

Latitude: 35.431553
Longitude: -83.999251
Drainage area: 8.96 square miles
Median particle size: cobble
Longitudinal slope: 0.01961 feet/foot
Stream classification: B3c

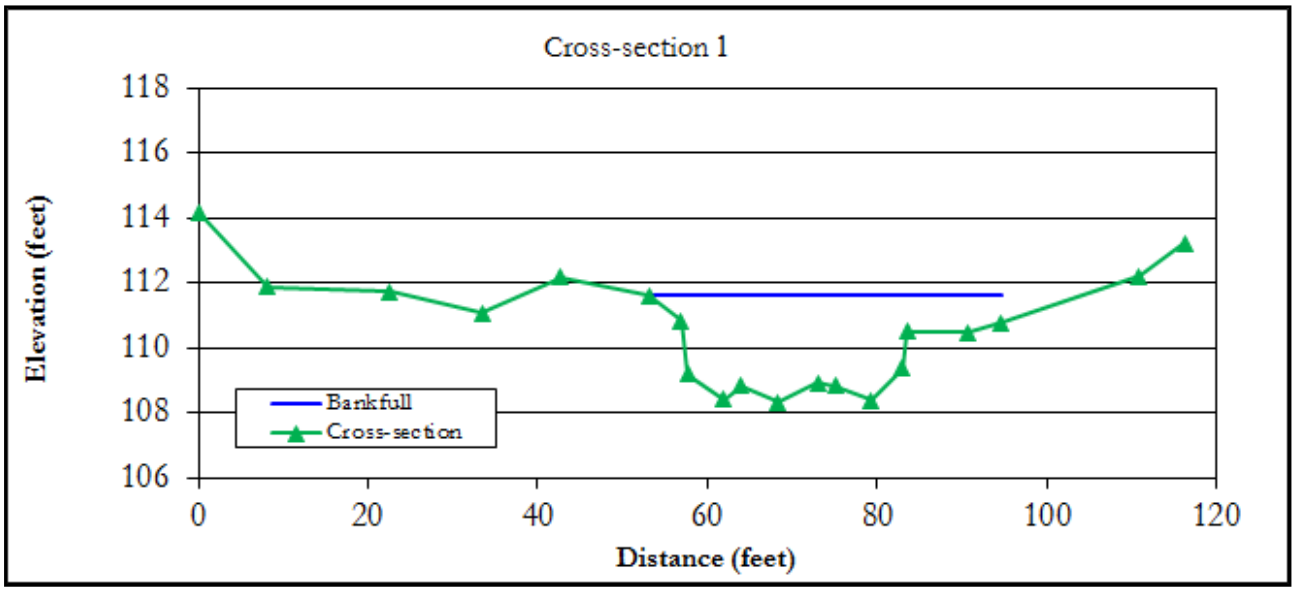


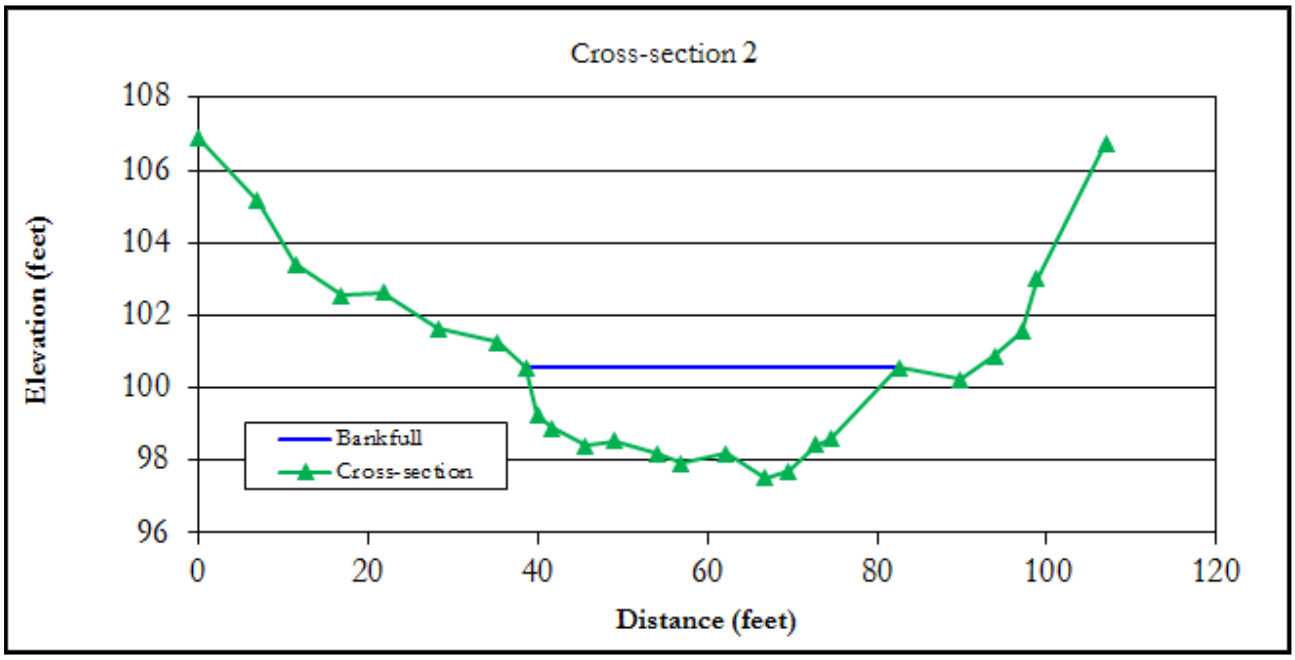
	X1	X2
Area (square feet) =	92.9	89.5
Width (feet) =	50.9	43.9
Mean depth =	1.8	2.0
Max depth =	3.3	3.1
Width/depth ratio =	27.9	21.6
Entrenchment ratio =	2.7	1.7



Longitudinal Profile

13. Slickrock Creek
Ecoregion 66, Tennessee

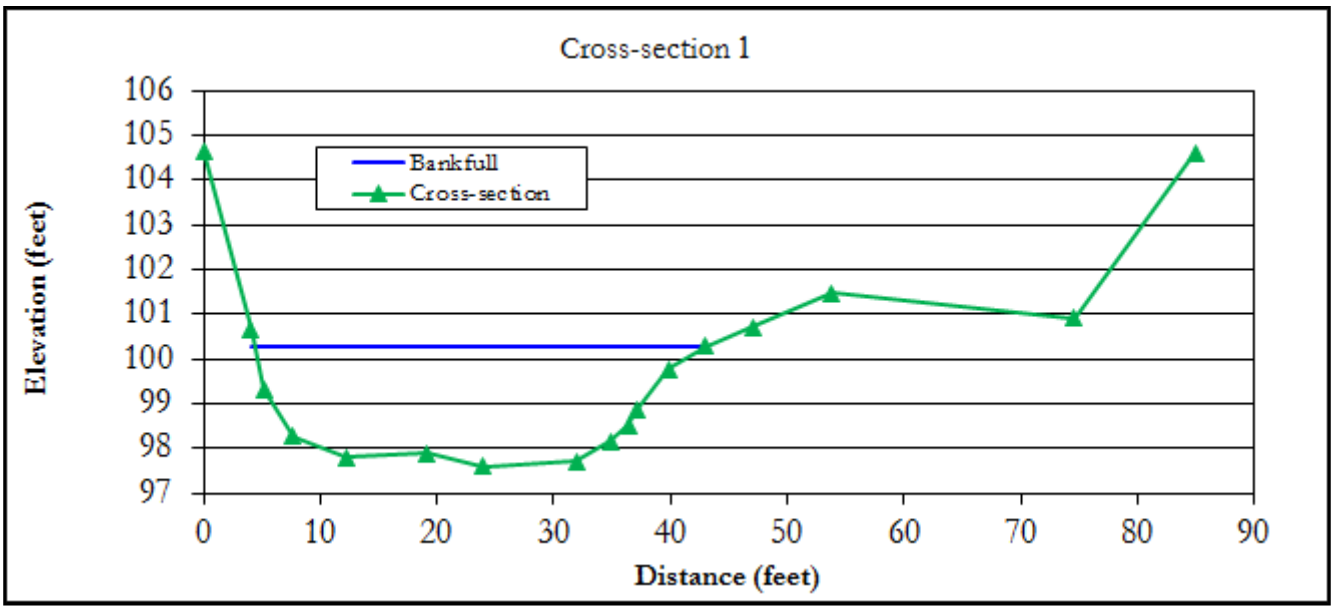




14. Clark Creek
Ecoregion 66, Tennessee

Latitude: 36.147859
Longitude: -82.528400
Drainage area: 9.48 square miles
Median particle size: cobble
Longitudinal slope: 0.01676 feet/foot
Stream classification: C3

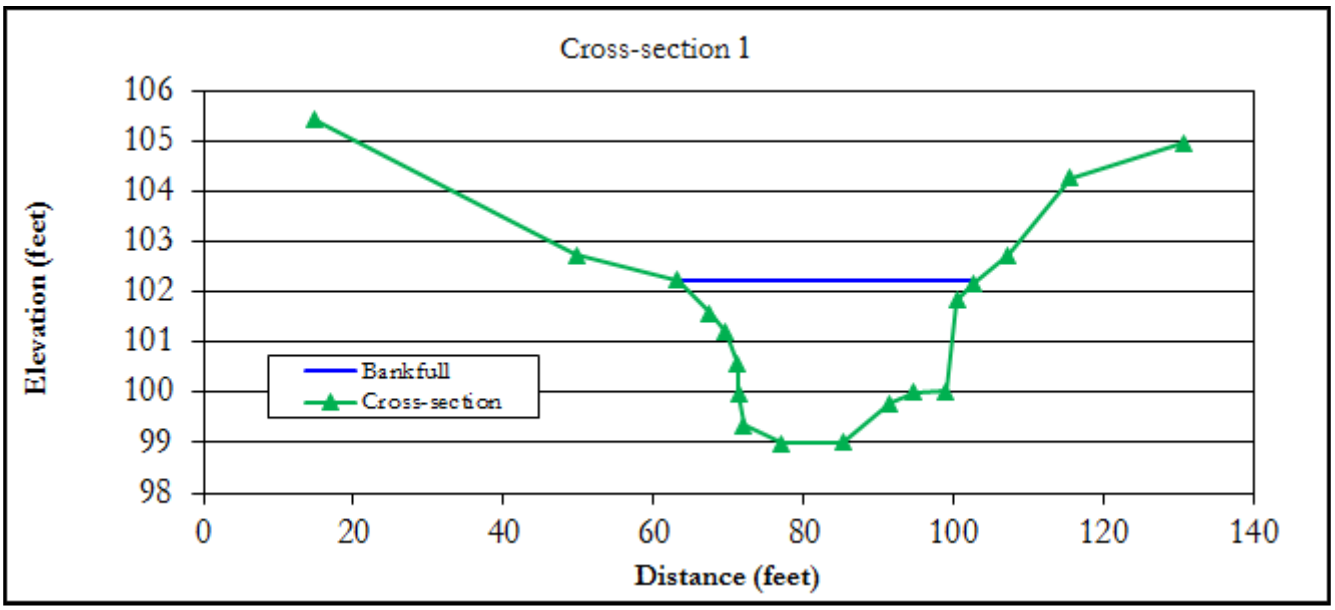
	X1
Area (square feet) =	79.2
Width (feet) =	38.6
Mean depth =	2.0
Max depth =	2.7
Width/depth ratio =	18.9
Entrenchment ratio =	2.1



15. Doe River
Ecoregion 66, Tennessee

Latitude: 36.157320
Longitude: -82.100600
Drainage area: 10.1 square miles
Median particle size: cobble
Longitudinal slope: 0.01514 feet/foot
Stream classification: C3

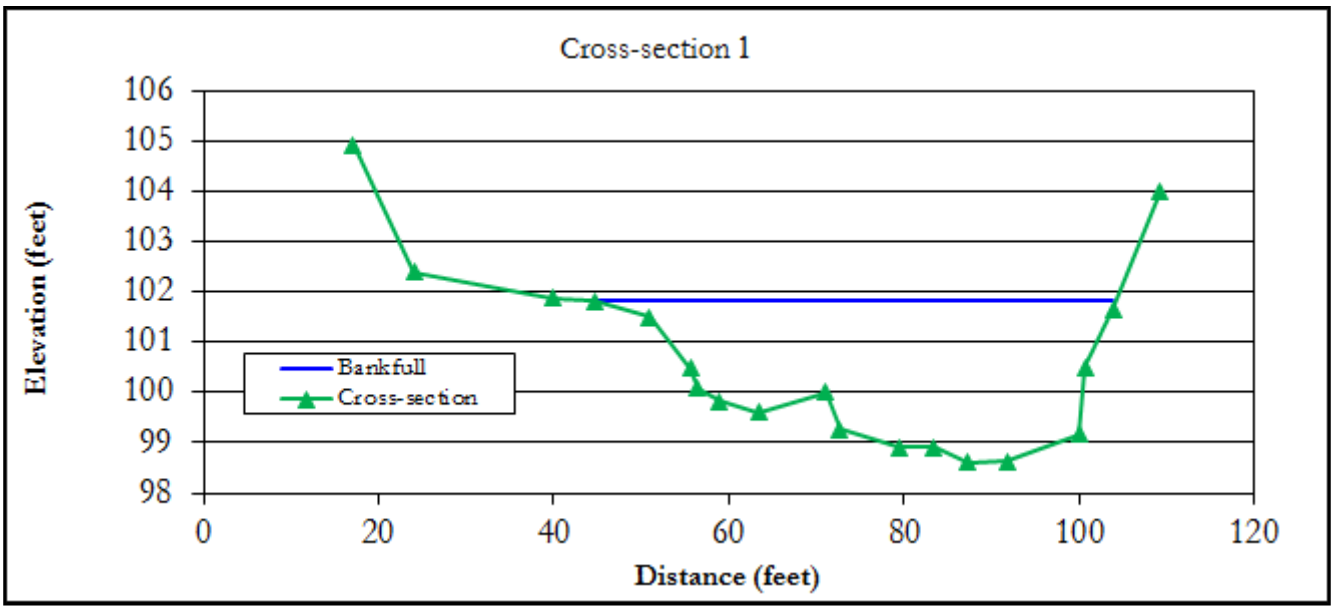
	X1
Area (square feet) =	86.6
Width (feet) =	40.0
Mean depth =	2.2
Max depth =	3.3
Width/depth ratio =	18.5
Entrenchment ratio =	3.1



16. Laurel Fork
Ecoregion 66, Tennessee

Latitude: 36.255862
Longitude: -82.109877
Drainage area: 17.4 square miles
Median particle size: gravel
Longitudinal slope: 0.00470 feet/foot
Stream classification: B4c

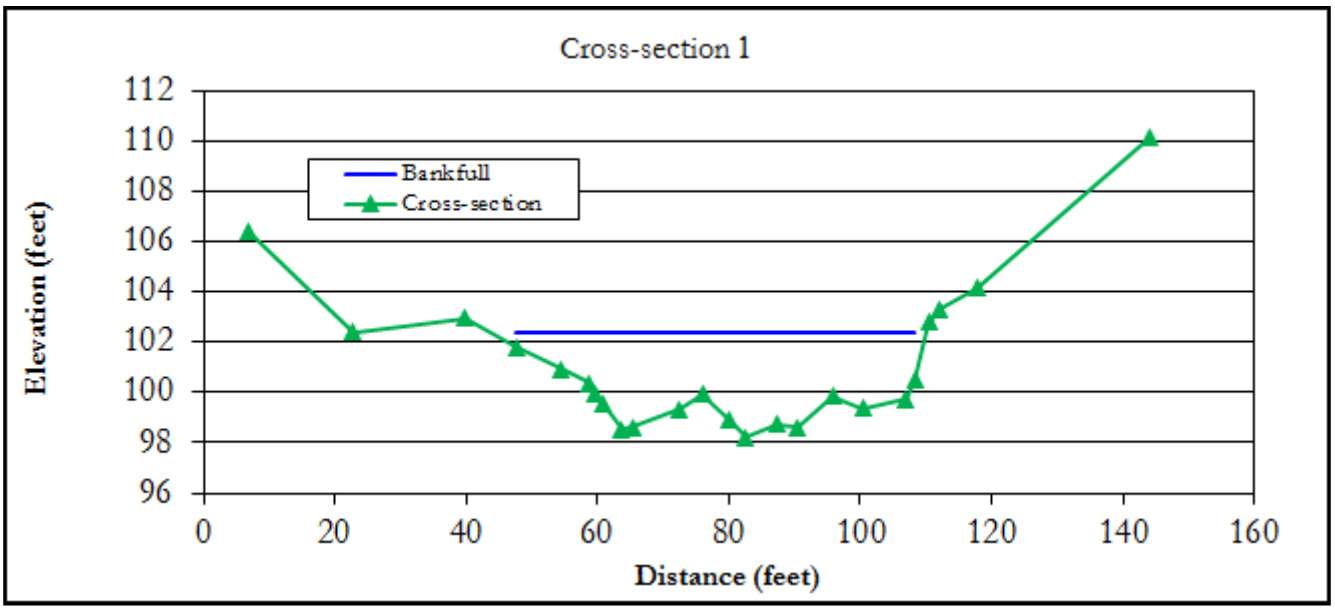
	X1
Area (square feet) =	122.6
Width (feet) =	59.6
Mean depth =	2.1
Max depth =	3.2
Width/depth ratio =	28.9
Entrenchment ratio =	1.6



17. Porters Creek
Ecoregion 66, Tennessee

Latitude: 35.706229
Longitude: -83.383259
Drainage area: 17.7 square miles
Median particle size: cobble
Longitudinal slope: 0.03043 feet/foot
Stream classification: B3

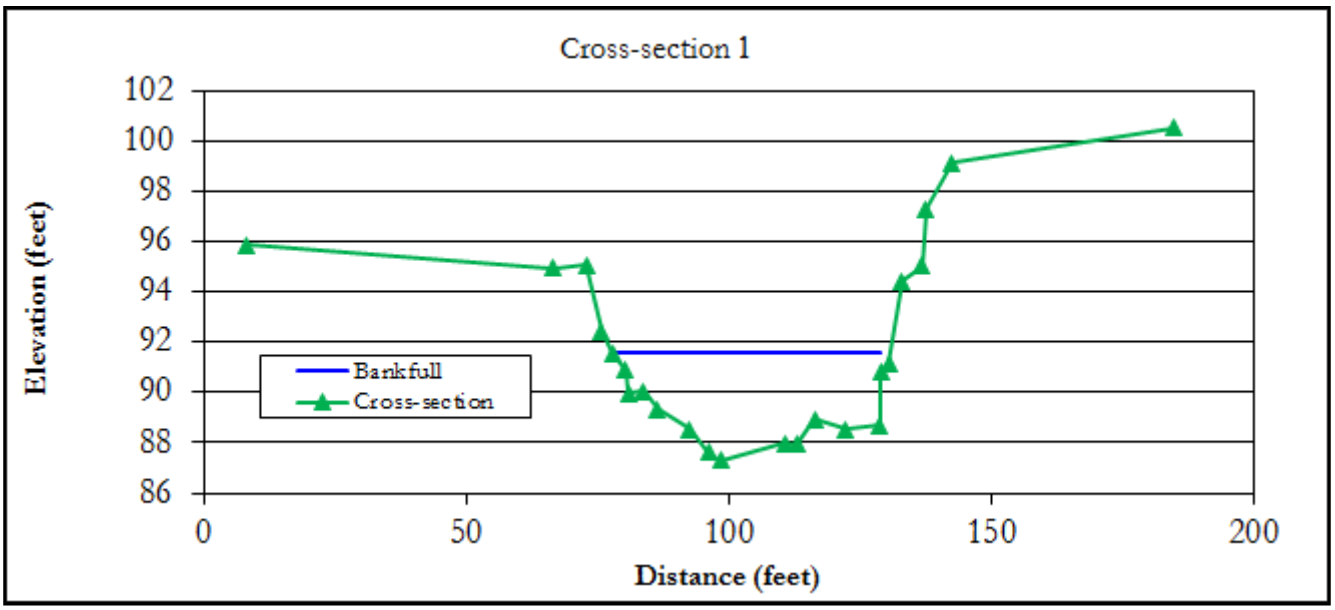
	X1
Area (square feet) =	175.4
Width (feet) =	66.4
Mean depth =	2.6
Max depth =	4.2
Width/depth ratio =	25.1
Entrenchment ratio =	2.3



18. Middle Prong Pigeon River
Ecoregion 66, Tennessee

Latitude: 35.707277
Longitude: -83.380050
Drainage area: 19.5 square miles
Median particle size: cobble
Longitudinal slope: 0.04168 feet/foot
Stream classification: B3a

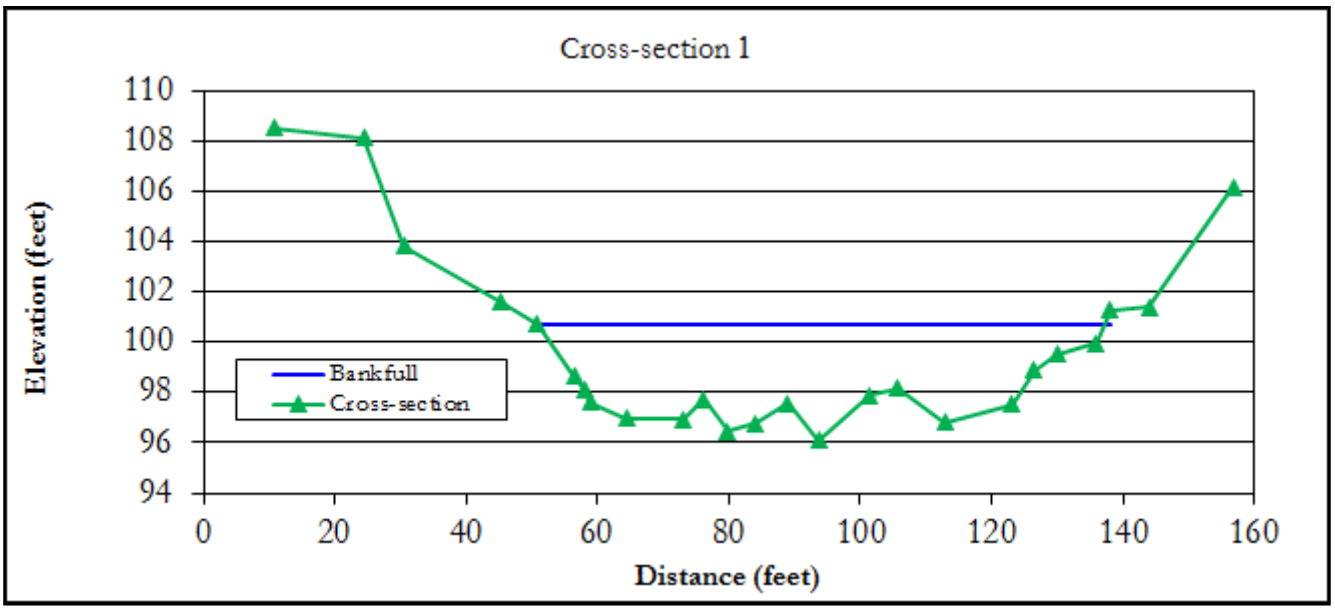
	X1
Area (square feet) =	151.9
Width (feet) =	52.9
Mean depth =	2.9
Max depth =	4.2
Width/depth ratio =	18.4
Entrenchment ratio =	2.3



19. Little River
Ecoregion 66, Tennessee

Latitude: 35.652767
Longitude: -83.573211
Drainage area: 31.3 square miles
Median particle size: cobble
Longitudinal slope: 0.02903 feet/foot
Stream classification: B3

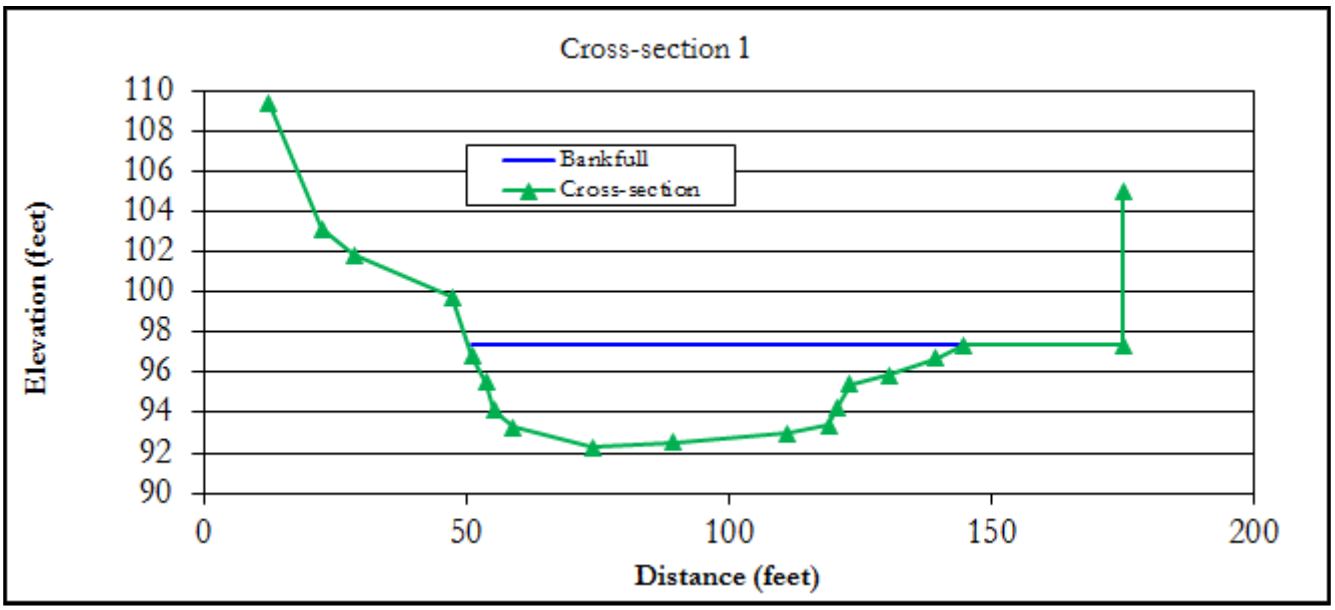
	X1
Area (square feet) =	259.8
Width (feet) =	86.3
Mean depth =	3.0
Max depth =	4.6
Width/depth ratio =	28.6
Entrenchment ratio =	1.5



20. Citico Creek
Ecoregion 66, Tennessee

Latitude: 35.506607
Longitude: -84.106280
Drainage area: 61.1 square miles
Median particle size: gravel
Longitudinal slope: 0.00251 feet/foot
Stream classification: B4c

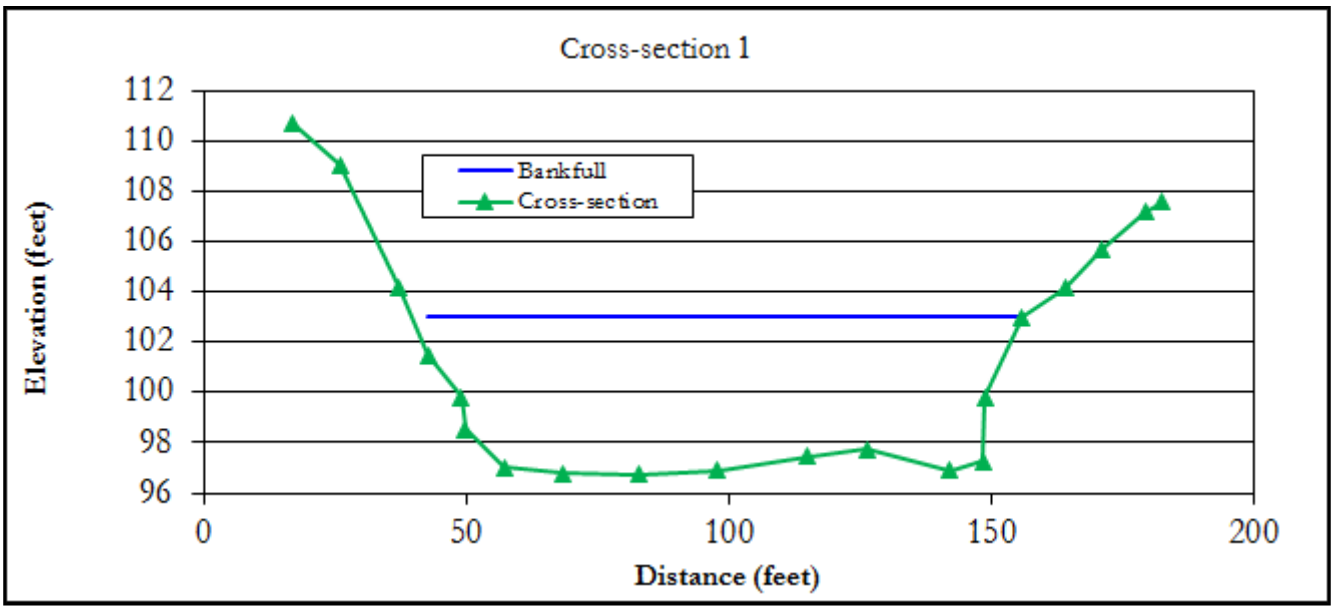
	X1
Area (square feet) =	335.2
Width (feet) =	94.3
Mean depth =	3.6
Max depth =	5.1
Width/depth ratio =	26.5
Entrenchment ratio =	1.6



21. Little River
Ecoregion 66, Tennessee

Latitude: 35.664700
Longitude: -83.711392
Drainage area: 106 square miles
Median particle size: cobble
Longitudinal slope: 0.00534 feet/foot
Stream classification: B3c

	X1
Area (square feet) =	611.5
Width (feet) =	116.1
Mean depth =	5.3
Max depth =	6.3
Width/depth ratio =	22.1
Entrenchment ratio =	1.4



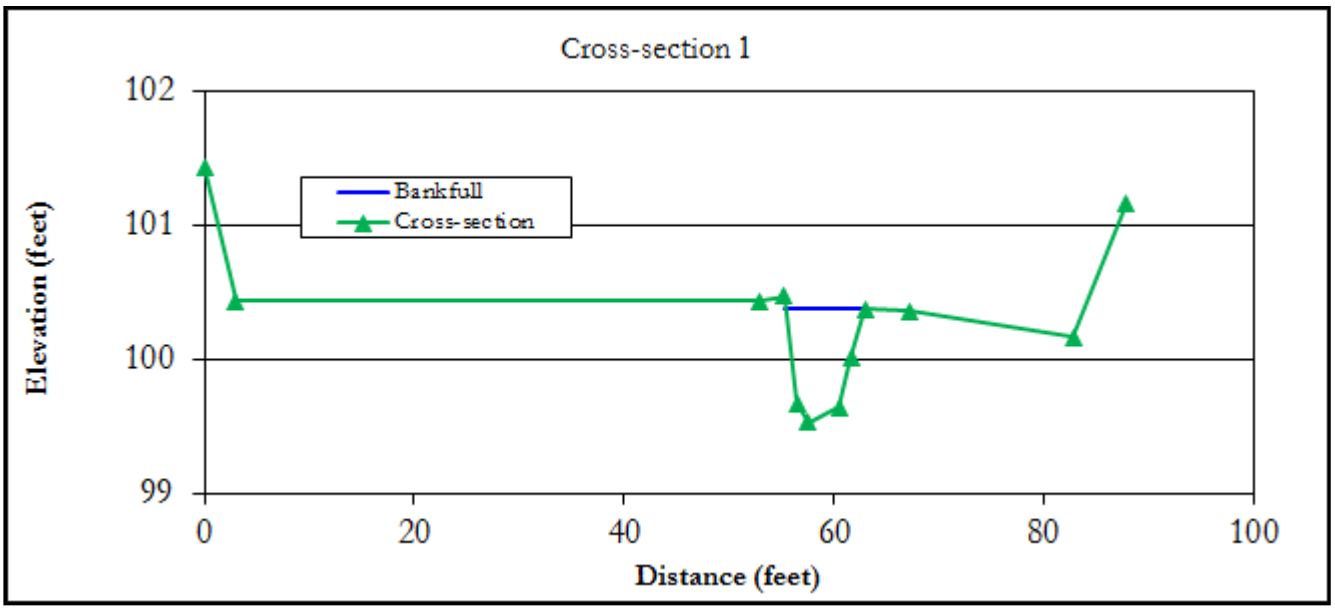
APPENDIX B

Ecoregion 67 Morphology Data

1. Forks Creek (3)
Ecoregion 67, Tennessee

Latitude: 35.937514
Longitude: -83.848191
Drainage area: 0.04 square miles
Median particle size: 35 millimeters
Longitudinal slope: 0.0071 feet/foot
Stream classification: C4

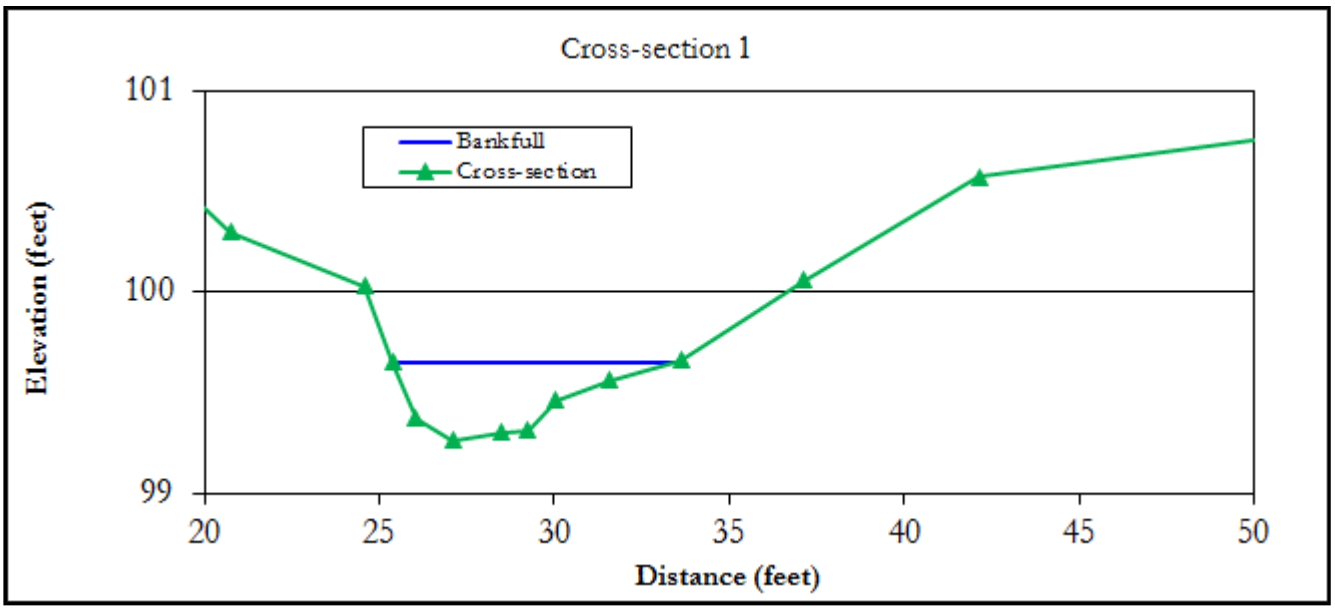
	X1
Area (square feet) =	4.4
Width (feet) =	7.6
Mean depth =	0.6
Max depth =	0.8
Width/depth ratio =	13.1
Entrenchment ratio =	10.9



2. Ijams Creek
Ecoregion 67, Tennessee

Latitude: 35.956553
Longitude: -83.868685
Drainage area: 0.05 square miles
Median particle size: 1 millimeter
Longitudinal slope: 0.0085 feet/foot
Stream classification: B5c

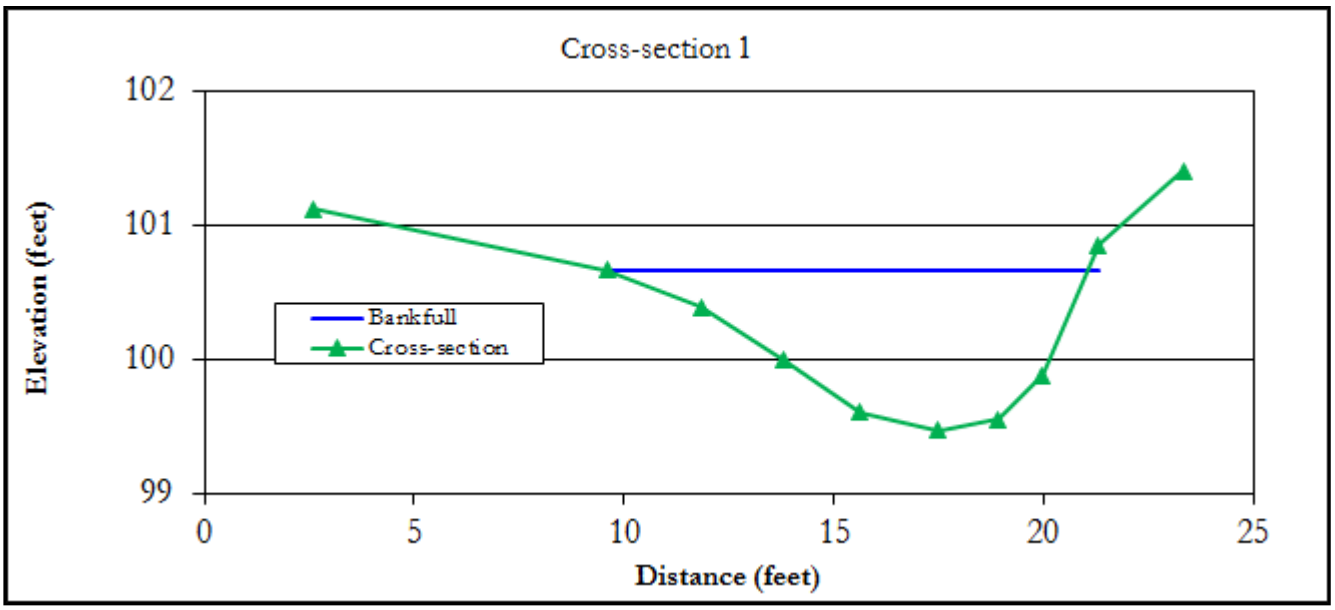
	X1
Area (square feet) =	1.7
Width (feet) =	8.0
Mean depth =	0.2
Max depth =	0.4
Width/depth ratio =	37.3
Entrenchment ratio =	1.6



3. Forks Creek (2)
Ecoregion 67, Tennessee

Latitude: 35.949691
Longitude: -83.853727
Drainage area: 0.29 square miles
Median particle size: 20 millimeters
Longitudinal slope: 0.0041 feet/foot
Stream classification: C4

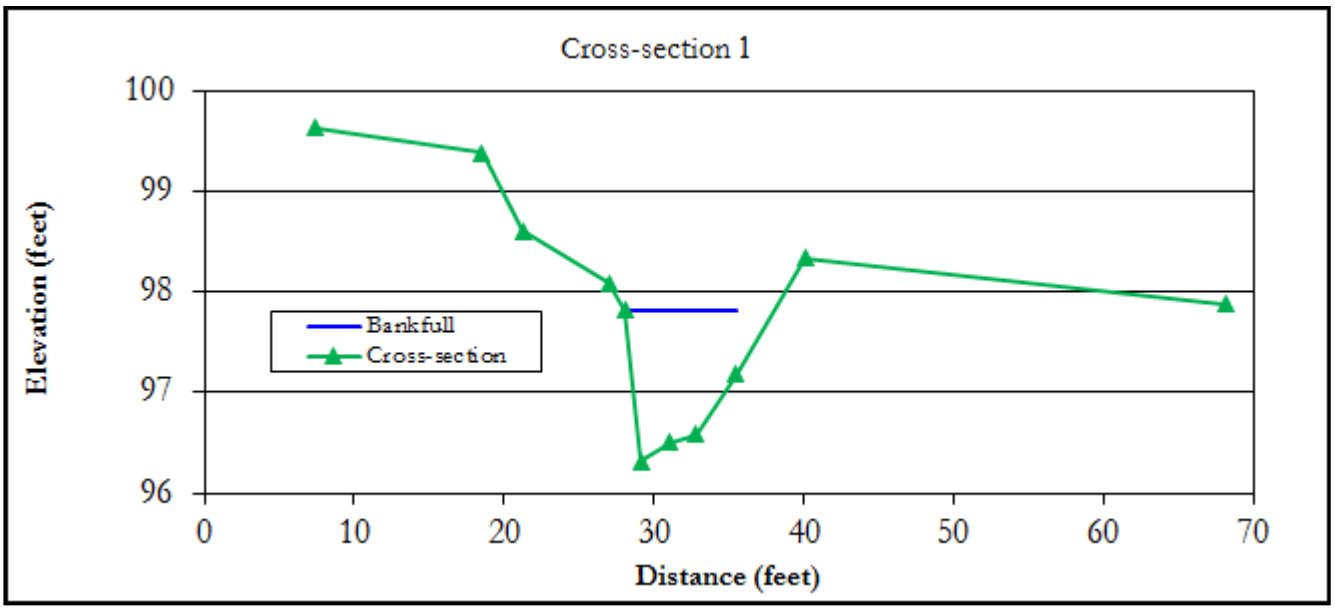
	X1
Area (square feet) =	7.9
Width (feet) =	11.4
Mean depth =	0.7
Max depth =	1.2
Width/depth ratio =	16.5
Entrenchment ratio =	6.4



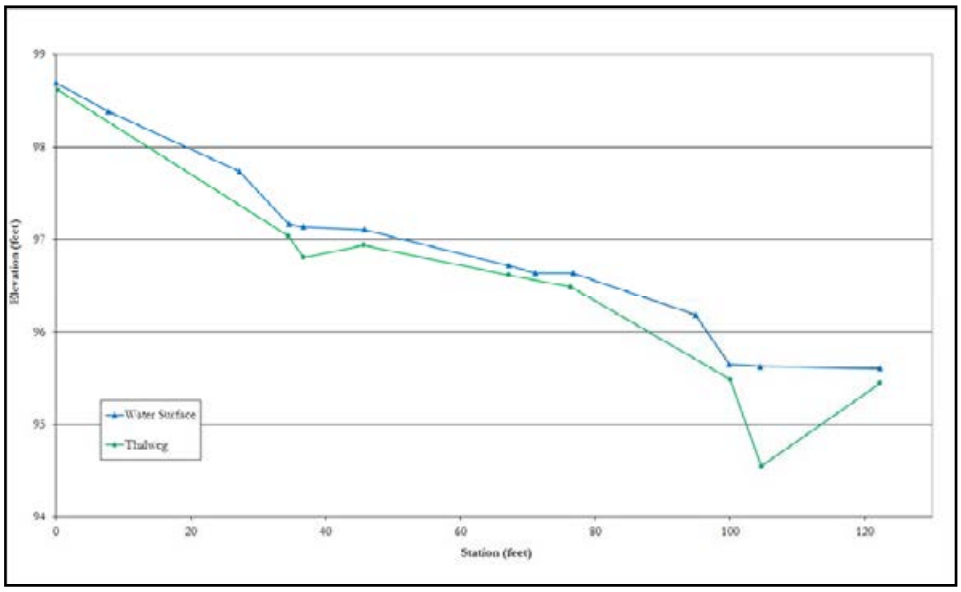
4. UT White Creek
Ecoregion 67, Tennessee

Latitude: 36.349005
Longitude: -83.899726
Drainage area: 0.33 square miles
Median particle size: 25 millimeters
Longitudinal slope: 0.0253 feet/foot
Stream classification: E4b

	X1
Area (square feet) =	9.0
Width (feet) =	9.9
Mean depth =	0.9
Max depth =	1.5
Width/depth ratio =	10.9
Entrenchment ratio =	5.6



4. UT White Creek
Ecoregion 67, Tennessee

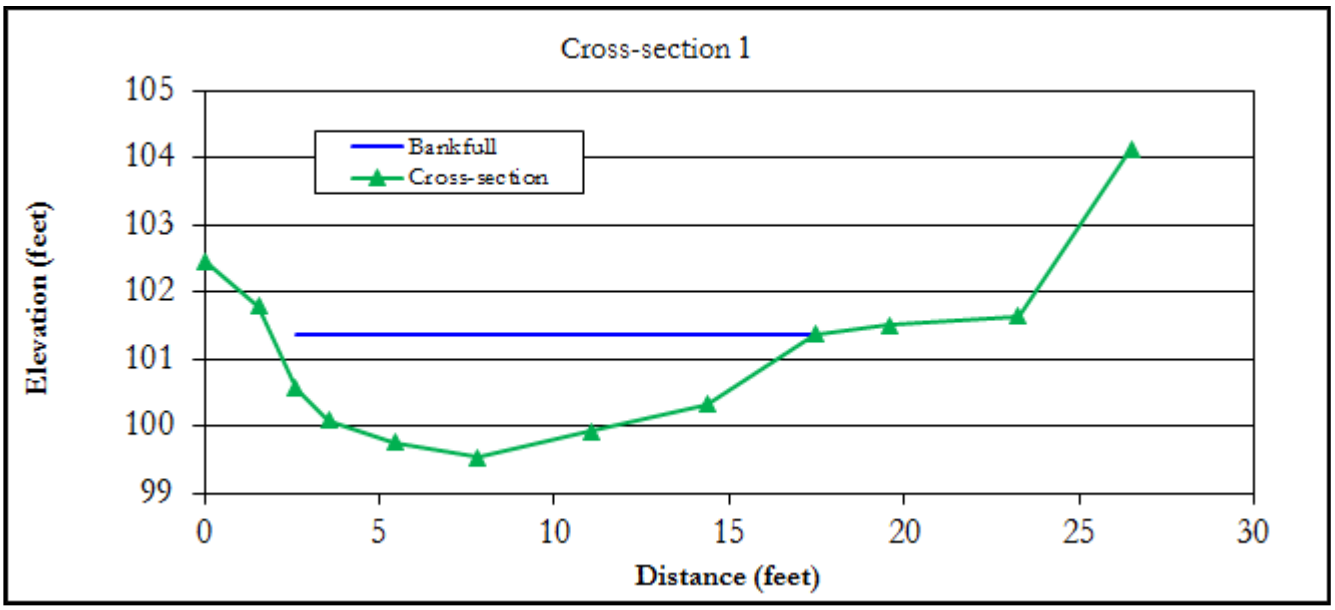


Longitudinal Profile

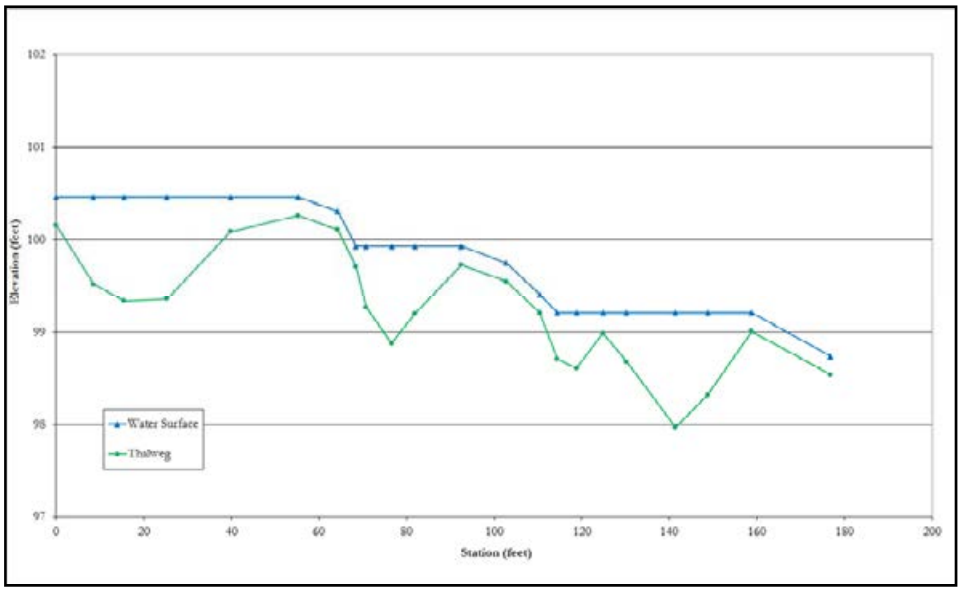
5. Forks Creek (1)
Ecoregion 67, Tennessee

Latitude: 35.936921
Longitude: -83.849549
Drainage area: 0.35 square miles
Median particle size: 70 millimeters
Longitudinal slope: 0.0121 feet/foot
Stream classification: C3

	X1
Area (square feet) =	19.1
Width (feet) =	15.5
Mean depth =	1.2
Max depth =	1.8
Width/depth ratio =	12.6
Entrenchment ratio =	2.3



5. Forks Creek (1)
Ecoregion 67, Tennessee

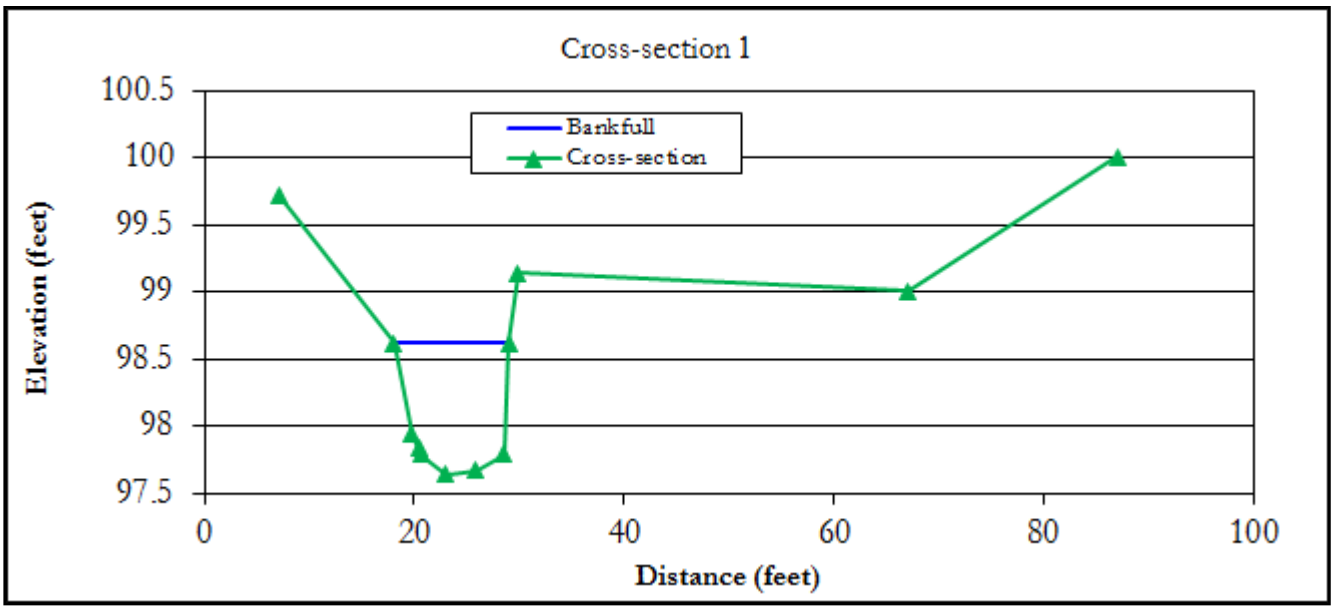


Longitudinal Profile

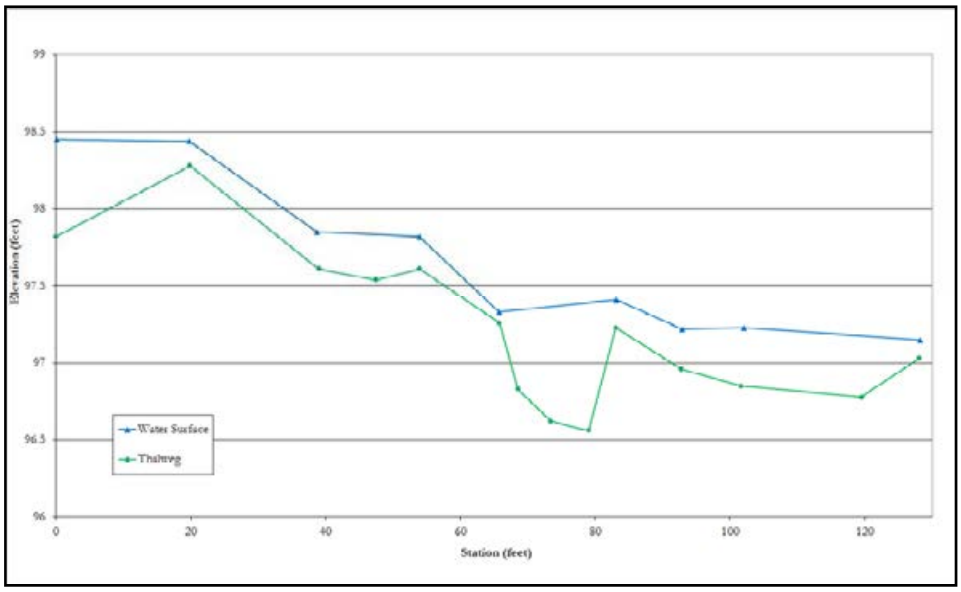
6. Big Ridge Creek
Ecoregion 67, Tennessee

Latitude: 36.246175
Longitude: -83.921839
Drainage area: 0.38 square miles
Median particle size: 12 millimeters
Longitudinal slope: 0.0119 feet/foot
Stream classification: C4

	X1
Area (square feet) =	8.8
Width (feet) =	11.0
Mean depth =	0.8
Max depth =	1.0
Width/depth ratio =	13.7
Entrenchment ratio =	5.3



6. Big Ridge Creek
Ecoregion 67, Tennessee

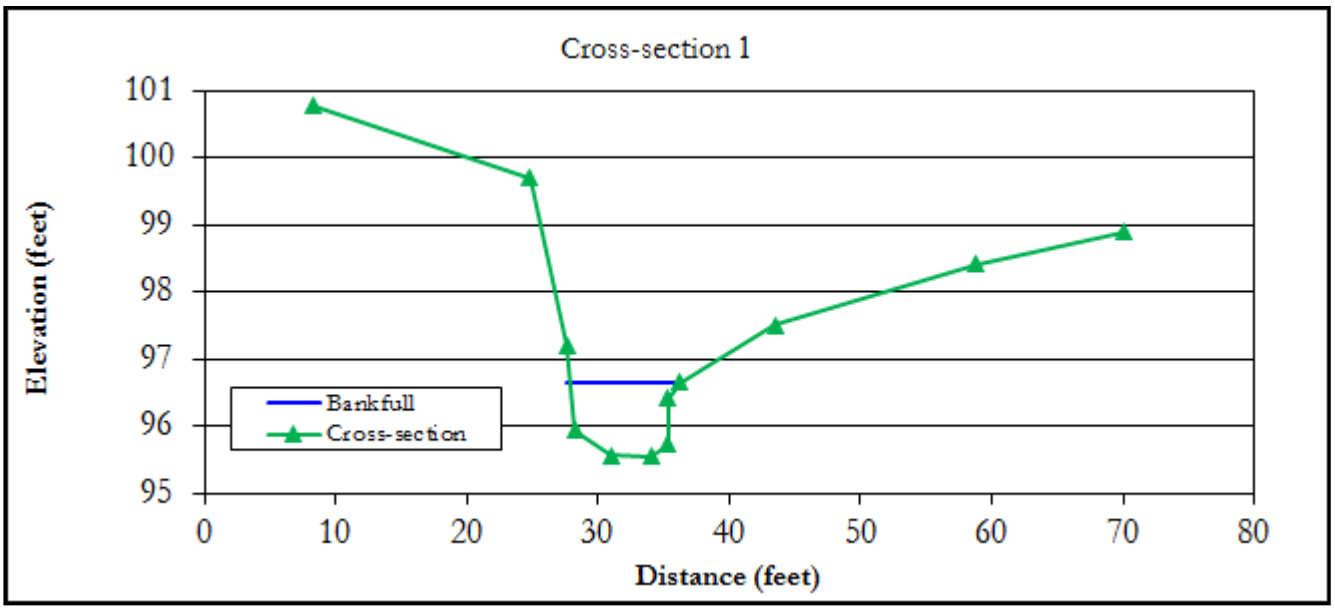


Longitudinal Profile

7. Big Spring Creek
Ecoregion 67, Tennessee

Latitude: 36.303581
Longitude: -83.944898
Drainage area: 0.79 square miles
Median particle size: 20 millimeters
Longitudinal slope: 0.0331 feet/foot
Stream classification: E4b

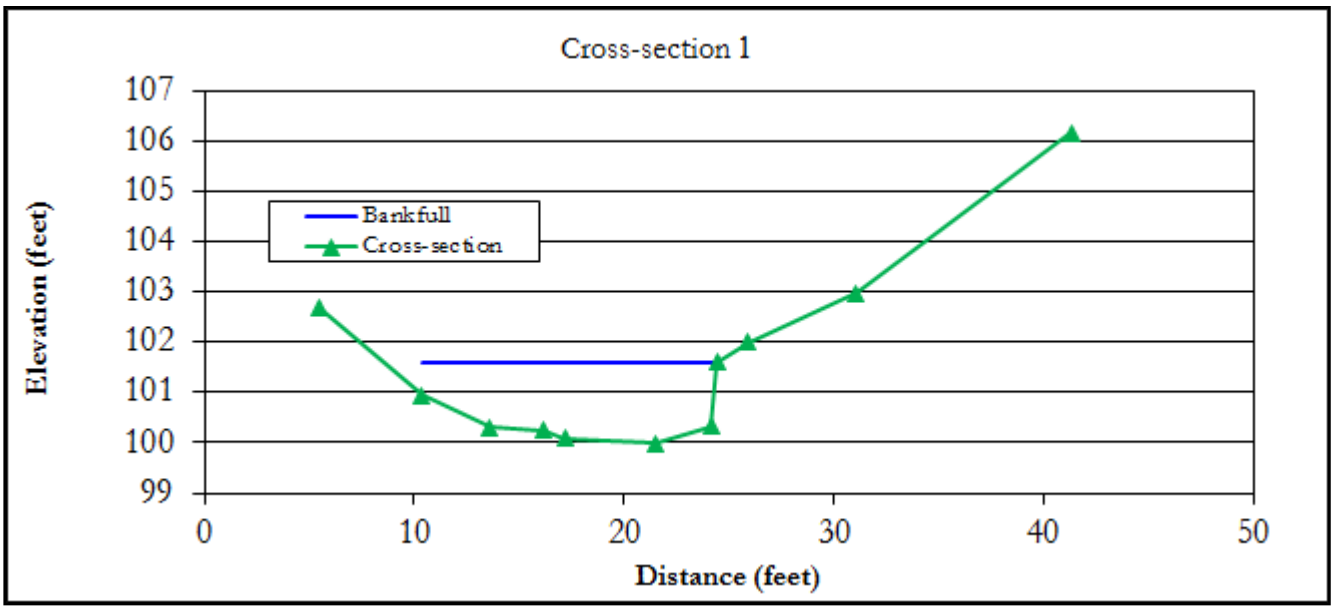
	X1
Area (square feet) =	7.3
Width (feet) =	8.4
Mean depth =	0.9
Max depth =	1.1
Width/depth ratio =	9.6
Entrenchment ratio =	2.5



8. White Creek
Ecoregion 67, Tennessee

Latitude: 36.348095
Longitude: -83.901602
Drainage area: 0.90 square miles
Median particle size: 25 millimeters
Longitudinal slope: 0.0187 feet/foot
Stream classification: C4

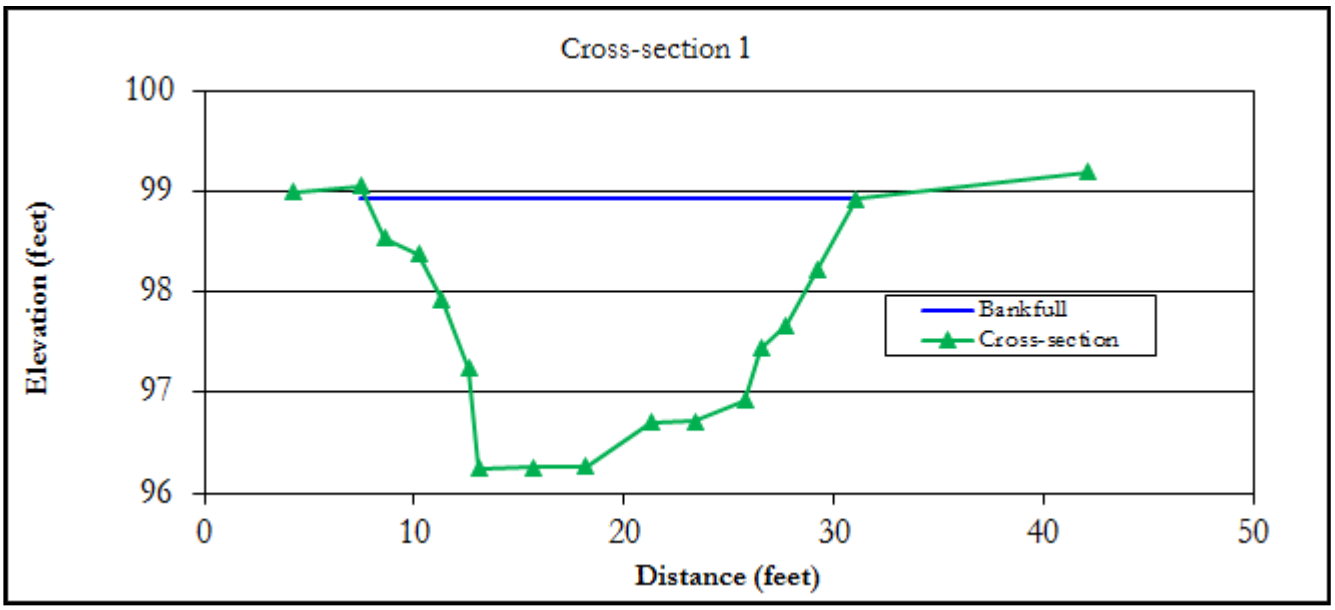
	X1
Area (square feet) =	19.5
Width (feet) =	15.9
Mean depth =	1.2
Max depth =	1.6
Width/depth ratio =	13.0
Entrenchment ratio =	3.6



9. Mill Creek
Ecoregion 67, Tennessee

Latitude: 35.988330
Longitude: -84.288880
Drainage area: 1.10 square miles
Median particle size: 15 millimeters
Longitudinal slope: 0.0039 feet/foot
Stream classification: C4

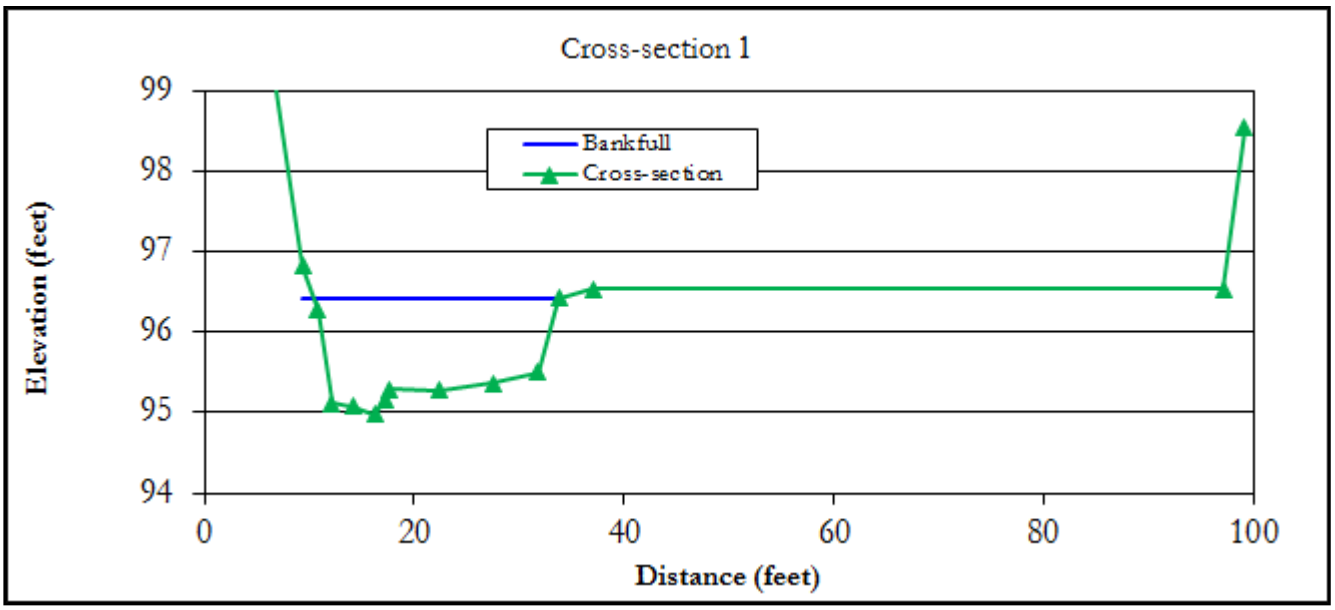
	X1
Area (square feet) =	40.3
Width (feet) =	23.3
Mean depth =	1.7
Max depth =	2.7
Width/depth ratio =	13.4
Entrenchment ratio =	3.4



10. Toll Creek
Ecoregion 67, Tennessee

Latitude: 35.952161
Longitude: -83.864656
Drainage area: 1.71 square miles
Median particle size: 50 millimeters
Longitudinal slope: 0.0174 feet/foot
Stream classification: C4

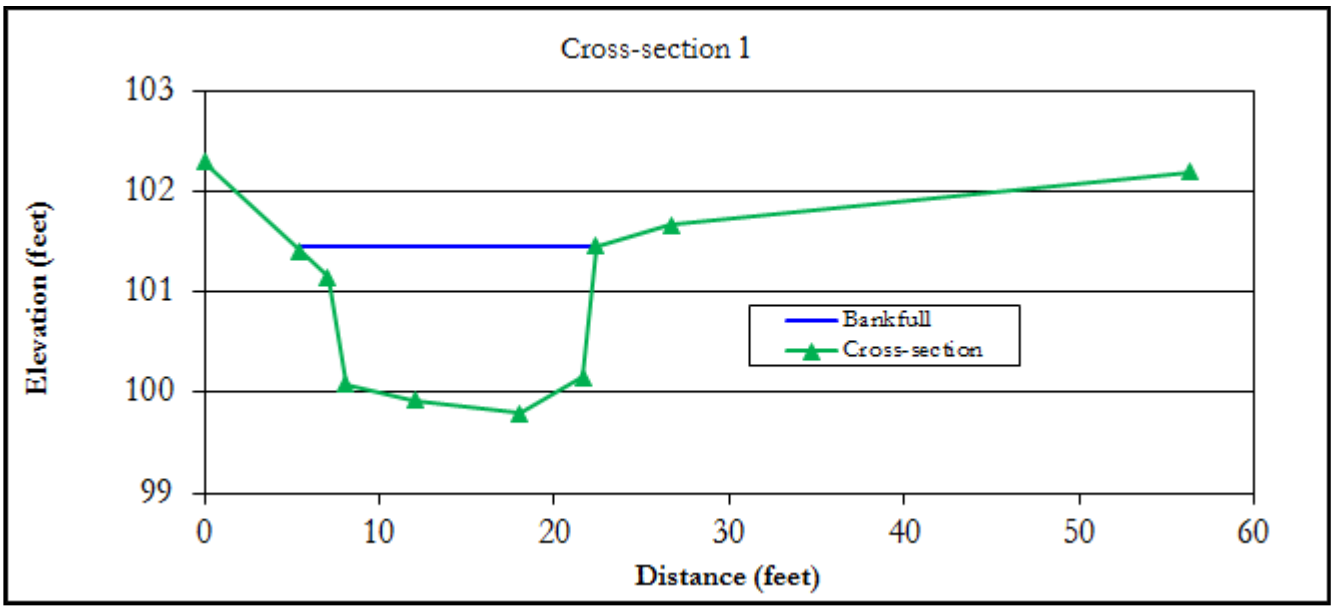
	X1
Area (square feet) =	24.5
Width (feet) =	23.3
Mean depth =	1.1
Max depth =	1.4
Width/depth ratio =	22.1
Entrenchment ratio =	3.9



11. Forks Creek (4)
Ecoregion 67, Tennessee

Latitude: 35.937082
Longitude: -83.848372
Drainage area: 1.84 square miles
Median particle size: 50 millimeters
Longitudinal slope: 0.0018 feet/foot
Stream classification: C4

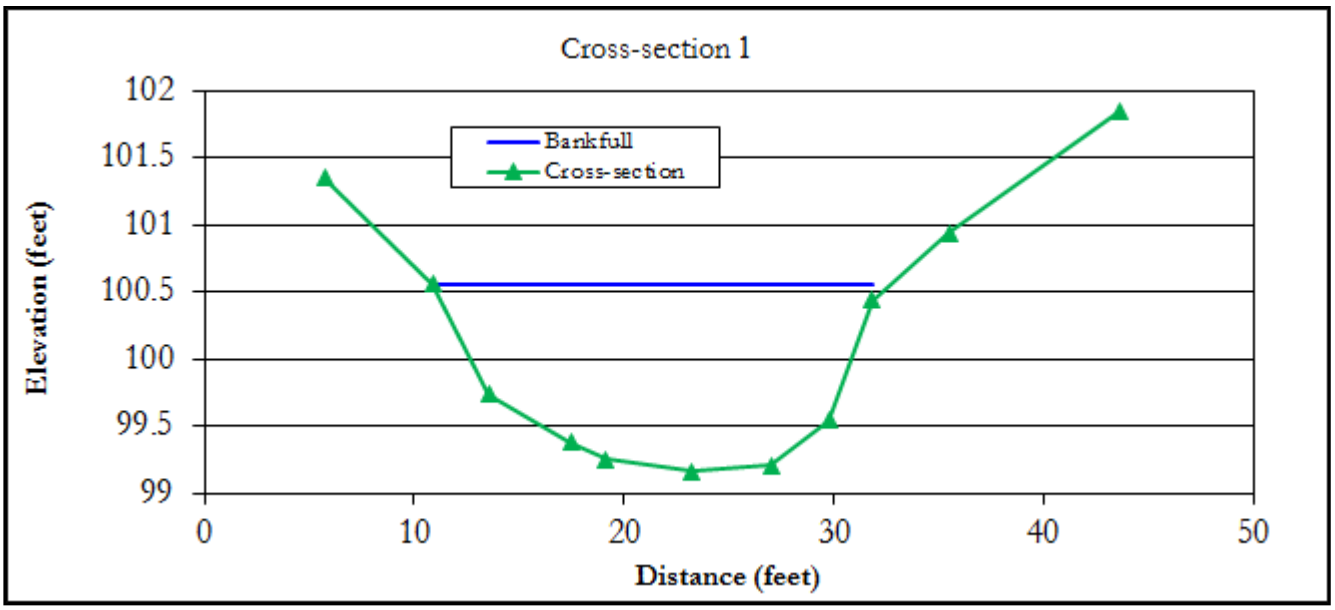
	X1
Area (square feet) =	22.4
Width (feet) =	17.2
Mean depth =	1.3
Max depth =	1.7
Width/depth ratio =	13.2
Entrenchment ratio =	4.0



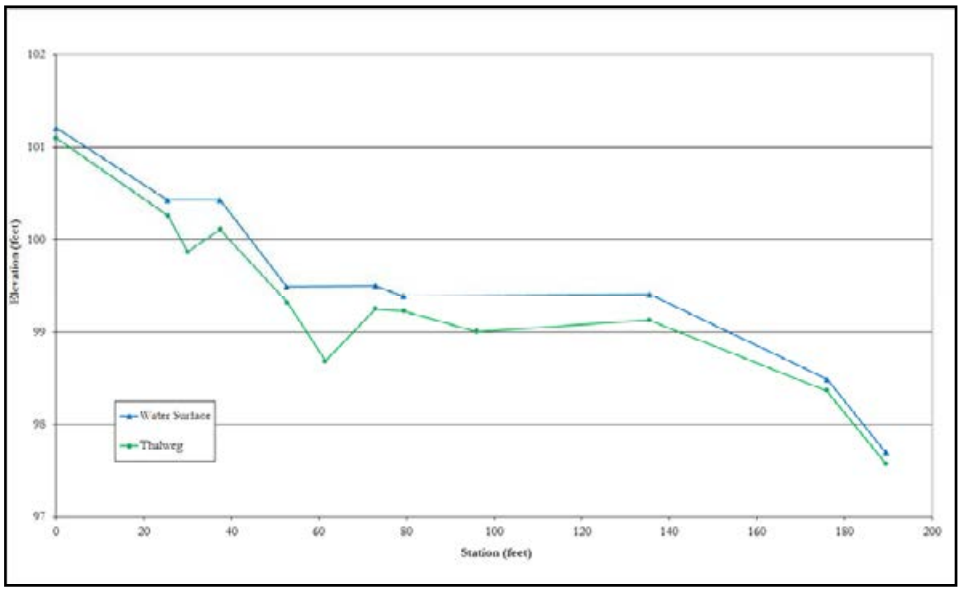
12. Clear Creek (1)
Ecoregion 67, Tennessee

Latitude: 36.322751
Longitude: -83.913806
Drainage area: 2.62 square miles
Median particle size: 30 millimeters
Longitudinal slope: 0.0133 feet/foot
Stream classification: C4

	X1
Area (square feet) =	22.3
Width (feet) =	21.8
Mean depth =	1.0
Max depth =	1.4
Width/depth ratio =	21.2
Entrenchment ratio =	2.3



12. Clear Creek (1)
Ecoregion 67, Tennessee

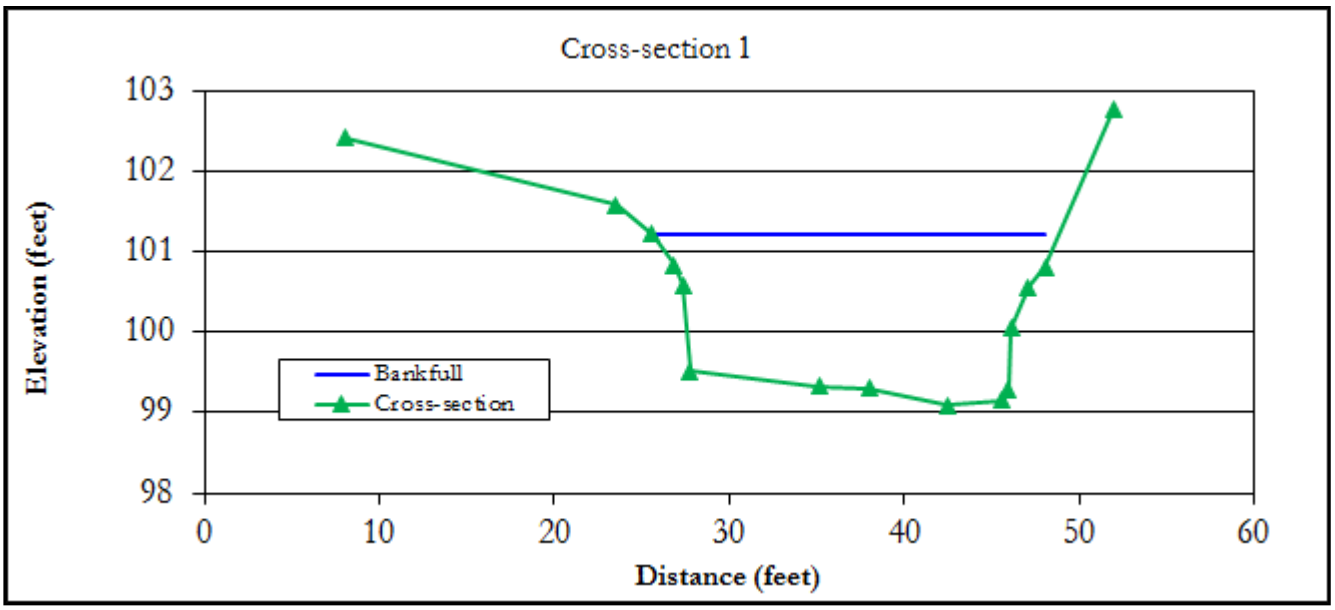


Longitudinal Profile

13. Clear Creek (2)
Ecoregion 67, Tennessee

Latitude: 36.213589
Longitude: -84.059333
Drainage area: 2.77 square miles
Median particle size: 8 millimeters
Longitudinal slope: 0.0048 feet/foot
Stream classification: C4

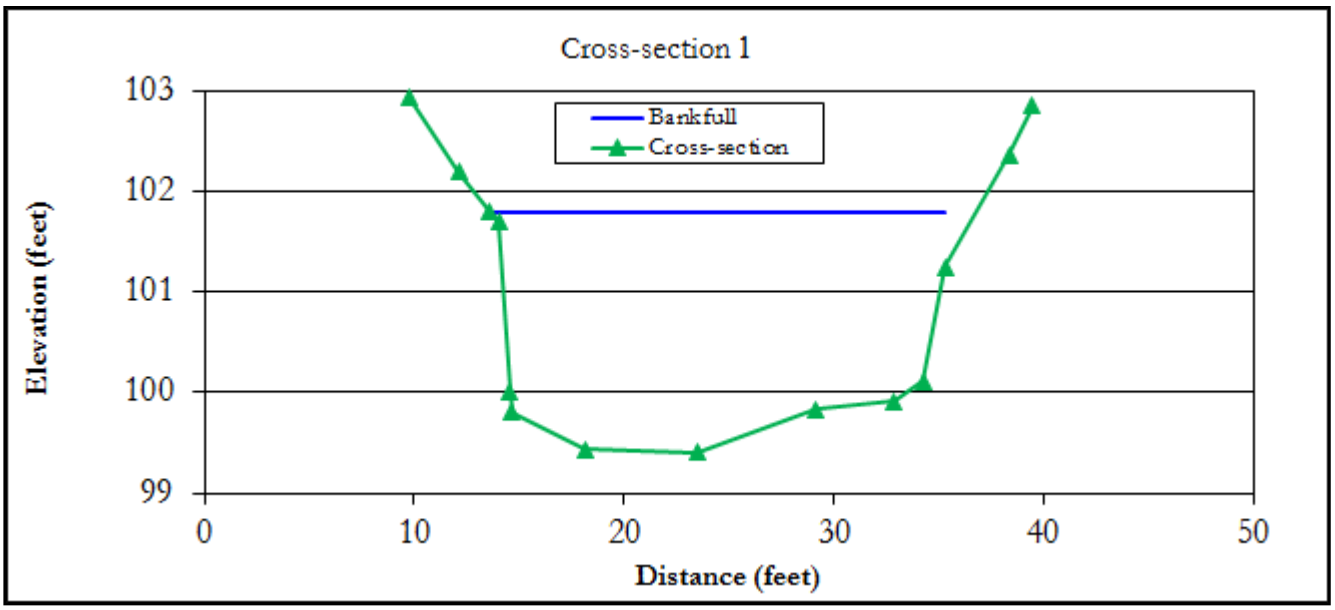
	X1
Area (square feet) =	37.9
Width (feet) =	23.3
Mean depth =	1.6
Max depth =	2.1
Width/depth ratio =	14.3
Entrenchment ratio =	3.1



14. Crockett Creek
Ecoregion 67, Tennessee

Latitude: 36.379817
Longitude: -83.046554
Drainage area: 4.67 square miles
Median particle size: 25 millimeters
Longitudinal slope: 0.0025 feet/foot
Stream classification: B4c

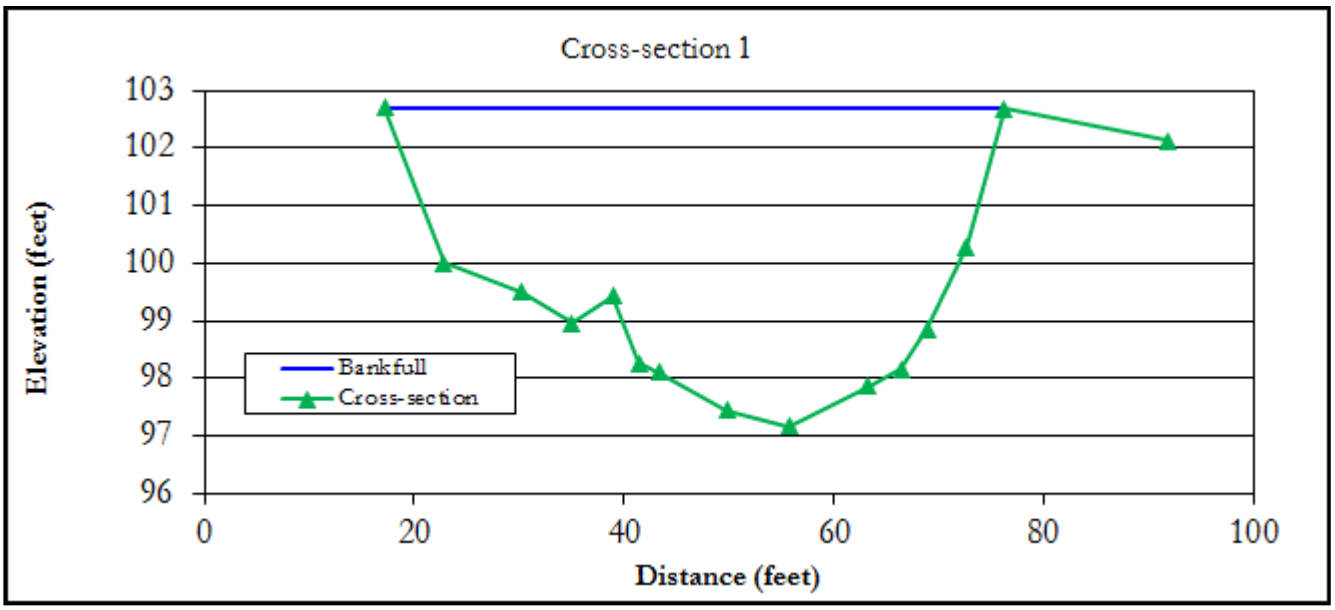
	X1
Area (square feet) =	44.6
Width (feet) =	23.2
Mean depth =	1.9
Max depth =	2.4
Width/depth ratio =	12.1
Entrenchment ratio =	2.0



15. Beaver Creek
Ecoregion 67, Tennessee

Latitude: 36.059269
Longitude: -83.972218
Drainage area: 36.4 square miles
Median particle size: 12 millimeters
Longitudinal slope: 0.0010 feet/foot
Stream classification: C3

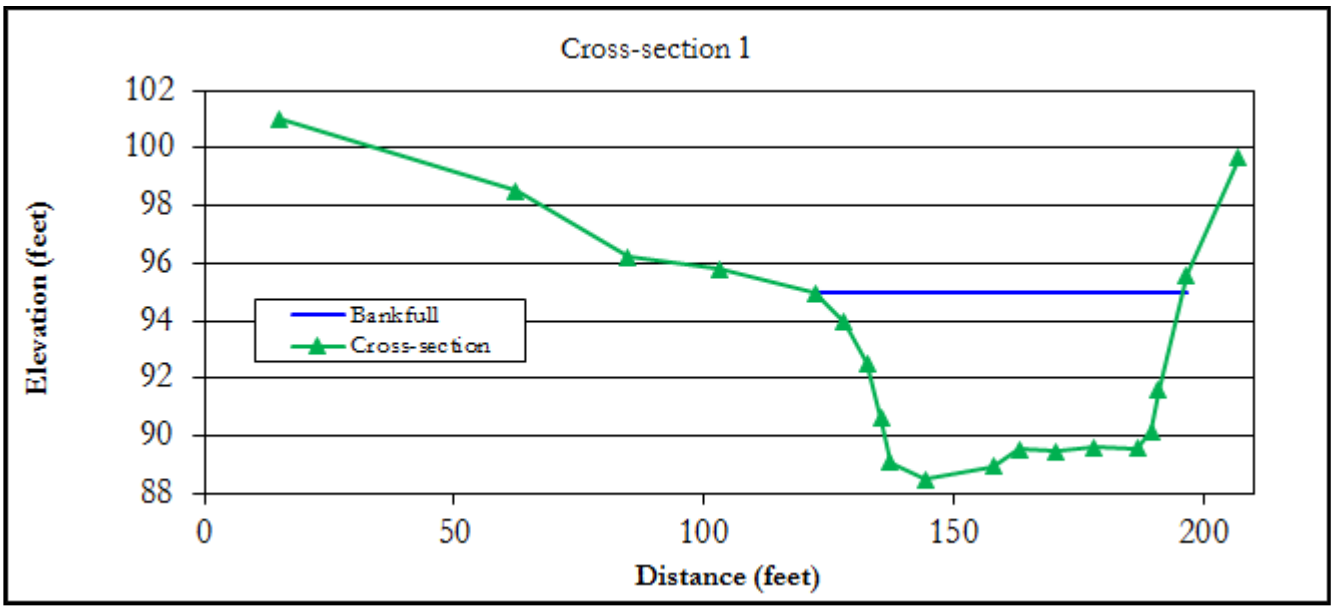
	X1
Area (square feet) =	220.9
Width (feet) =	58.9
Mean depth =	3.8
Max depth =	5.5
Width/depth ratio =	15.7
Entrenchment ratio =	3.7



16. Oostanaula Creek
Ecoregion 67, Tennessee

Latitude: 35.327517
Longitude: -84.705082
Drainage area: 57.0 square miles
Median particle size: 60 millimeters
Longitudinal slope: 0.0015 feet/foot
Stream classification: C4

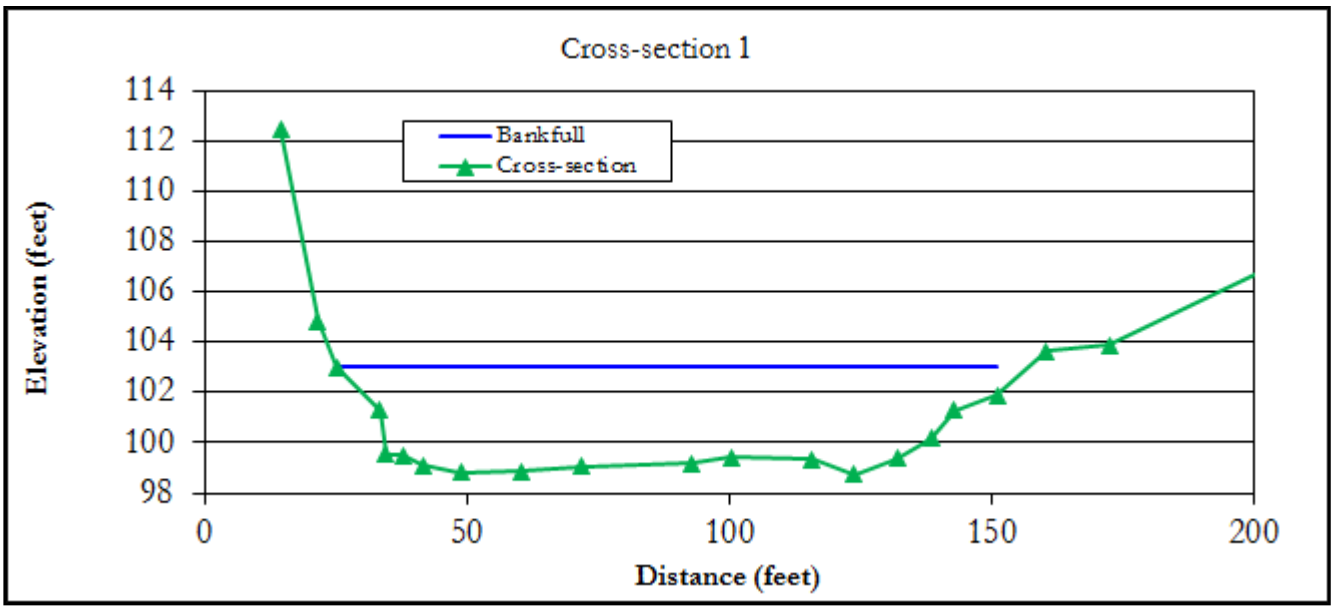
	X1
Area (square feet) =	344.9
Width (feet) =	73.3
Mean depth =	4.7
Max depth =	6.5
Width/depth ratio =	15.6
Entrenchment ratio =	3.0



17. Big Limestone Creek
Ecoregion 67, Tennessee

Latitude: 36.205938
Longitude: -82.650427
Drainage area: 79.0 square miles
Median particle size: bedrock
Longitudinal slope: 0.0023 feet/foot
Stream classification: B1c

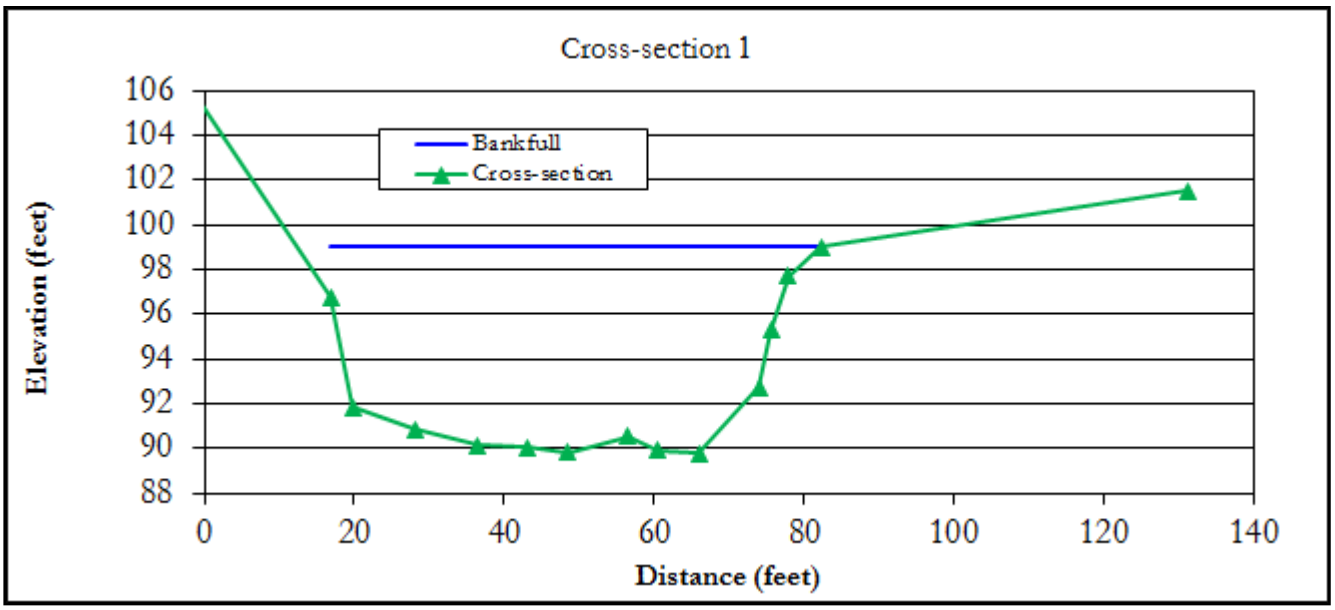
	X1
Area (square feet) =	431.5
Width (feet) =	131.7
Mean depth =	3.3
Max depth =	4.3
Width/depth ratio =	40.2
Entrenchment ratio =	1.4



18. Sewee Creek
Ecoregion 67, Tennessee

Latitude: 35.577894
Longitude: -84.749564
Drainage area: 117 square miles
Median particle size: 50 millimeters
Longitudinal slope: 0.0010 feet/foot
Stream classification: E4

	X1
Area (square feet) =	497.5
Width (feet) =	69.8
Mean depth =	7.1
Max depth =	9.3
Width/depth ratio =	9.8
Entrenchment ratio =	2.9



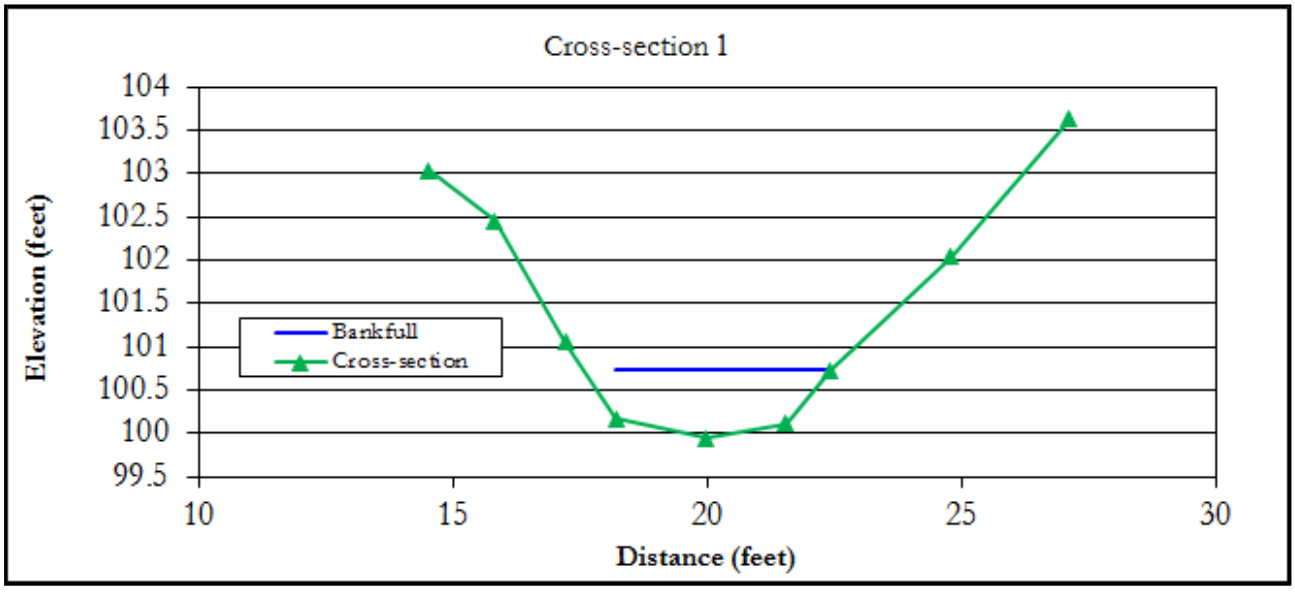
APPENDIX C

Ecoregions 68/69 Morphology Data

1. UT1 New River
Ecoregion 69, Tennessee

Latitude: 36.120713
Longitude: -84.432341
Drainage area: 0.02 square miles
Median particle size: 40 millimeters
Longitudinal slope: 0.1420 feet/foot
Stream classification: A4a+

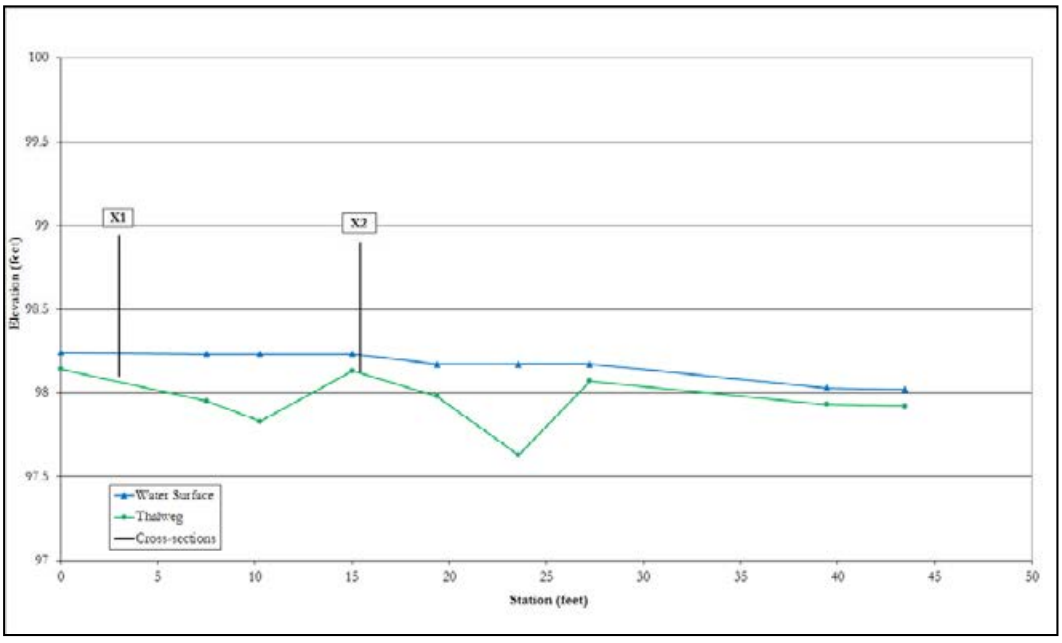
	X1
Area (square feet) =	2.8
Width (feet) =	4.9
Mean depth =	0.6
Max depth =	0.8
Width/depth ratio =	8.5
Entrenchment ratio =	1.4



2. UT Groom Branch
Ecoregion 68, Tennessee

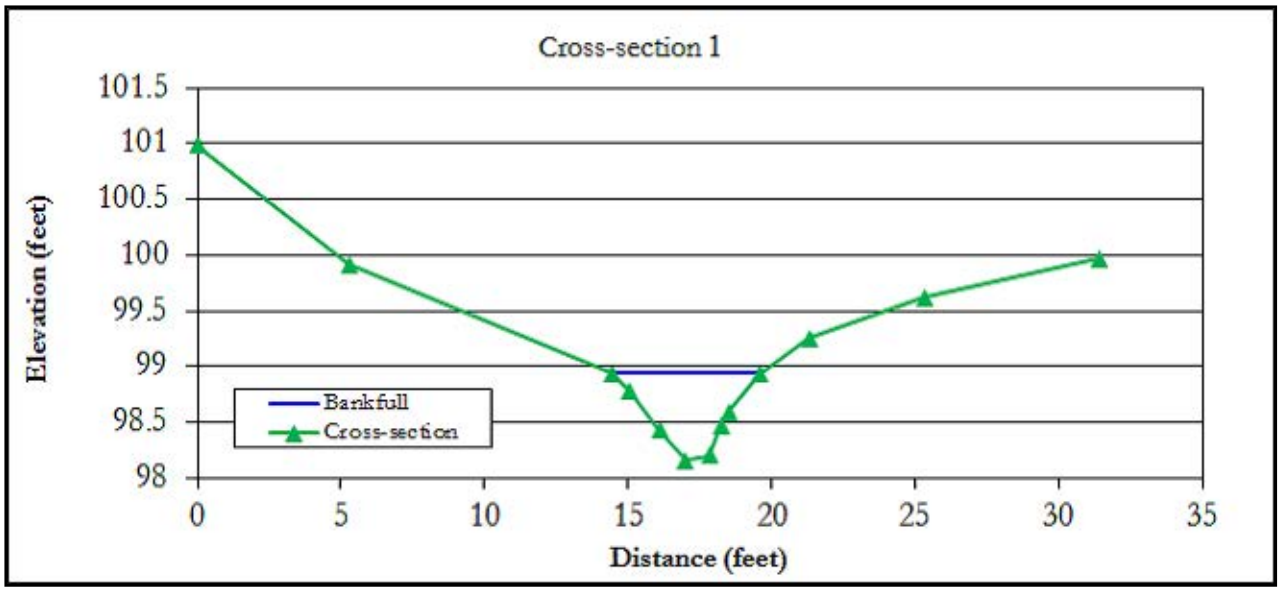
Latitude: 36.450189
Longitude: -84.708111
Drainage area: 0.05 square miles
Median particle size: 0.50 millimeters
Longitudinal slope: 0.0051 feet/foot
Stream classification: E5

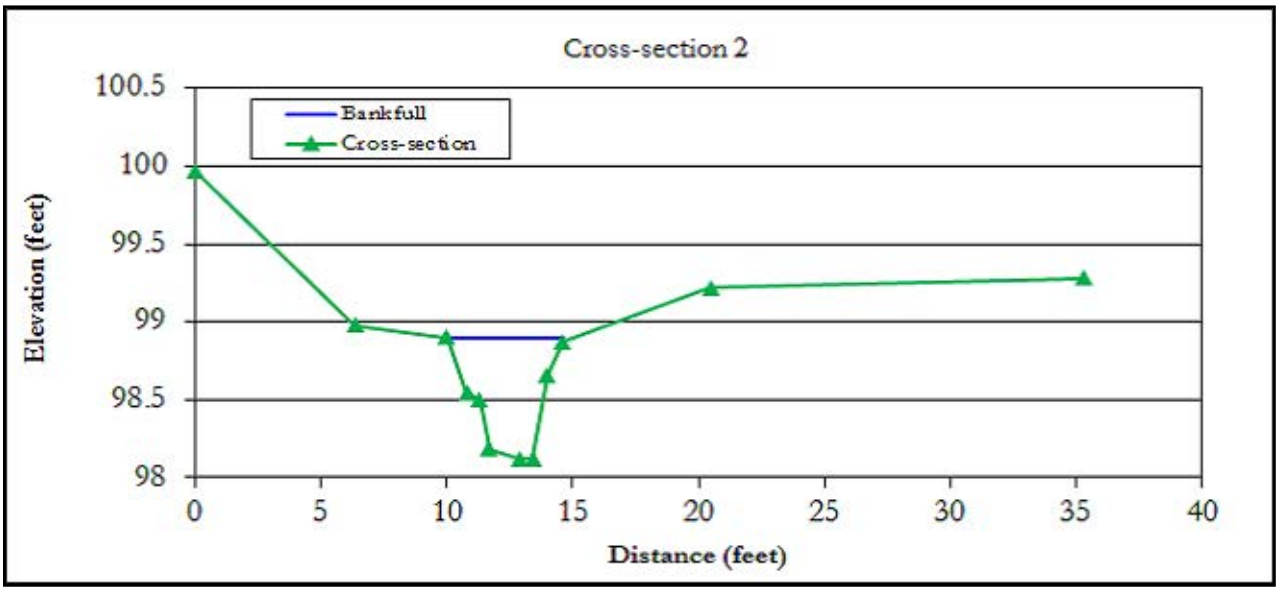
	X1	X2
Area (square feet) =	2.2	2.2
Width (feet) =	5.2	5.1
Mean depth =	0.4	0.4
Max depth =	0.8	0.8
Width/depth ratio =	12.3	11.6
Entrenchment ratio =	3.9	6.5



Longitudinal Profile

2. UT Groom Branch
Ecoregion 68, Tennessee

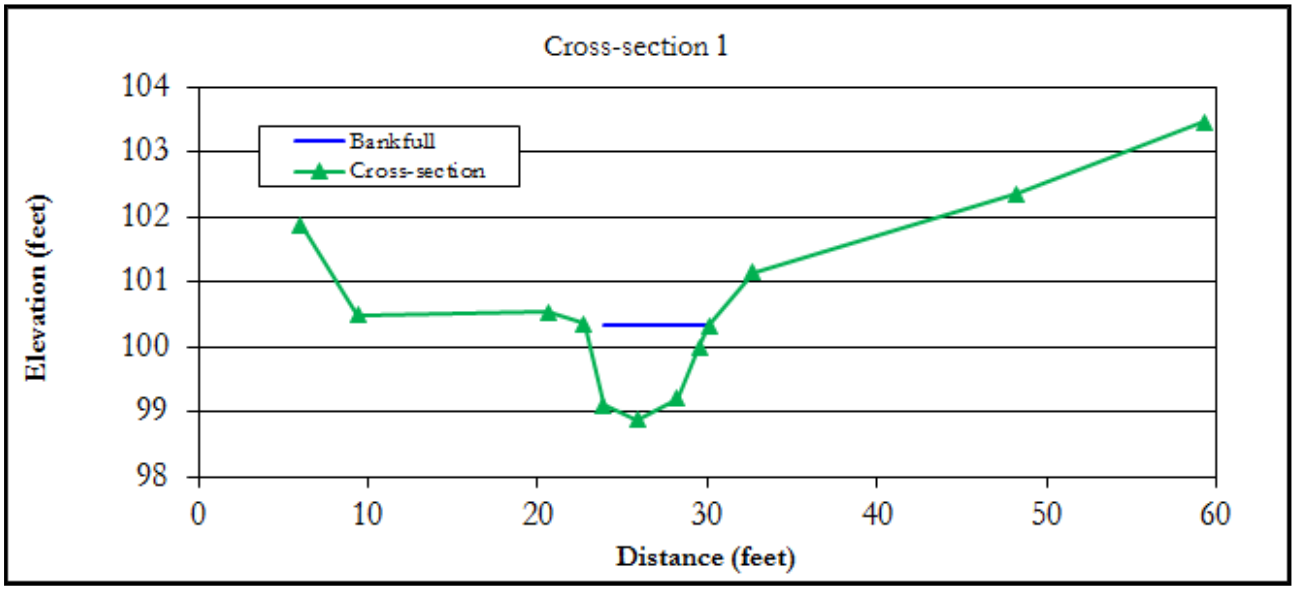




3. UT2 New River
Ecoregion 69, Tennessee

Latitude: 36.121060
Longitude: -84.430431
Drainage area: 0.06 square miles
Median particle size: 50 millimeters
Longitudinal slope: 0.0928 feet/foot
Stream classification: E4a

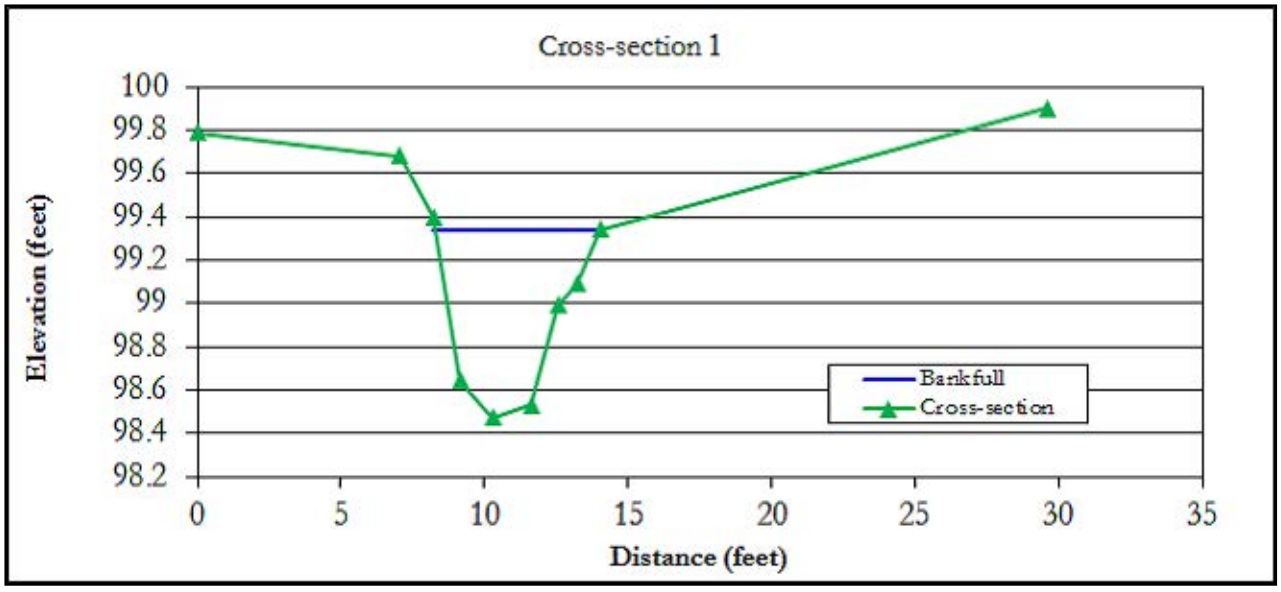
	X1
Area (square feet) =	7.4
Width (feet) =	7.3
Mean depth =	1.0
Max depth =	1.4
Width/depth ratio =	7.3
Entrenchment ratio =	4.7



4. UT West Fork Coyte Branch
Ecoregion 68, Tennessee

Latitude: 36.463306
Longitude: -84.714556
Drainage area: 0.08 square miles
Median particle size: 0.25 millimeters
Longitudinal slope: 0.0071 feet/foot
Stream classification: E5

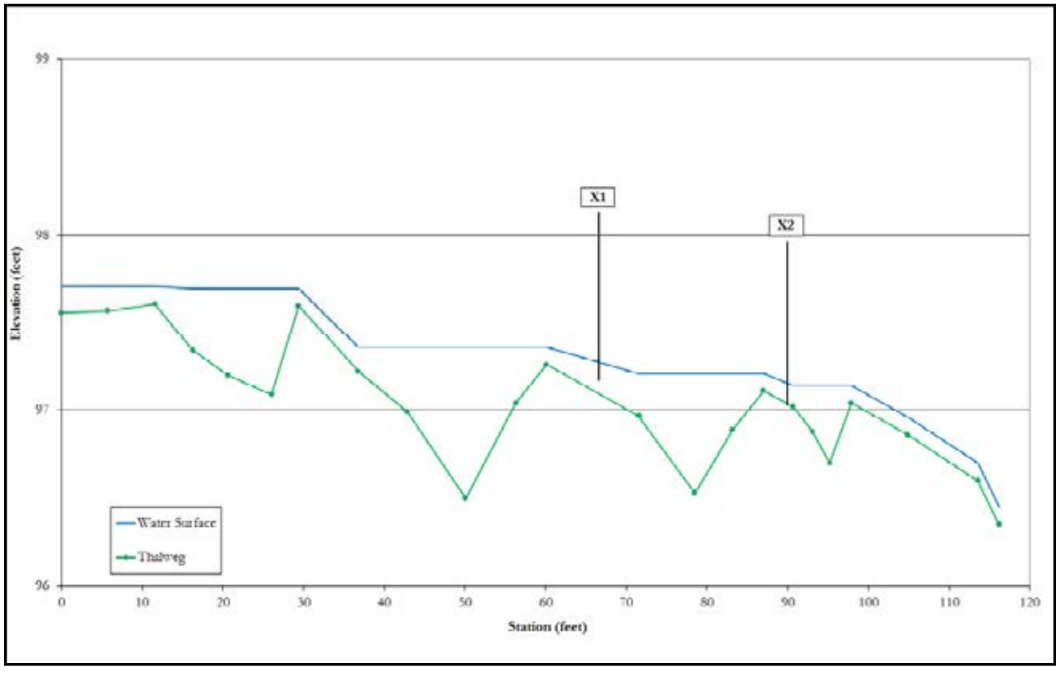
	X1
Area (square feet) =	3.2
Width (feet) =	5.7
Mean depth =	0.6
Max depth =	0.9
Width/depth ratio =	10.4
Entrenchment ratio =	5.2



5. UT Weaver Branch
Ecoregion 68, Tennessee

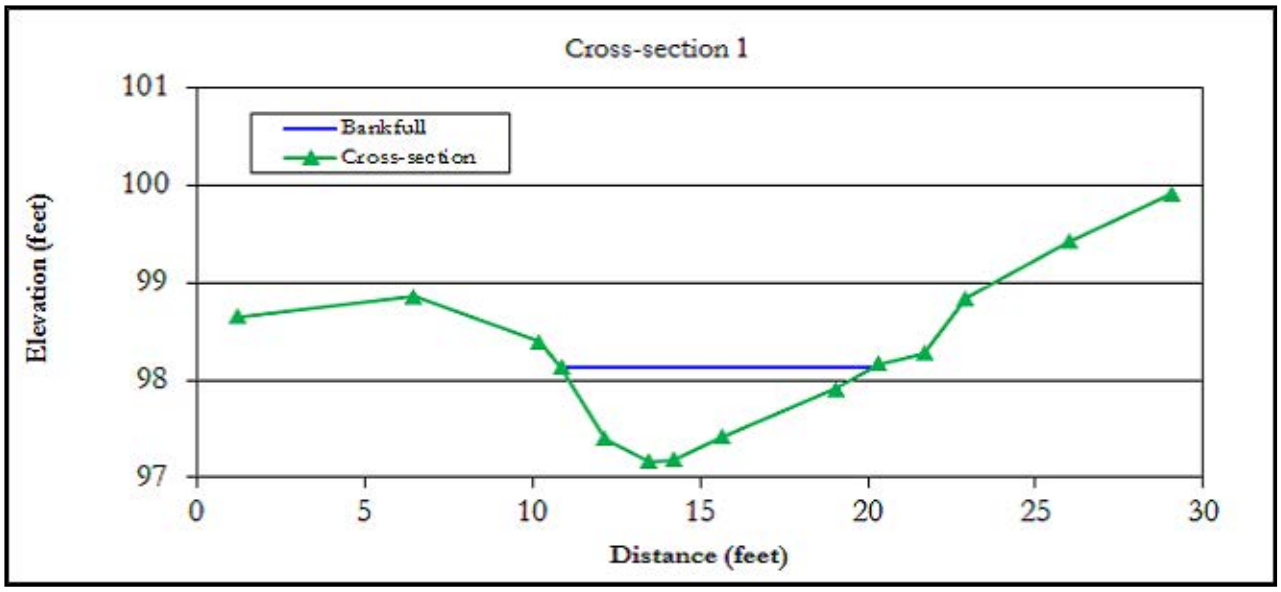
Latitude: 35.934432
Longitude: -84.859921
Drainage area: 0.09 square miles
Median particle size: 7.4 millimeters
Longitudinal slope: 0.0108 feet/foot
Stream classification: C4

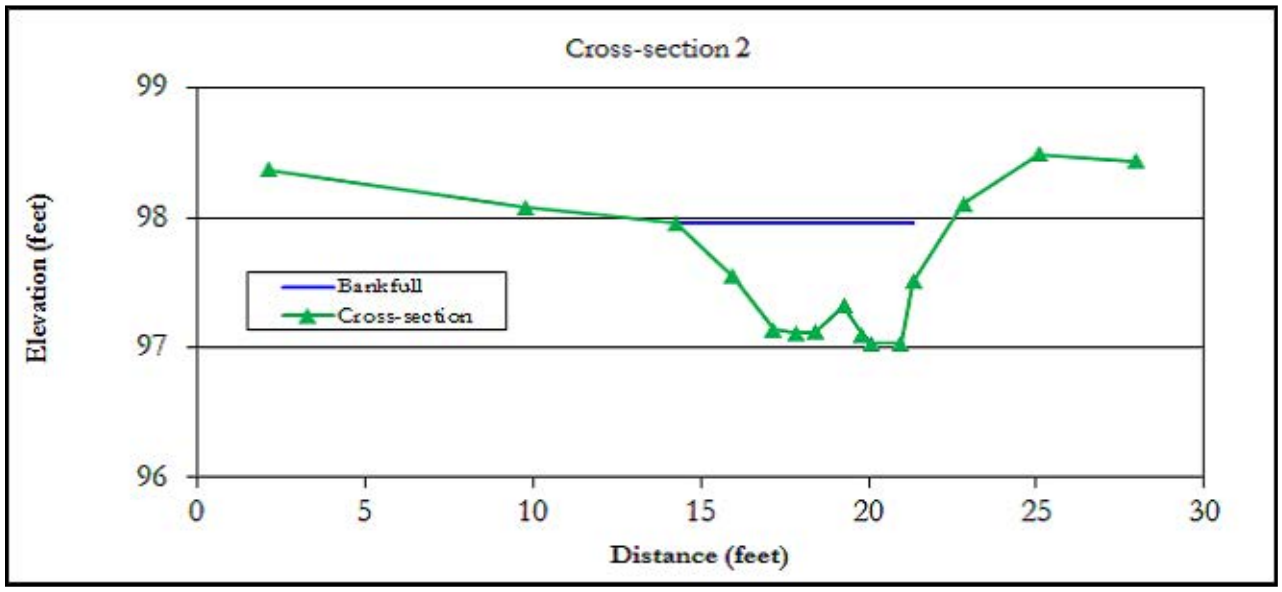
	X1	X2
Area (square feet) =	5.2	4.8
Width (feet) =	9.3	8.2
Mean depth =	0.6	0.6
Max depth =	1.0	0.9
Width/depth ratio =	16.7	14.2
Entrenchment ratio =	3.0	3.5



Longitudinal Profile

5. UT Weaver Branch
Ecoregion 68, Tennessee

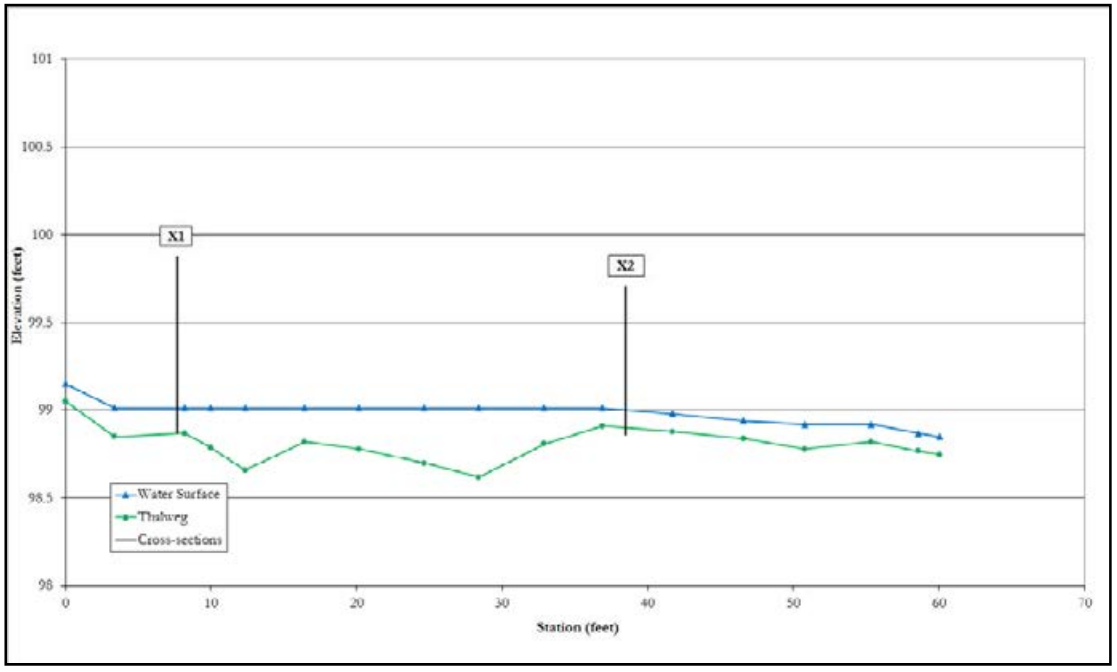




6. UT Bee Ridge Creek
Ecoregion 68, Tennessee

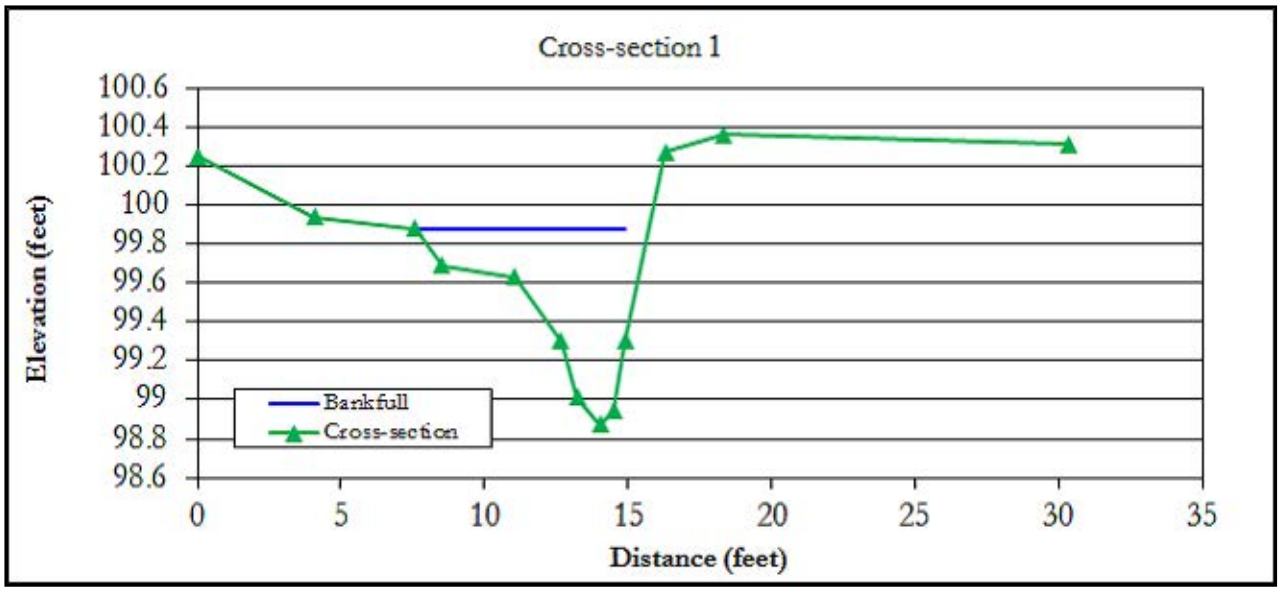
Latitude: 36.075083
Longitude: -84.931611
Drainage area: 0.11 square miles
Median particle size: 0.13 millimeters
Longitudinal slope: 0.0050 feet/foot
Stream classification: C5

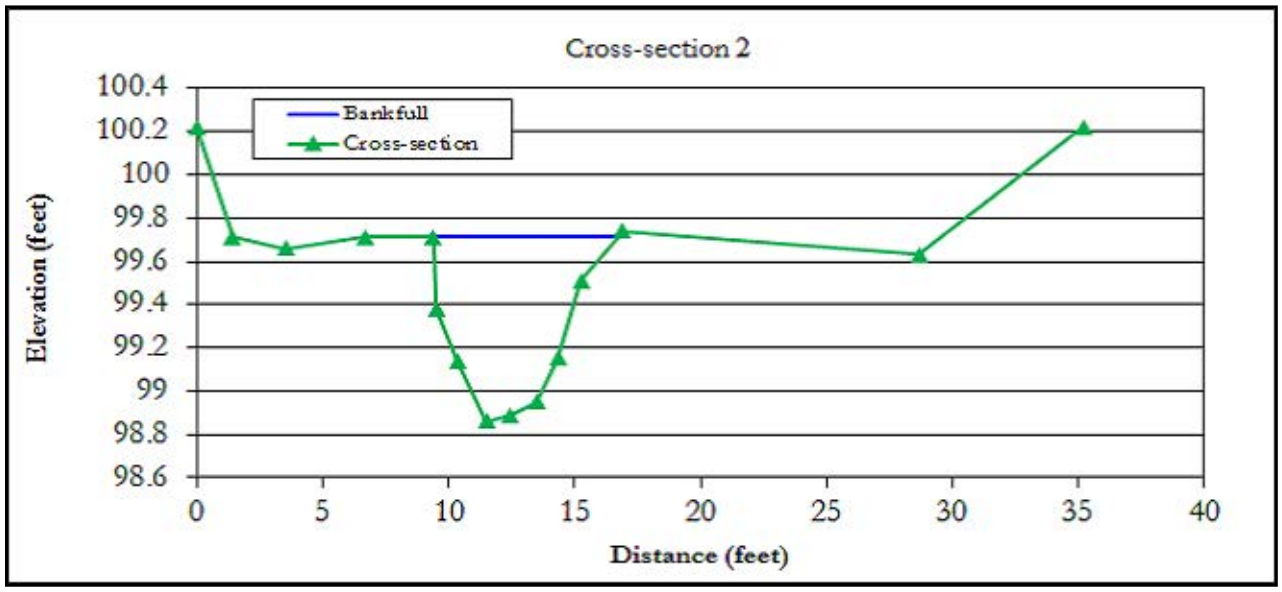
	X1	X2
Area (square feet) =	3.5	3.9
Width (feet) =	8.1	7.3
Mean depth =	0.4	0.5
Max depth =	1.0	0.8
Width/depth ratio =	19.1	13.7
Entrenchment ratio =	5.0	4.8



Longitudinal Profile

6. UT Bee Ridge Creek
Ecoregion 68, Tennessee

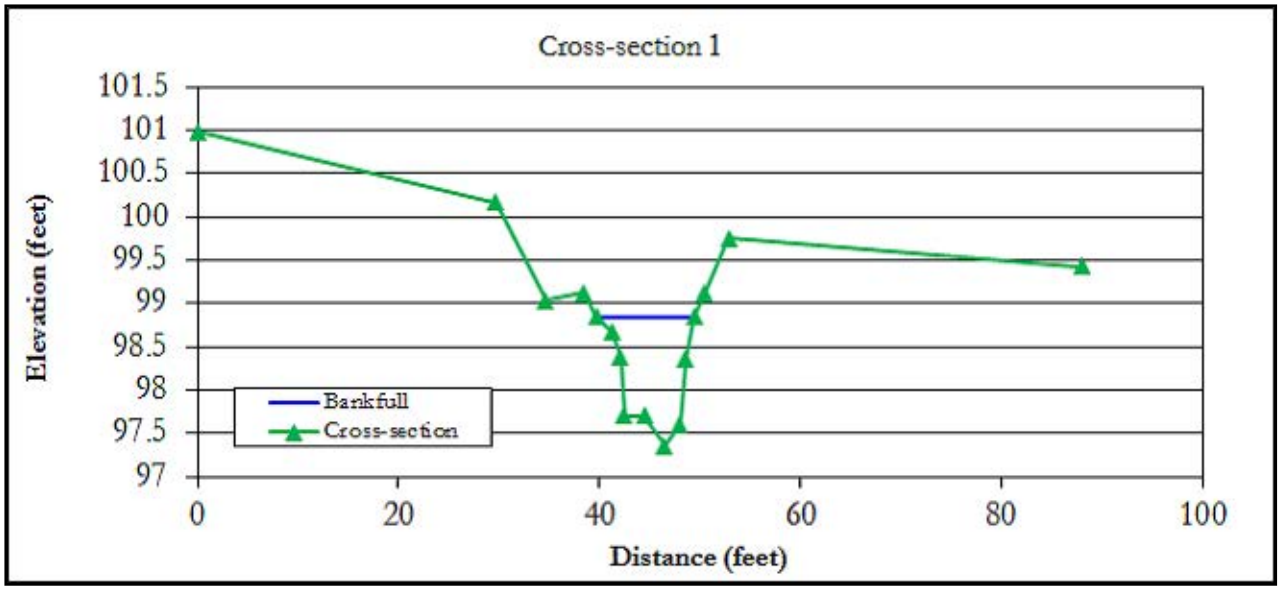




7. UT Slave Falls
Ecoregion 68, Tennessee

Latitude: 36.531368
Longitude: -84.769519
Drainage area: 0.29 square miles
Median particle size: 0.50 millimeters
Longitudinal slope: 0.0038 feet/foot
Stream classification: E5

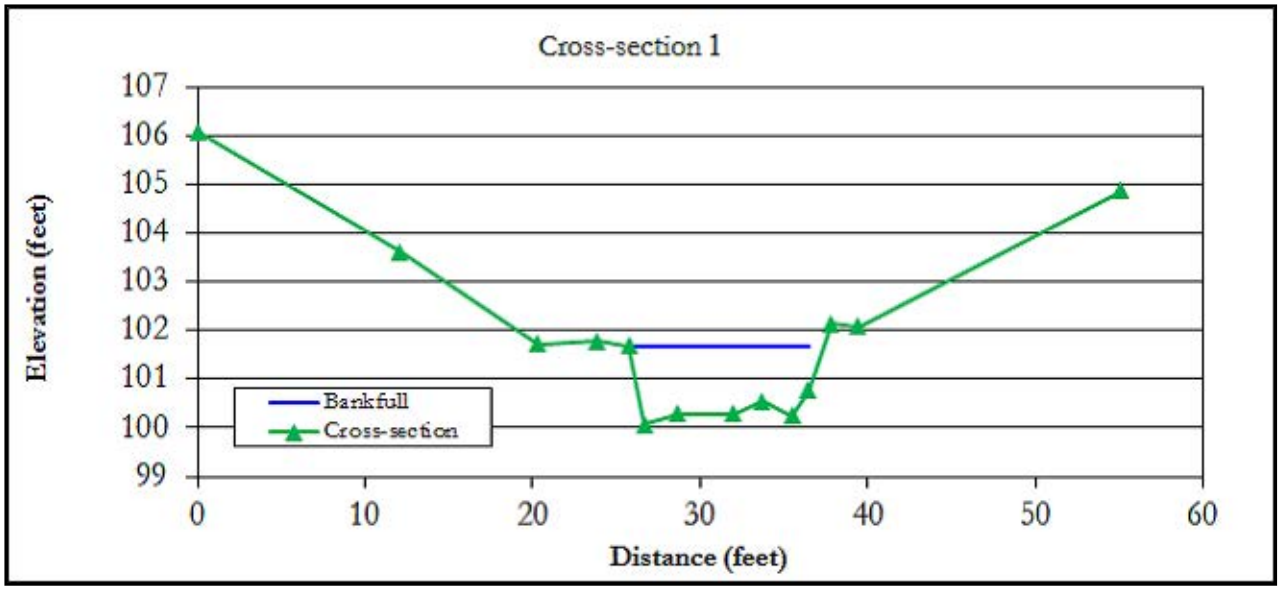
	X1
Area (square feet) =	8.3
Width (feet) =	9.7
Mean depth =	0.9
Max depth =	1.5
Width/depth ratio =	11.3
Entrenchment ratio =	6.6



8. Underwood Branch
Ecoregion 68, Tennessee

Latitude: 36.079056
Longitude: -84.911972
Drainage area: 0.34 square miles
Median particle size: 98 millimeters
Longitudinal slope: 0.0282 feet/foot
Stream classification: E3b

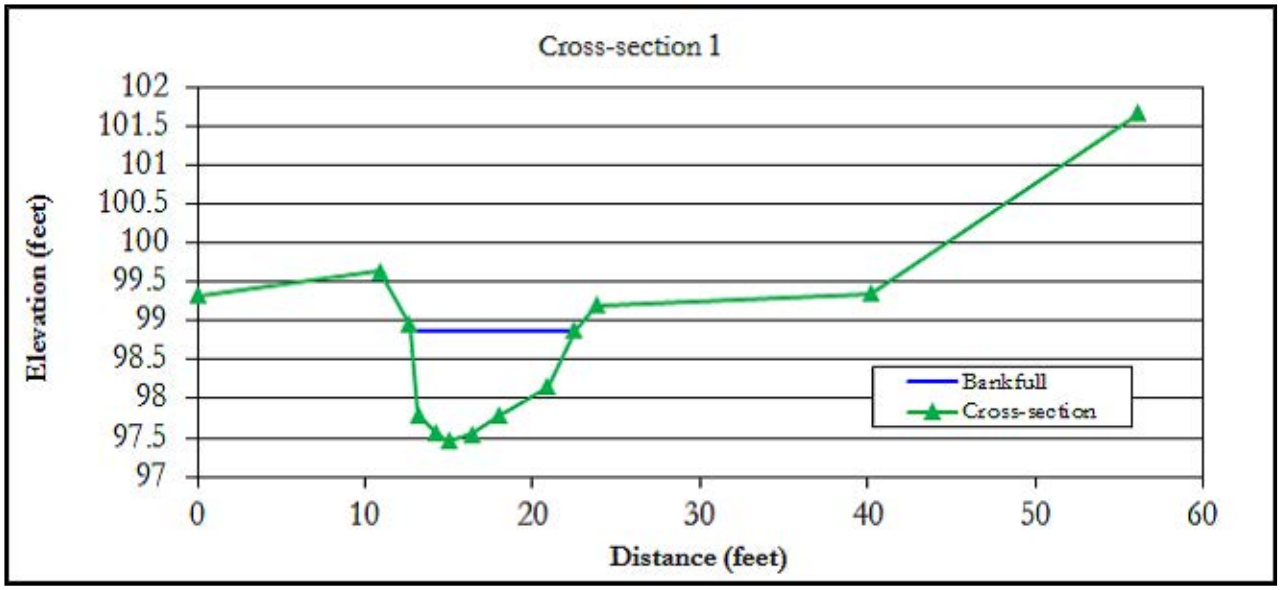
	X1
Area (square feet) =	14.4
Width (feet) =	11.6
Mean depth =	1.2
Max depth =	1.6
Width/depth ratio =	9.4
Entrenchment ratio =	2.8



9. West Fork Coyte Branch
Ecoregion 68, Tennessee

Latitude: 36.463139
Longitude: -84.714583
Drainage area: 0.43 square miles
Median particle size: 0.50 millimeters
Longitudinal slope: 0.0040 feet/foot
Stream classification: E5

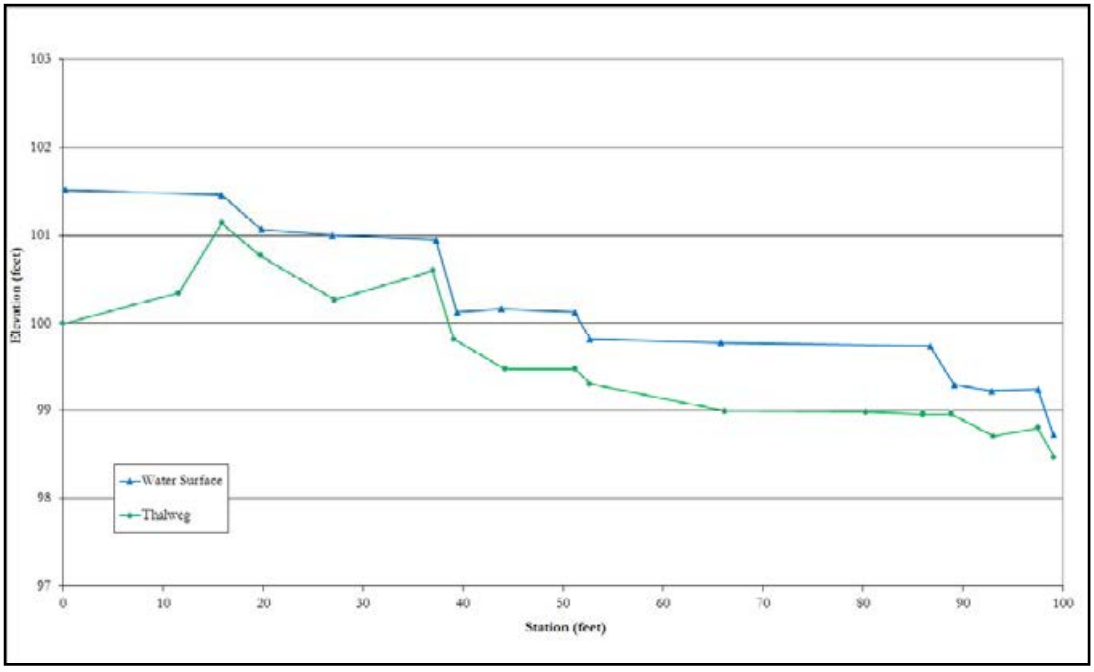
	X1
Area (square feet) =	9.6
Width (feet) =	9.8
Mean depth =	1.0
Max depth =	1.4
Width/depth ratio =	10.0
Entrenchment ratio =	4.8



10. Coon Creek
Ecoregion 68, Tennessee

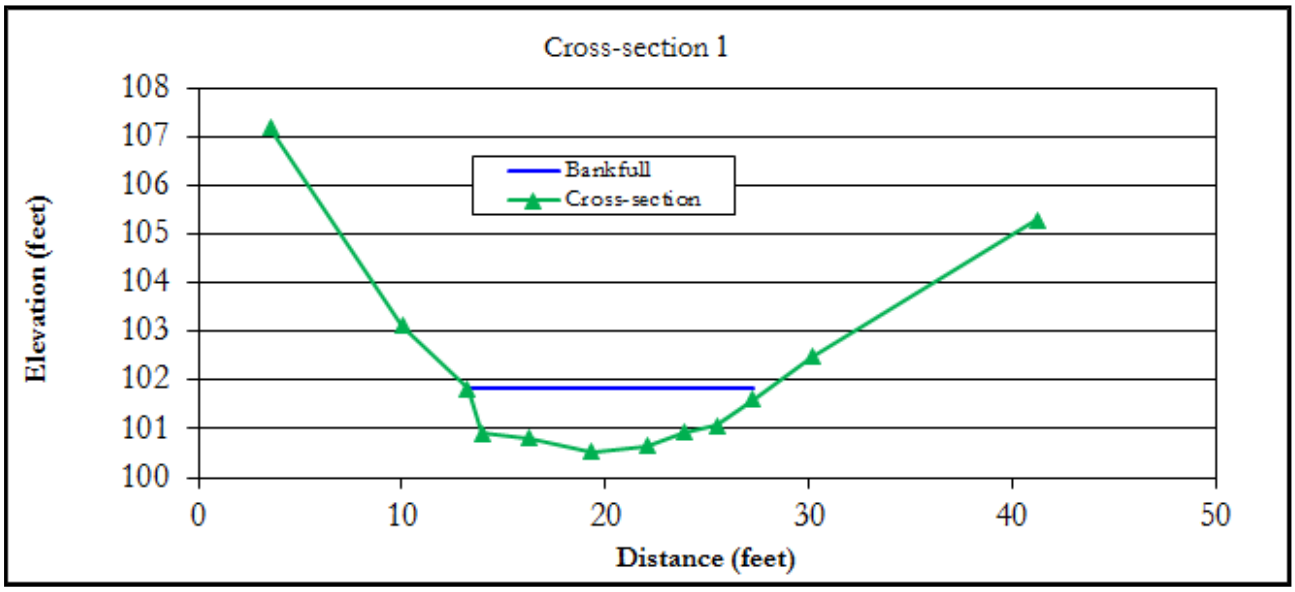
Latitude: 35.666057
Longitude: -85.356841
Drainage area: 0.50 square miles
Median particle size: 199 millimeters
Longitudinal slope: 0.0272 feet/foot
Stream classification: B3

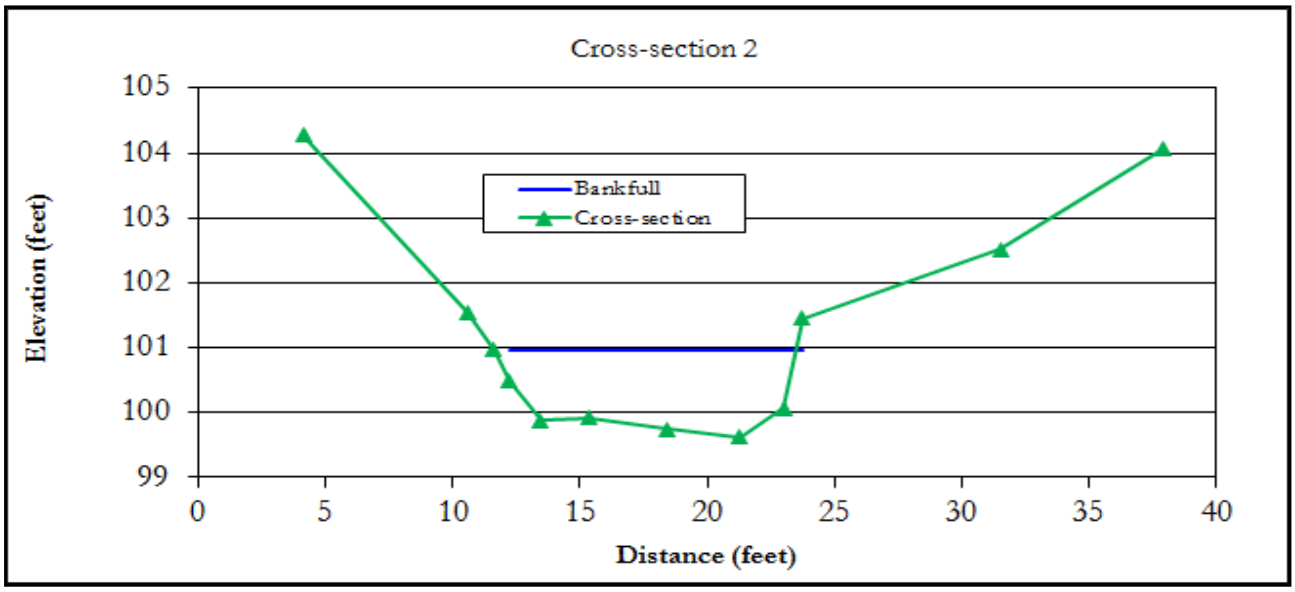
	X1	X2	X3
Area (square feet) =	13.5	12.5	11.4
Width (feet) =	14.8	11.8	11.9
Mean depth =	0.9	1.1	1.0
Max depth =	1.3	1.3	1.5
Width/depth ratio =	16.1	11.2	12.4
Entrenchment ratio =	1.5	1.8	2.7

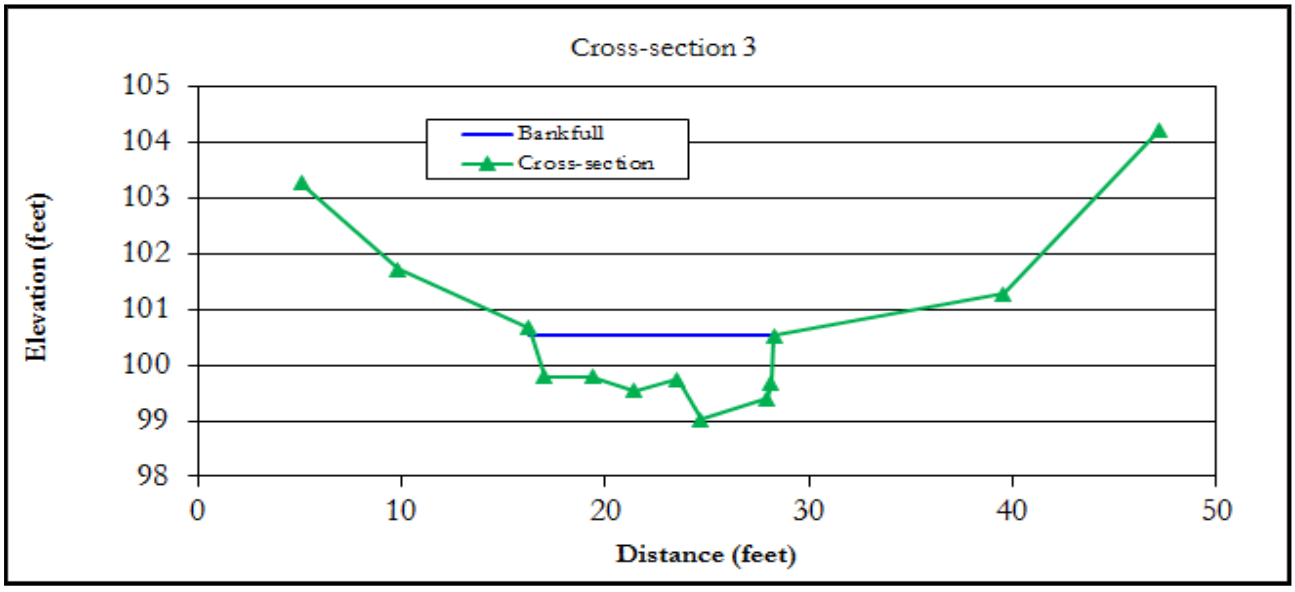


Longitudinal Profile

10. Coon Creek
Ecoregion 68, Tennessee



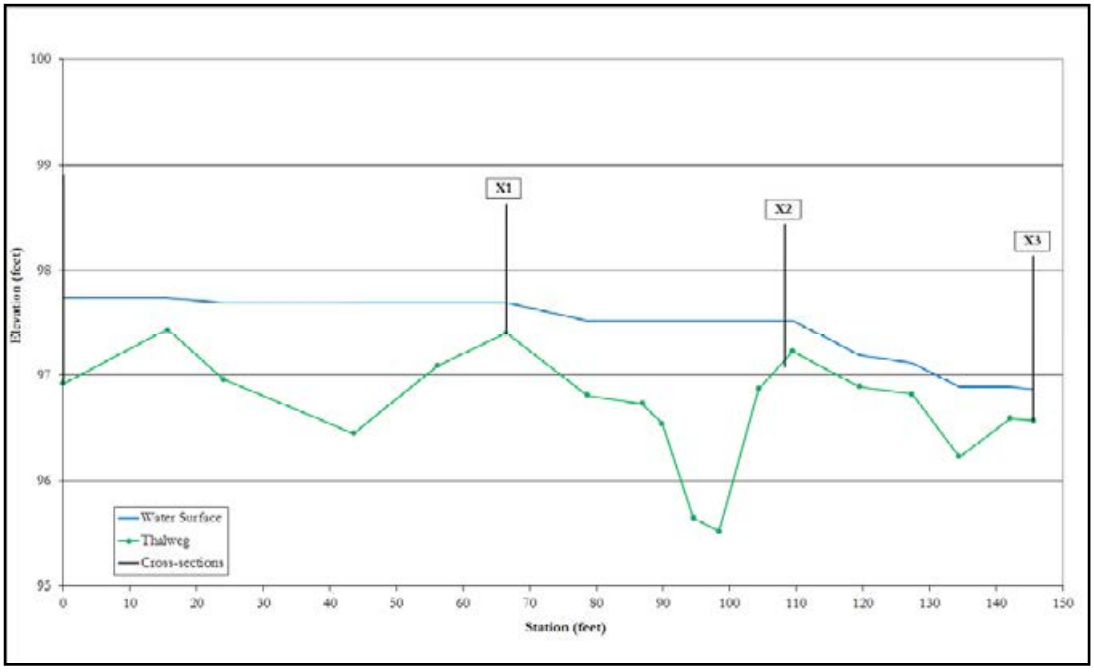




11. Weaver Branch
Ecoregion 68, Tennessee

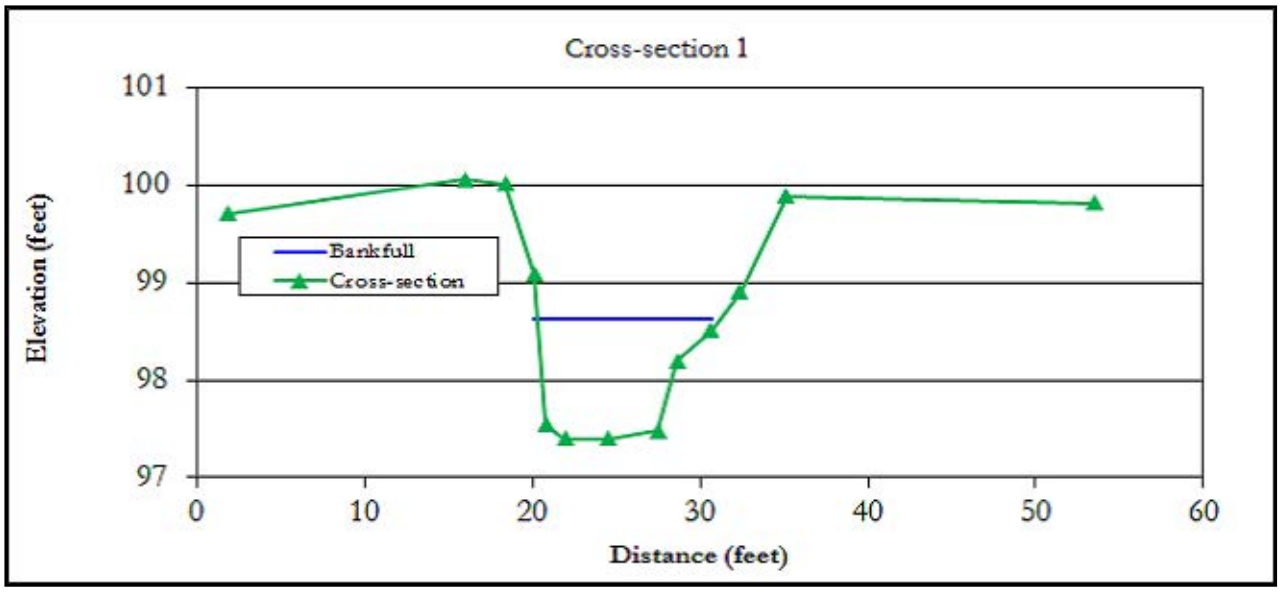
Latitude: 35.936126
Longitude: -84.857636
Drainage area: 0.51 square miles
Median particle size: 6.2 millimeters
Longitudinal slope: 0.0067 feet/foot
Stream classification: B4c

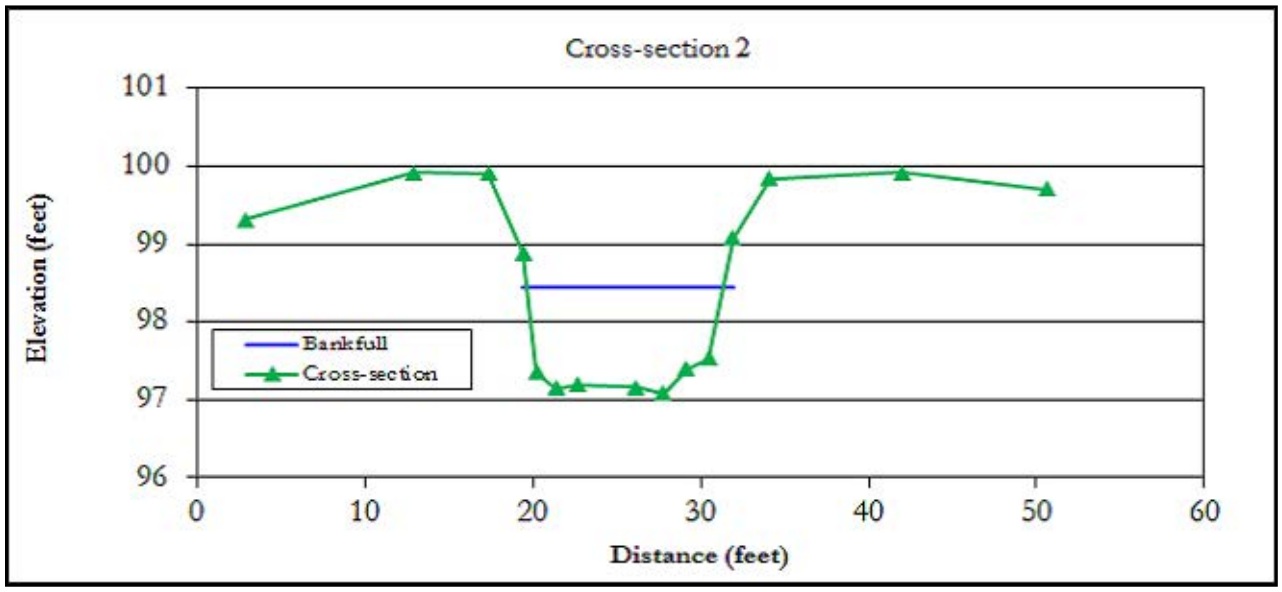
	X1	X2	X3
Area (square feet) =	9.7	13.2	11.3
Width (feet) =	10.9	11.7	10.0
Mean depth =	0.9	1.1	1.1
Max depth =	1.2	1.4	1.6
Width/depth ratio =	12.1	10.3	8.9
Entrenchment ratio =	1.6	1.4	1.6

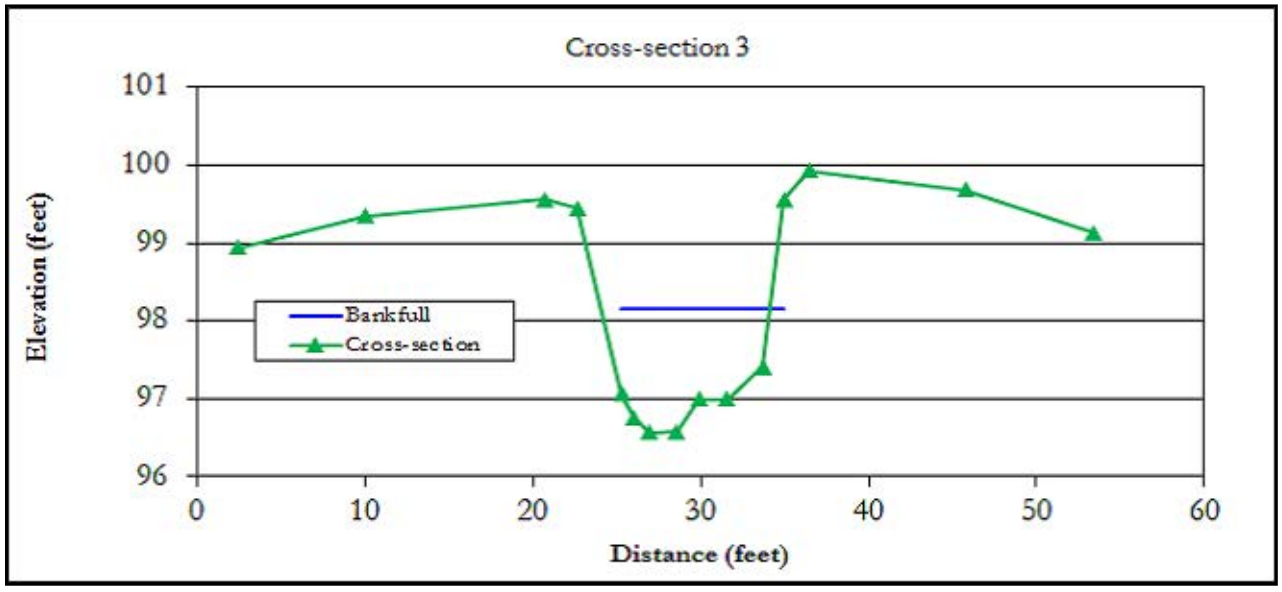


Longitudinal Profile

11. Weaver Branch
Ecoregion 68, Tennessee



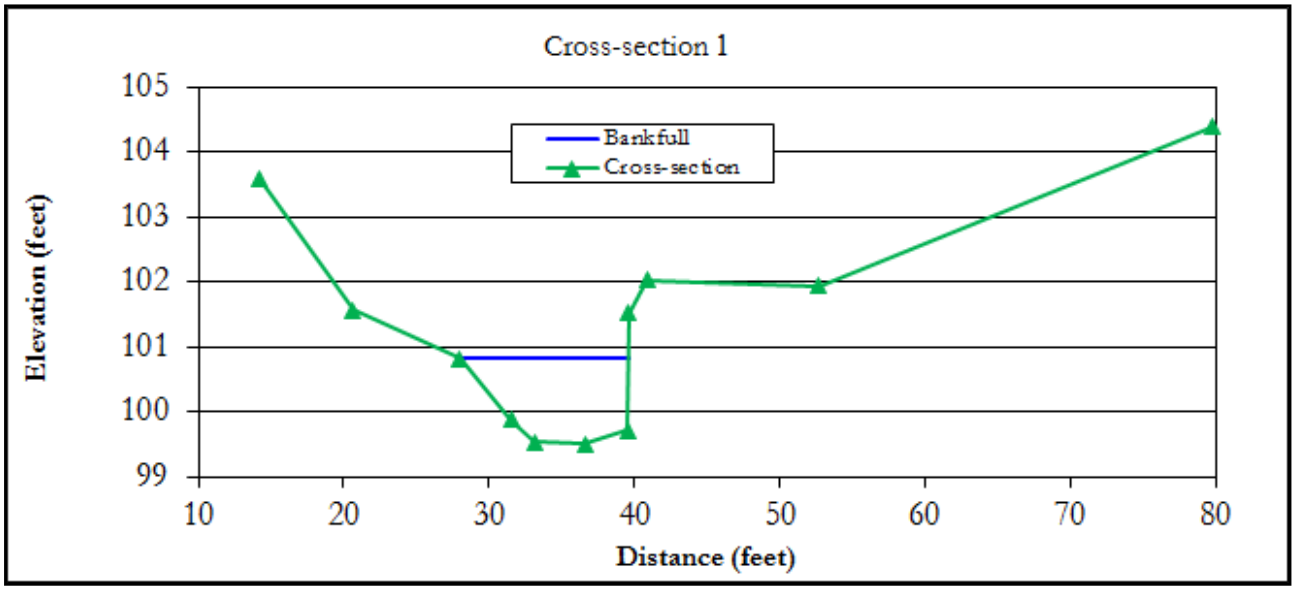




12. Flatrock Branch
Ecoregion 69, Tennessee

Latitude: 36.123561
Longitude: -84.424819
Drainage area: 0.71 square miles
Median particle size: 40 millimeters
Longitudinal slope: 0.0262 feet/foot
Stream classification: E4b

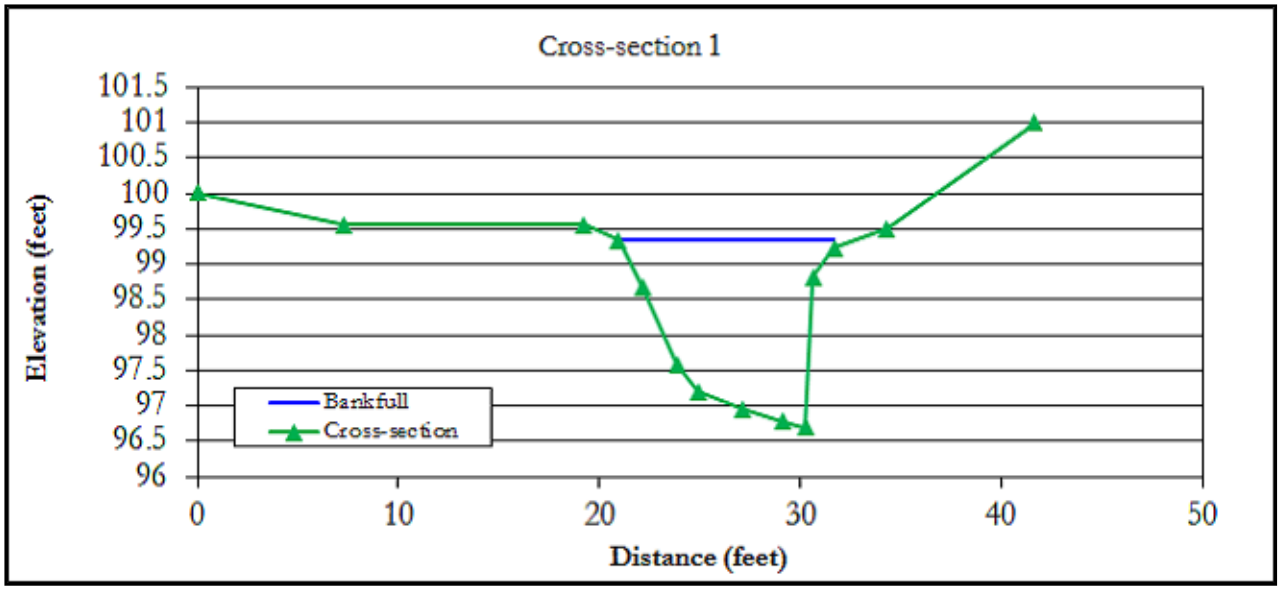
	X1
Area (square feet) =	11.5
Width (feet) =	11.6
Mean depth =	1.0
Max depth =	1.3
Width/depth ratio =	11.7
Entrenchment ratio =	3.1



13. Bandy Creek
Ecoregion 68, Tennessee

Latitude: 36.489056
Longitude: -84.710028
Drainage area: 0.76 square miles
Median particle size: 0.50 millimeters
Longitudinal slope: 0.0018 feet/foot
Stream classification: E5

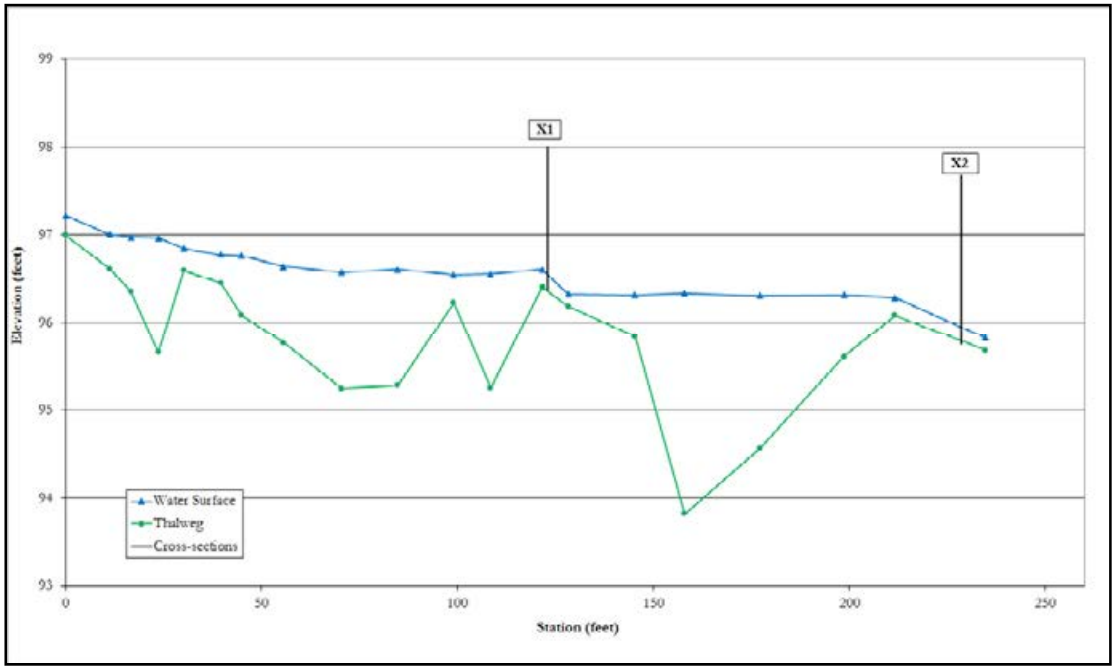
	X1
Area (square feet) =	18.4
Width (feet) =	11.8
Mean depth =	1.6
Max depth =	2.6
Width/depth ratio =	7.5
Entrenchment ratio =	3.5



14. Black House Branch
Ecoregion 68, Tennessee

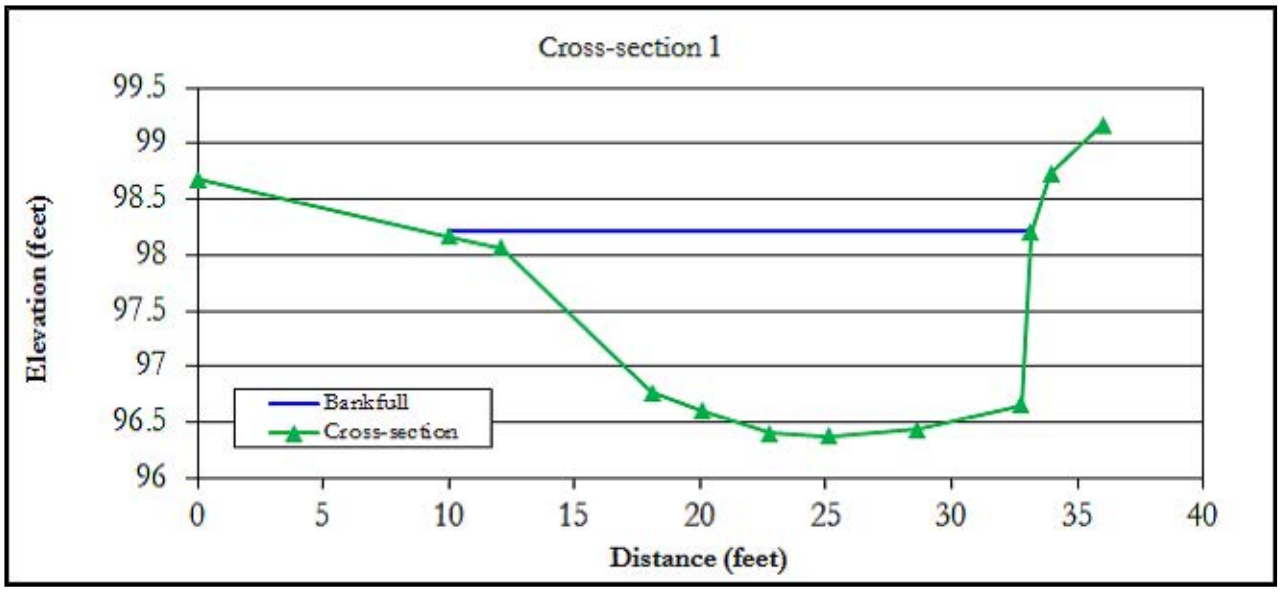
Latitude: 36.515389
Longitude: -84.716944
Drainage area: 2.05 square miles
Median particle size: 20 millimeters
Longitudinal slope: 0.0044 feet/foot
Stream classification: C4

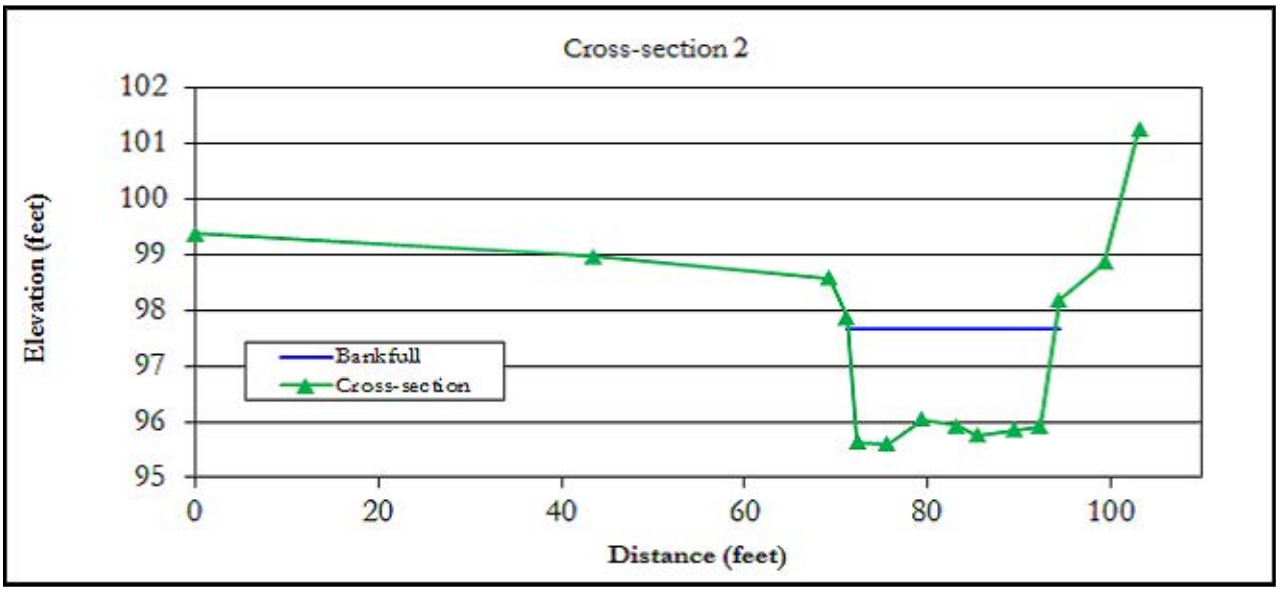
	X1	X2
Area (square feet) =	30.5	39.4
Width (feet) =	23.9	22.6
Mean depth =	1.3	1.7
Max depth =	1.8	2.1
Width/depth ratio =	18.8	13.0
Entrenchment ratio =	5.0	5.3



Longitudinal Profile

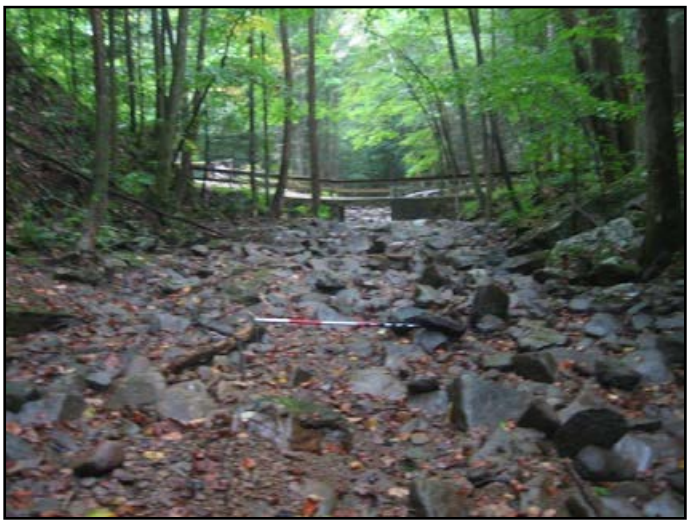
14. Black House Branch
Ecoregion 68, Tennessee



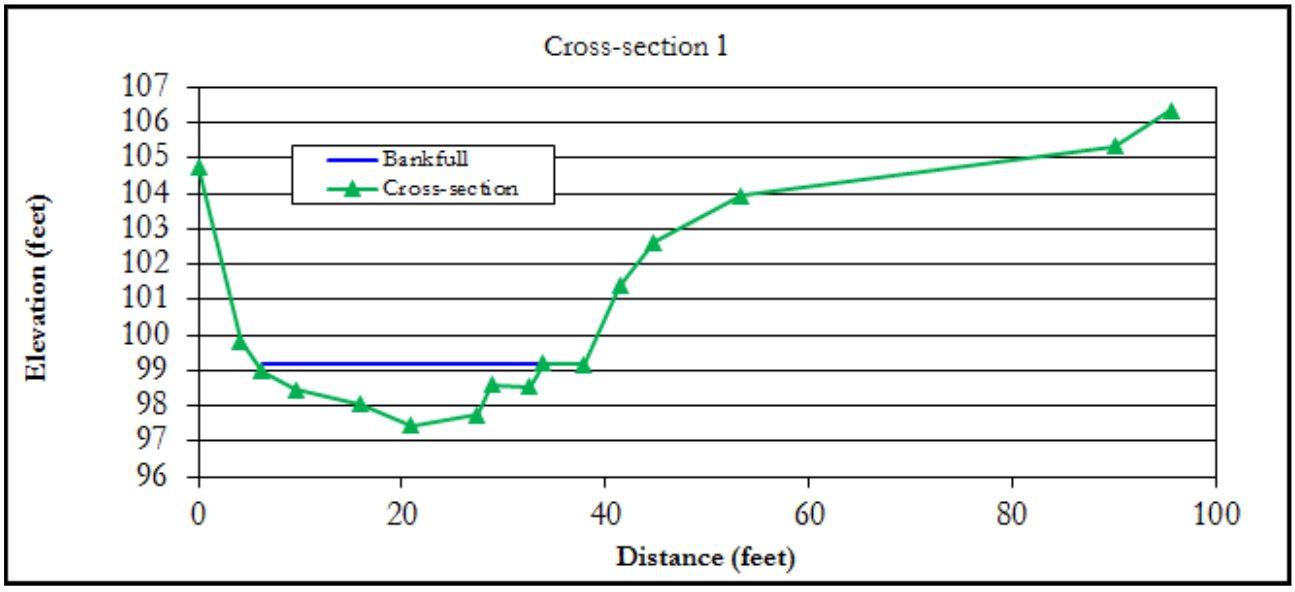


15. Flat Fork
Ecoregion 69, Tennessee

Latitude: 36.136792
Longitude: -84.487200
Drainage area: 2.37 square miles
Median particle size: 90 millimeters
Longitudinal slope: 0.0165 feet/foot
Stream classification: B3c



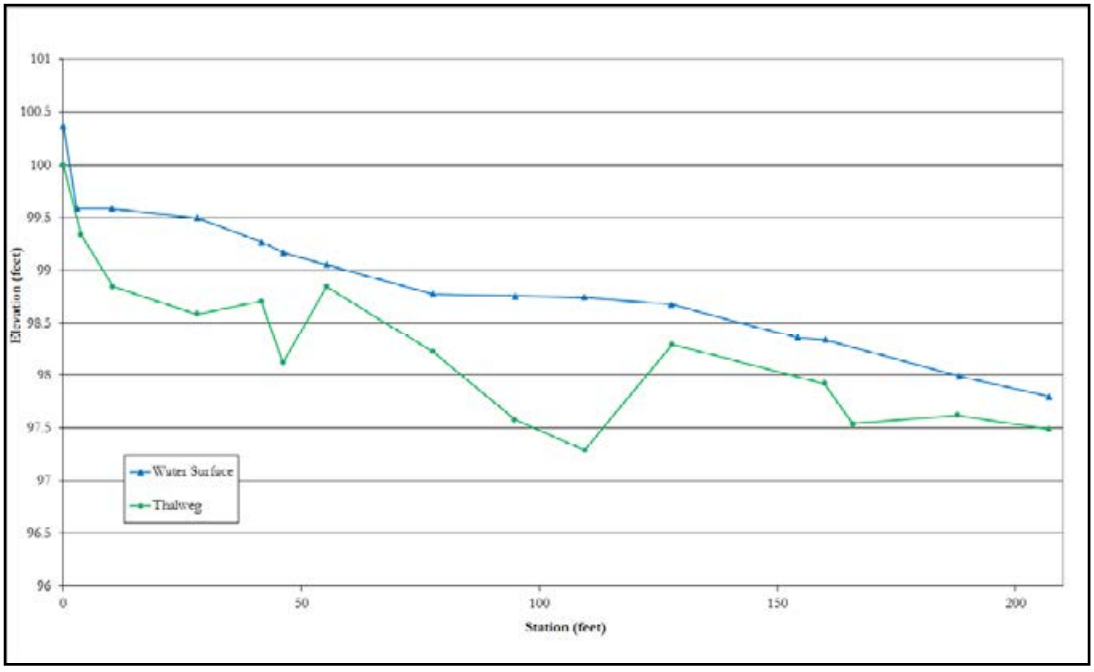
	X1
Area (square feet) =	29.3
Width (feet) =	28.1
Mean depth =	1.0
Max depth =	1.8
Width/depth ratio =	27.0
Entrenchment ratio =	1.3



16. Rockhouse Creek
Ecoregion 68, Tennessee

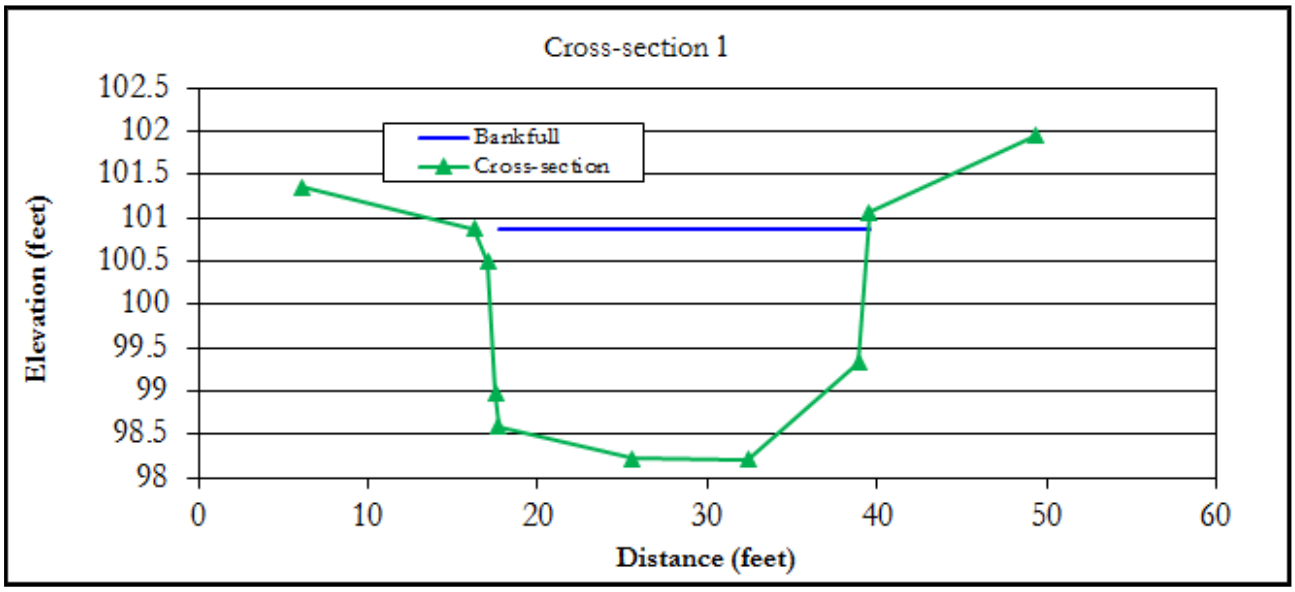
Latitude: 35.663490
Longitude: -85.346584
Drainage area: 3.11 square miles
Median particle size: 218 millimeters
Longitudinal slope: 0.0124 feet/foot
Stream classification: E3

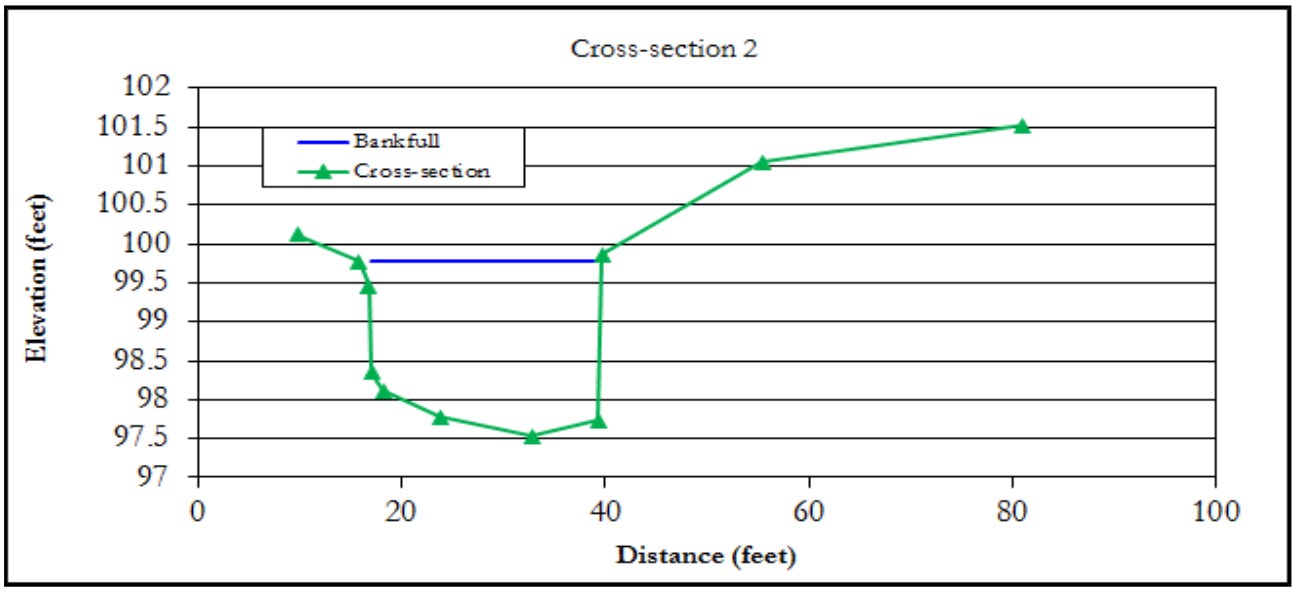
	X1	X2
Area (square feet) =	52.9	45.6
Width (feet) =	23.2	23.8
Mean depth =	2.3	1.9
Max depth =	2.7	2.2
Width/depth ratio =	10.2	12.5
Entrenchment ratio =	8.7	5.0



Longitudinal Profile

16. Rockhouse Creek
Ecoregion 68, Tennessee

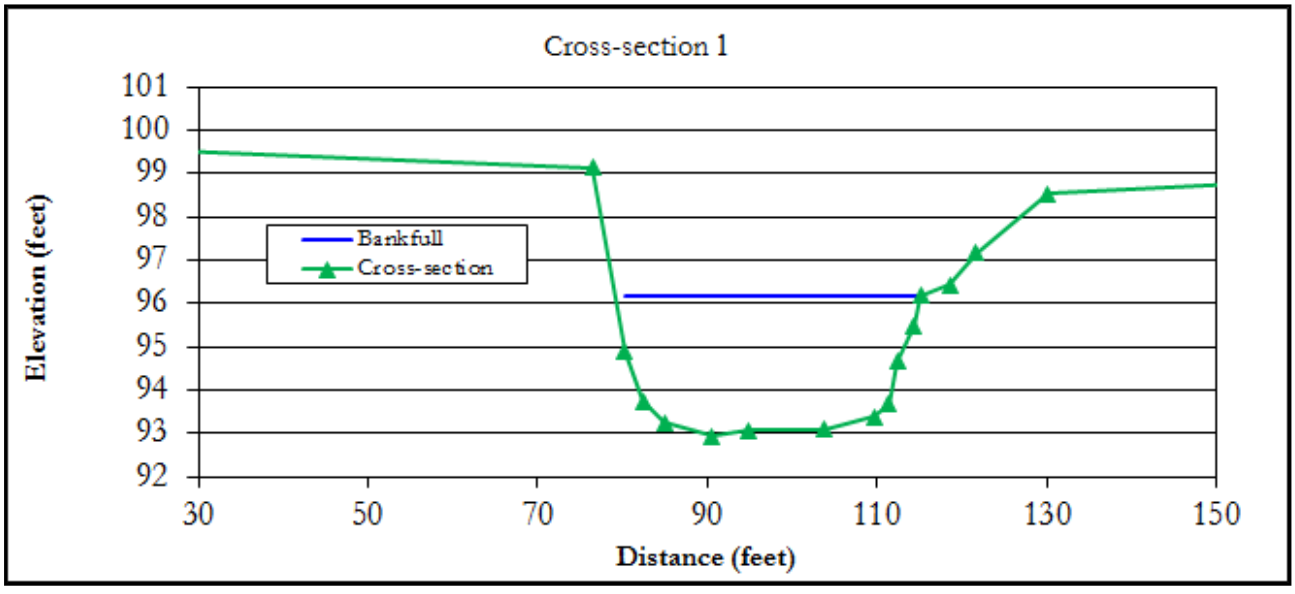




17. New River
Ecoregion 69, Tennessee

Latitude: 36.125320
Longitude: -84.420904
Drainage area: 4.15 square miles
Median particle size: 35 millimeters
Longitudinal slope: 0.0080 feet/foot
Stream classification: C4

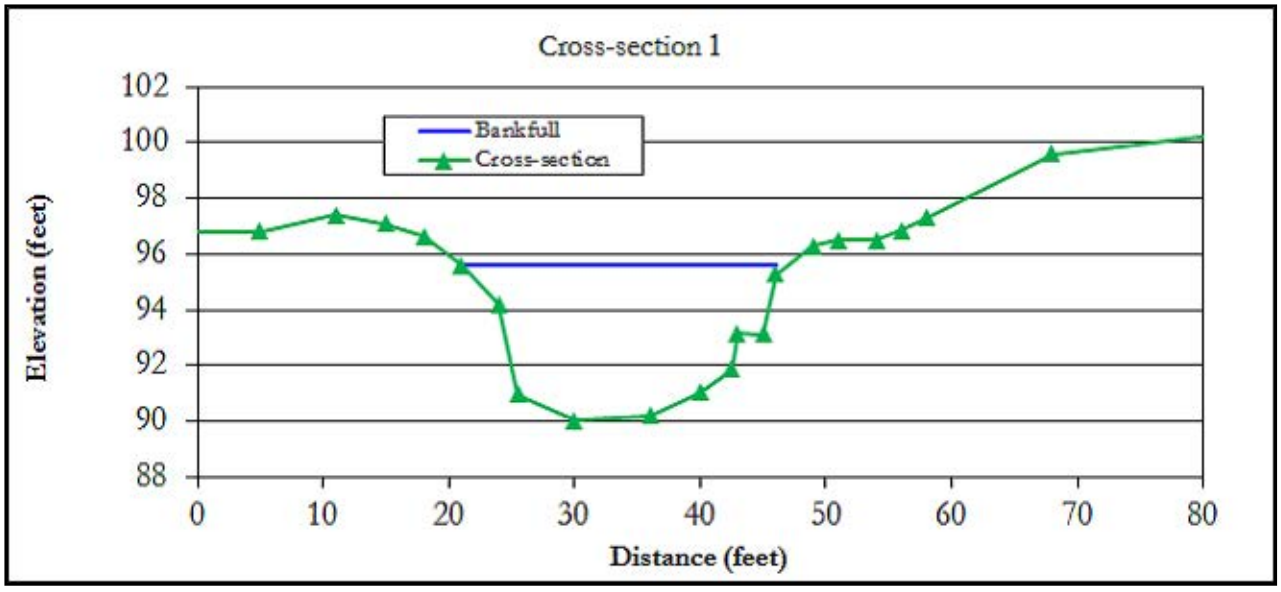
	X1
Area (square feet) =	96.8
Width (feet) =	36.0
Mean depth =	2.7
Max depth =	3.3
Width/depth ratio =	13.4
Entrenchment ratio =	5.2



18. Basses Creek
Ecoregion 68, Tennessee

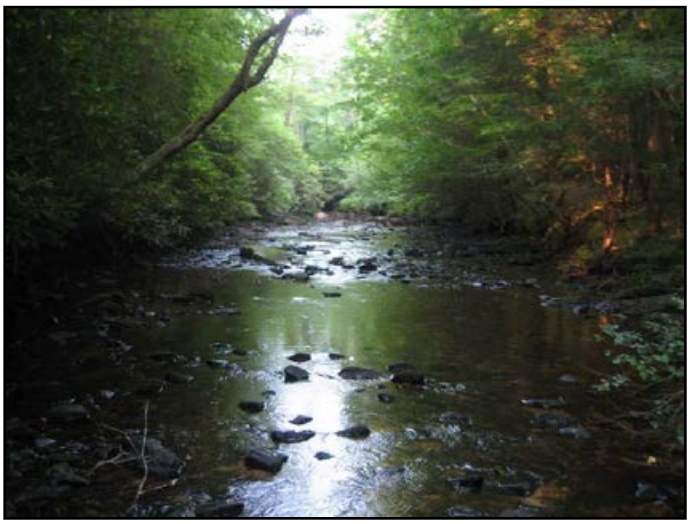
Latitude: 35.850888
Longitude: -85.055245
Drainage area: 8.07 square miles
Median particle size: 60 millimeters
Longitudinal slope: 0.0012 feet/foot
Stream classification: E4

	X1
Area (square feet) =	101.2
Width (feet) =	26.0
Mean depth =	3.9
Max depth =	5.6
Width/depth ratio =	6.7
Entrenchment ratio =	6.4

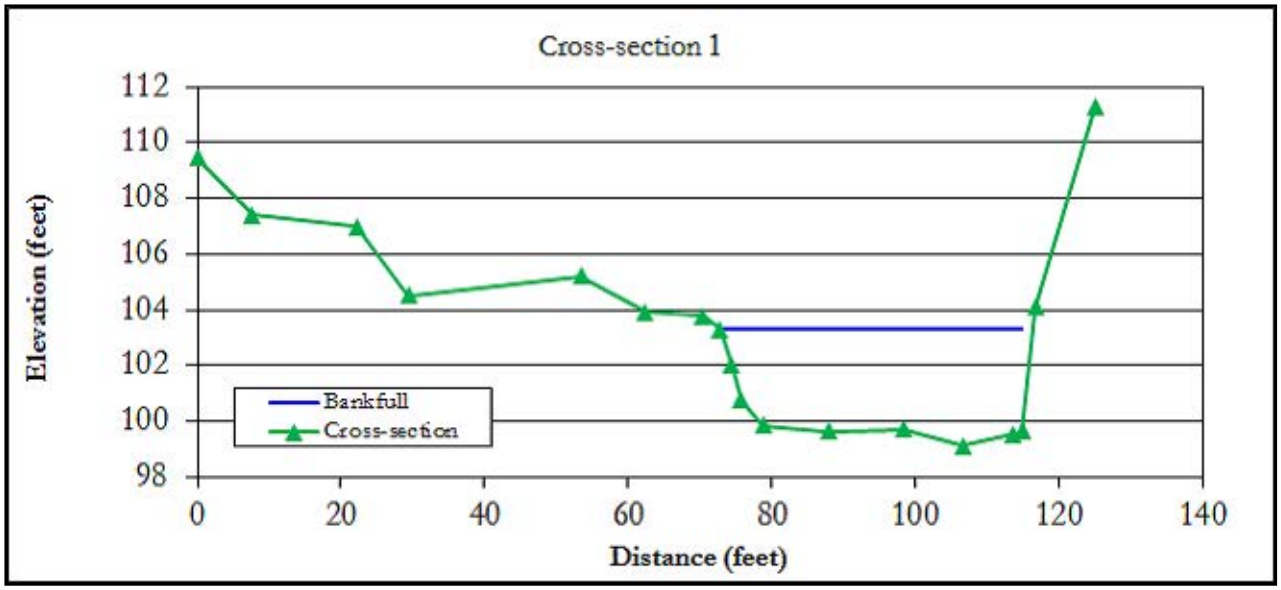


19. Laurel Fork
Ecoregion 68, Tennessee

Latitude: 36.513783
Longitude: -84.715431
Drainage area: 12.7 square miles
Median particle size: 35 millimeters
Longitudinal slope: 0.0047 feet/foot
Stream classification: C4



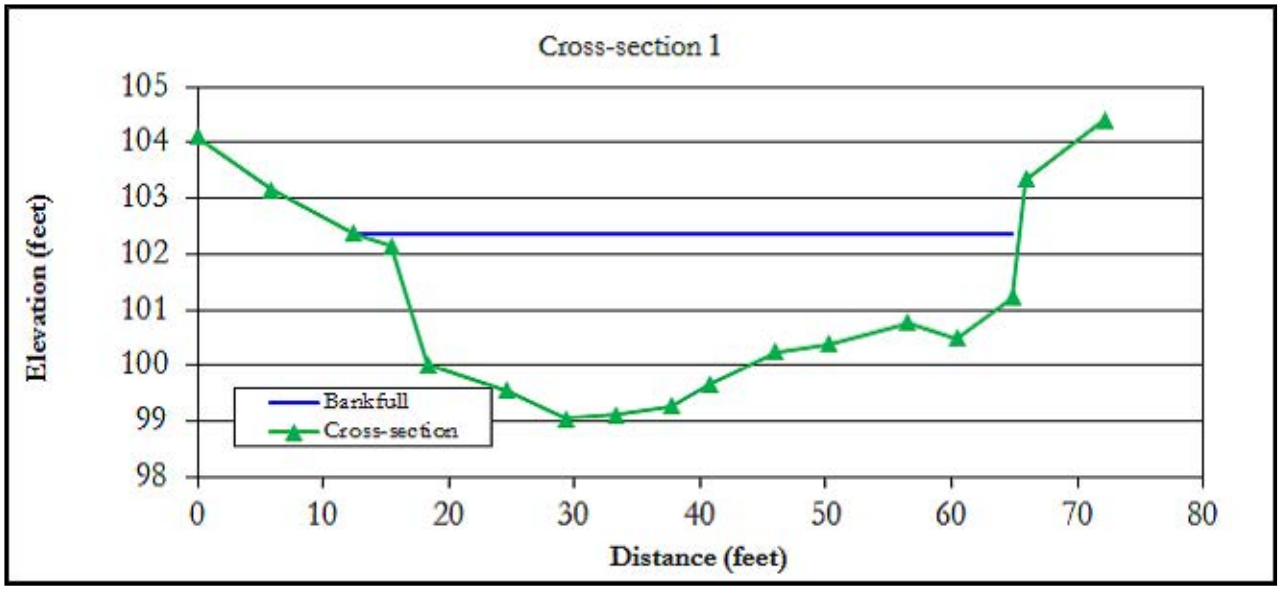
	X1
Area (square feet) =	150.5
Width (feet) =	43.6
Mean depth =	3.4
Max depth =	4.2
Width/depth ratio =	12.6
Entrenchment ratio =	2.6



20. Otter Creek
Ecoregion 68, Tennessee

Latitude: 36.053528
Longitude: -84.856222
Drainage area: 16.9 square miles
Median particle size: 225 millimeters
Longitudinal slope: 0.0065 feet/foot
Stream classification: C3

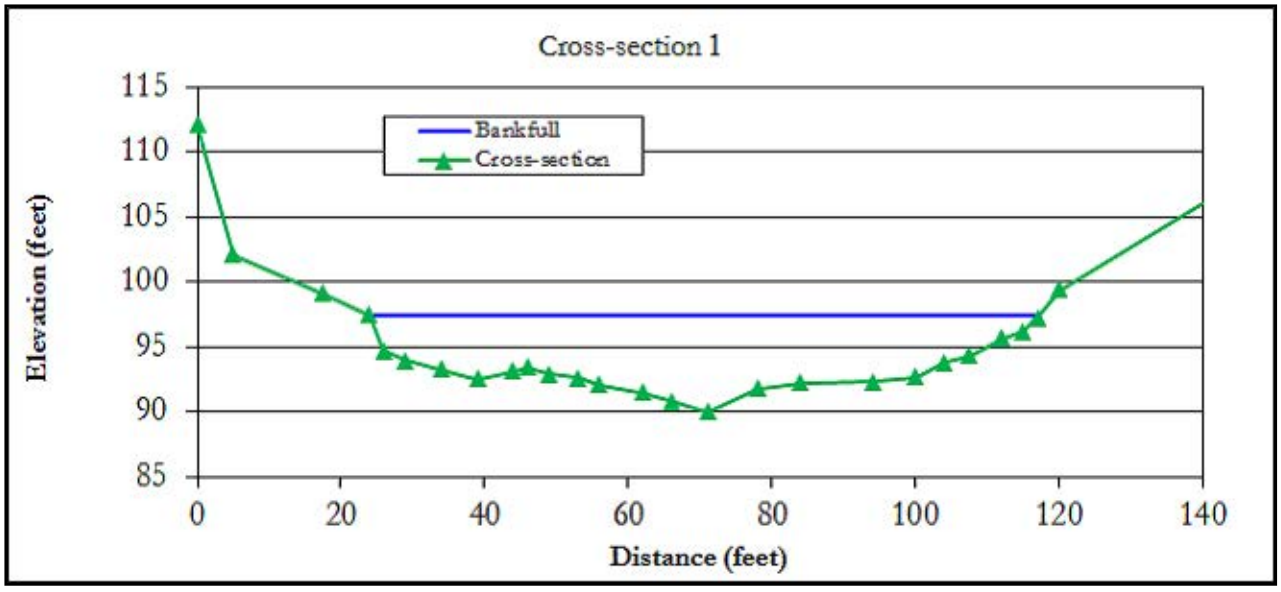
	X1
Area (square feet) =	117.5
Width (feet) =	53.0
Mean depth =	2.2
Max depth =	3.3
Width/depth ratio =	23.9
Entrenchment ratio =	2.9



21. North Chickamauga Creek
Ecoregion 68, Tennessee

Latitude: 35.237027
Longitude: -85.234943
Drainage area: 60.6 square miles
Median particle size: 300 millimeters
Longitudinal slope: 0.0311 feet/foot
Stream classification: B2

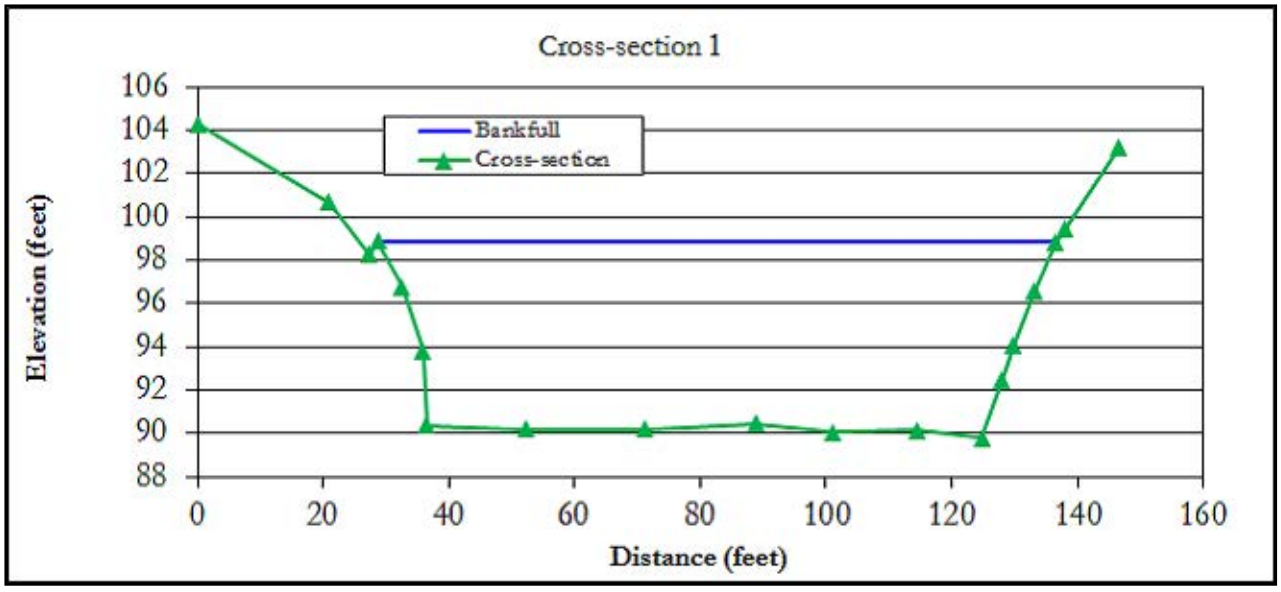
	X1
Area (square feet) =	432.9
Width (feet) =	93.3
Mean depth =	4.6
Max depth =	7.5
Width/depth ratio =	20.1
Entrenchment ratio =	1.4



22. Obed River
Ecoregion 68, Tennessee

Latitude: 36.061667
Longitude: -84.961389
Drainage area: 91.8 square miles
Median particle size: 100 millimeters
Longitudinal slope: 0.0006 feet/foot
Stream classification: F3

	X1
Area (square feet) =	835.4
Width (feet) =	107.8
Mean depth =	7.8
Max depth =	9.1
Width/depth ratio =	13.9
Entrenchment ratio =	1.8



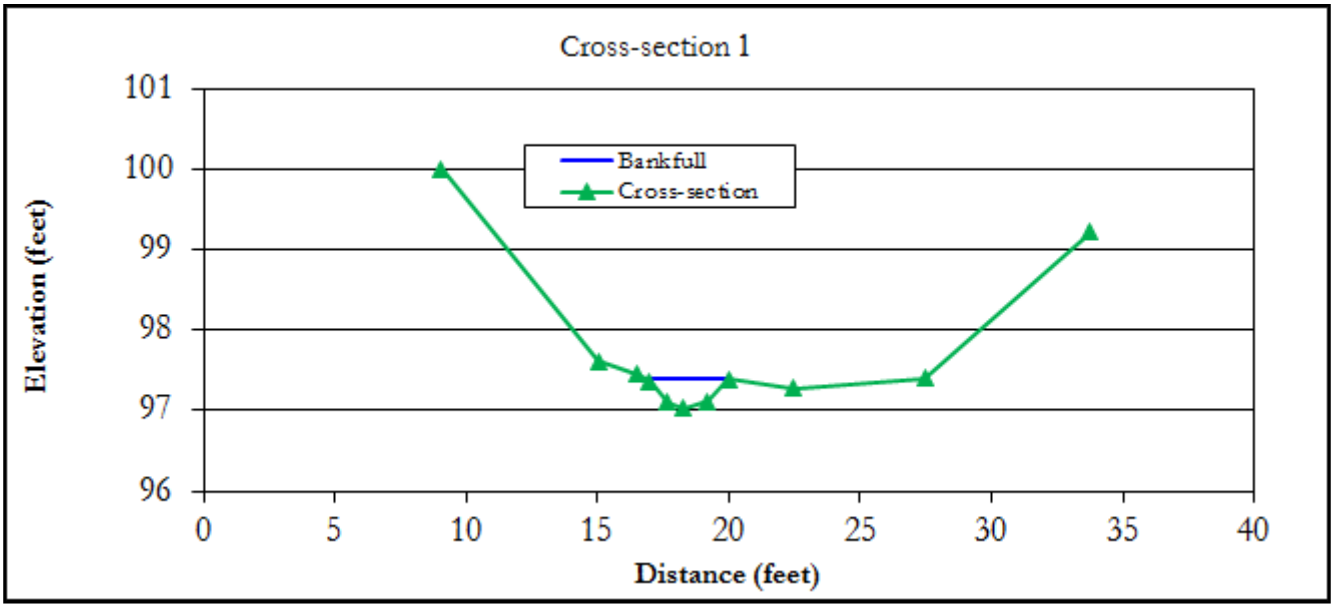
APPENDIX D

Ecoregion 71 Morphology Data

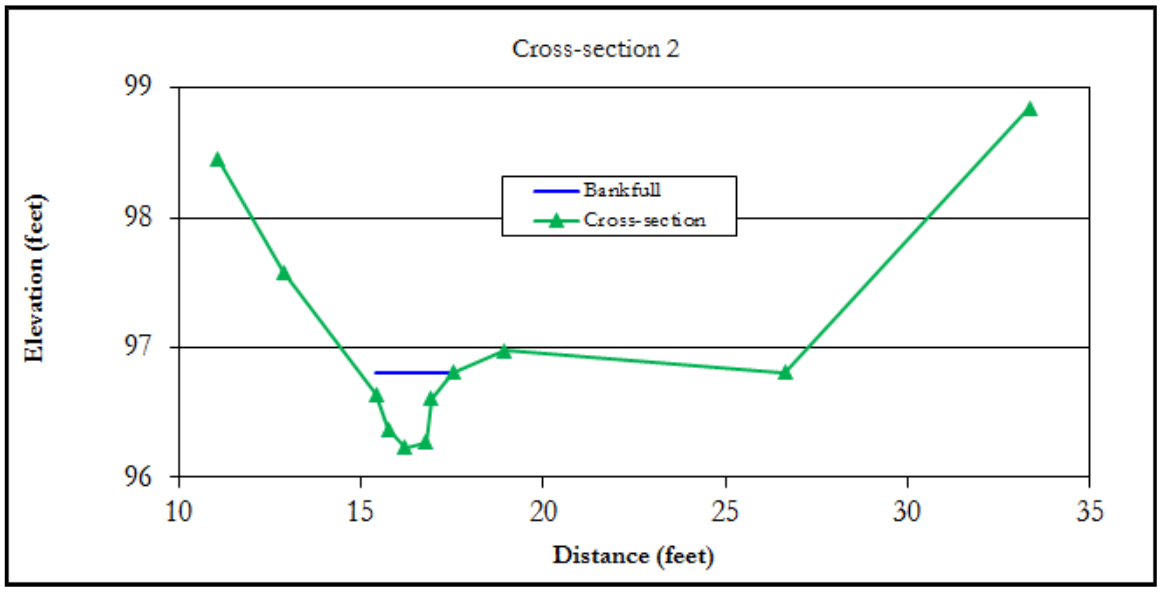
1. UT6 Little Swan Creek
Ecoregion 71, Tennessee

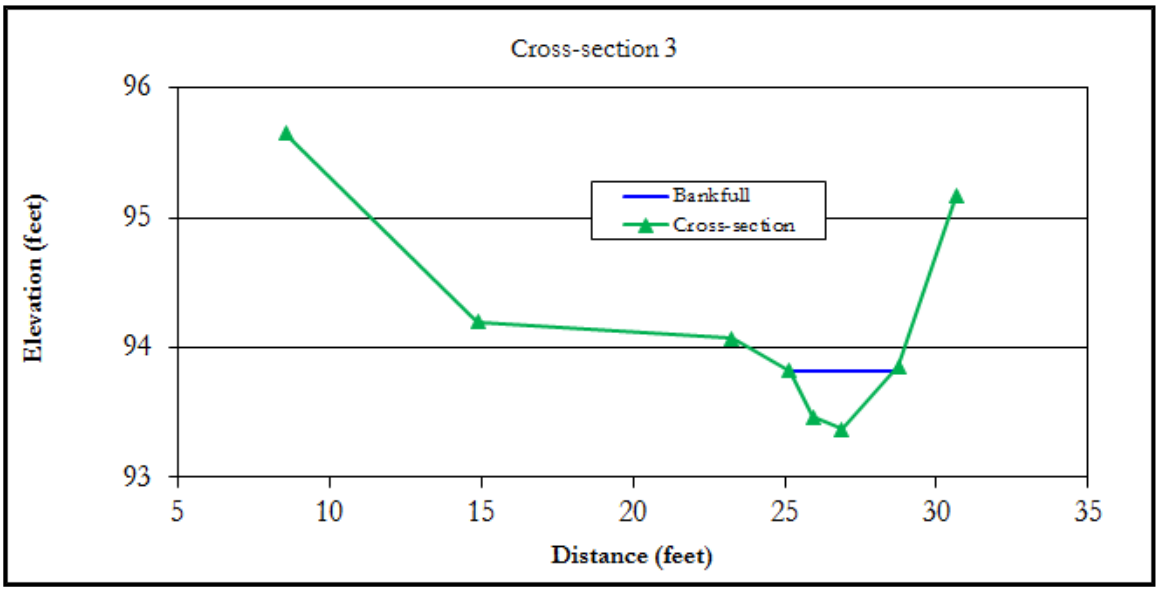
Latitude: 35.522566
Longitude: -87.451521
Drainage area: 0.02 square miles
Median particle size: 25 millimeters
Longitudinal slope: 0.0814 feet/foot
Stream classification: C4a

	X1	X2	X3
Area (square feet) =	0.7	0.8	0.9
Width (feet) =	3.2	2.5	3.4
Mean depth =	0.2	0.3	0.3
Max depth =	0.4	0.6	0.4
Width/depth ratio =	14.2	8.1	13.2
Entrenchment ratio =	4.4	6.0	4.4



1. UT6 Little Swan Creek
Ecoregion 71, Tennessee

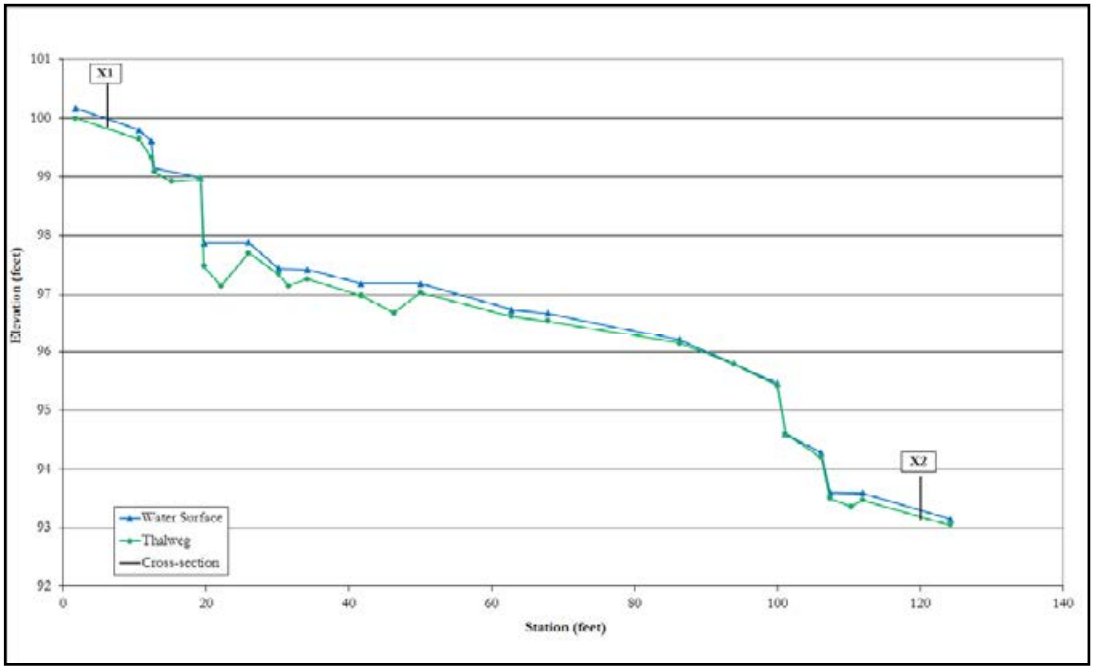




2. UT2 Little Swan Creek
Ecoregion 71, Tennessee

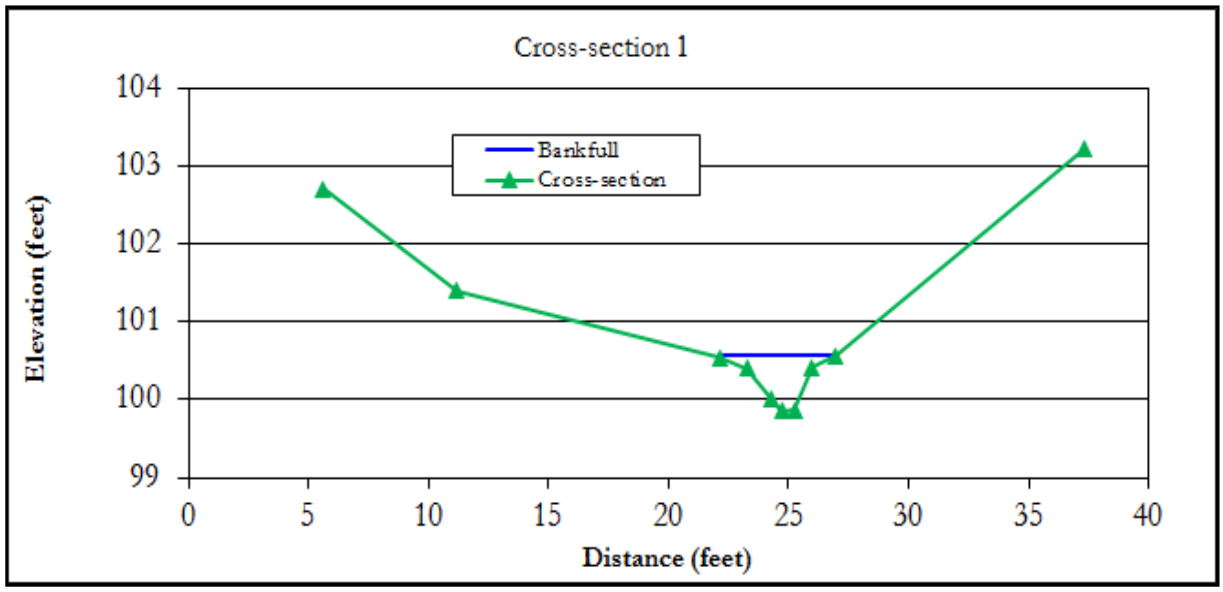
Latitude: 35.519570
Longitude: -87.456770
Drainage area: 0.03 square miles
Median particle size: 5.7 millimeters
Longitudinal slope: 0.0597 feet/foot
Stream classification: C4a

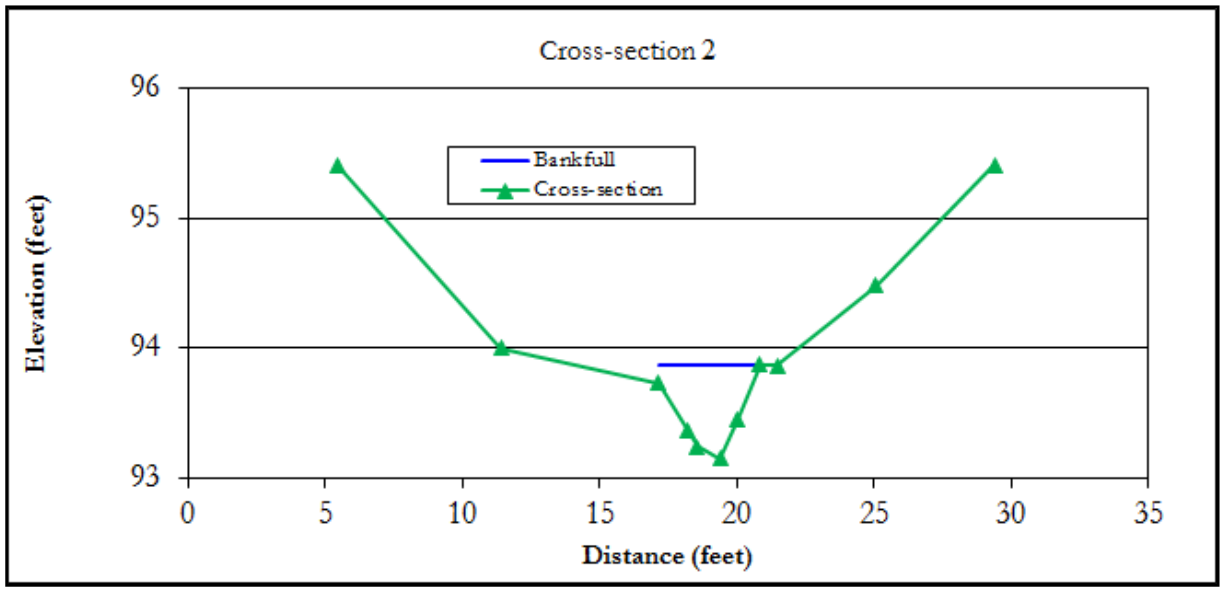
	X1	X2
Area (square feet) =	1.5	1.8
Width (feet) =	5.3	7.4
Mean depth =	0.3	0.2
Max depth =	0.7	0.7
Width/depth ratio =	18.2	29.4
Entrenchment ratio =	3.2	2.3



Longitudinal Profile

2. UT2 Little Swan Creek
Ecoregion 71, Tennessee

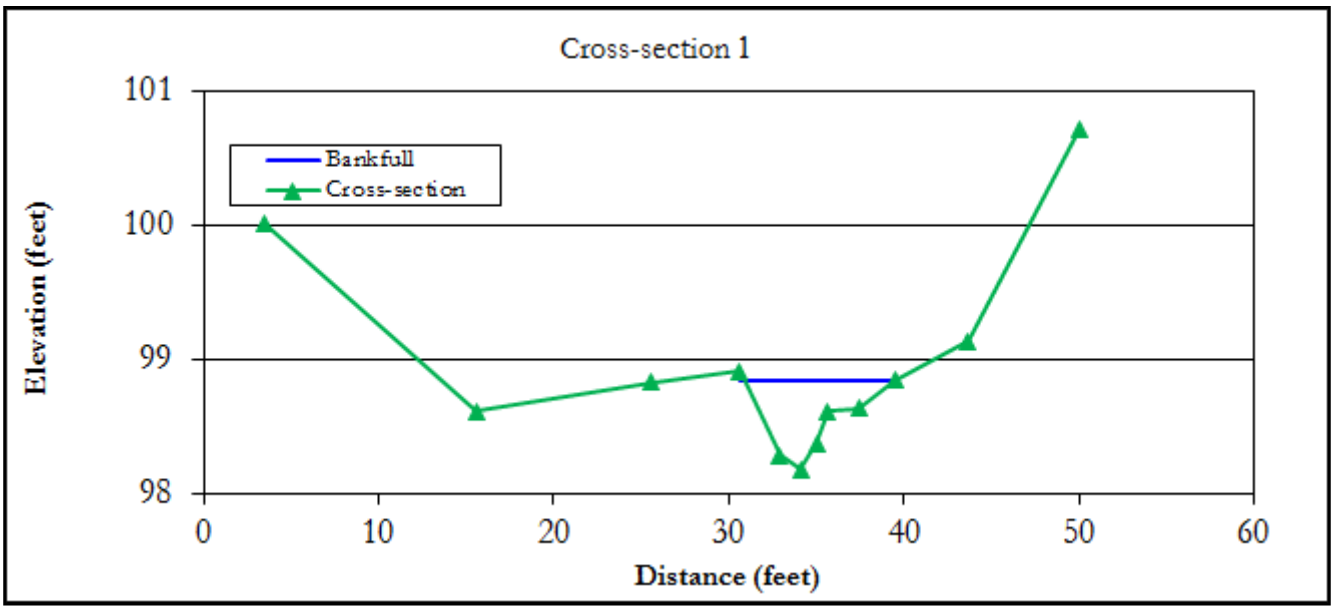




3. UT3 Little Swan Creek
Ecoregion 71, Tennessee

Latitude: 35.512135
Longitude: -87.455704
Drainage area: 0.04 square miles
Median particle size: 18 millimeters
Longitudinal slope: 0.0440 feet/foot
Stream classification: C4a

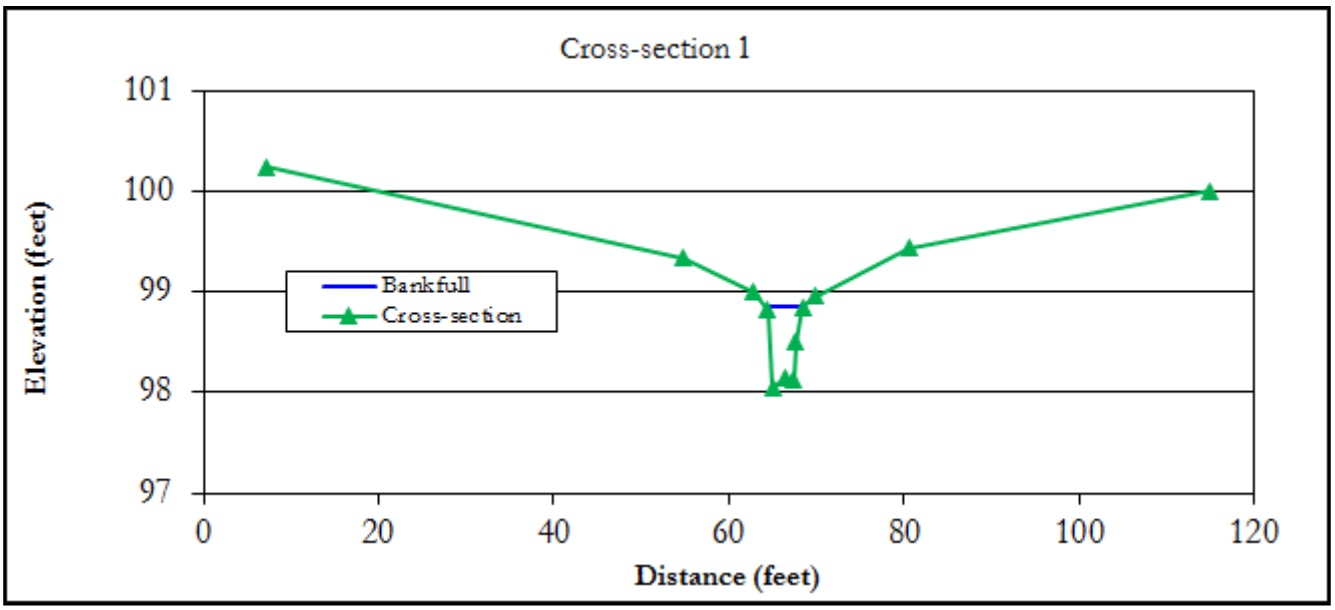
	X1
Area (square feet) =	2.6
Width (feet) =	8.6
Mean depth =	0.3
Max depth =	0.7
Width/depth ratio =	27.8
Entrenchment ratio =	4.3



4. UT UT2 Woodhaven Lake
Ecoregion 71, Tennessee

Latitude: 36.073430
Longitude: -87.283140
Drainage area: 0.04 square miles
Median particle size: 5.0 millimeters
Longitudinal slope: 0.0108 feet/foot
Stream classification: E4

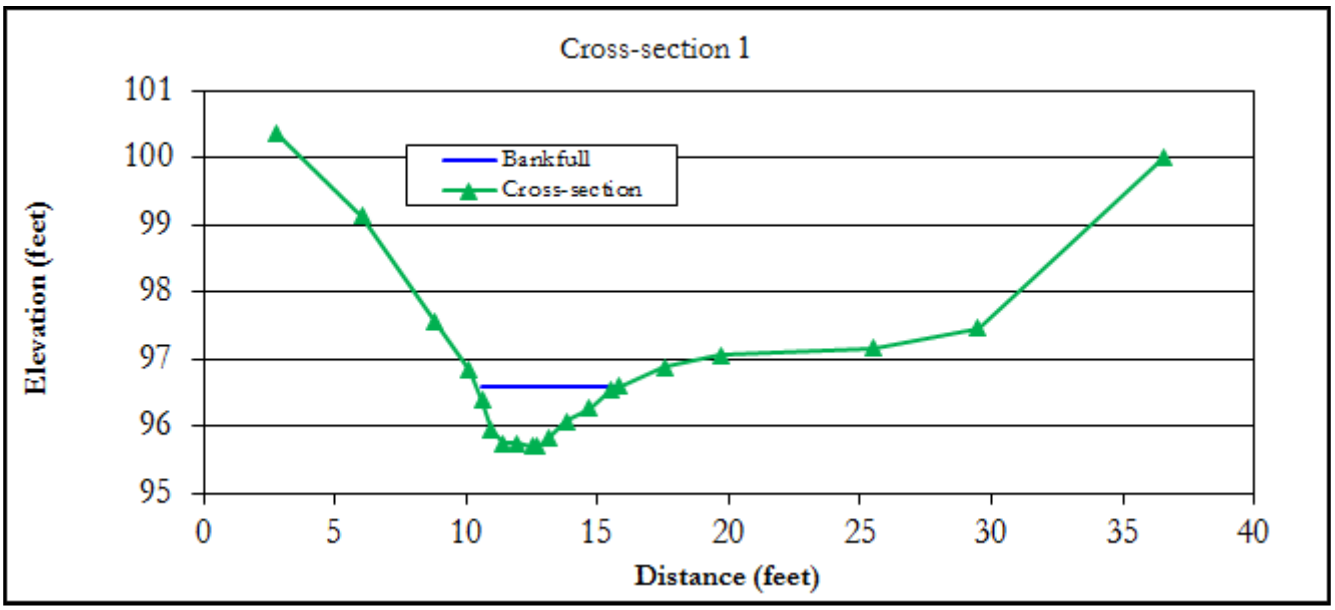
	X1
Area (square feet) =	2.3
Width (feet) =	4.2
Mean depth =	0.5
Max depth =	0.8
Width/depth ratio =	7.8
Entrenchment ratio =	13.1



5. UT Little Buffalo River
Ecoregion 71, Tennessee

Latitude: 35.352084
Longitude: -87.505361
Drainage area: 0.05 square miles
Median particle size: 7.3 millimeters
Longitudinal slope: 0.0419 feet/foot
Stream classification: E4a

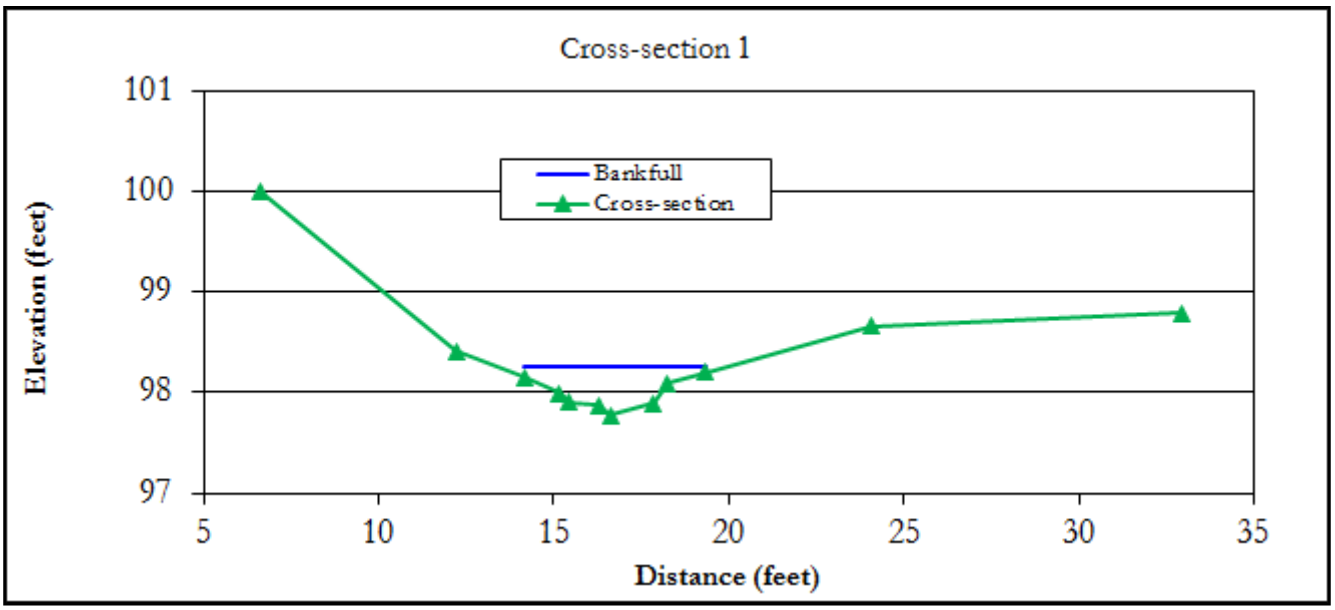
	X1
Area (square feet) =	3.0
Width (feet) =	5.5
Mean depth =	0.5
Max depth =	0.9
Width/depth ratio =	10.1
Entrenchment ratio =	3.7



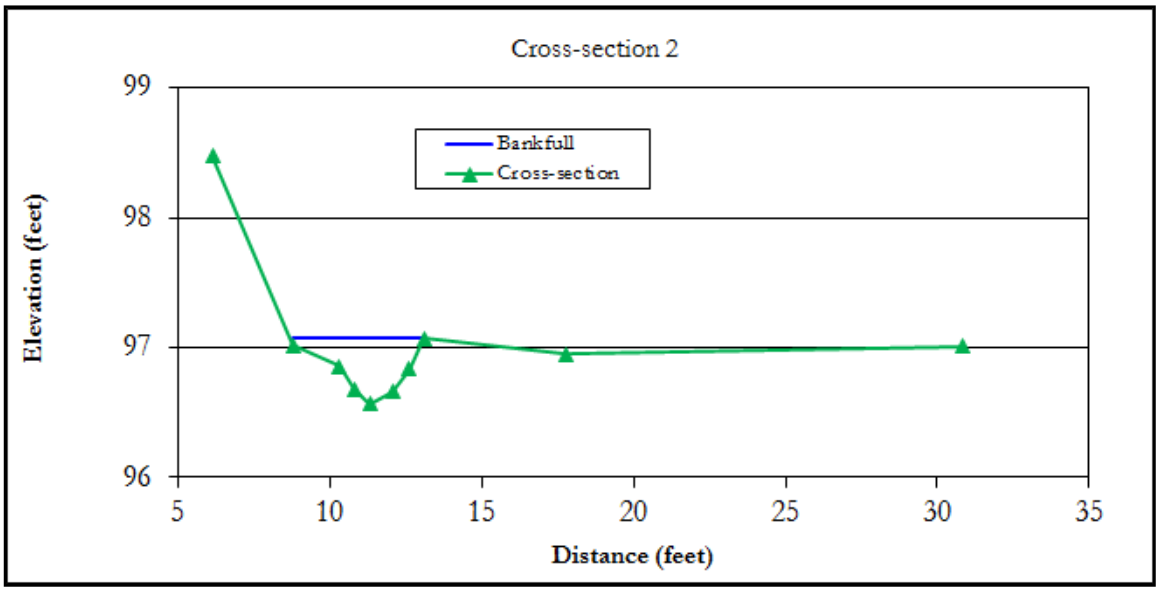
6. UT7 Little Swan Creek
Ecoregion 71, Tennessee

Latitude: 35.517061
Longitude: -87.456661
Drainage area: 0.05 square miles
Median particle size: 13 millimeters
Longitudinal slope: 0.0623 feet/foot
Stream classification: C4a

	X1	X2
Area (square feet) =	1.6	1.2
Width (feet) =	6.6	4.4
Mean depth =	0.2	0.3
Max depth =	0.5	0.5
Width/depth ratio =	27.9	16.7
Entrenchment ratio =	2.9	5.9



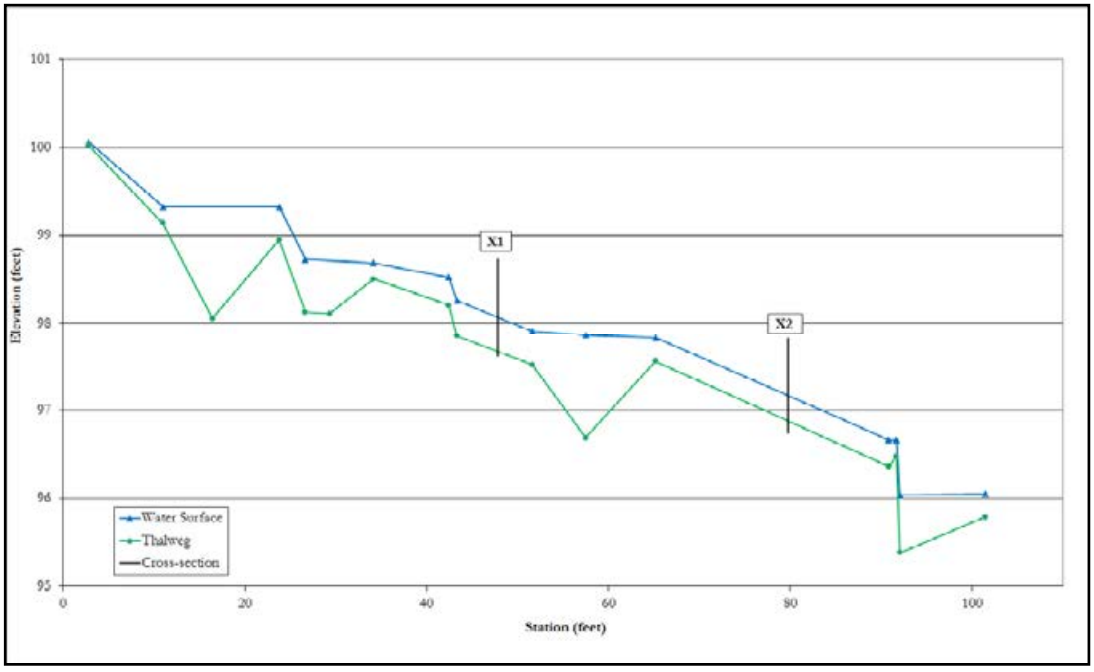
6. UT7 Little Swan Creek
Ecoregion 71, Tennessee



7. UT5 Little Swan Creek
Ecoregion 71, Tennessee

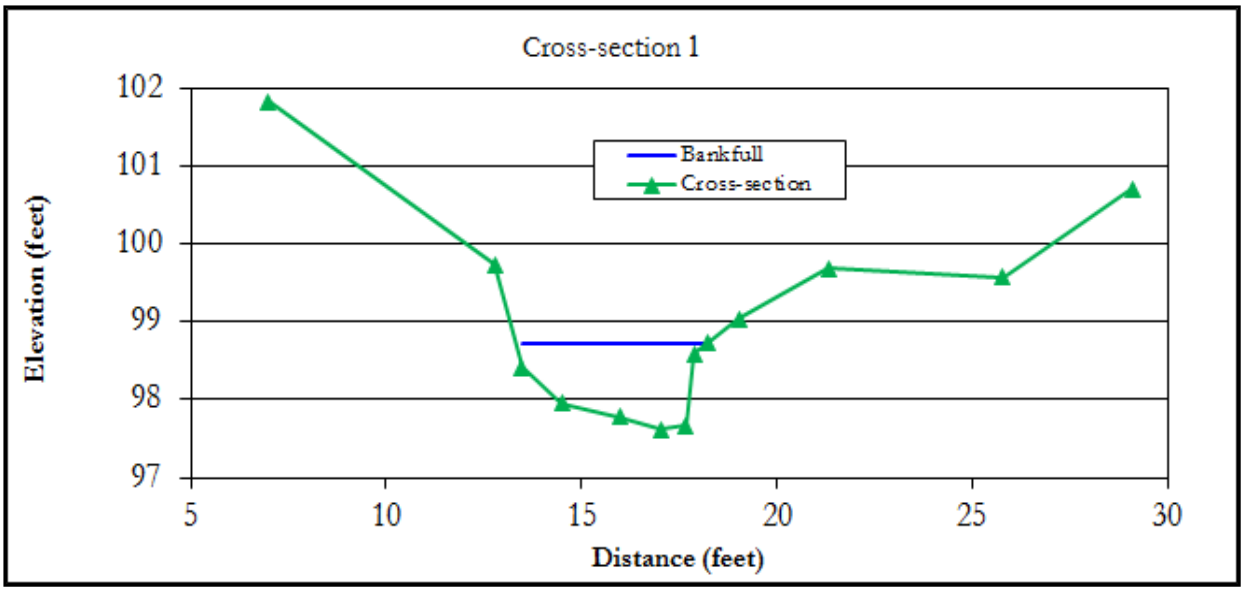
Latitude: 35.525536
Longitude: -87.457892
Drainage area: 0.06 square miles
Median particle size: 18 millimeters
Longitudinal slope: 0.0406 feet/foot
Stream classification: E4a

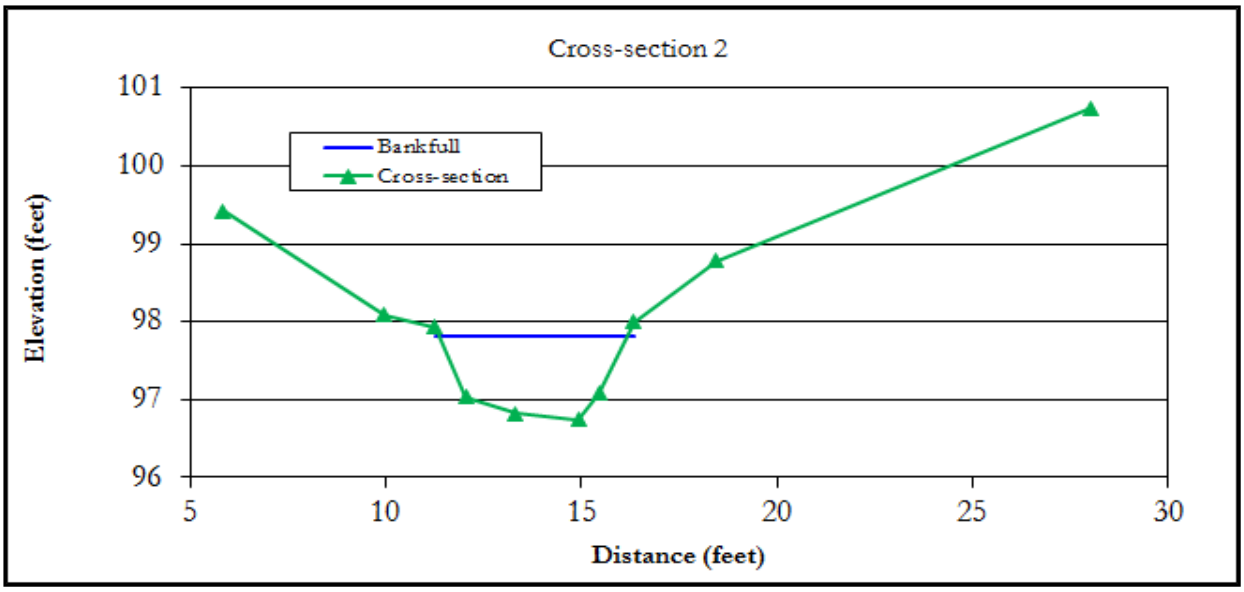
	X1	X2
Area (square feet) =	3.8	3.8
Width (feet) =	4.9	4.8
Mean depth =	0.8	0.8
Max depth =	1.1	1.1
Width/depth ratio =	6.3	6.1
Entrenchment ratio =	2.9	2.4



Longitudinal Profile

7. UT5 Little Swan Creek
Ecoregion 71, Tennessee

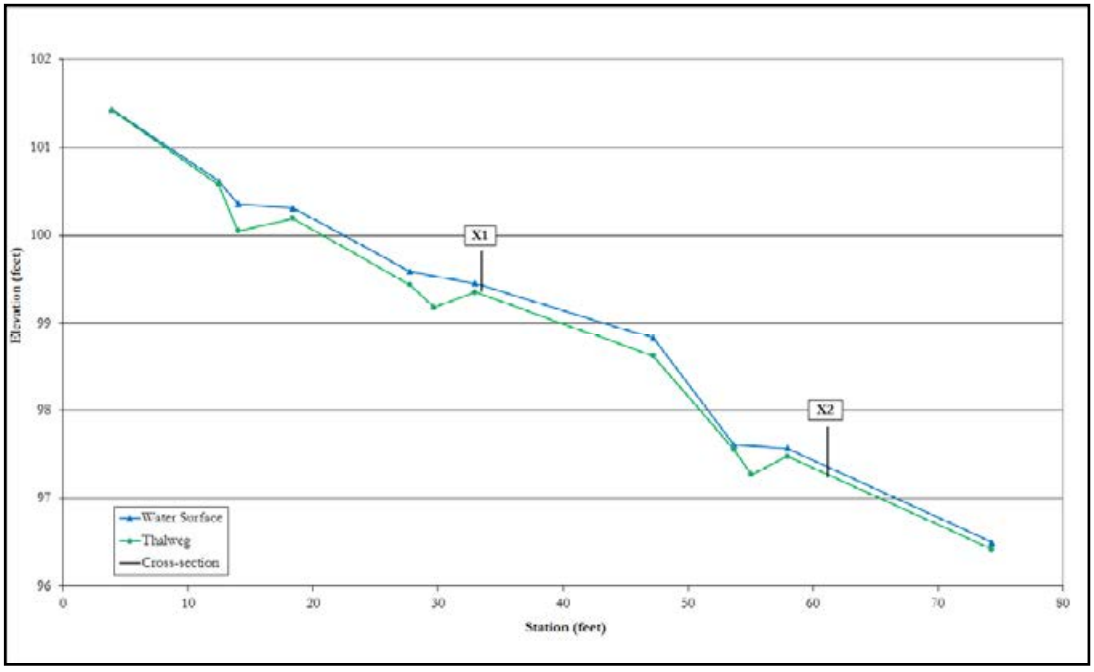




8. UT4 Little Swan Creek
Ecoregion 71, Tennessee

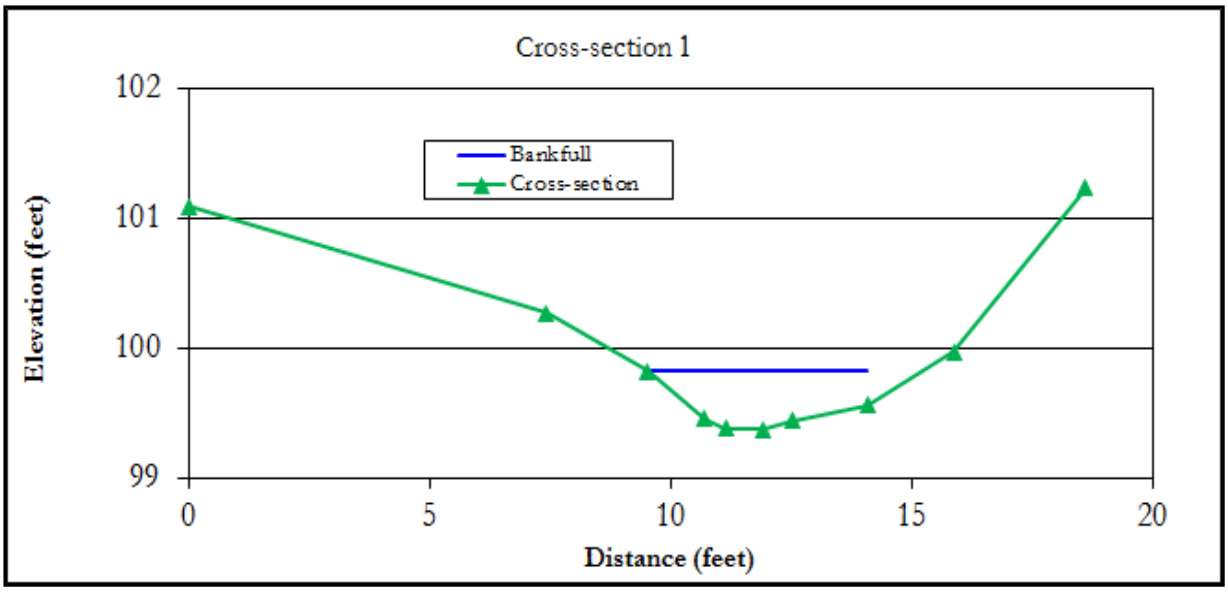
Latitude: 35.513963
Longitude: -87.455846
Drainage area: 0.06 square miles
Median particle size: 9.8 millimeters
Longitudinal slope: 0.0714 feet/foot
Stream classification: B4a

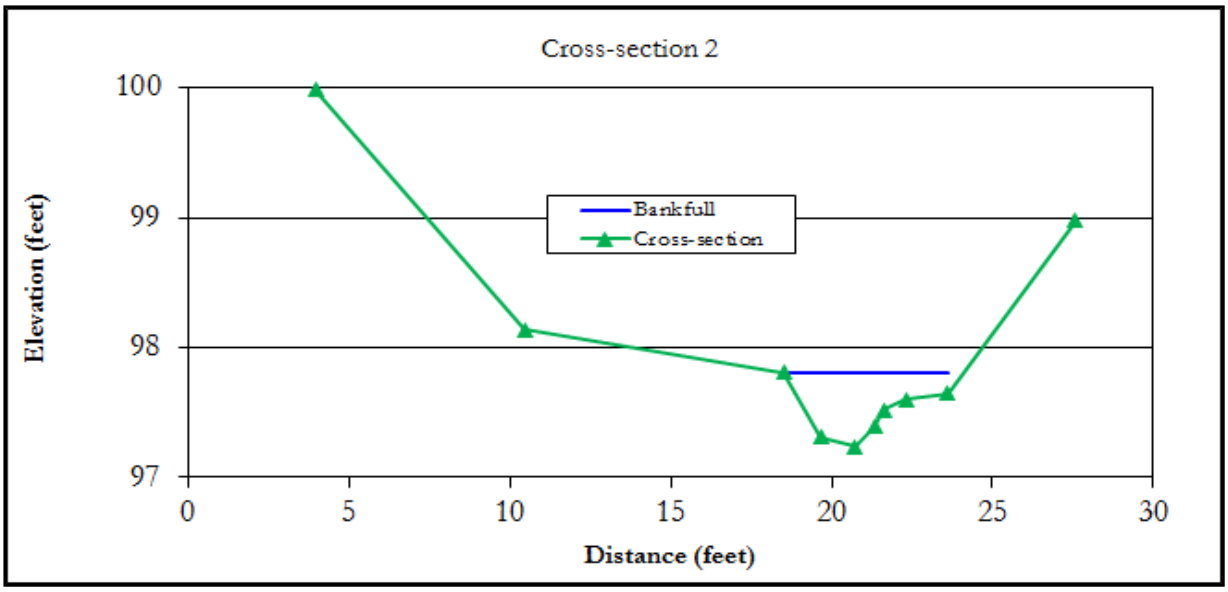
	X1	X2
Area (square feet) =	1.6	1.7
Width (feet) =	5.7	5.6
Mean depth =	0.3	0.3
Max depth =	0.4	0.6
Width/depth ratio =	19.8	18.2
Entrenchment ratio =	1.6	2.9



Longitudinal Profile

8. UT4 Little Swan Creek
Ecoregion 71, Tennessee

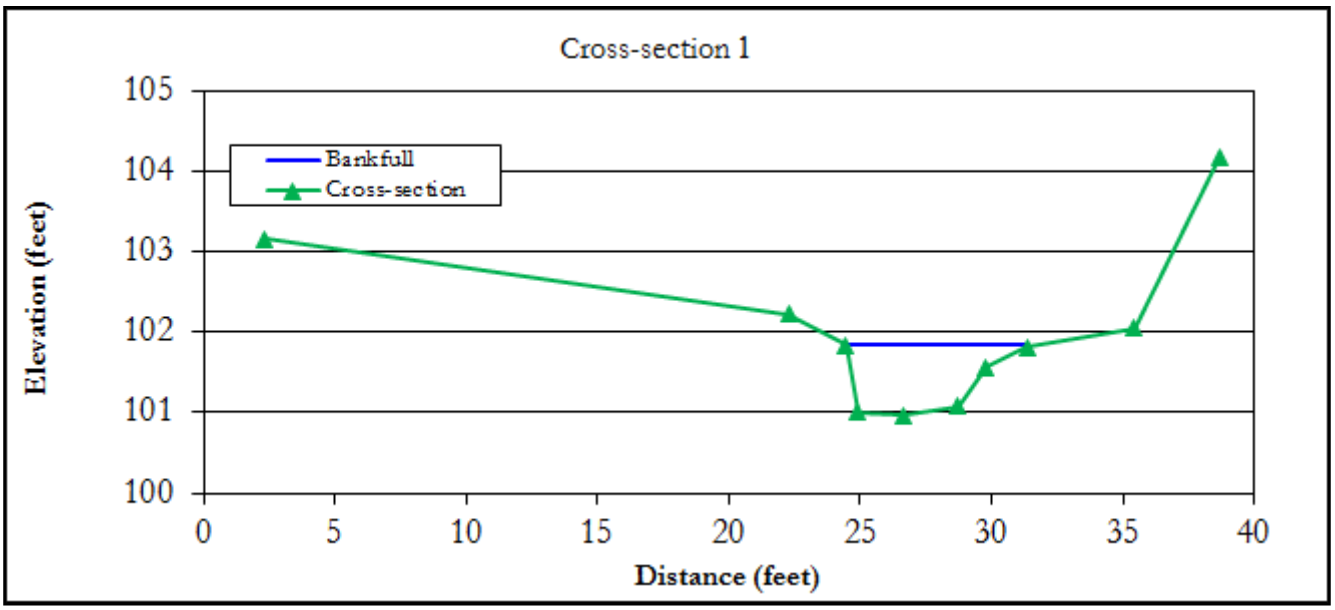




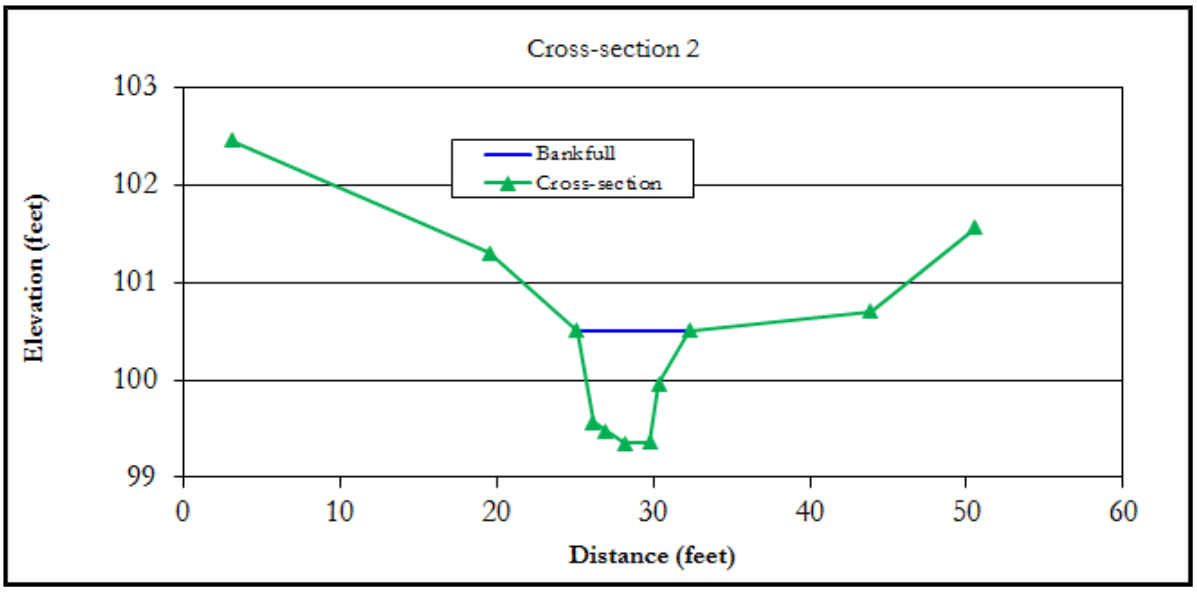
9. UT UT1 Woodhaven Lake
Ecoregion 71, Tennessee

Latitude: 36.076054
Longitude: -87.275324
Drainage area: 0.10 square miles
Median particle size: 46 millimeters
Longitudinal slope: 0.0310 feet/foot
Stream classification: E4b

	X1	X2
Area (square feet) =	4.2	5.5
Width (feet) =	7.4	7.2
Mean depth =	0.6	0.8
Max depth =	0.9	1.2
Width/depth ratio =	13.2	9.4
Entrenchment ratio =	3.3	5.0



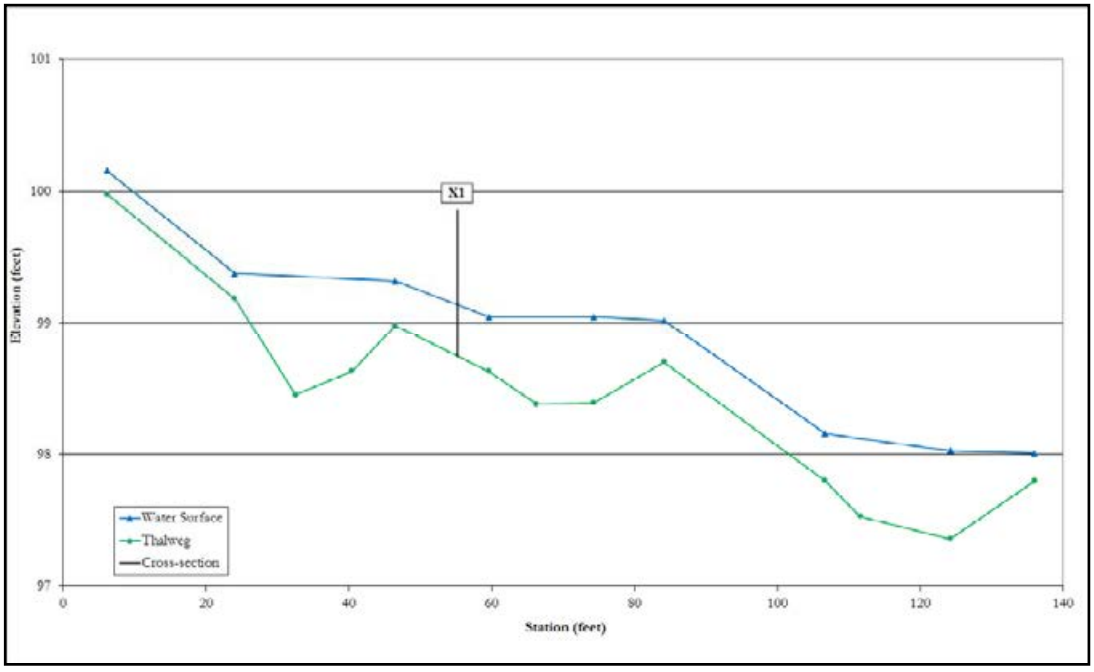
9. UT UT1 Woodhaven Lake
Ecoregion 71, Tennessee



10. Ham Branch
Ecoregion 71, Tennessee

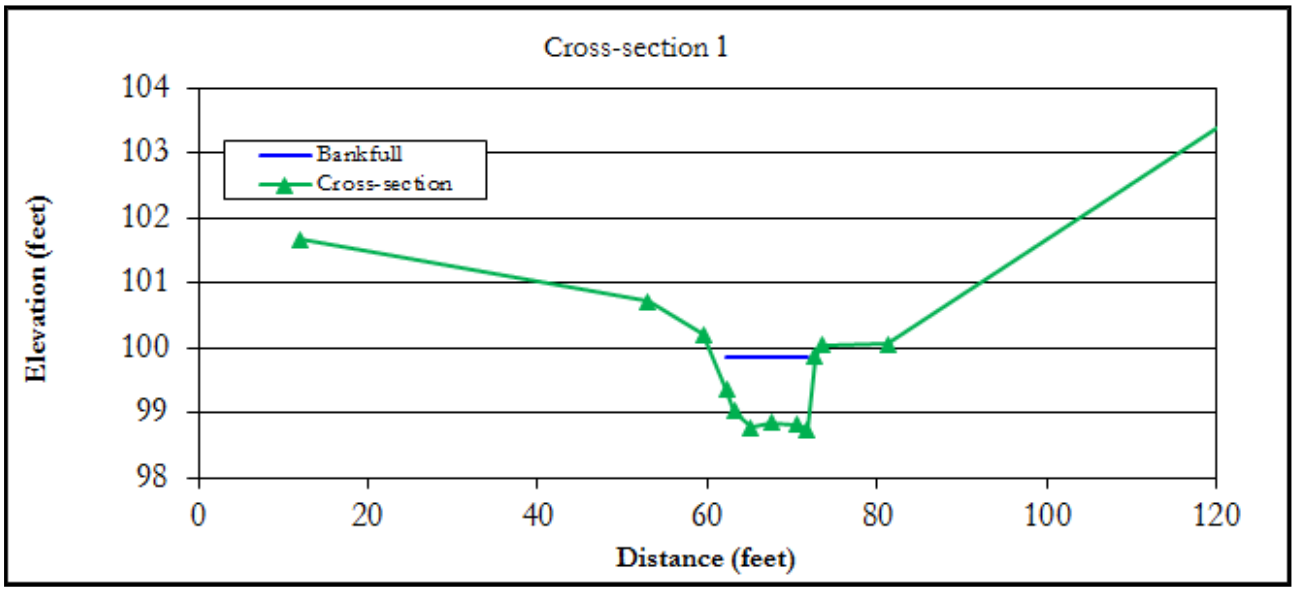
Latitude: 35.356584
Longitude: -87.512692
Drainage area: 0.22 square miles
Median particle size: 45 millimeters
Longitudinal slope: 0.0166 feet/foot
Stream classification: C4

	X1
Area (square feet) =	10.3
Width (feet) =	12.0
Mean depth =	0.9
Max depth =	1.1
Width/depth ratio =	14.0
Entrenchment ratio =	4.2



Longitudinal Profile

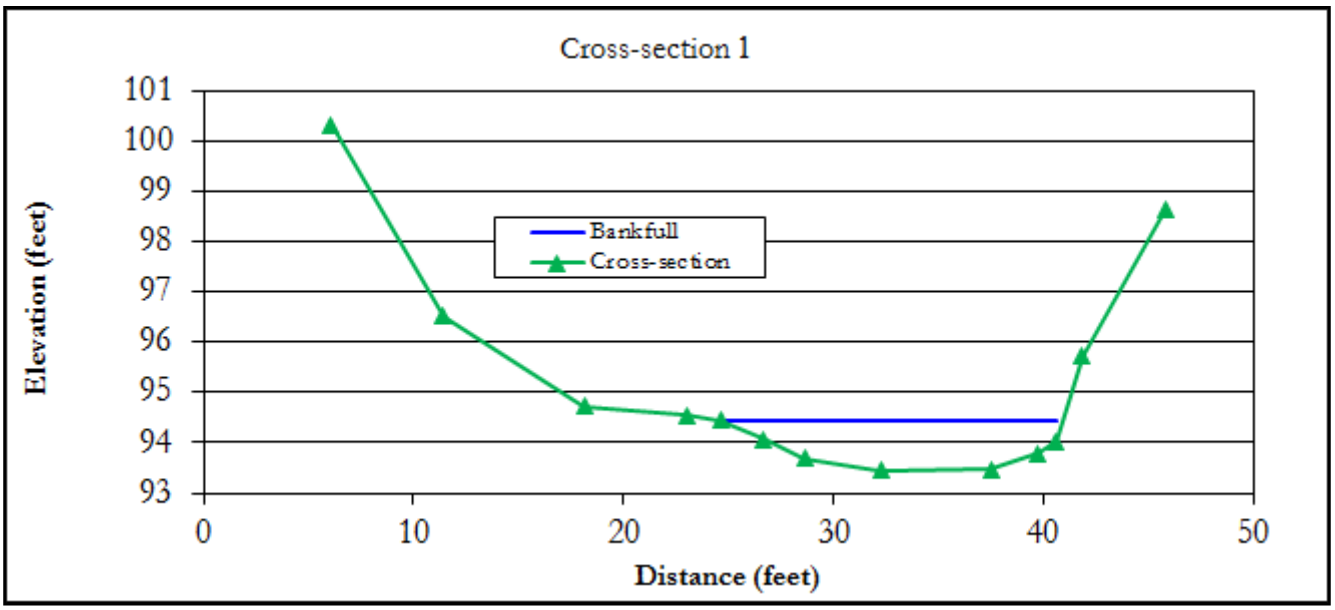
10. Ham Branch
Ecoregion 71, Tennessee



11. UT2 Bryans Fork
Ecoregion 71, Tennessee

Latitude: 36.456187
Longitude: -85.420767
Drainage area: 0.23 square miles
Median particle size: 74 millimeters
Longitudinal slope: 0.0455 feet/foot
Stream classification: B3a

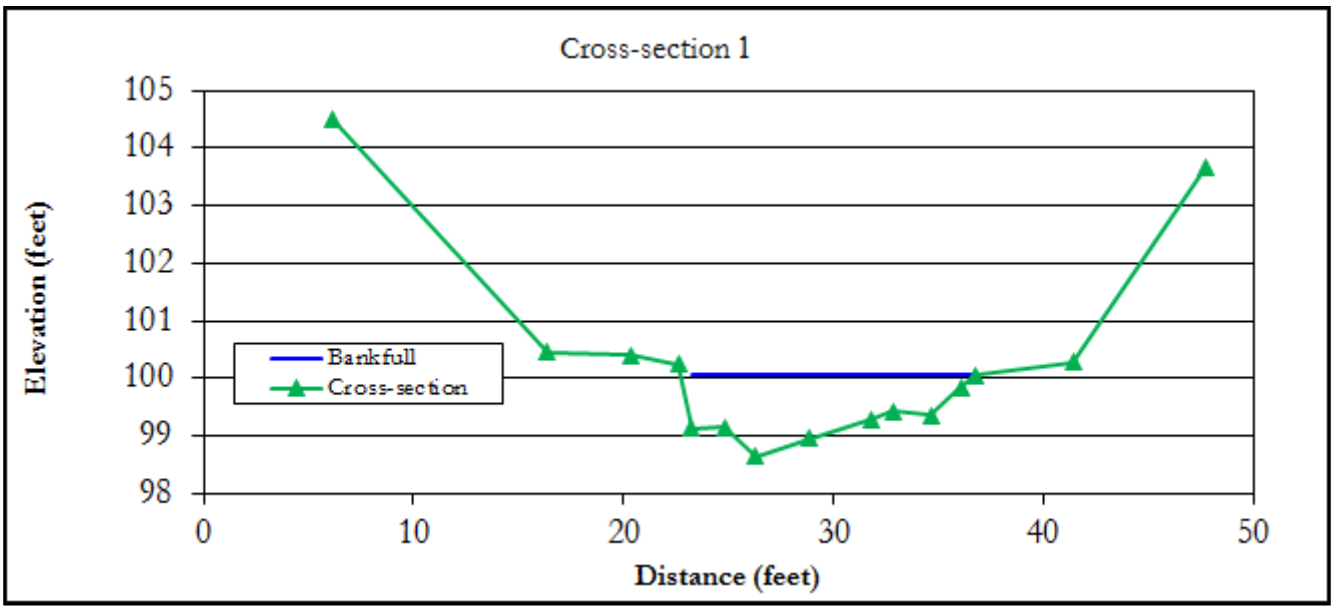
	X1
Area (square feet) =	12.1
Width (feet) =	16.3
Mean depth =	0.7
Max depth =	1.0
Width/depth ratio =	21.9
Entrenchment ratio =	1.6



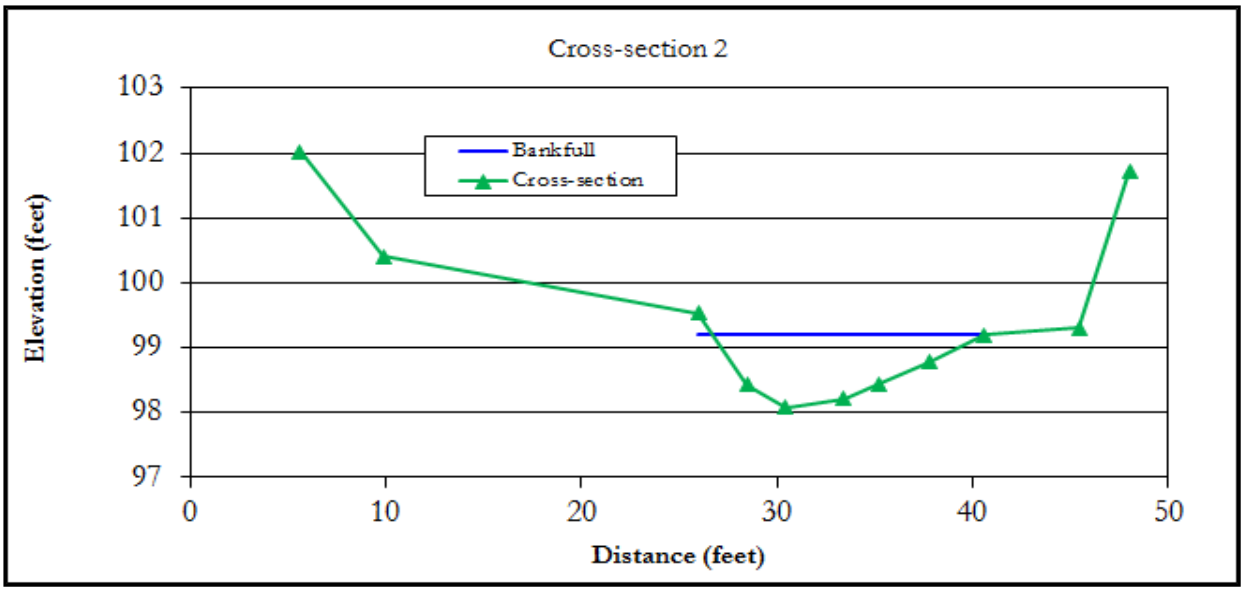
12. UT1 Bryans Fork
Ecoregion 71, Tennessee

Latitude: 36.458705
Longitude: -85.426768
Drainage area: 0.24 square miles
Median particle size: 73 millimeters
Longitudinal slope: 0.0339 feet/foot
Stream classification: C3b

	X1	X2
Area (square feet) =	11.9	9.3
Width (feet) =	14.0	13.8
Mean depth =	0.8	0.7
Max depth =	1.4	1.1
Width/depth ratio =	16.6	20.6
Entrenchment ratio =	2.1	2.5



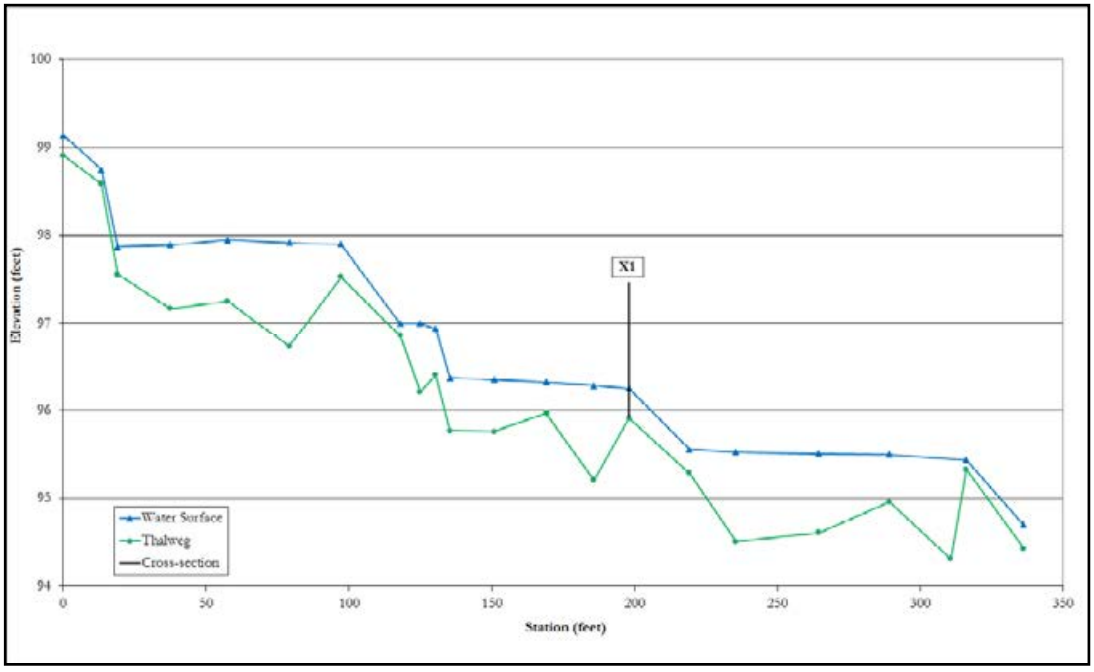
12. UT1 Bryans Fork
Ecoregion 71, Tennessee



13. UT1 Woodhaven Lake
Ecoregion 71, Tennessee

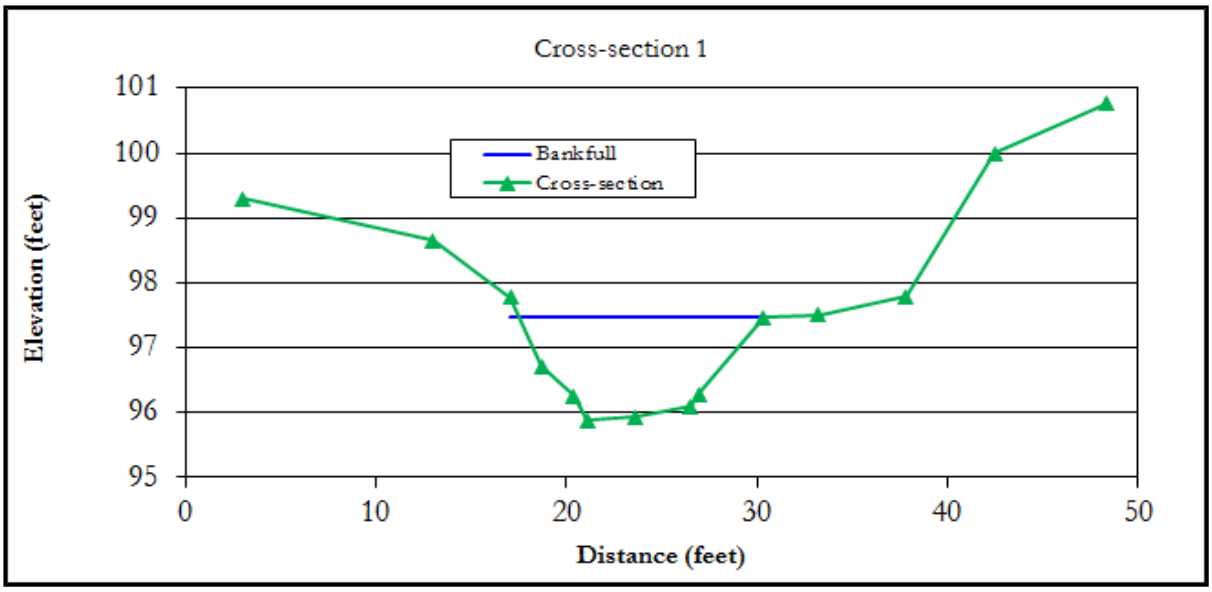
Latitude: 36.076194
Longitude: -87.275732
Drainage area: 0.27 square miles
Median particle size: 35 millimeters
Longitudinal slope: 0.0117 feet/foot
Stream classification: E4

	X1
Area (square feet) =	13.9
Width (feet) =	12.8
Mean depth =	1.1
Max depth =	1.6
Width/depth ratio =	11.8
Entrenchment ratio =	2.6



Longitudinal Profile

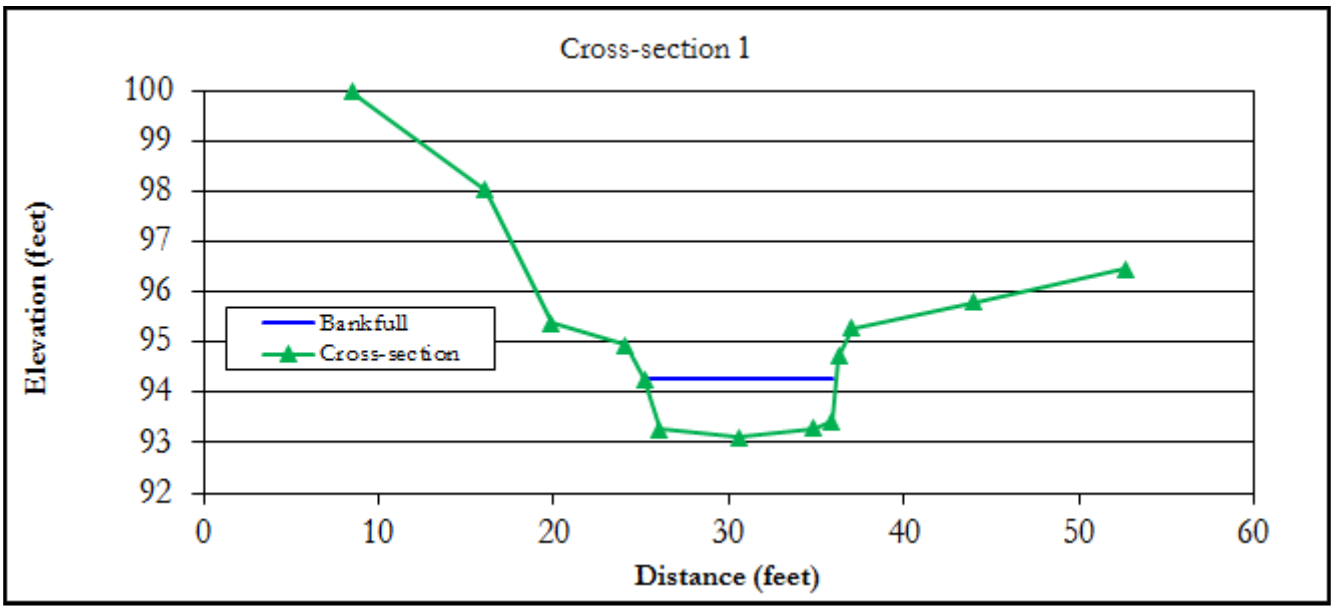
13. UT1 Woodhaven Lake
Ecoregion 71, Tennessee



14. UT Morgan Creek
Ecoregion 71, Tennessee

Latitude: 36.449308
Longitude: -85.392042
Drainage area: 0.32 square miles
Median particle size: 80 millimeters
Longitudinal slope: 0.0260 feet/foot
Stream classification: B3

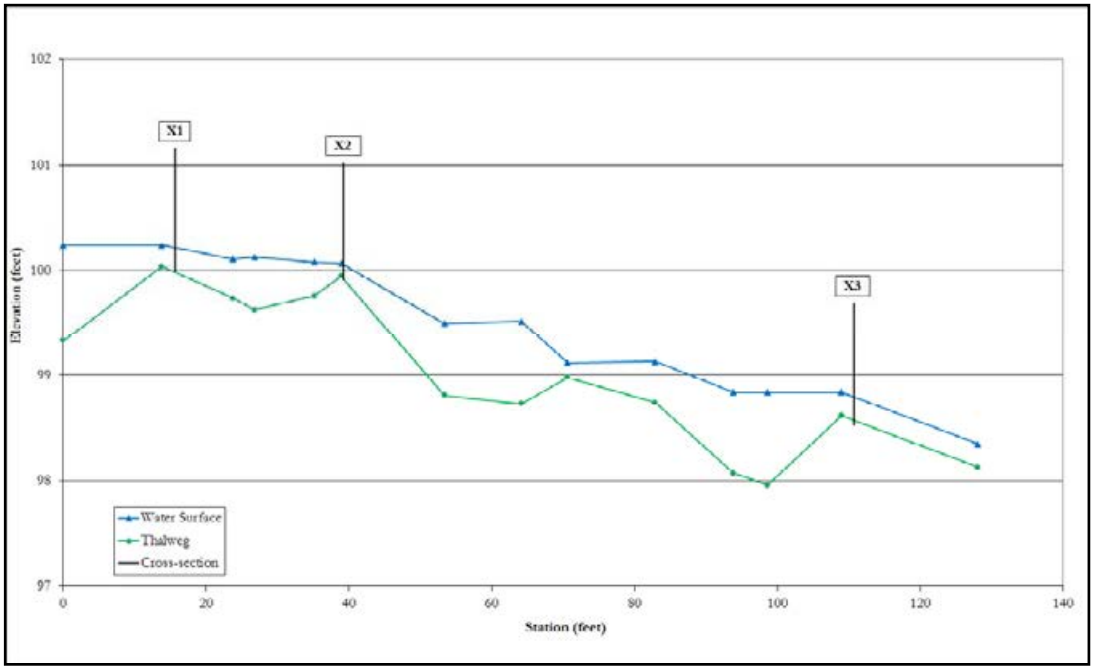
	X1
Area (square feet) =	11.0
Width (feet) =	11.0
Mean depth =	1.0
Max depth =	1.2
Width/depth ratio =	11.0
Entrenchment ratio =	1.7



15. East Fork Hurricane Creek
Ecoregion 71, Tennessee

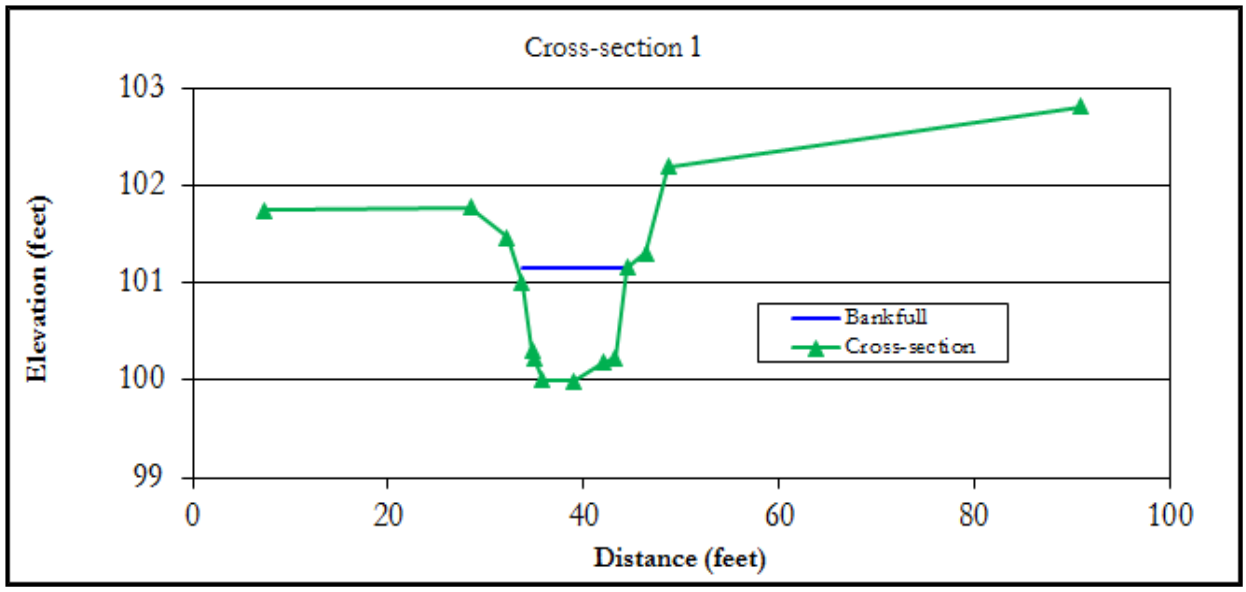
Latitude: 36.055688
Longitude: -86.277492
Drainage area: 0.36 square miles
Median particle size: 10 millimeters
Longitudinal slope: 0.0147 feet/foot
Stream classification: C4

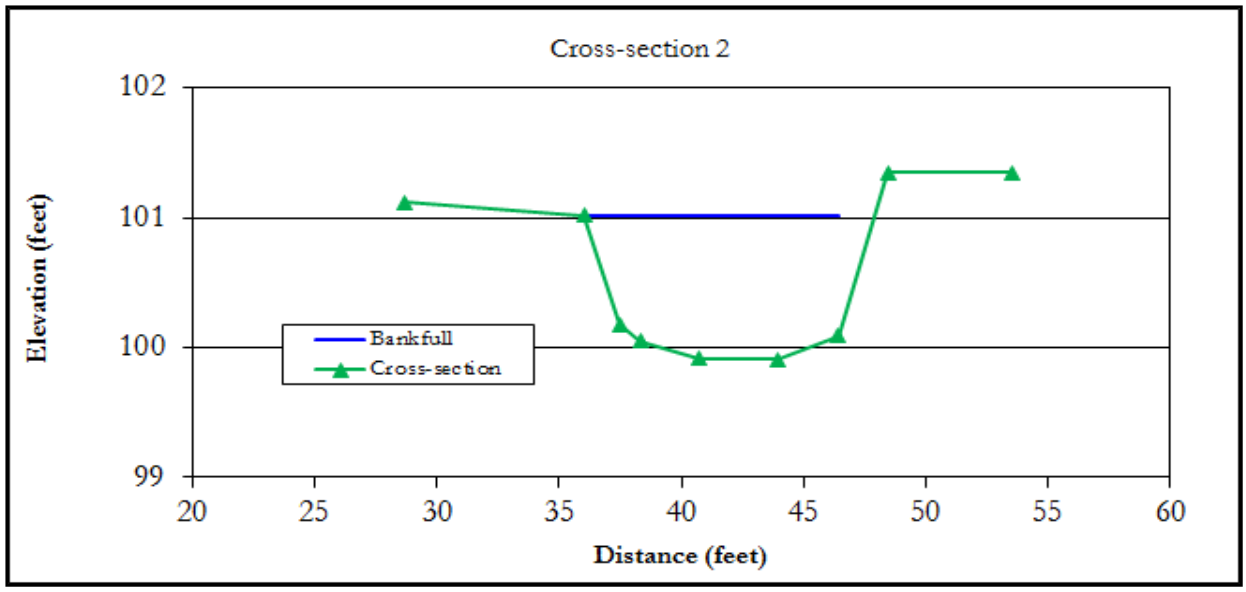
	X1	X2	X3
Area (square feet) =	10.4	10.6	13.8
Width (feet) =	11.3	11.9	14.8
Mean depth =	0.9	0.9	0.9
Max depth =	1.2	1.1	1.2
Width/depth ratio =	12.3	13.3	15.9
Entrenchment ratio =	5.4	5.1	7.2

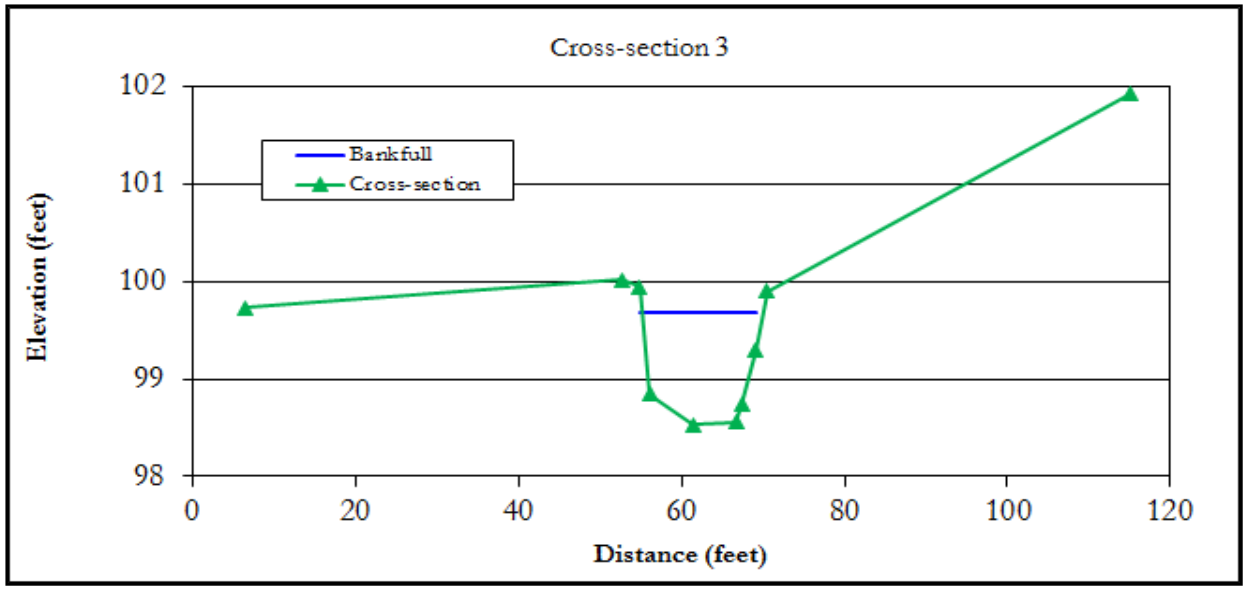


Longitudinal Profile

15. East Fork Hurricane Creek
Ecoregion 71, Tennessee



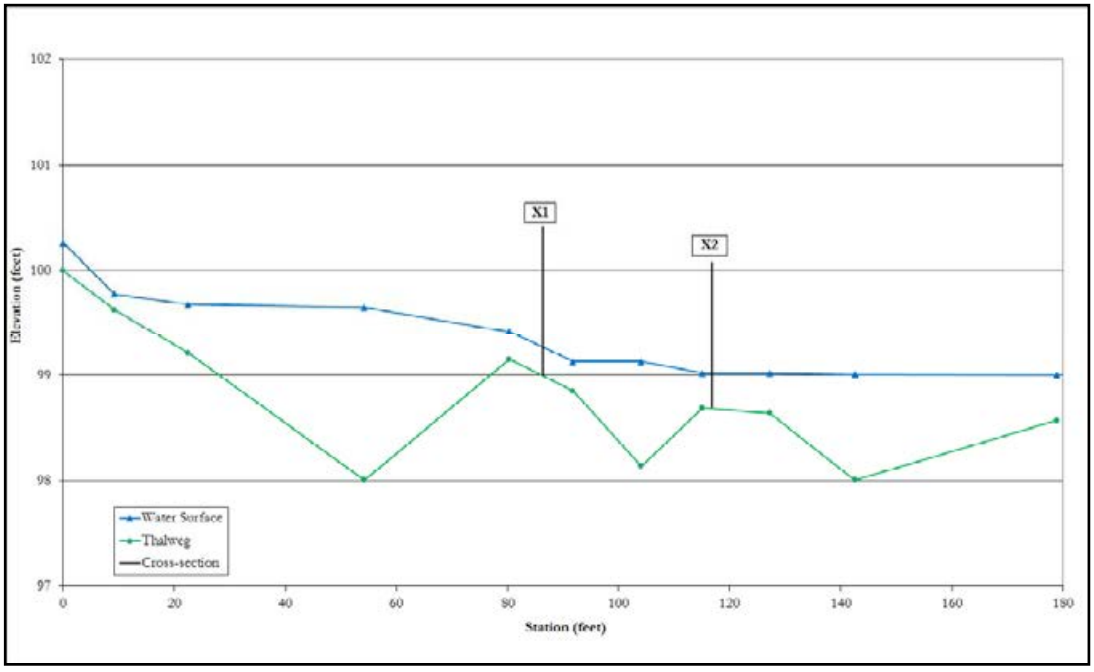




16. UT2 Woodhaven Lake
Ecoregion 71, Tennessee

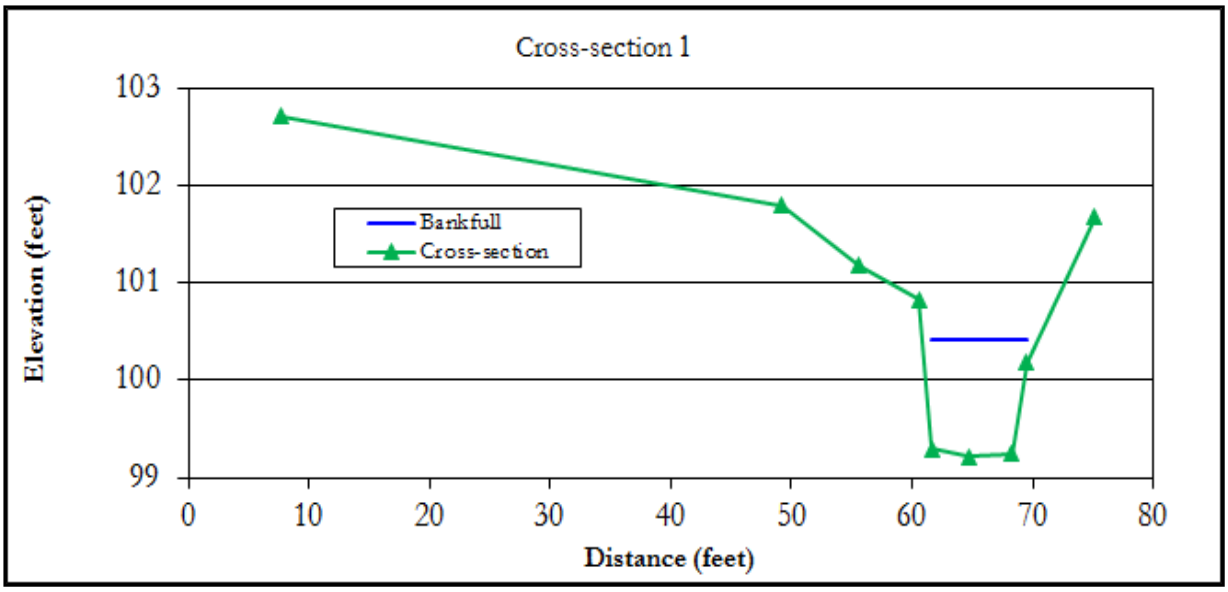
Latitude: 36.073827
Longitude: -87.283168
Drainage area: 0.44 square miles
Median particle size: 14 millimeters
Longitudinal slope: 0.0070 feet/foot
Stream classification: E4

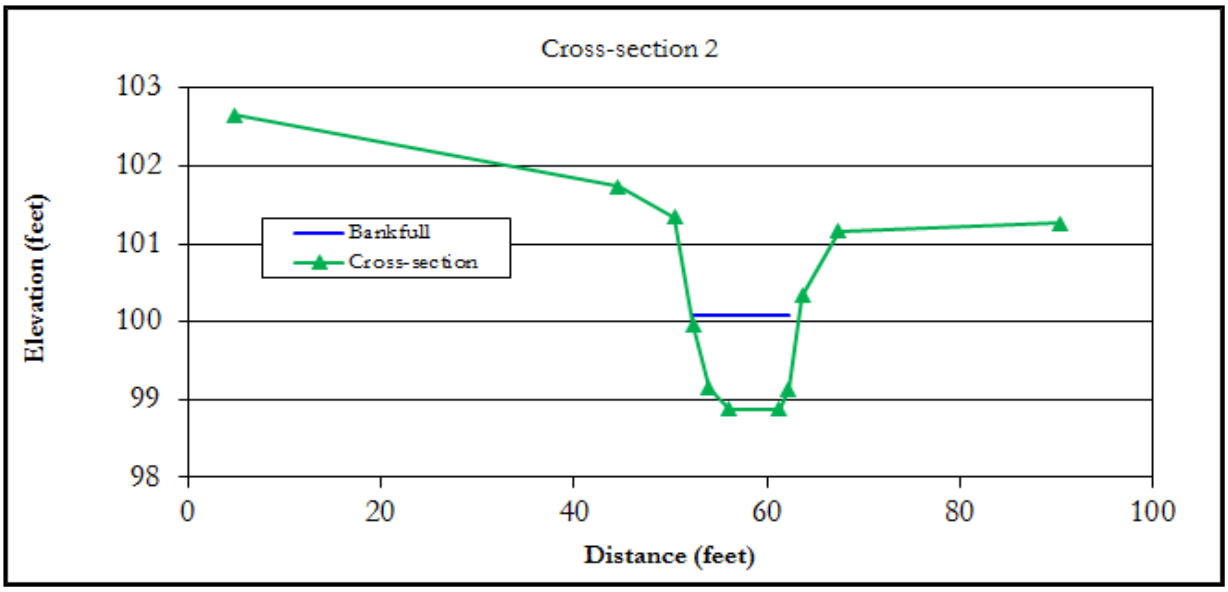
	X1	X2
Area (square feet) =	9.1	10.8
Width (feet) =	9.5	11.1
Mean depth =	1.0	1.0
Max depth =	1.2	1.2
Width/depth ratio =	9.9	11.4
Entrenchment ratio =	2.5	3.6



Longitudinal Profile

16. UT2 Woodhaven Lake
Ecoregion 71, Tennessee

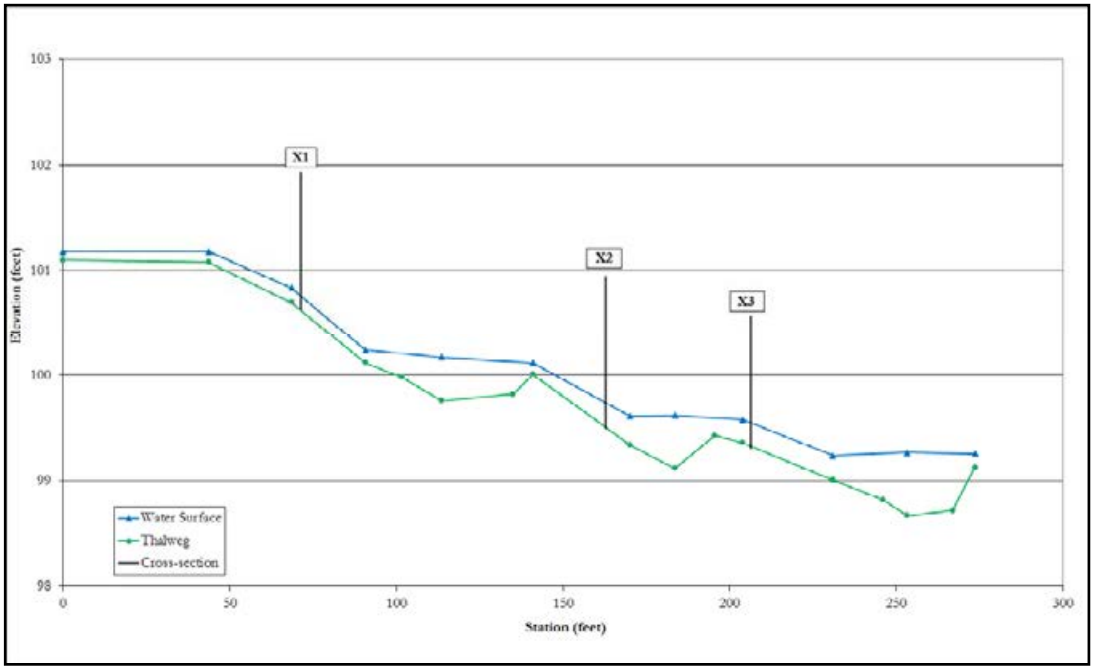




17. UT Little Marrowbone Creek
Ecoregion 71, Tennessee

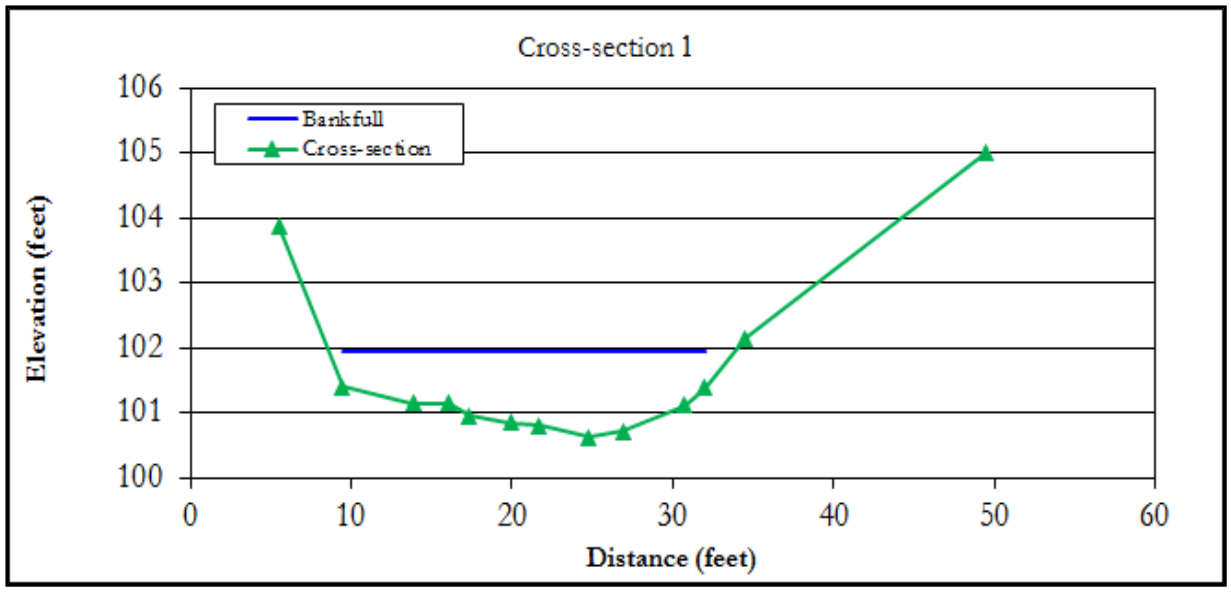
Latitude: 36.272148
Longitude: -86.902682
Drainage area: 0.66 square miles
Median particle size: 47 millimeters
Longitudinal slope: 0.0084 feet/foot
Stream classification: B4c

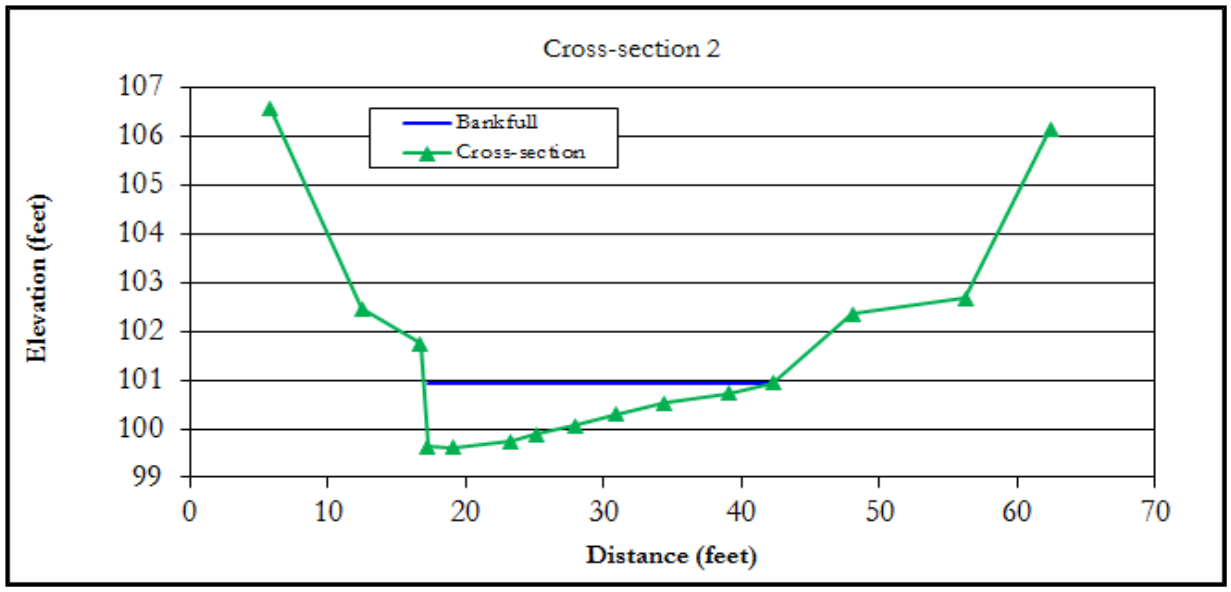
	X1	X2	X3
Area (square feet) =	22.3	18.8	17.8
Width (feet) =	25.2	25.4	22.9
Mean depth =	0.9	0.7	0.8
Max depth =	1.3	1.3	1.3
Width/depth ratio =	28.4	34.3	29.5
Entrenchment ratio =	1.3	1.3	1.7

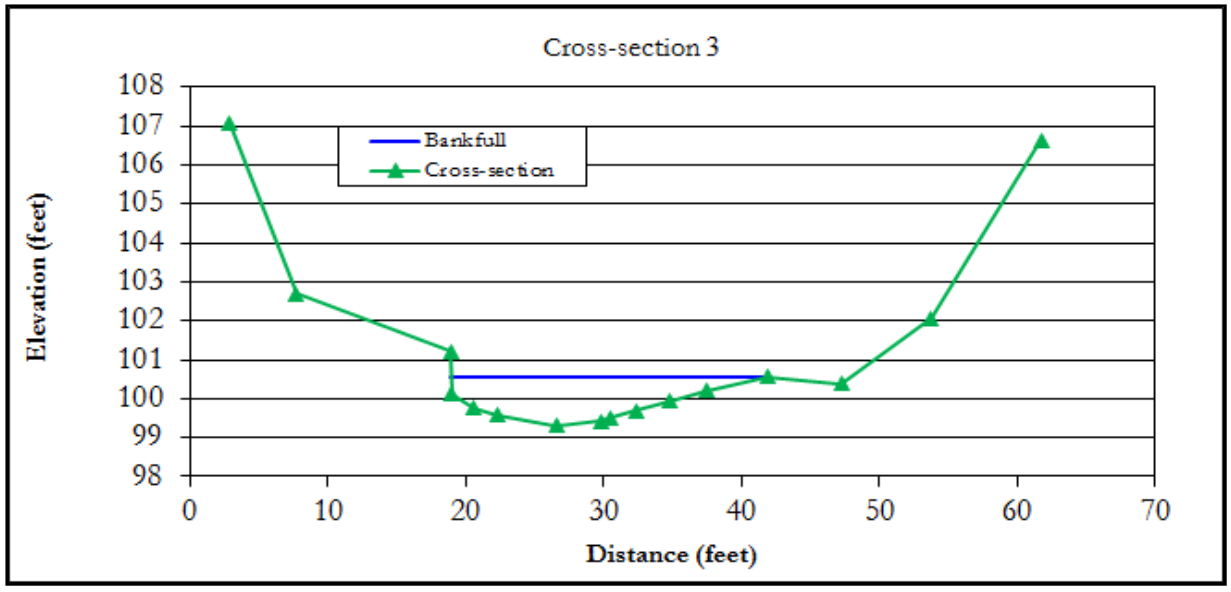


Longitudinal Profile

17. UT Little Marrowbone Creek
Ecoregion 71, Tennessee



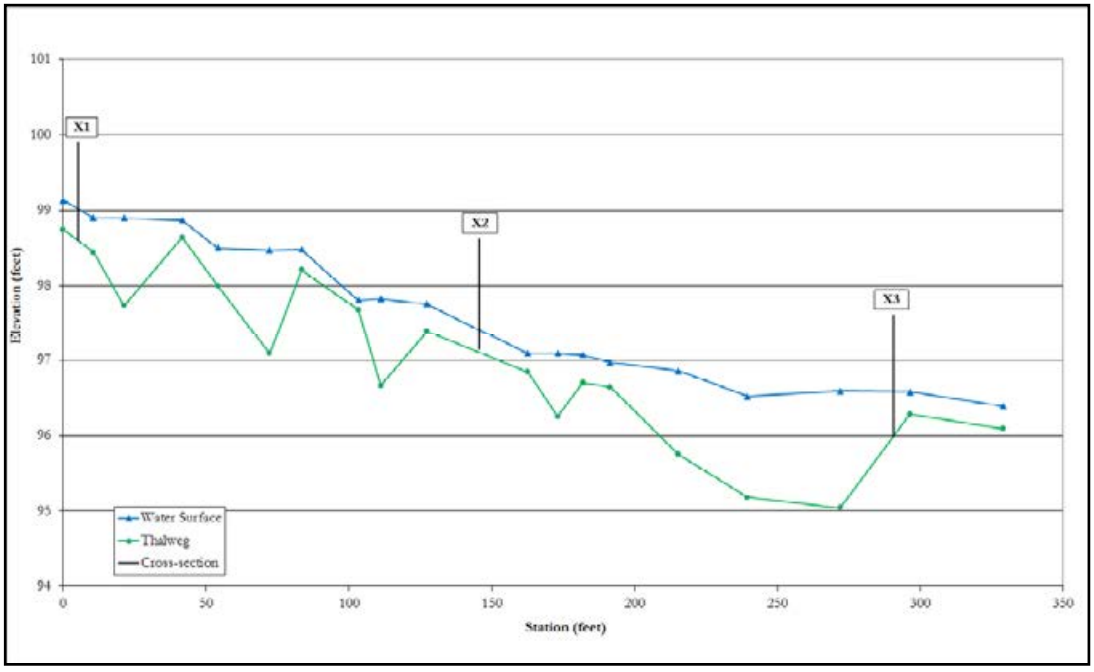




18. UT3 Woodhaven Lake
Ecoregion 71, Tennessee

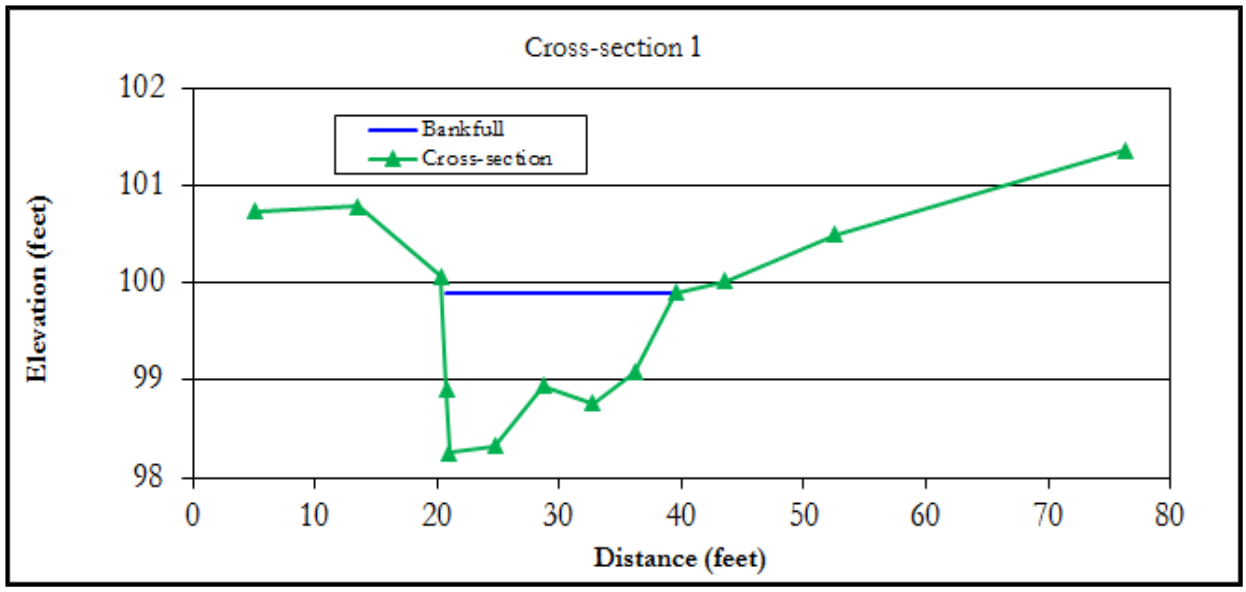
Latitude: 36.081146
Longitude: -87.294231
Drainage area: 0.66 square miles
Median particle size: 14 millimeters
Longitudinal slope: 0.0086 feet/foot
Stream classification: C4

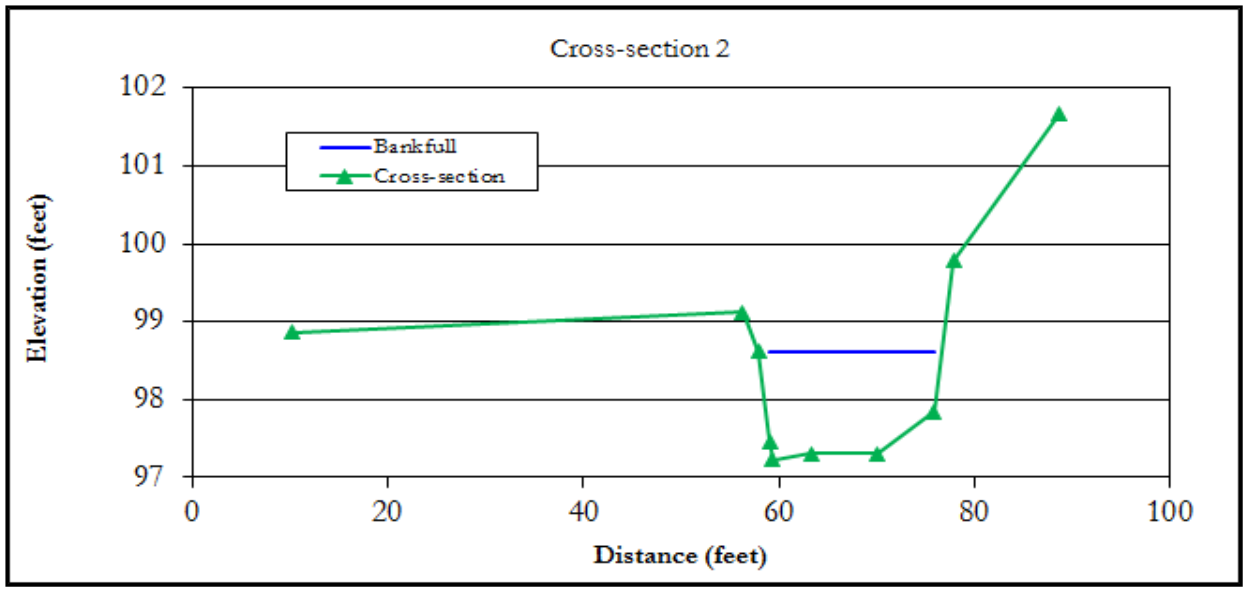
	X1	X2	X3
Area (square feet) =	20.5	21.5	18.9
Width (feet) =	19.1	18.7	15.3
Mean depth =	1.1	1.1	1.2
Max depth =	1.6	1.4	1.5
Width/depth ratio =	17.9	16.3	12.3
Entrenchment ratio =	4.8	5.0	5.1

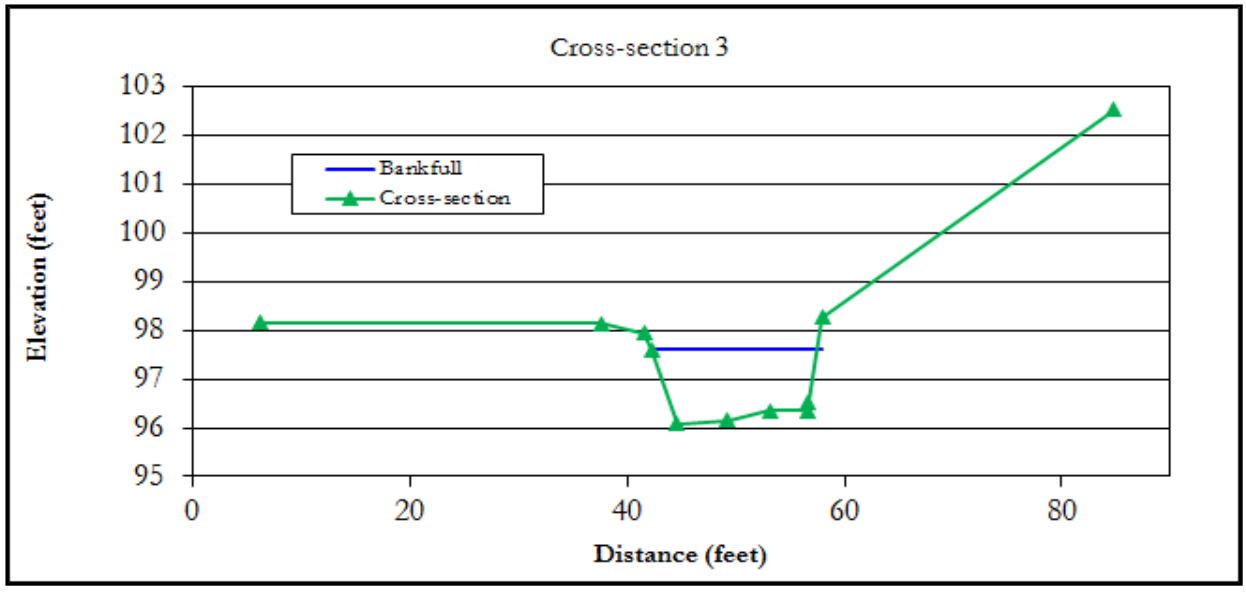


Longitudinal Profile

18. UT3 Woodhaven Lake
Ecoregion 71, Tennessee



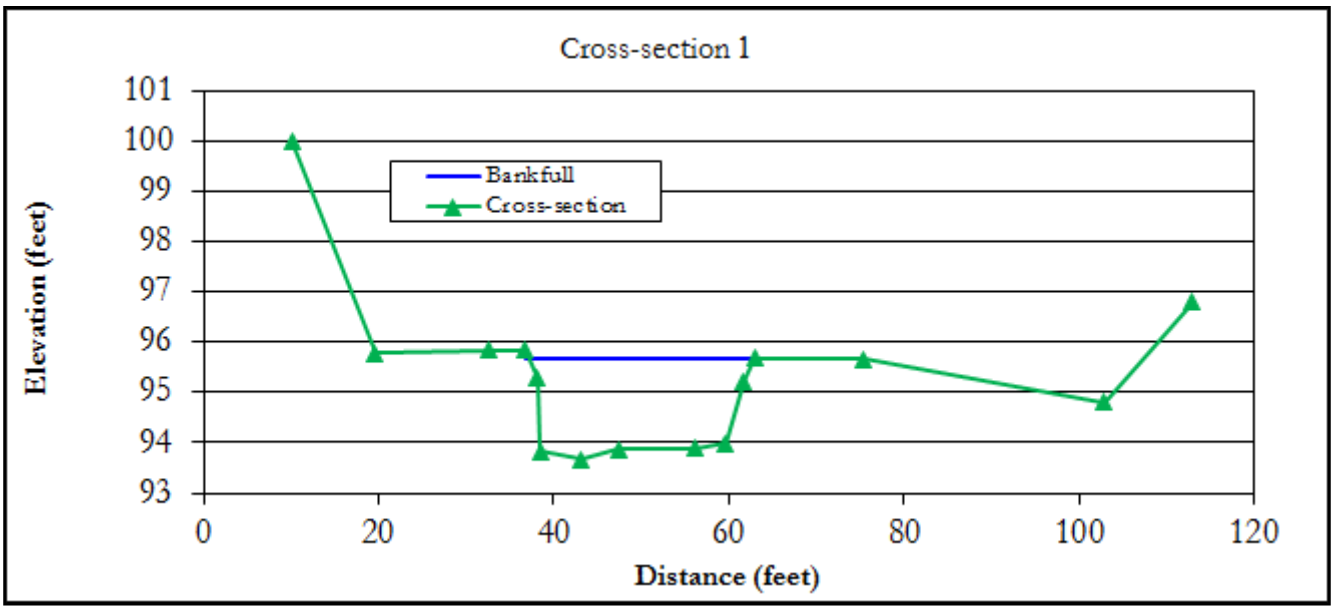




19. UT1 Little Swan Creek
Ecoregion 71, Tennessee

Latitude: 35.527900
Longitude: -87.456635
Drainage area: 1.18 square miles
Median particle size: 40 millimeters
Longitudinal slope: 0.0090 feet/foot
Stream classification: C4

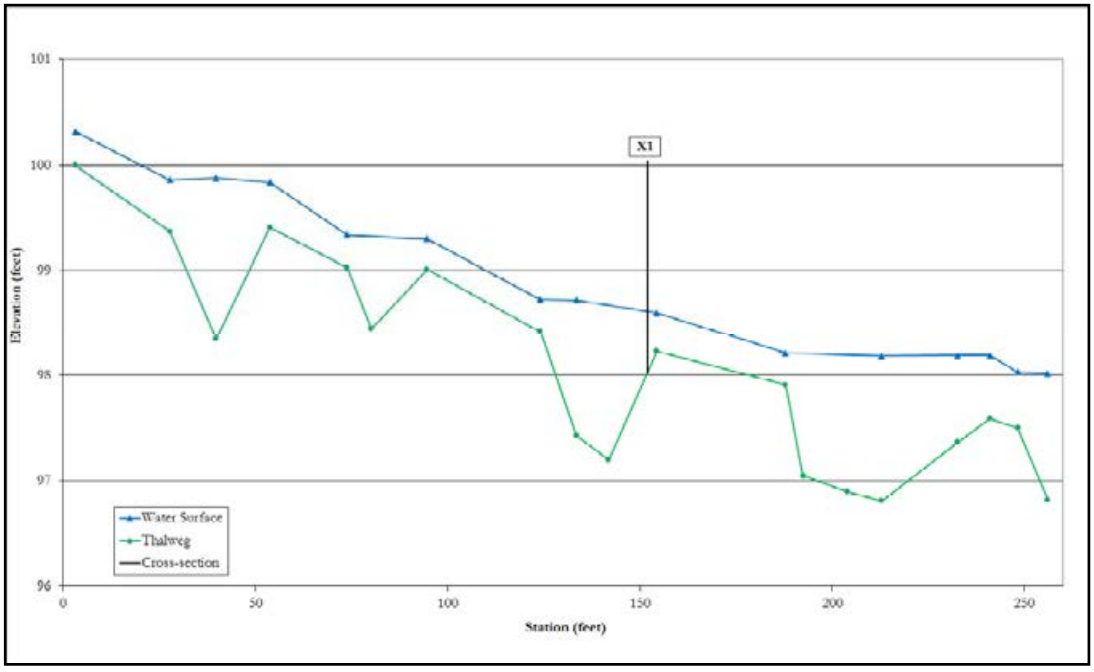
	X1
Area (square feet) =	42.2
Width (feet) =	25.8
Mean depth =	1.6
Max depth =	2.0
Width/depth ratio =	15.8
Entrenchment ratio =	3.7



20. Weaver Branch
Ecoregion 71, Tennessee

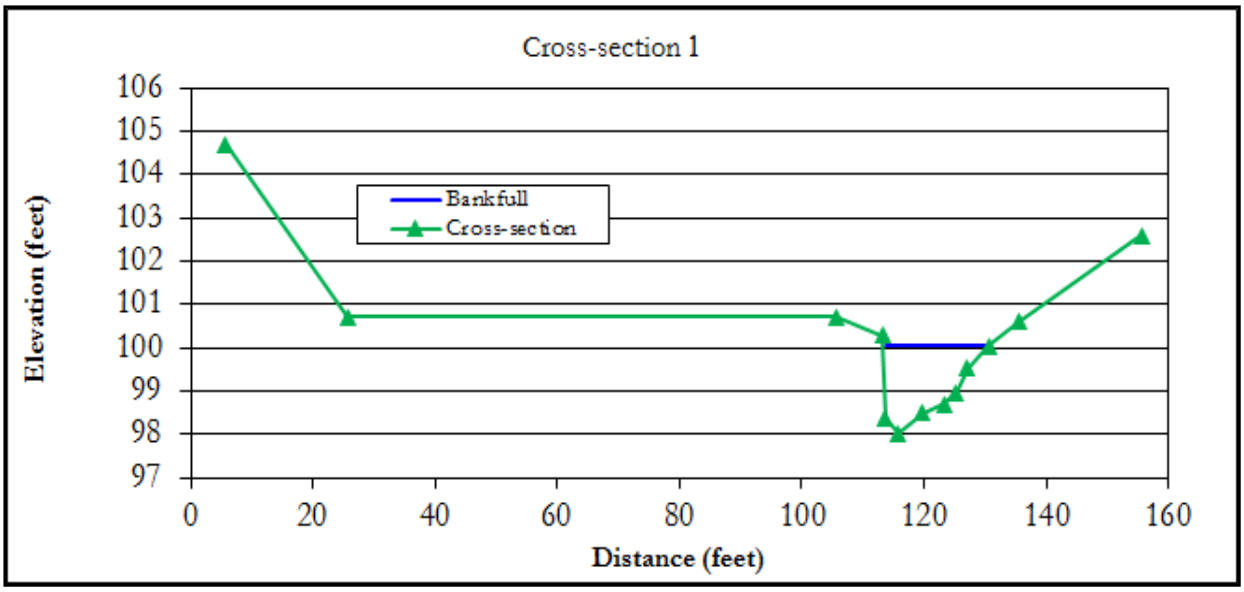
Latitude: 35.355438
Longitude: -87.502046
Drainage area: 1.44 square miles
Median particle size: 27 millimeters
Longitudinal slope: 0.0090 feet/foot
Stream classification: C4

	X1
Area (square feet) =	21.3
Width (feet) =	17.4
Mean depth =	1.2
Max depth =	2.0
Width/depth ratio =	14.3
Entrenchment ratio =	6.3



Longitudinal Profile

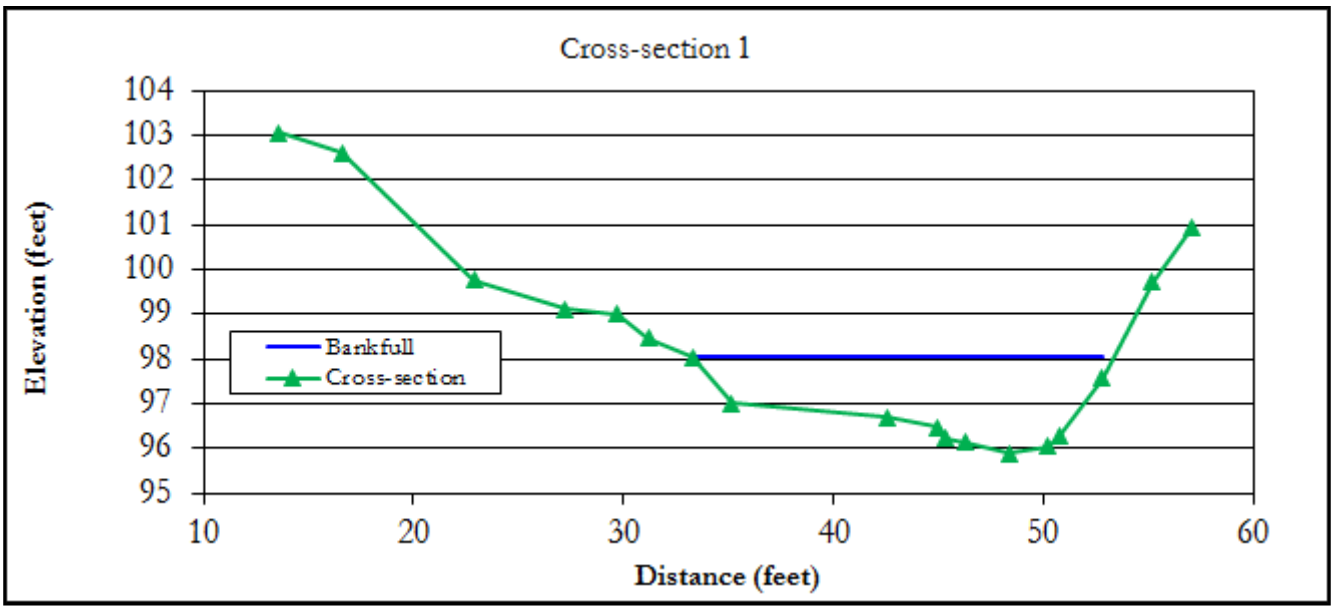
20. Weaver Branch
Ecoregion 71, Tennessee



21. West Fork Brown Creek
Ecoregion 71, Tennessee

Latitude: 36.093543
Longitude: -86.793250
Drainage area: 1.51 square miles
Median particle size: 81 millimeters
Longitudinal slope: 0.0178 feet/foot
Stream classification: B3c

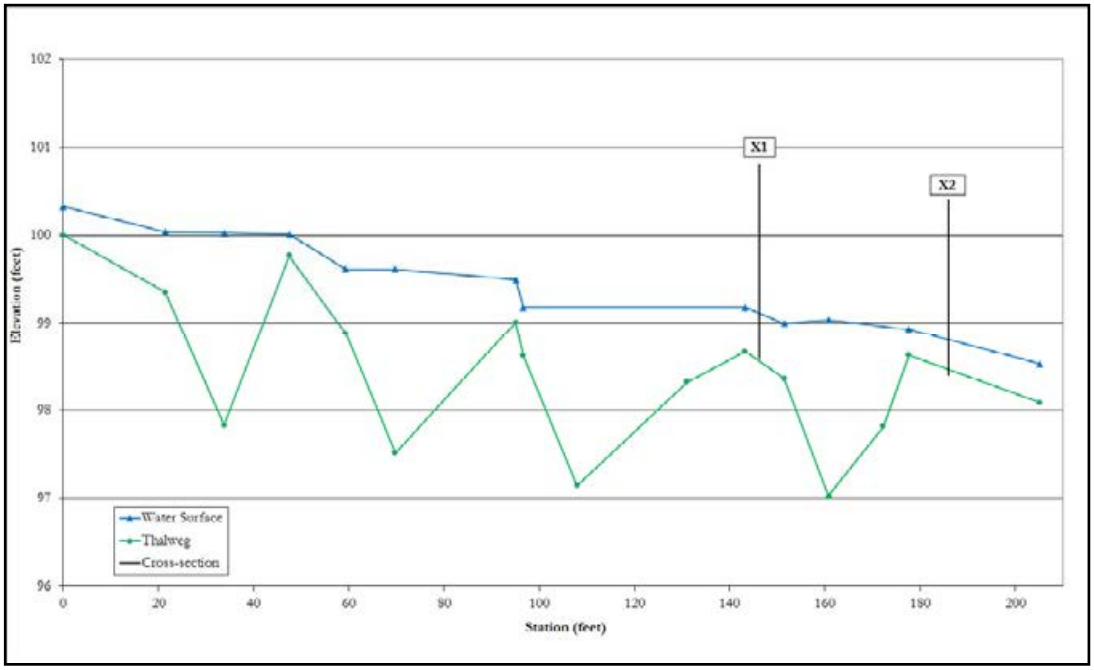
	X1
Area (square feet) =	27.2
Width (feet) =	20.0
Mean depth =	1.4
Max depth =	2.2
Width/depth ratio =	14.8
Entrenchment ratio =	1.7



22. Will Hall Creek
Ecoregion 71, Tennessee

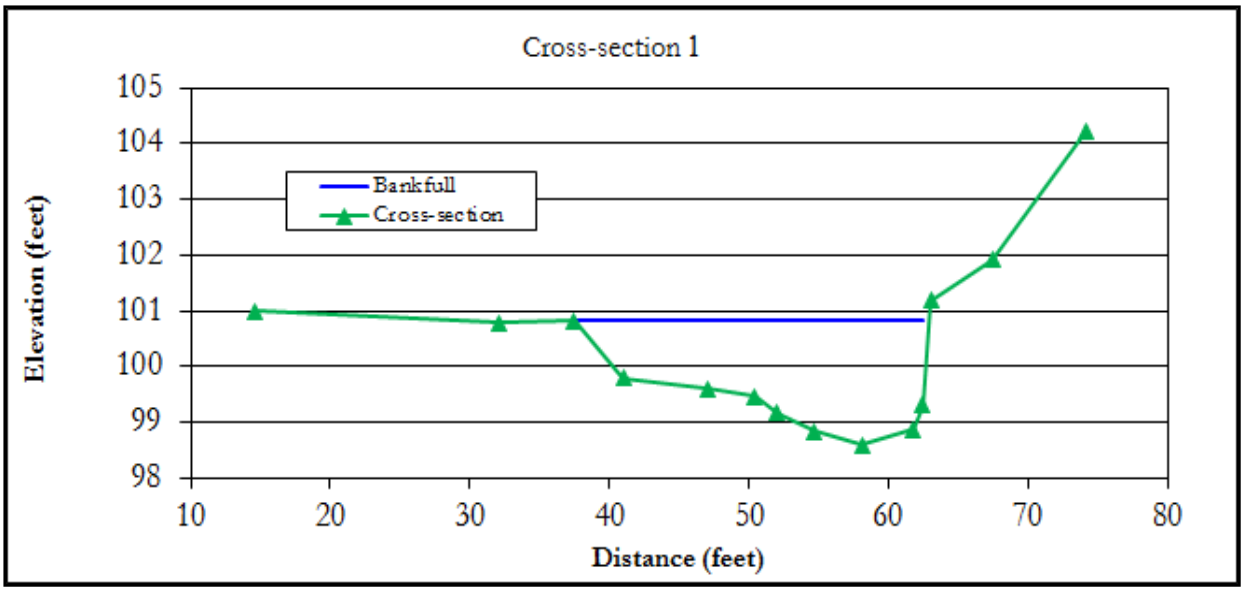
Latitude: 36.071609
Longitude: -87.294206
Drainage area: 2.34 square miles
Median particle size: 57 millimeters
Longitudinal slope: 0.0079 feet/foot
Stream classification: C4

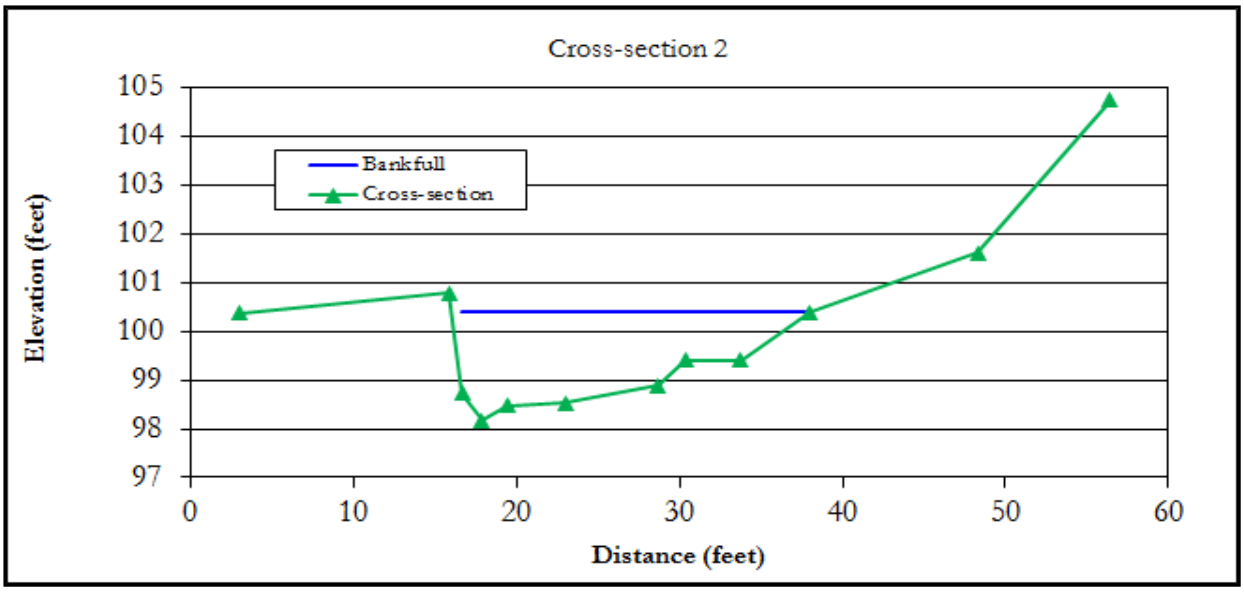
	X1	X2
Area (square feet) =	36.4	30.0
Width (feet) =	25.5	22.0
Mean depth =	1.4	1.4
Max depth =	2.2	2.2
Width/depth ratio =	17.8	16.1
Entrenchment ratio =	3.8	4.2



Longitudinal Profile

22. Will Hall Creek
Ecoregion 71, Tennessee

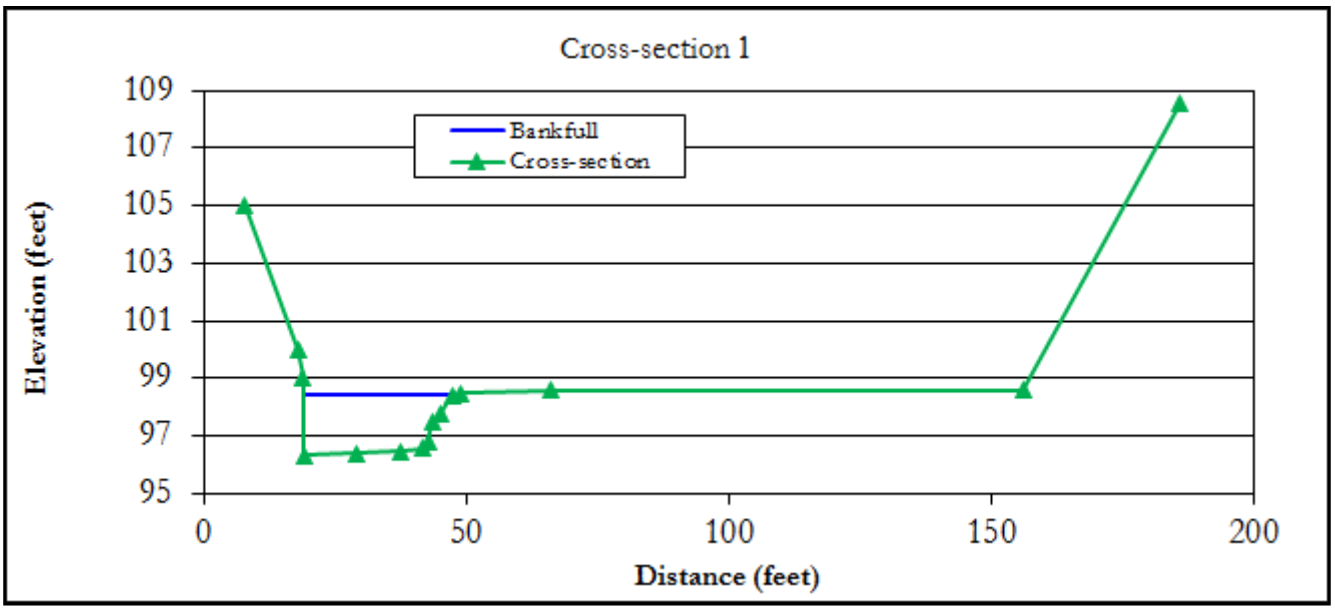




23. Bryans Fork
Ecoregion 71, Tennessee

Latitude: 36.457484
Longitude: -85.425834
Drainage area: 2.53 square miles
Median particle size: 27 millimeters
Longitudinal slope: 0.0046 feet/foot
Stream classification: C4

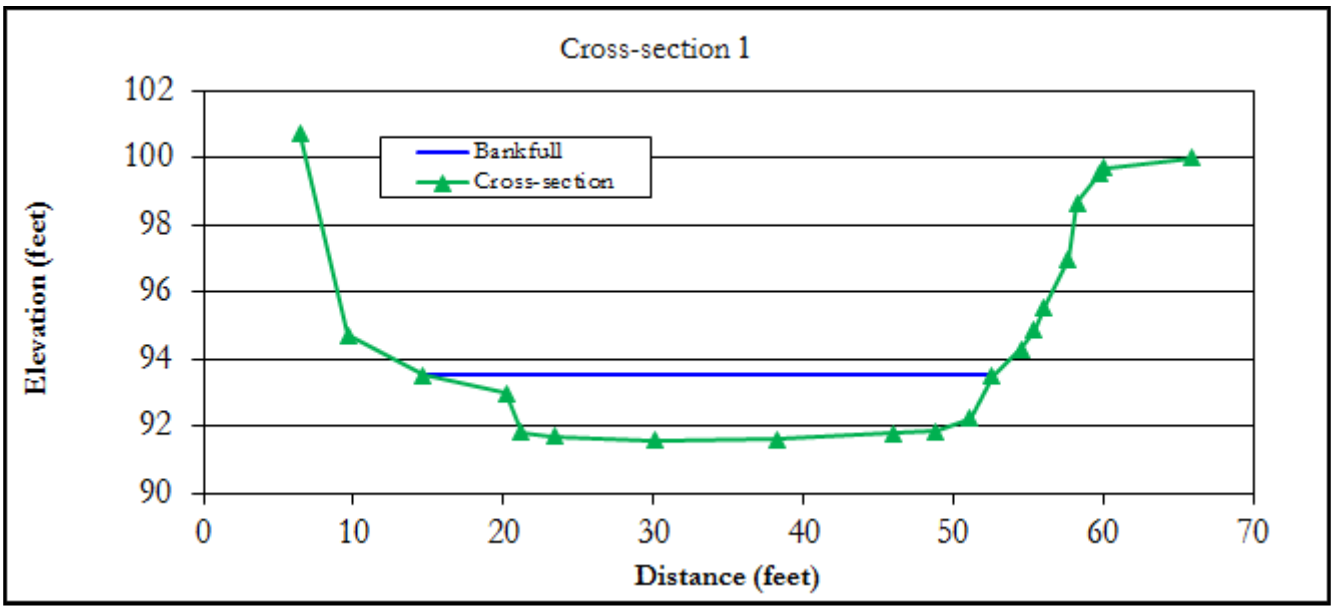
	X1
Area (square feet) =	50.1
Width (feet) =	28.4
Mean depth =	1.8
Max depth =	2.1
Width/depth ratio =	16.1
Entrenchment ratio =	5.1



24. Mansker Creek
Ecoregion 71, Tennessee

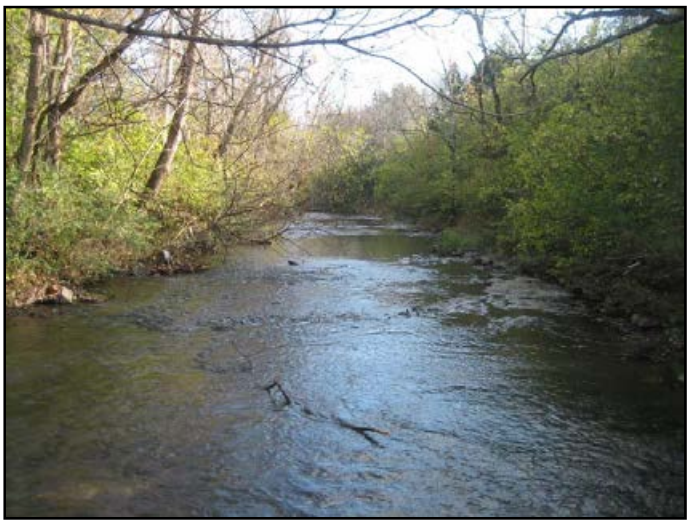
Latitude: 36.355880
Longitude: -86.724127
Drainage area: 4.97 square miles
Median particle size: bedrock
Longitudinal slope: 0.0056 feet/foot
Stream classification: F1

	X1
Area (square feet) =	58.9
Width (feet) =	38.0
Mean depth =	1.5
Max depth =	2.0
Width/depth ratio =	24.6
Entrenchment ratio =	1.2

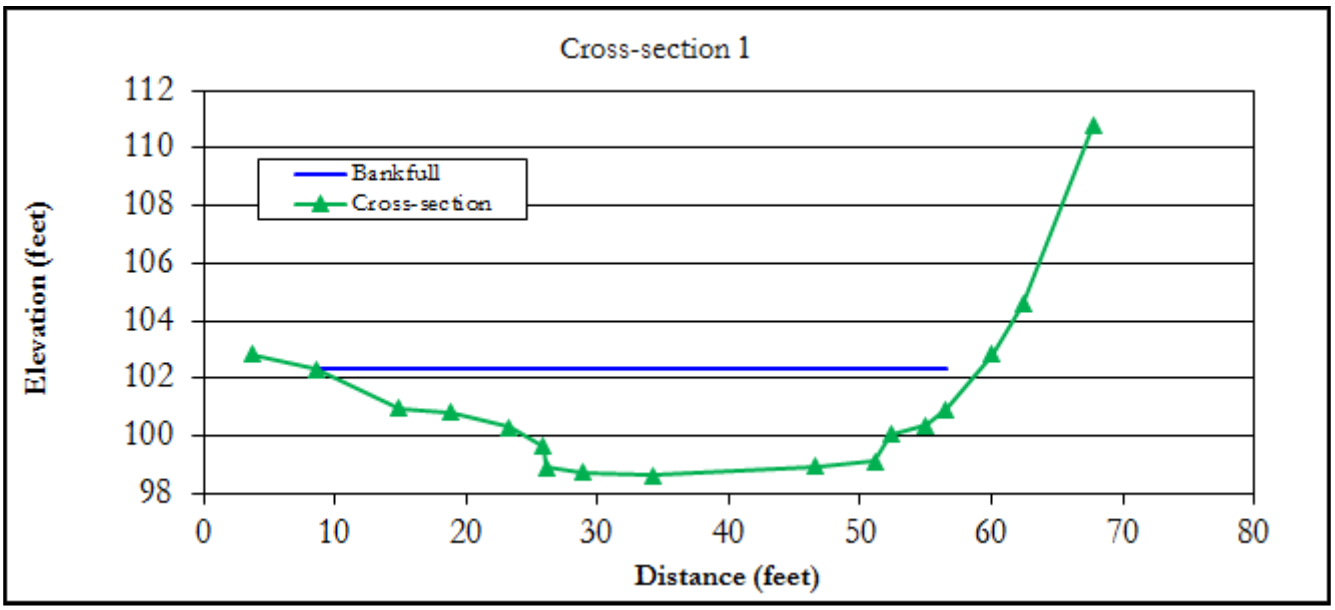


25. Dry Creek
Ecoregion 71, Tennessee

Latitude: 36.284345
Longitude: -86.705335
Drainage area: 7.64 square miles
Median particle size: bedrock
Longitudinal slope: 0.0073 feet/foot
Stream classification: C1



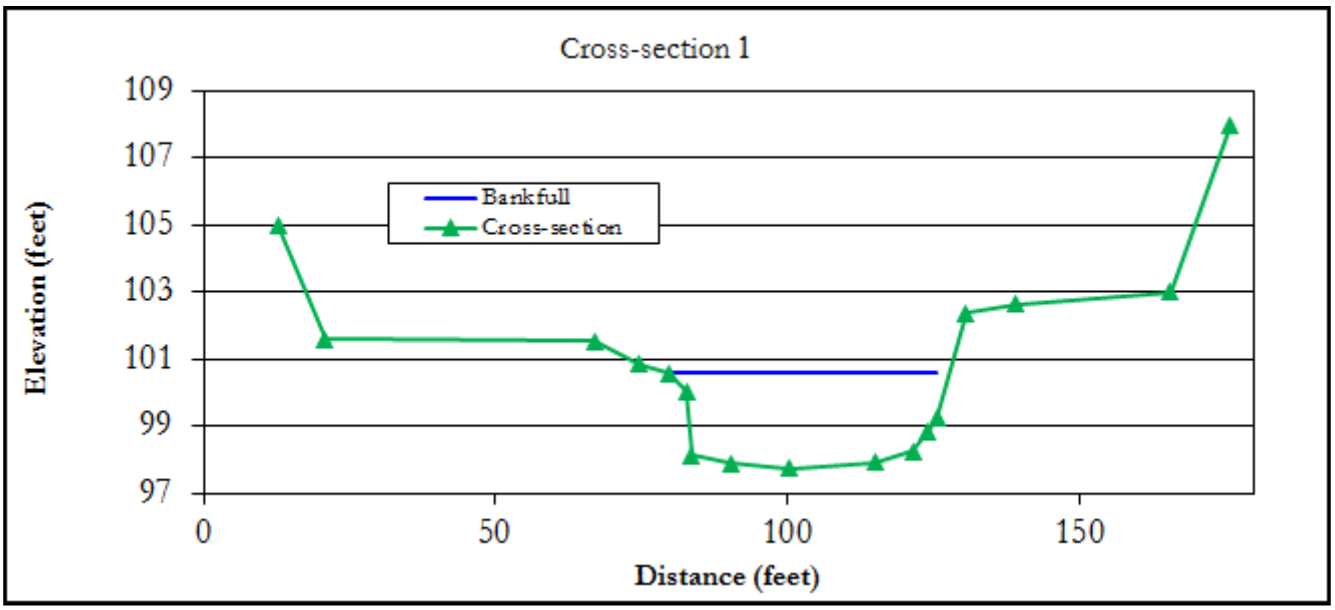
	X1
Area (square feet) =	126.1
Width (feet) =	50.5
Mean depth =	2.5
Max depth =	3.7
Width/depth ratio =	20.2
Entrenchment ratio =	2.4



26. Little Swan Creek
Ecoregion 71, Tennessee

Latitude: 35.529466
Longitude: -87.453971
Drainage area: 8.82 square miles
Median particle size: 45 millimeters
Longitudinal slope: 0.0055 feet/foot
Stream classification: C4

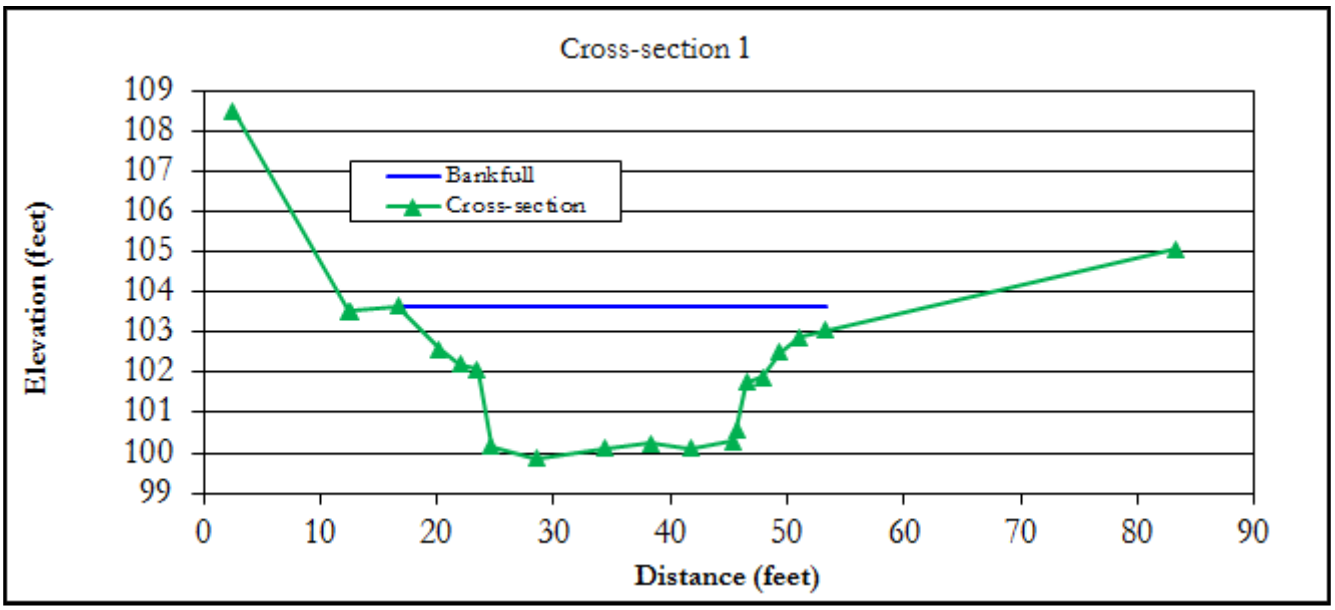
	X1
Area (square feet) =	113.3
Width (feet) =	48.1
Mean depth =	2.4
Max depth =	2.9
Width/depth ratio =	20.4
Entrenchment ratio =	3.1



27. Sevenmile Creek
Ecoregion 71, Tennessee

Latitude: 36.072007
Longitude: -86.733542
Drainage area: 12.2 square miles
Median particle size: bedrock
Longitudinal slope: 0.0039 feet/foot
Stream classification: C1

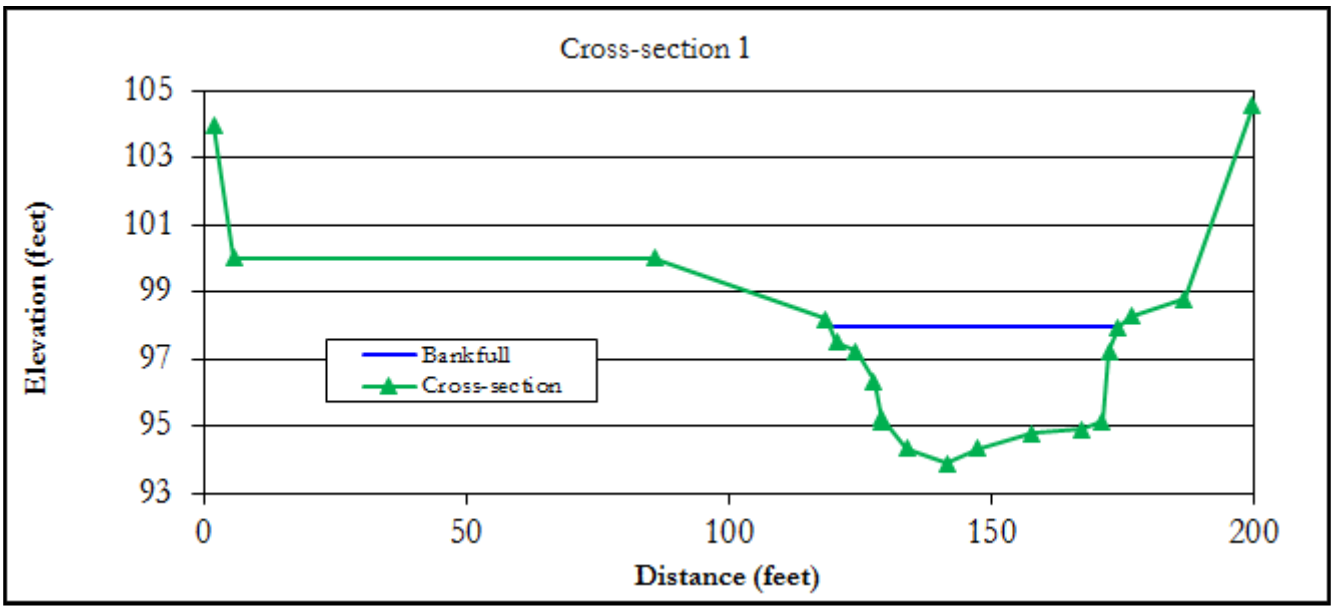
	X1
Area (square feet) =	94.3
Width (feet) =	36.7
Mean depth =	2.6
Max depth =	3.8
Width/depth ratio =	14.3
Entrenchment ratio =	3.1



28. Little Buffalo River
Ecoregion 71, Tennessee

Latitude: 35.352696
Longitude: -87.503928
Drainage area: 13.2 square miles
Median particle size: 62 millimeters
Longitudinal slope: 0.0072 feet/foot
Stream classification: C4

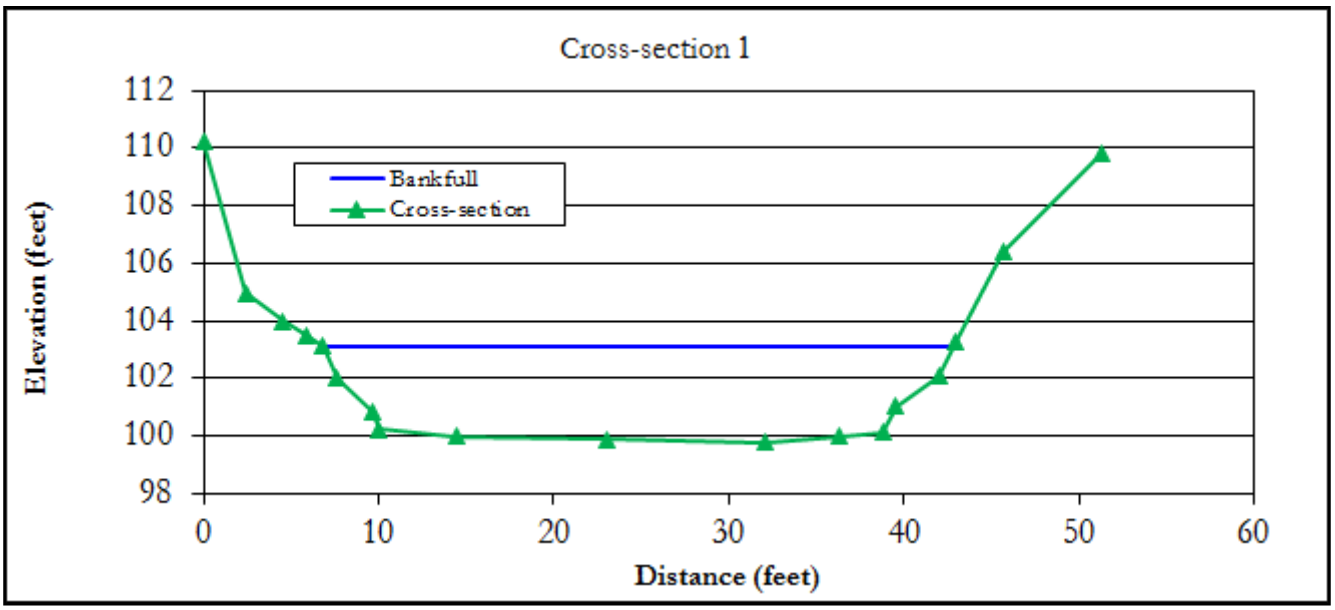
	X1
Area (square feet) =	155.5
Width (feet) =	54.9
Mean depth =	2.8
Max depth =	4.1
Width/depth ratio =	19.4
Entrenchment ratio =	3.5



29. Whites Creek
Ecoregion 71, Tennessee

Latitude: 36.273604
Longitude: -86.817171
Drainage area: 13.8 square miles
Median particle size: bedrock
Longitudinal slope: 0.0031 feet/foot
Stream classification: F1

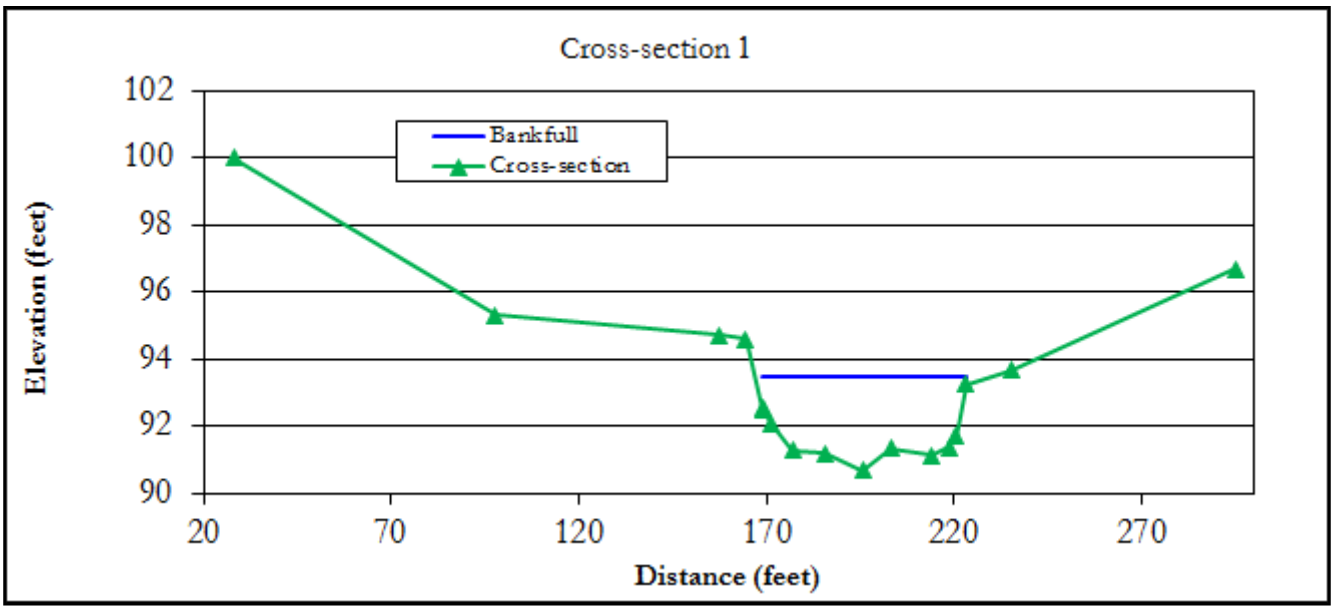
	X1
Area (square feet) =	102.4
Width (feet) =	36.0
Mean depth =	2.8
Max depth =	3.3
Width/depth ratio =	12.6
Entrenchment ratio =	1.2



30. Salt Lick Creek
Ecoregion 71, Tennessee

Latitude: 36.551887
Longitude: -85.857300
Drainage area: 14.5 square miles
Median particle size: bedrock
Longitudinal slope: 0.0024 feet/foot
Stream classification: C1

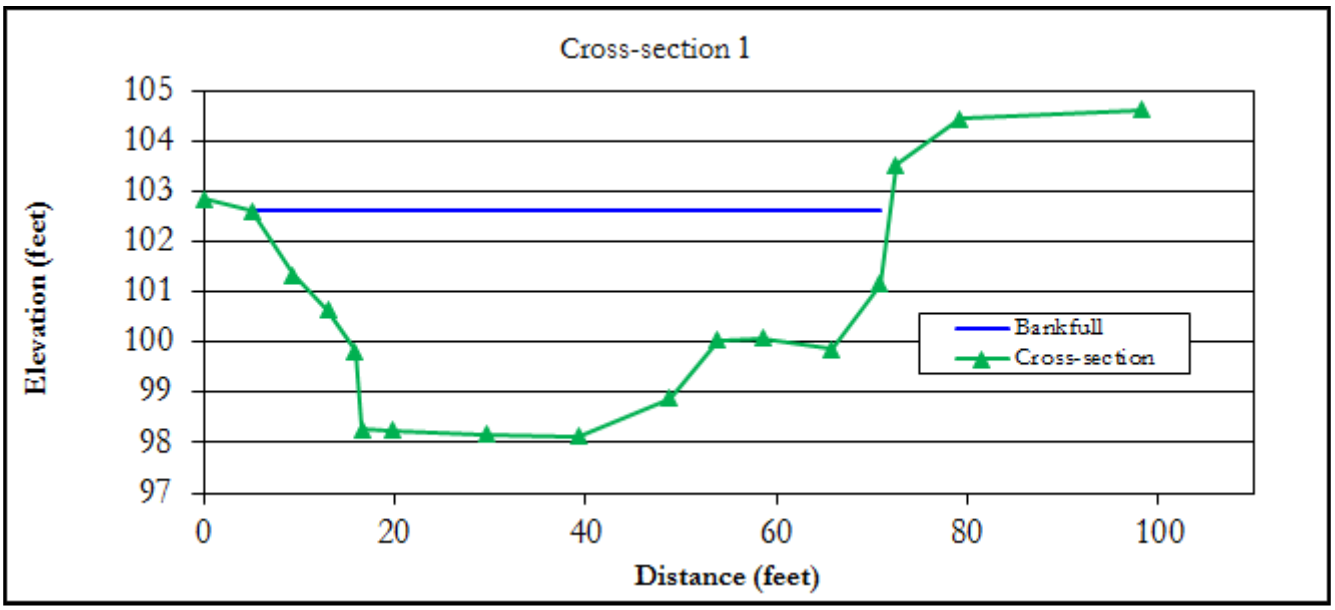
	X1
Area (square feet) =	118.7
Width (feet) =	62.3
Mean depth =	1.9
Max depth =	2.8
Width/depth ratio =	32.7
Entrenchment ratio =	2.4



31. Richland Creek
Ecoregion 71, Tennessee

Latitude: 36.144459
Longitude: -86.852688
Drainage area: 24.3 square miles
Median particle size: 60 millimeters
Longitudinal slope: 0.0074 feet/foot
Stream classification: C4

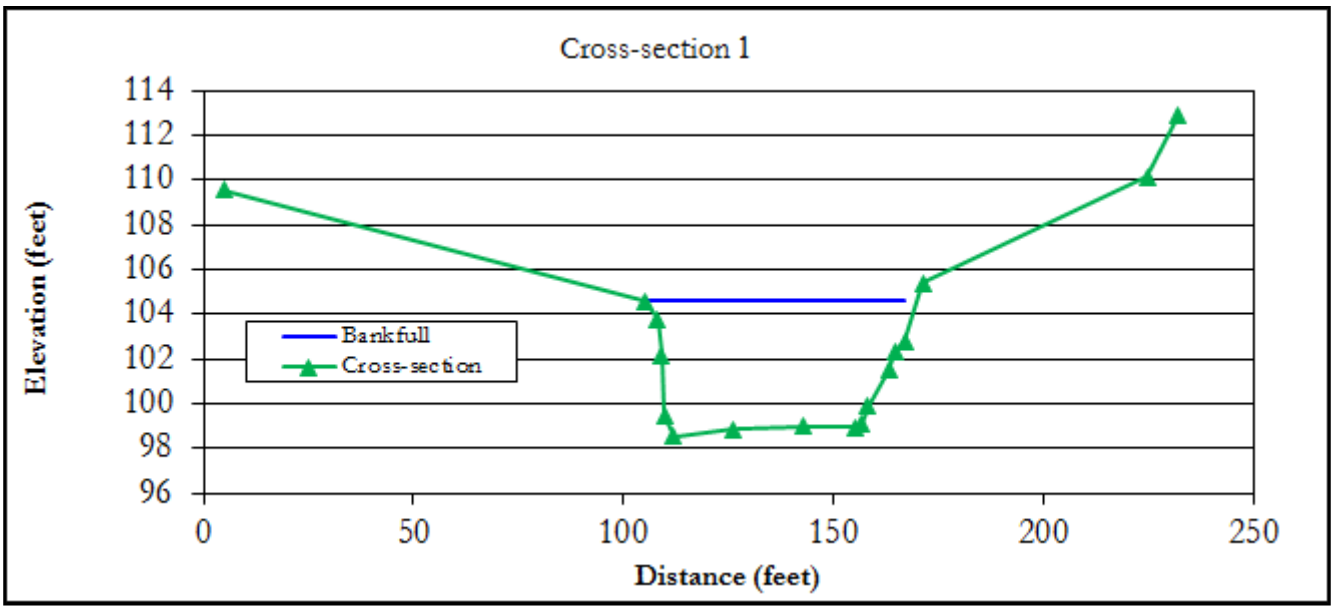
	X1
Area (square feet) =	215.5
Width (feet) =	66.8
Mean depth =	3.2
Max depth =	45.
Width/depth ratio =	20.7
Entrenchment ratio =	3.5



32. Wartrace Creek
Ecoregion 71, Tennessee

Latitude: 35.526917
Longitude: -86.340099
Drainage area: 35.7 square miles
Median particle size: bedrock
Longitudinal slope: 0.0030 feet/foot
Stream classification: C1

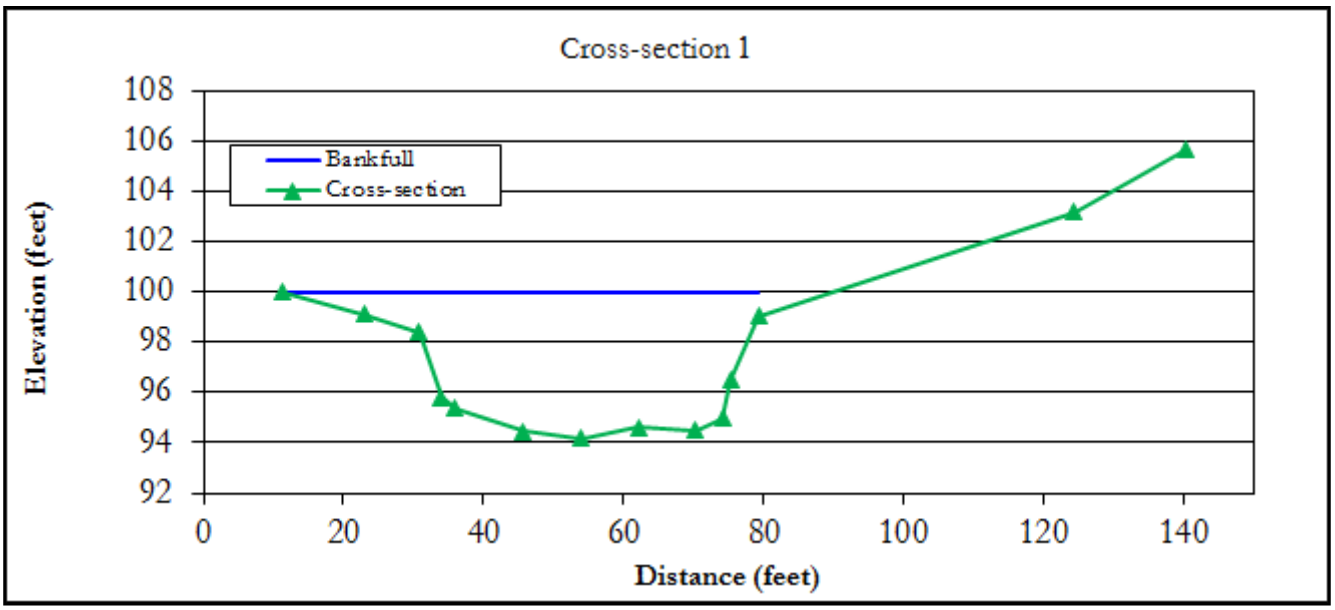
	X1
Area (square feet) =	311.4
Width (feet) =	65.0
Mean depth =	4.8
Max depth =	6.1
Width/depth ratio =	13.6
Entrenchment ratio =	3.7



33. Bradley Creek
Ecoregion 71, Tennessee

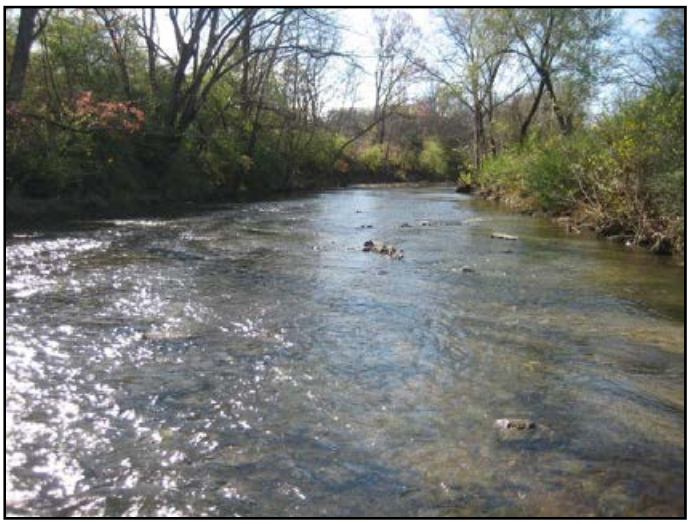
Latitude: 35.356352
Longitude: -85.978926
Drainage area: 41.3 square miles
Median particle size: 2.8 millimeters
Longitudinal slope: 0.0014 feet/foot
Stream classification: C4

	X1
Area (square feet) =	260.0
Width (feet) =	78.6
Mean depth =	3.3
Max depth =	5.9
Width/depth ratio =	23.8
Entrenchment ratio =	2.4

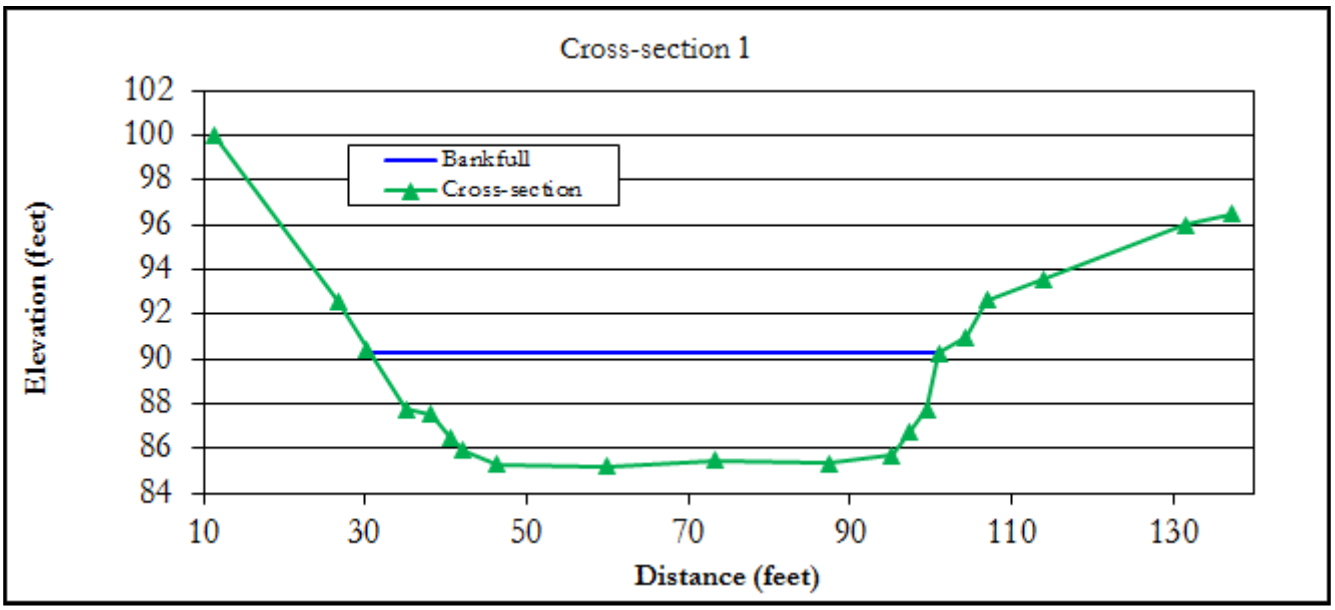


34. Whites Creek
Ecoregion 71, Tennessee

Latitude: 36.216224
Longitude: -86.819321
Drainage area: 51.3 square miles
Median particle size: bedrock
Longitudinal slope: 0.0022 feet/foot
Stream classification: B1c



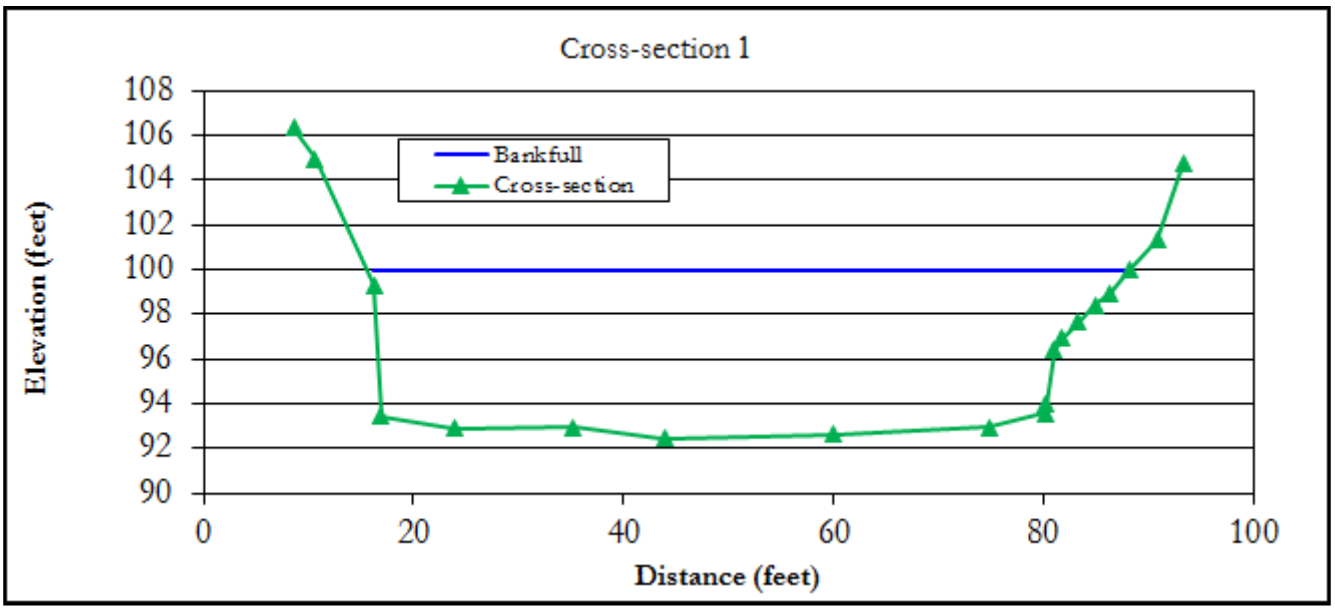
	X1
Area (square feet) =	305.1
Width (feet) =	70.4
Mean depth =	4.3
Max depth =	5.1
Width/depth ratio =	16.3
Entrenchment ratio =	1.5



35. Fountain Creek
Ecoregion 71, Tennessee

Latitude: 35.518370
Longitude: -86.942251
Drainage area: 74.0 square miles
Median particle size: 200 millimeters
Longitudinal slope: 0.0022 feet/foot
Stream classification: E3

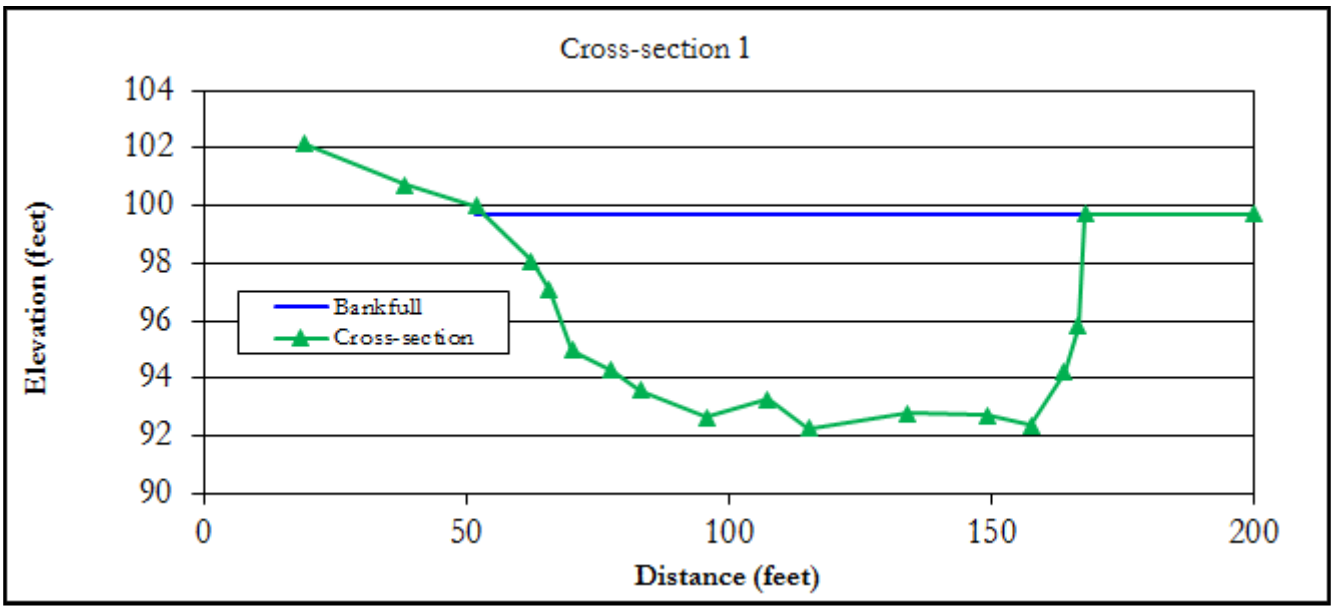
	X1
Area (square feet) =	472.0
Width (feet) =	72.6
Mean depth =	6.5
Max depth =	7.5
Width/depth ratio =	11.2
Entrenchment ratio =	2.2



36. Duck River
Ecoregion 71, Tennessee

Latitude: 35.471141
Longitude: -86.121514
Drainage area: 107 square miles
Median particle size: 100 millimeters
Longitudinal slope: 0.0014 feet/foot
Stream classification: C3

	X1
Area (square feet) =	675.1
Width (feet) =	114.2
Mean depth =	5.9
Max depth =	7.5
Width/depth ratio =	19.3
Entrenchment ratio =	5.6



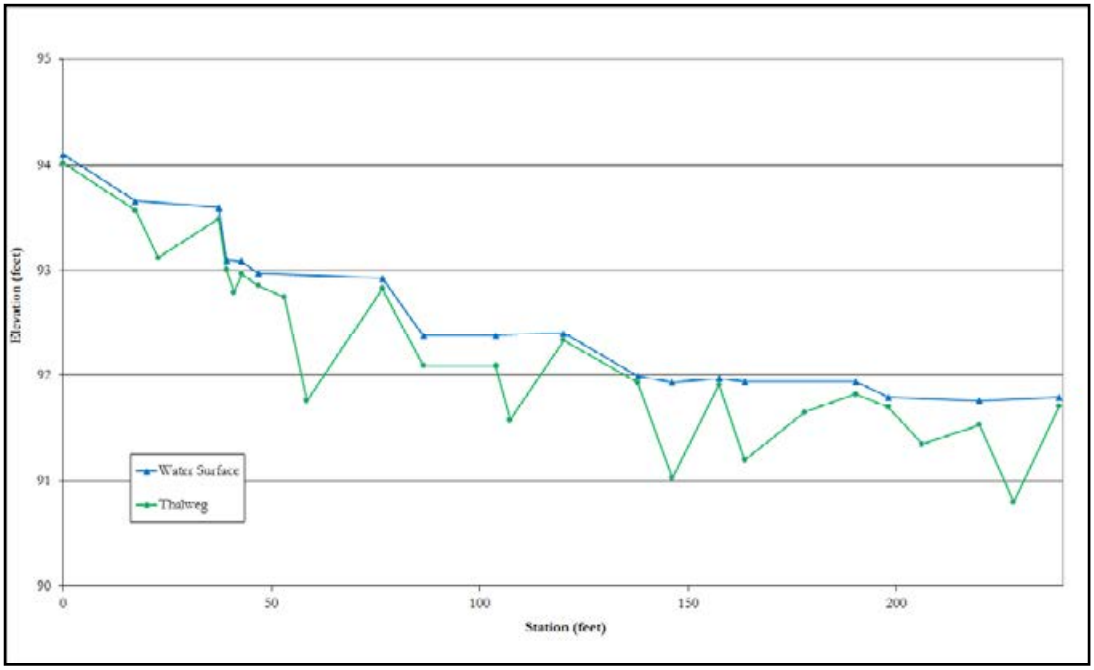
APPENDIX E

Ecoregions 65/74 Morphology Data

1. UT1 Barnishee Bayou
Ecoregion 74, Tennessee

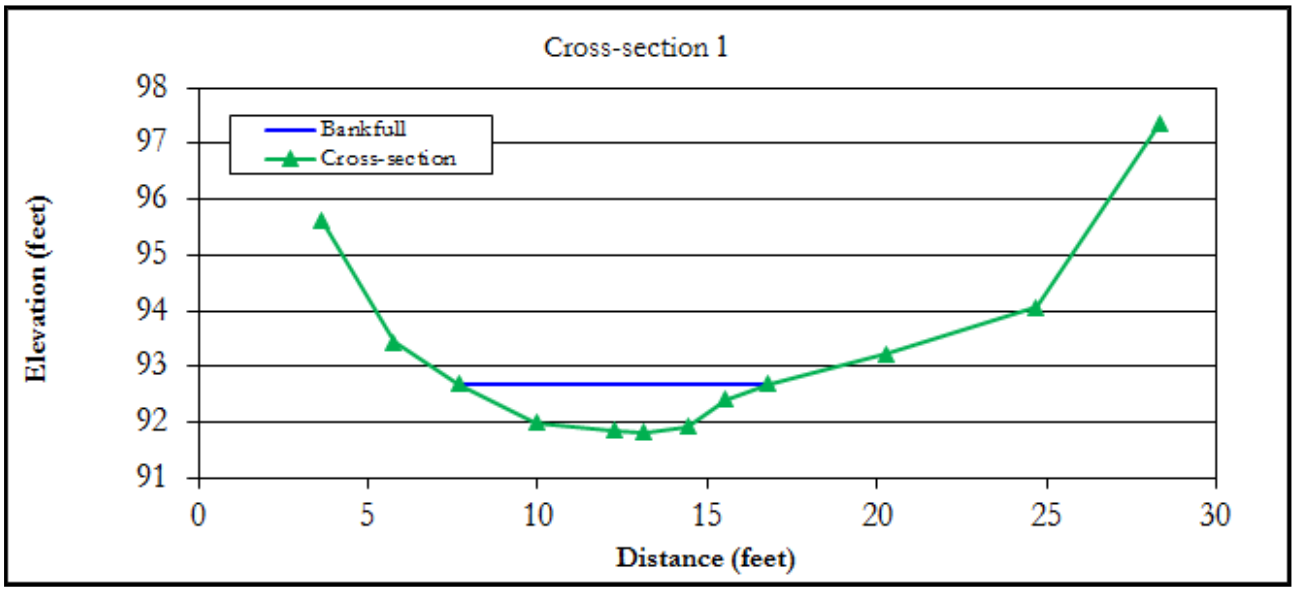
Latitude: 35.351310
Longitude: -90.046340
Drainage area: 0.09 square miles
Median particle size: medium gravel
Longitudinal slope: 0.00966 feet/foot
Stream classification: B4c

	X1
Area (square feet) =	5.2
Width (feet) =	9.2
Mean depth =	0.6
Max depth =	0.9
Width/depth ratio =	16.2
Entrenchment ratio =	1.8



Longitudinal Profile

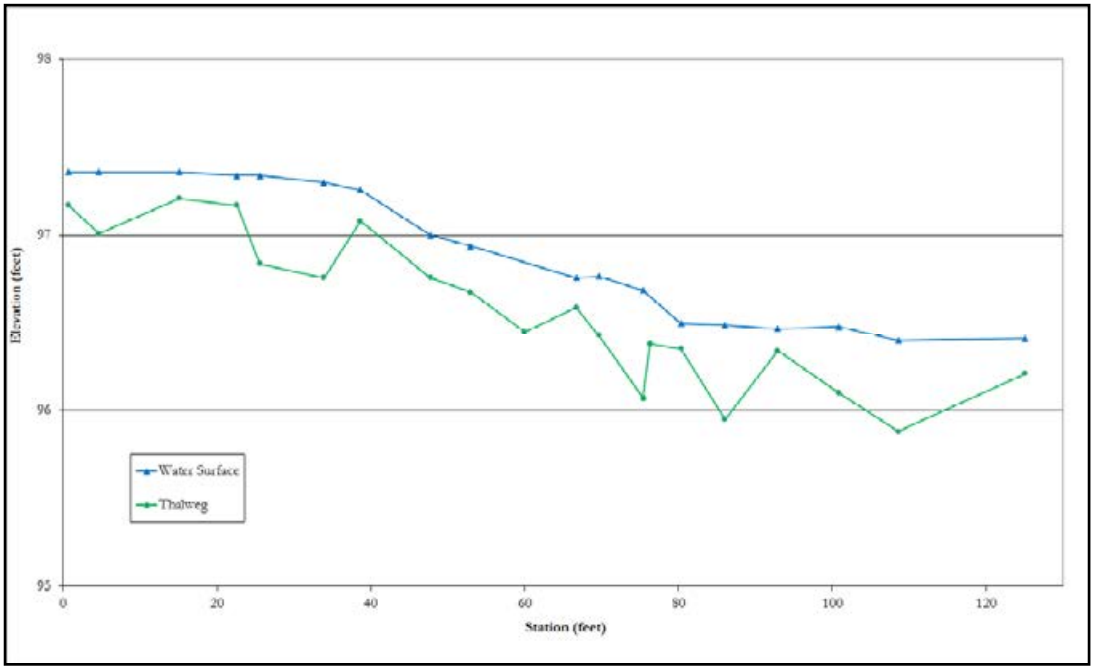
1. UT1 Barnishee Bayou
Ecoregion 74, Tennessee



2. UT Piney Creek
Ecoregion 65, Tennessee

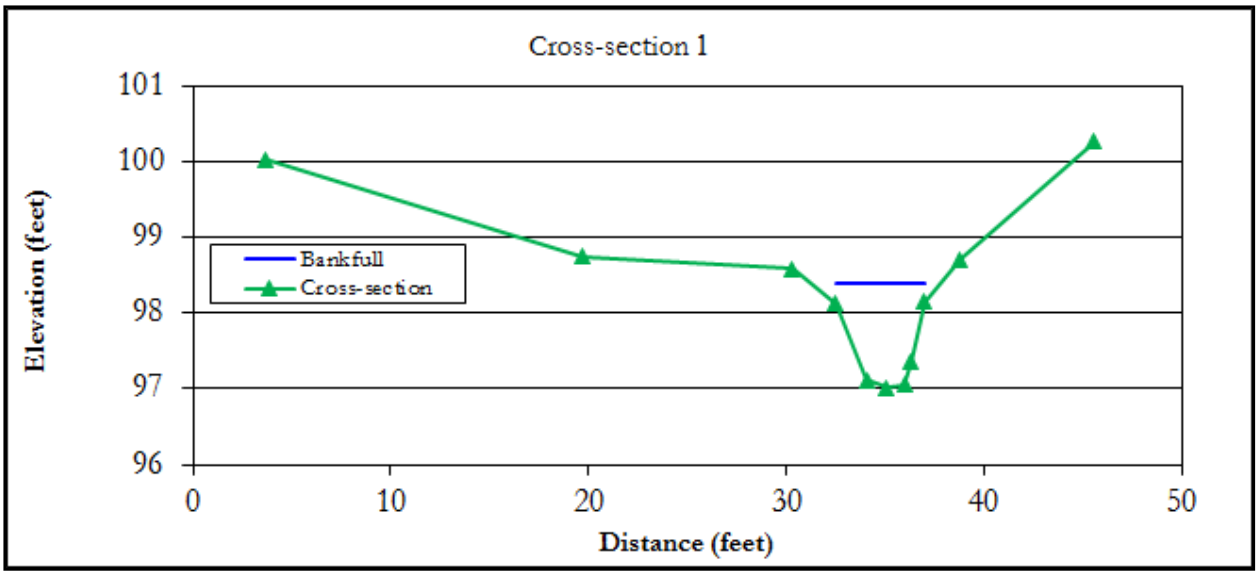
Latitude: 35.389989
Longitude: -88.789536
Drainage area: 0.09 square miles
Median particle size: sand
Longitudinal slope: 0.00863 feet/foot
Stream classification: E5

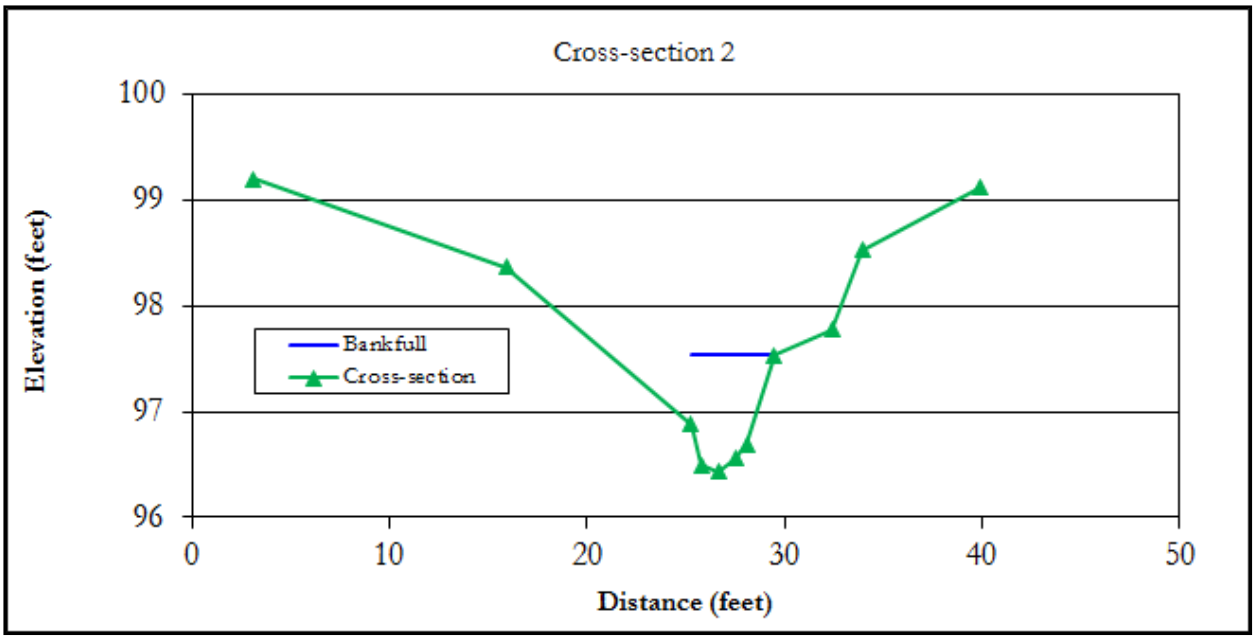
	X1	X2
Area (square feet) =	4.9	4.8
Width (feet) =	6.6	8.4
Mean depth =	0.7	0.6
Max depth =	1.4	1.1
Width/depth ratio =	9.0	14.7
Entrenchment ratio =	5.5	2.8



Longitudinal Profile

2. UT Piney Creek
Ecoregion 65, Tennessee

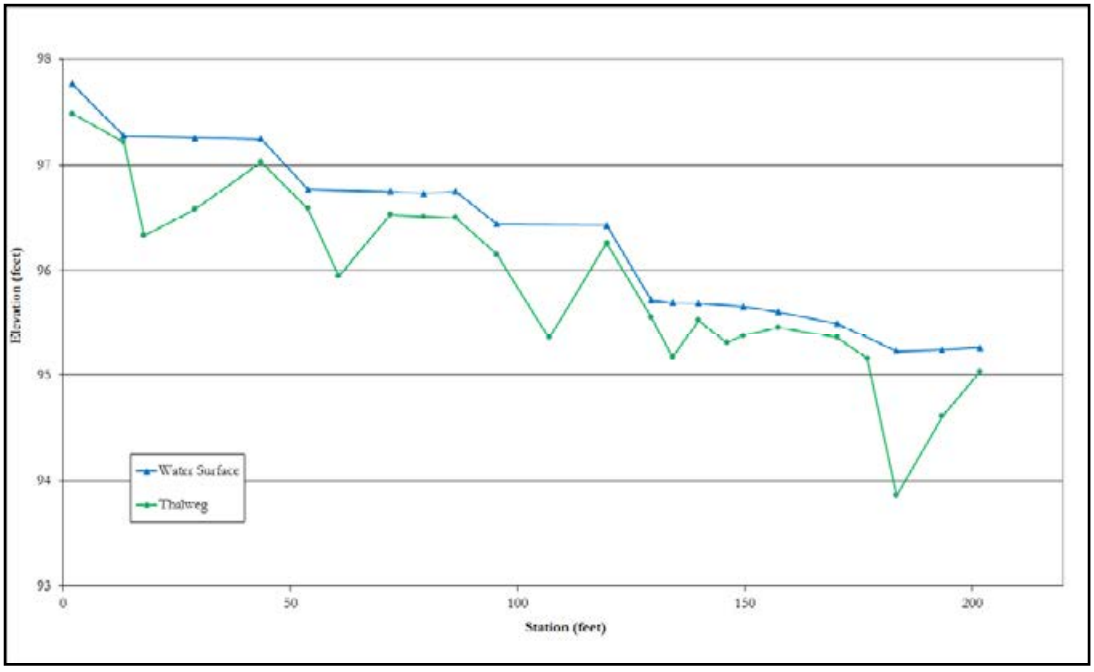




3. UT Tuscumbia River
Ecoregion 65, Tennessee

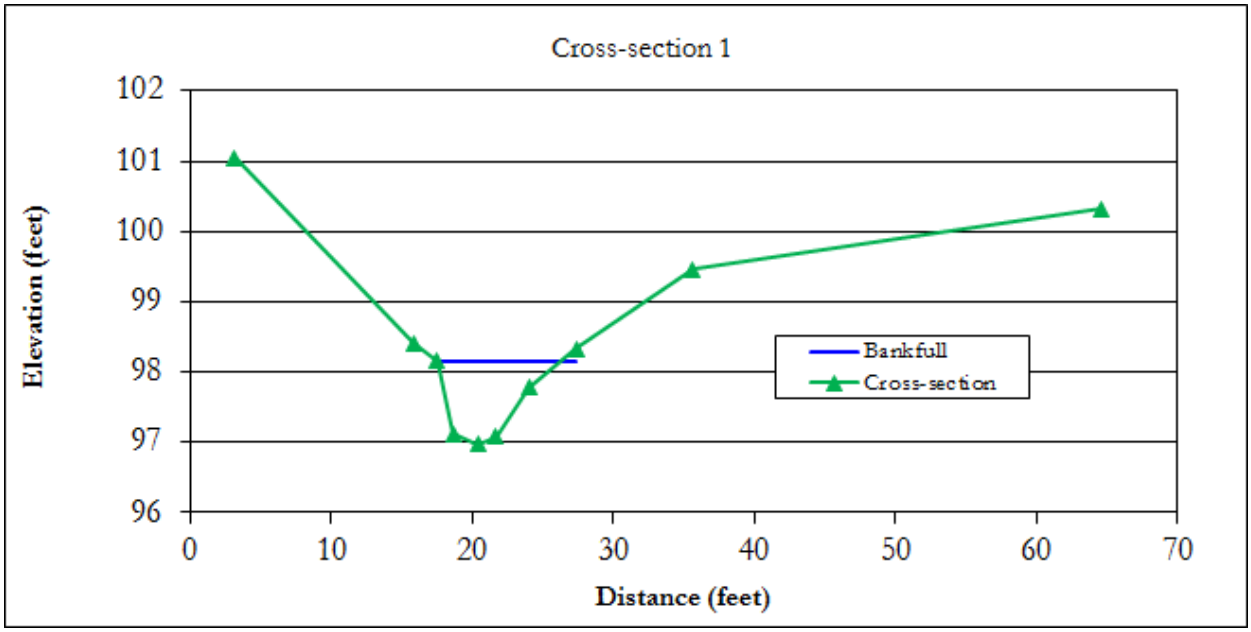
Latitude: 35.051156
Longitude: -88.750444
Drainage area: 0.12 square miles
Median particle size: sand
Longitudinal slope: 0.01257 feet/foot
Stream classification: E5

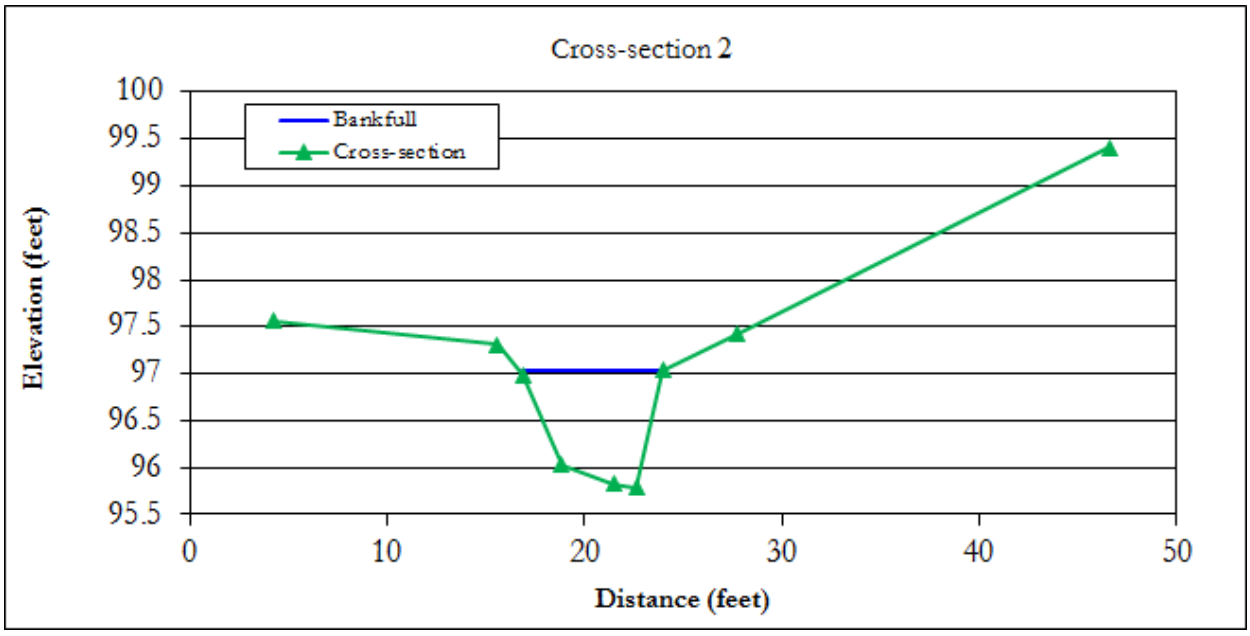
	X1	X2
Area (square feet) =	6.1	6.2
Width (feet) =	8.8	7.3
Mean depth =	0.7	0.9
Max depth =	1.2	1.3
Width/depth ratio =	12.7	8.6
Entrenchment ratio =	2.7	4.9



Longitudinal Profile

3. UT Tuscumbia River
Ecoregion 65, Tennessee

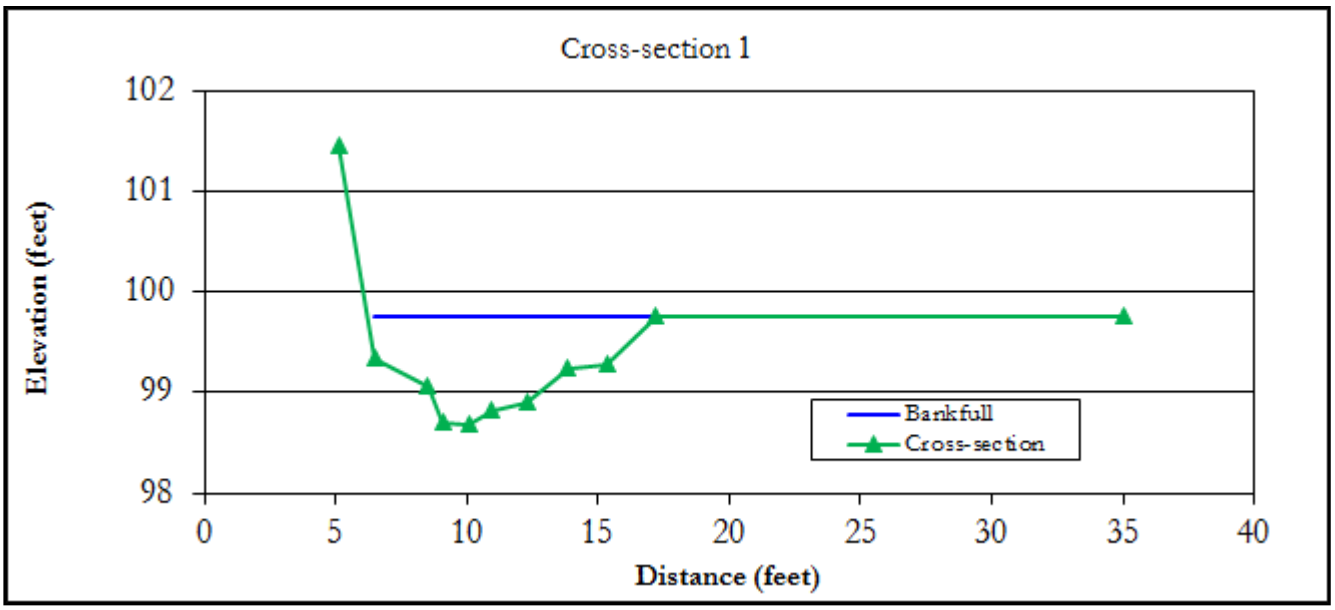




4. UT3 Barnishee Bayou
Ecoregion 74, Tennessee

Latitude: 35.371643
Longitude: -90.026829
Drainage area: 0.13 square miles
Median particle size: sand
Longitudinal slope: 0.00755 feet/foot
Stream classification: C5

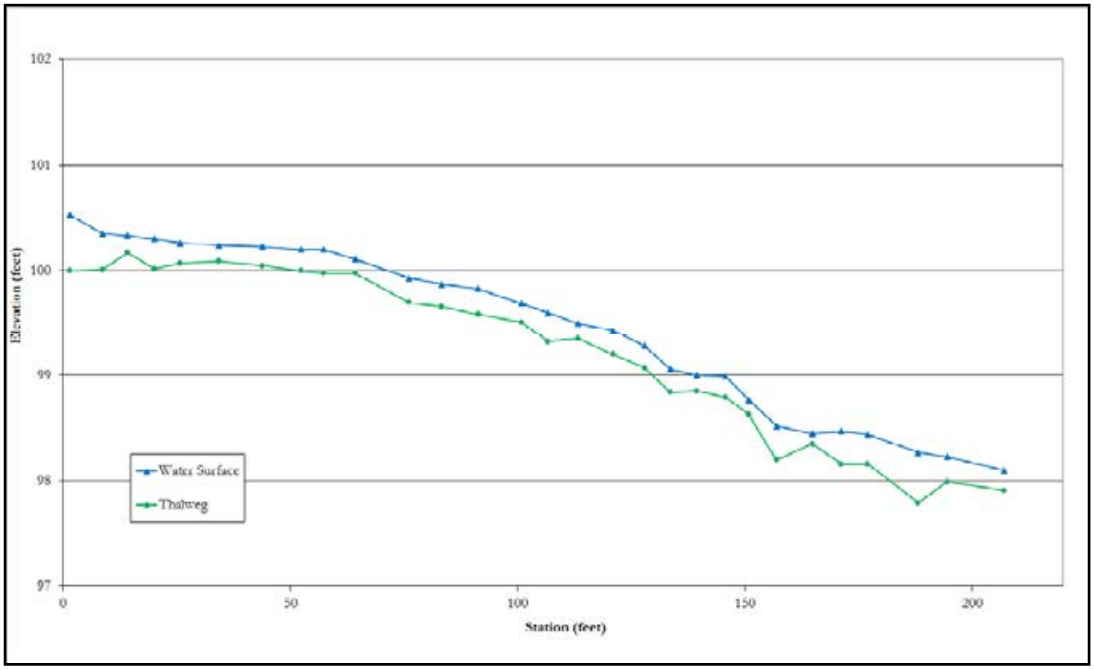
	X1
Area (square feet) =	7.1
Width (feet) =	11.0
Mean depth =	0.6
Max depth =	1.1
Width/depth ratio =	17.0
Entrenchment ratio =	>10.0



5. UT North Fork Cub Creek
Ecoregion 65, Tennessee

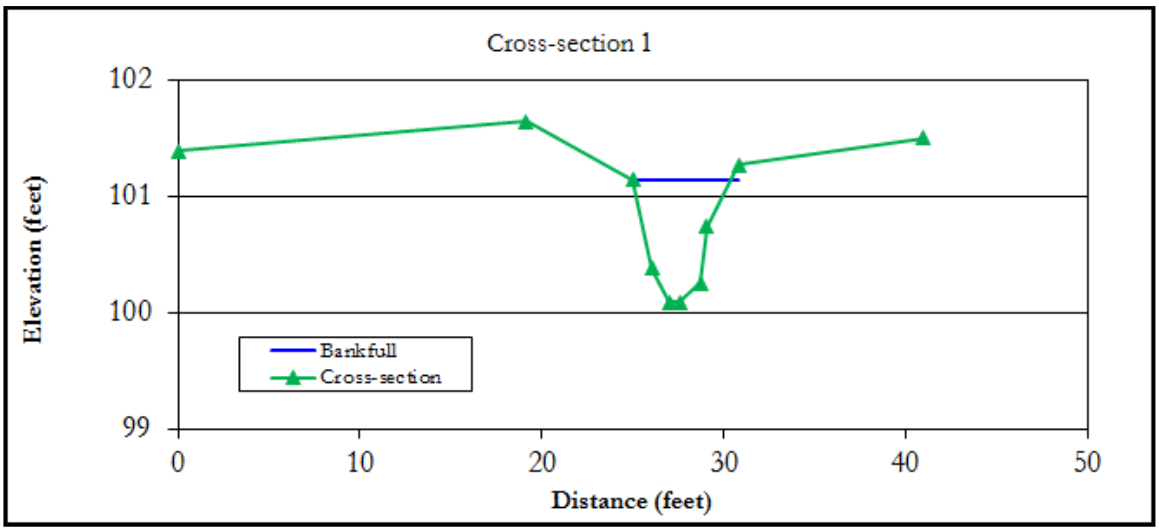
Latitude: 35.785215
Longitude: -88.264681
Drainage area: 0.16 square miles
Median particle size: sand
Longitudinal slope: 0.01164 feet/foot
Stream classification: E5

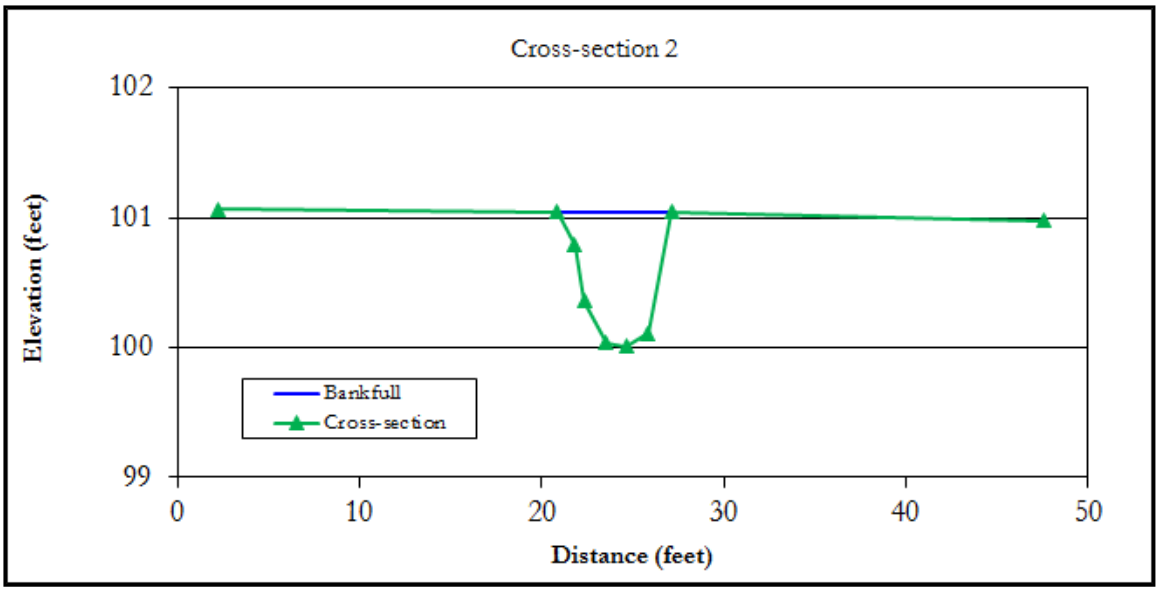
	X1	X2	X3
Area (square feet) =	3.4	4.3	4.9
Width (feet) =	5.4	6.3	6.5
Mean depth =	0.6	0.7	0.8
Max depth =	1.1	1.0	1.1
Width/depth ratio =	8.4	9.1	8.7
Entrenchment ratio =	>10.0	>10.0	>10.0

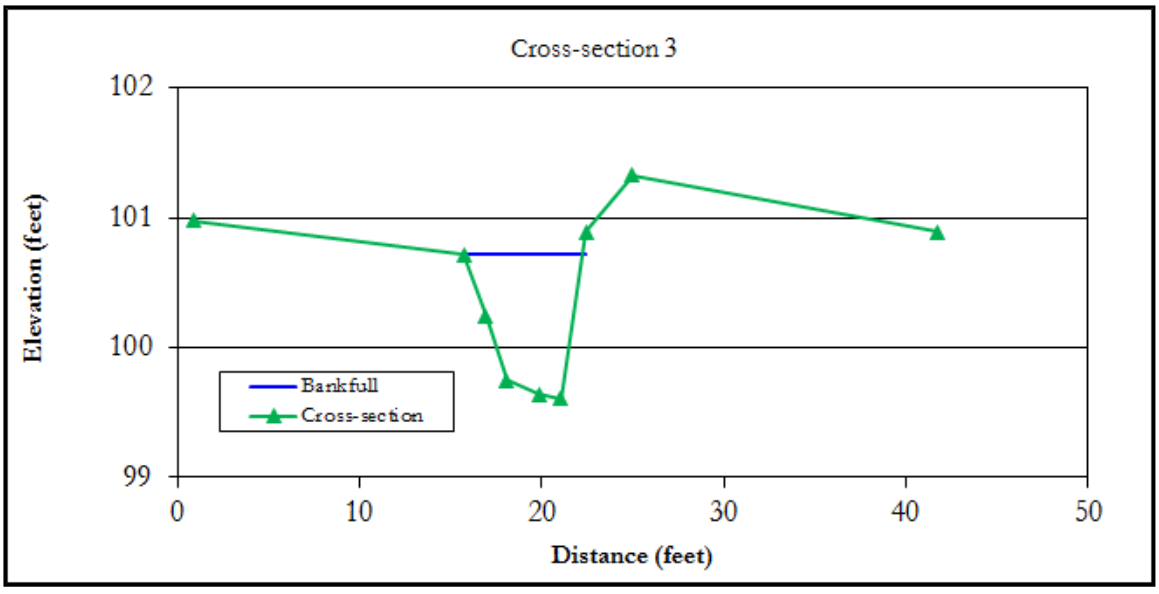


Longitudinal Profile

5. UT North Fork Cub Creek
Ecoregion 65, Tennessee



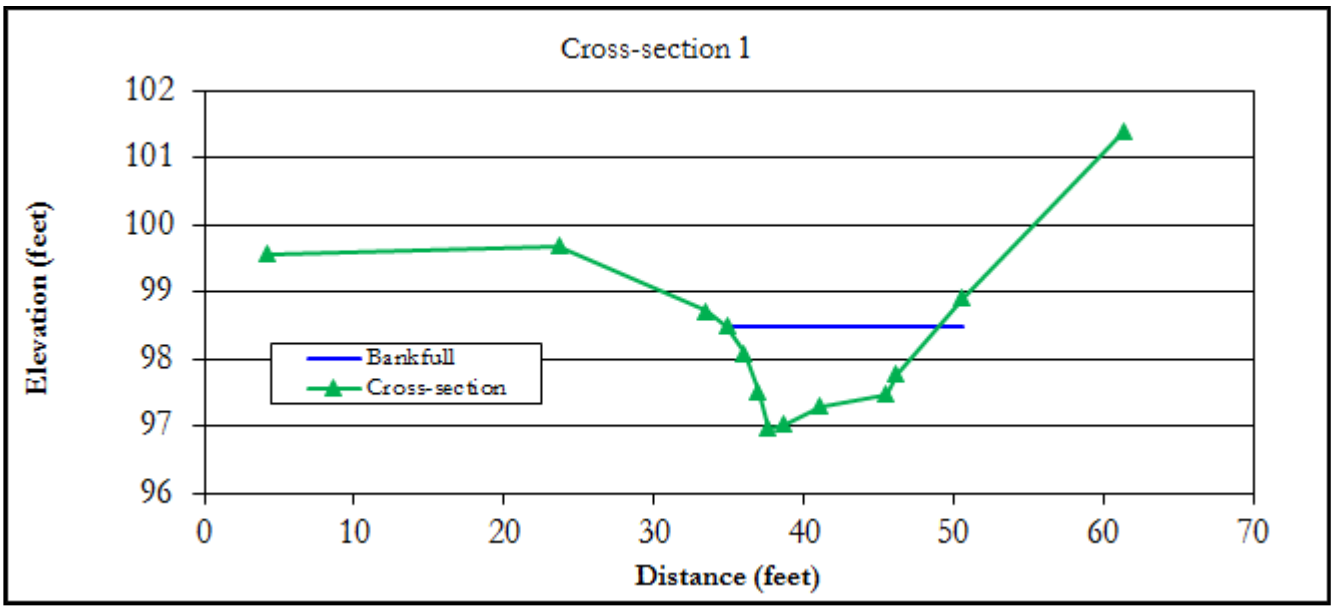




6. UT Poplar Tree Lake
Ecoregion 74, Tennessee

Latitude: 35.314997
Longitude: -90.058076
Drainage area: 0.22 square miles
Median particle size: sand
Longitudinal slope: 0.00495 feet/foot
Stream classification: C5

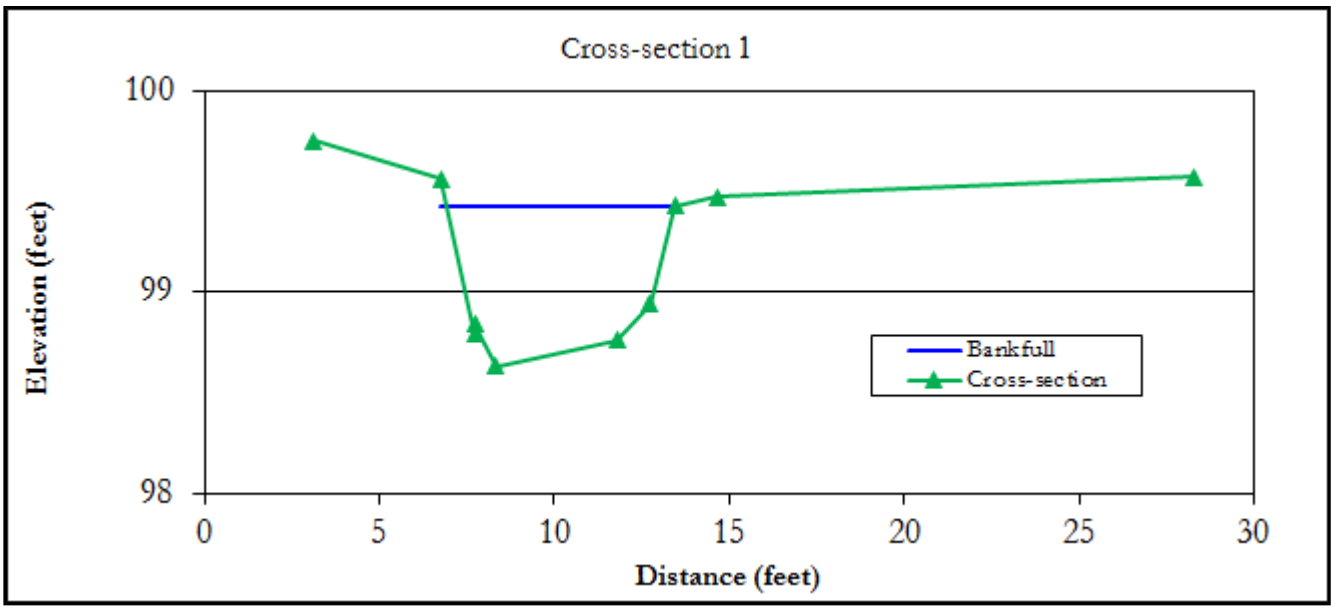
	X1
Area (square feet) =	12.9
Width (feet) =	14.1
Mean depth =	0.9
Max depth =	1.5.
Width/depth ratio =	15.3
Entrenchment ratio =	3.9



7. UT2 Barnishee Bayou
Ecoregion 74, Tennessee

Latitude: 35.365364
Longitude: -90.033687
Drainage area: 0.23 square miles
Median particle size: sand
Longitudinal slope: 0.01040 feet/foot
Stream classification: E5

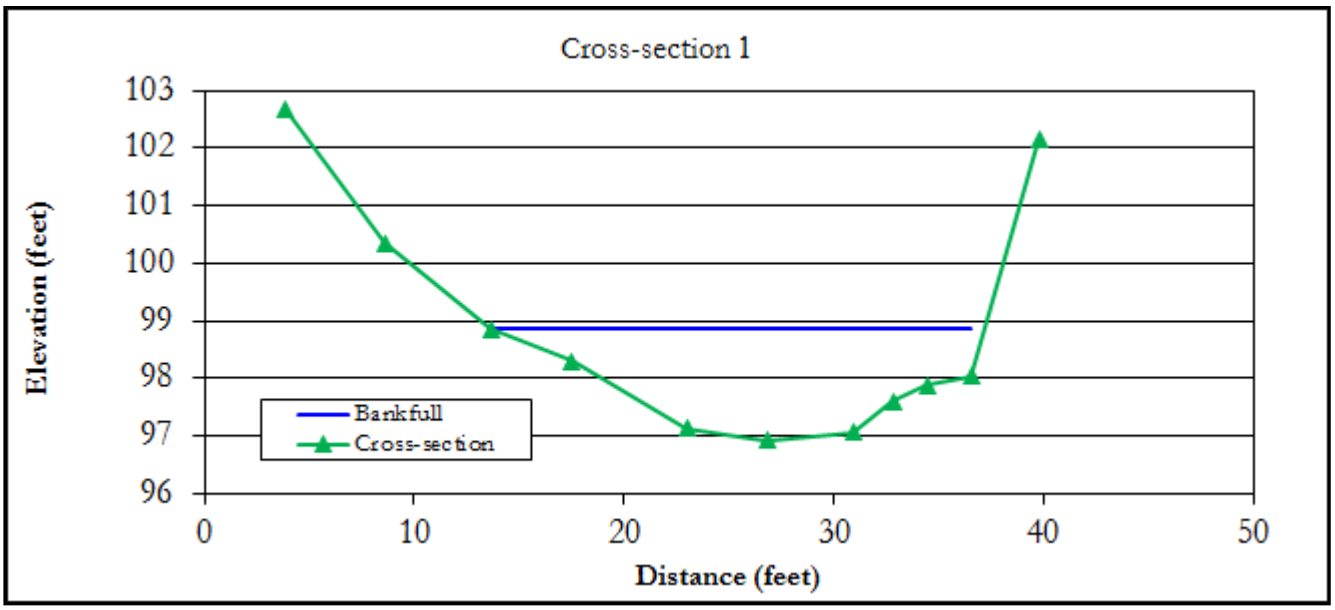
	X1
Area (square feet) =	3.9
Width (feet) =	6.5
Mean depth =	0.6
Max depth =	0.8
Width/depth ratio =	10.8
Entrenchment ratio =	>10.0



8. Barnishee Bayou
Ecoregion 74, Tennessee

Latitude: 35.352193
Longitude: -90.046466
Drainage area: 0.86 square miles
Median particle size: sand
Longitudinal slope: 0.00560 feet/foot
Stream classification: F5

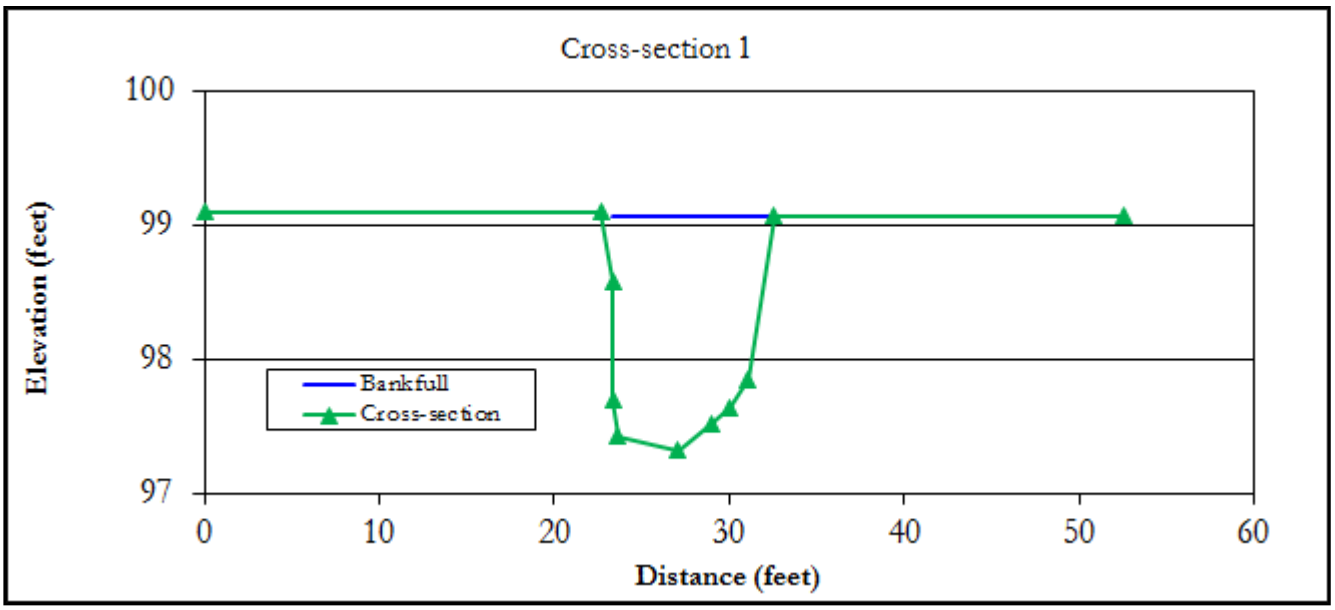
	X1
Area (square feet) =	28.8
Width (feet) =	23.5
Mean depth =	1.2
Max depth =	1.9
Width/depth ratio =	19.2
Entrenchment ratio =	1.3



9. Cypress Creek
Ecoregion 65, Tennessee

Latitude: 35.376401
Longitude: -88.852283
Drainage area: 1.42 square miles
Median particle size: sand
Longitudinal slope: 0.00111 feet/foot
Stream classification: E5

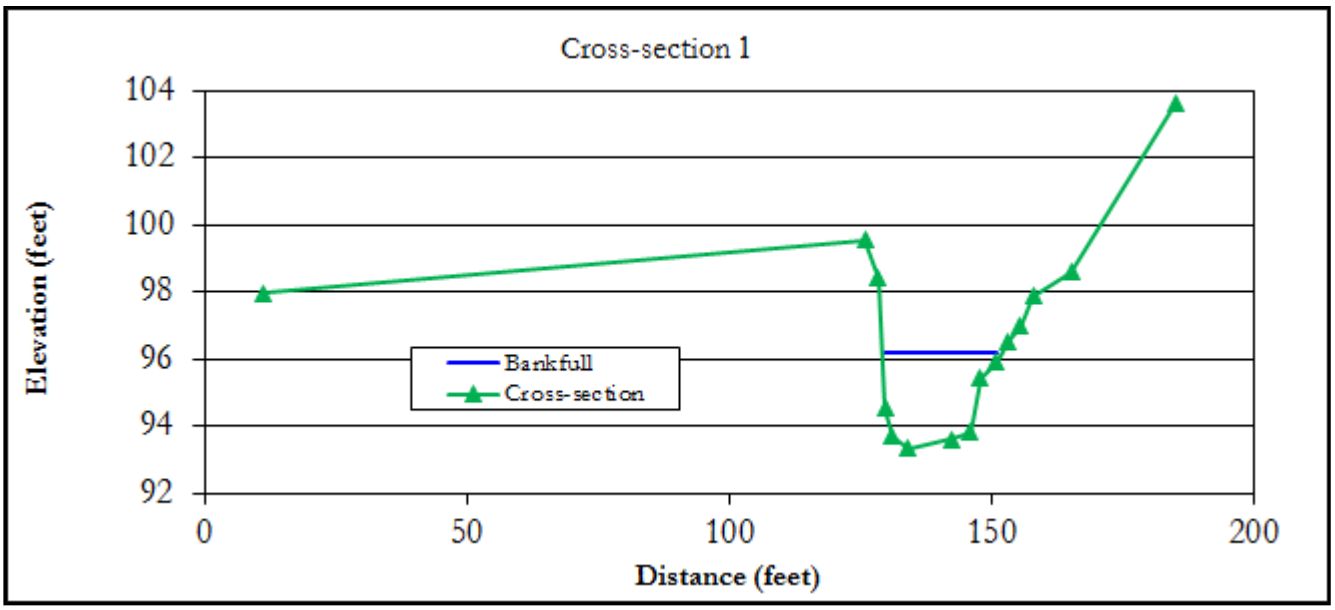
	X1
Area (square feet) =	13.5
Width (feet) =	9.9
Mean depth =	1.4
Max depth =	1.8
Width/depth ratio =	7.2
Entrenchment ratio =	>10.0



10. Scotts Creek
Ecoregion 74, Tennessee

Latitude: 35.267750
Longitude: -89.740489
Drainage area: 2.53 square miles
Median particle size: fine gravel
Longitudinal slope: 0.00188 feet/foot
Stream classification: B4c

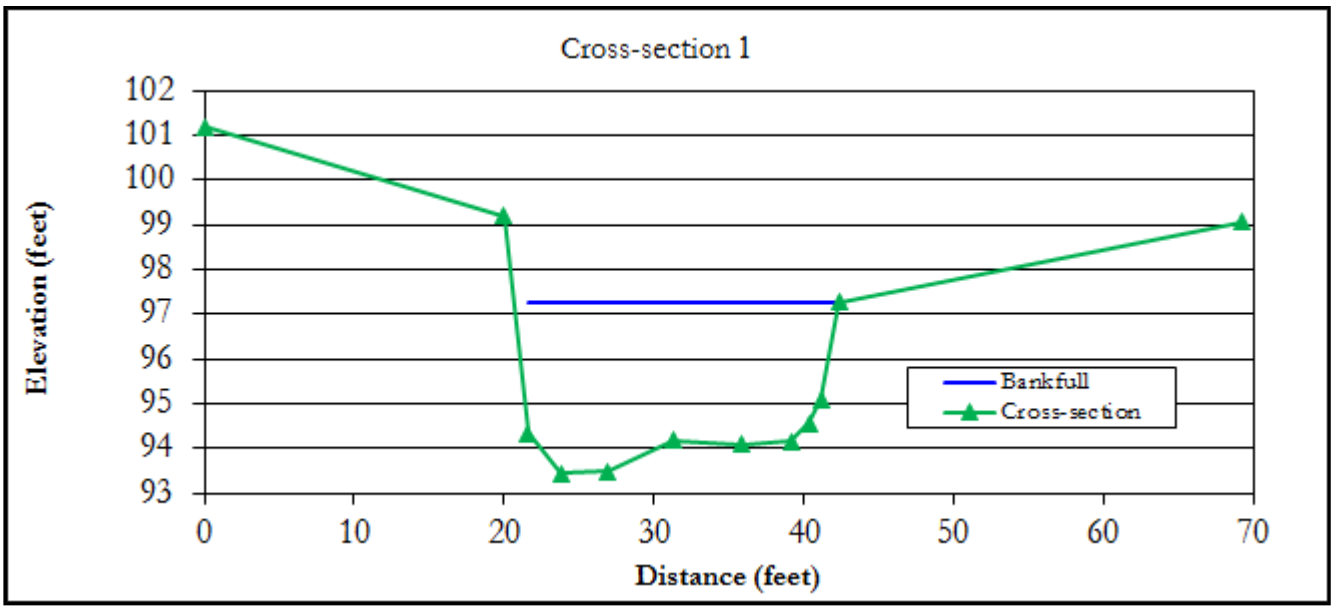
	X1
Area (square feet) =	47.6
Width (feet) =	22.8
Mean depth =	2.1
Max depth =	2.8
Width/depth ratio =	10.9
Entrenchment ratio =	1.7



11. Trace Creek
Ecoregion 65, Tennessee

Latitude: 35.662943
Longitude: -88.668672
Drainage area: 5.57 square miles
Median particle size: sand
Longitudinal slope: 0.00341 feet/foot
Stream classification: E5

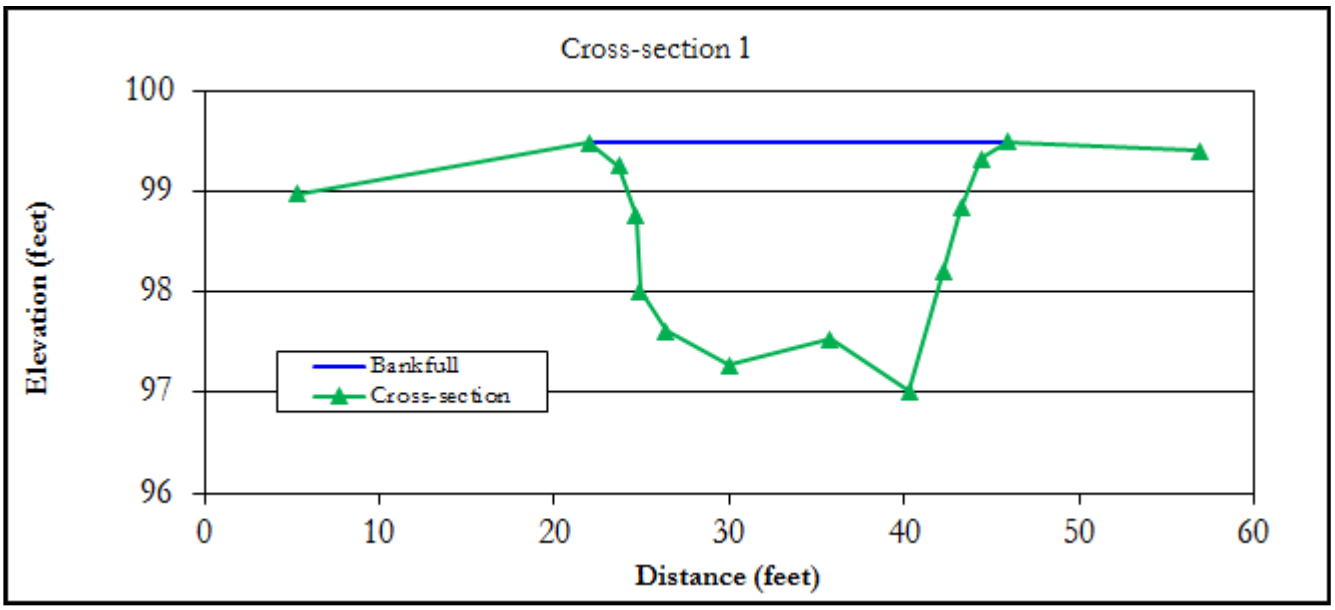
	X1
Area (square feet) =	67.4
Width (feet) =	21.7
Mean depth =	3.1
Max depth =	3.8
Width/depth ratio =	7.0
Entrenchment ratio =	>10.0



12. Marshall Creek
Ecoregion 65, Tennessee

Latitude: 35.160921
Longitude: -89.067608
Drainage area: 6.40 square miles
Median particle size: sand
Longitudinal slope: 0.00111 feet/foot
Stream classification: C5

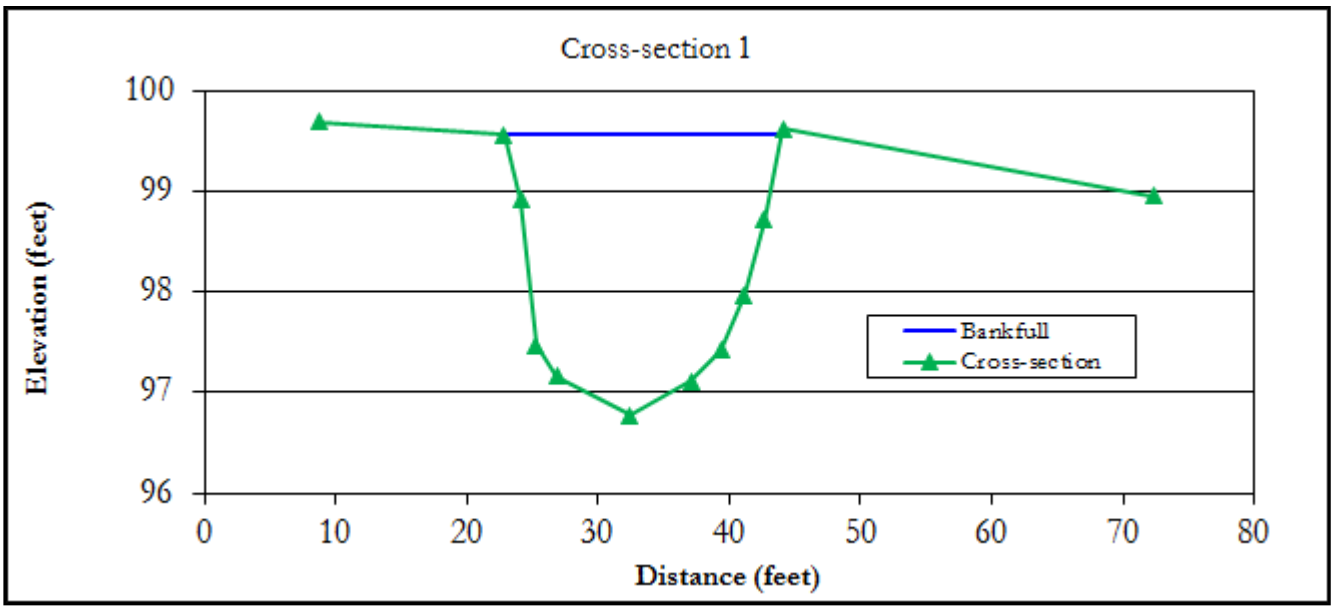
	X1
Area (square feet) =	37.9
Width (feet) =	23.8
Mean depth =	1.6
Max depth =	2.5
Width/depth ratio =	14.9
Entrenchment ratio =	>10.0



13. Spring Creek
Ecoregion 65, Tennessee

Latitude: 35.770129
Longitude: -88.691930
Drainage area: 8.47 square miles
Median particle size: sand
Longitudinal slope: 0.00283 feet/foot
Stream classification: E5

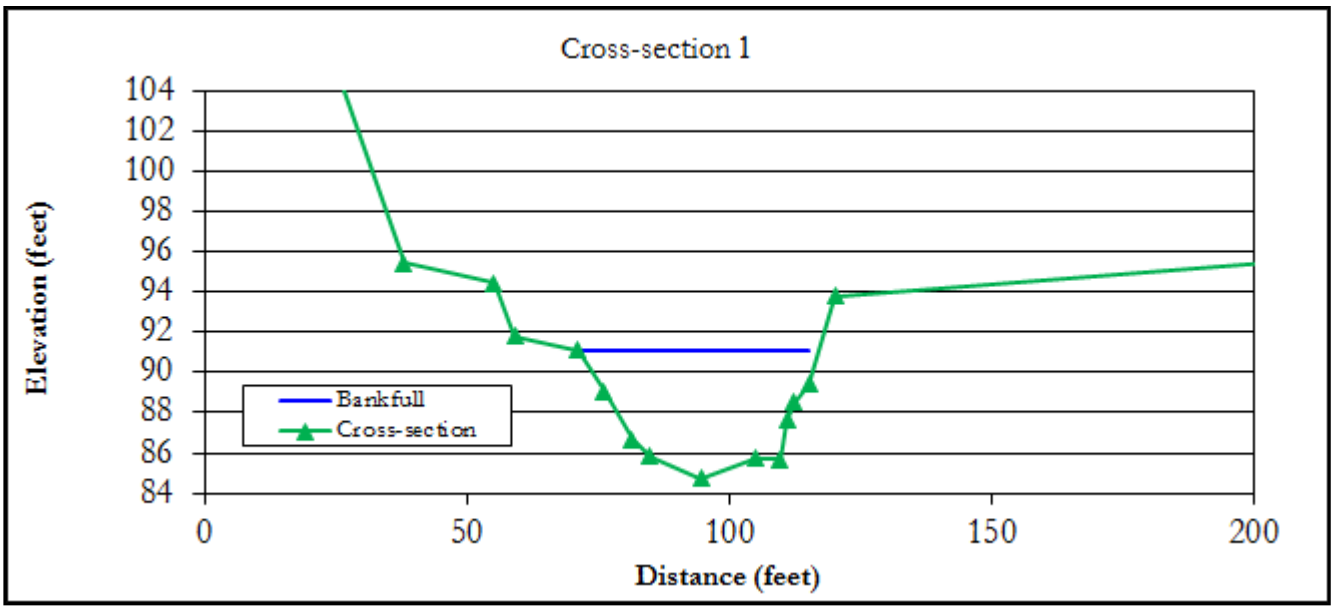
	X1
Area (square feet) =	43.1
Width (feet) =	21.2
Mean depth =	2.0
Max depth =	2.8
Width/depth ratio =	10.4
Entrenchment ratio =	>10.0



14. Harris Creek
Ecoregion 65, Tennessee

Latitude: 35.626065
Longitude: -88.694443
Drainage area: 20.2 square miles
Median particle size: sand
Longitudinal slope: 0.00206 feet/foot
Stream classification: E5

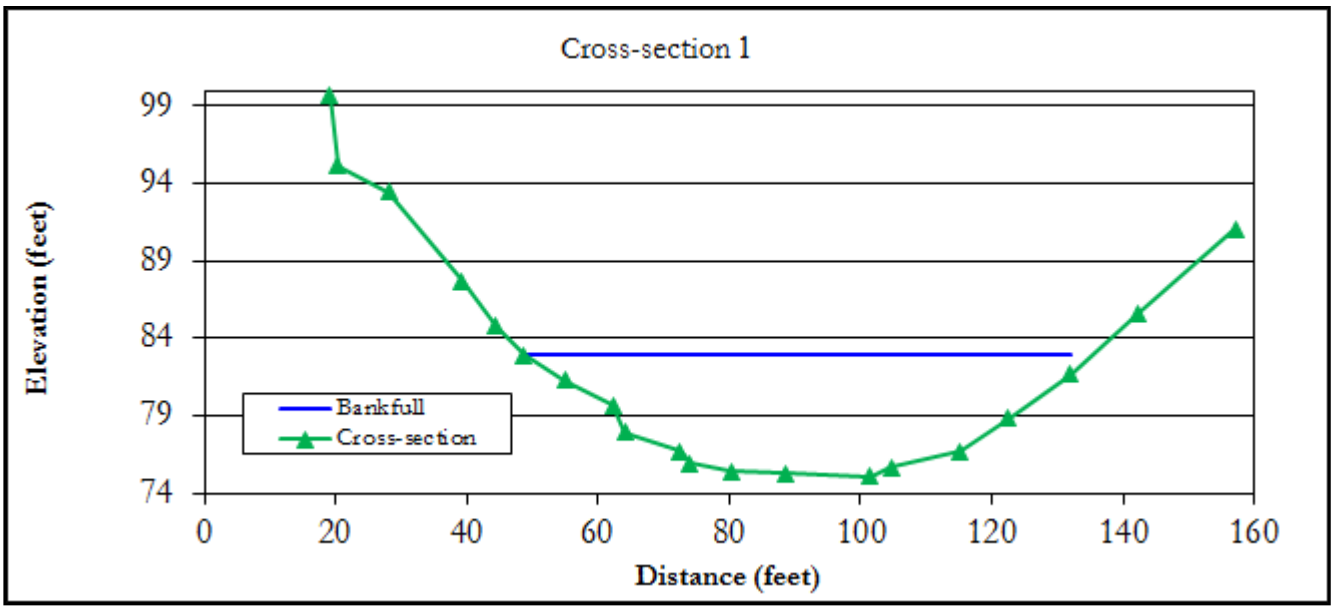
	X1
Area (square feet) =	198.9
Width (feet) =	46.0
Mean depth =	4.3
Max depth =	6.3
Width/depth ratio =	10.7
Entrenchment ratio =	5.8



15. Fletcher Creek
Ecoregion 74, Tennessee

Latitude: 35.169307
Longitude: -89.866455
Drainage area: 30.5 square miles
Median particle size: sand
Longitudinal slope: 0.00383 feet/foot
Stream classification: B5c

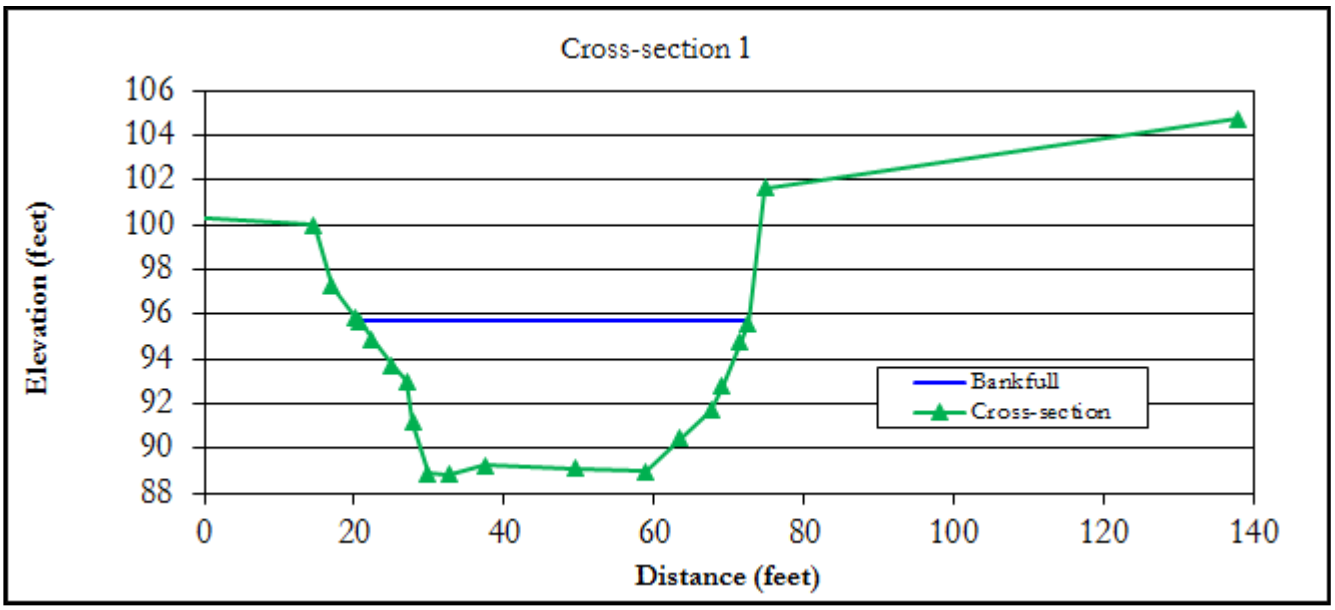
	X1
Area (square feet) =	454.6
Width (feet) =	86.4
Mean depth =	5.3
Max depth =	7.9
Width/depth ratio =	16.4
Entrenchment ratio =	1.4



16. Beech River
Ecoregion 65, Tennessee

Latitude: 35.634167
Longitude: -88.414722
Drainage area: 43.6 square miles
Median particle size: sand
Longitudinal slope: 0.00110 feet/foot
Stream classification: E5

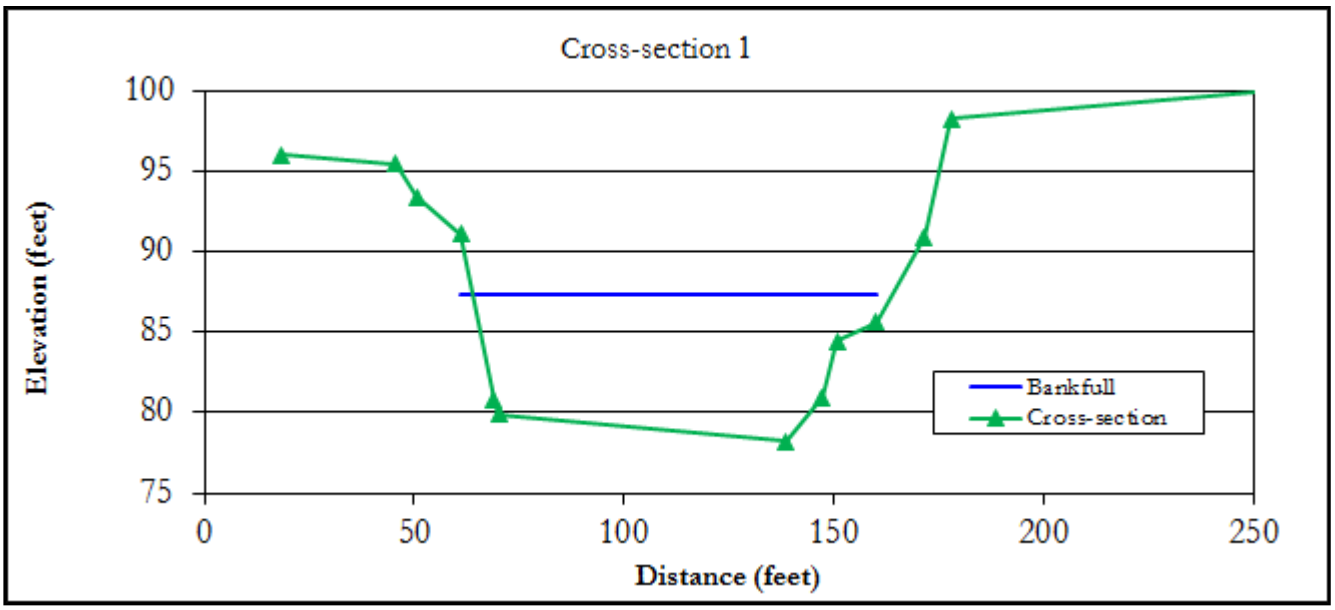
	X1
Area (square feet) =	272.7
Width (feet) =	51.7
Mean depth =	5.3
Max depth =	6.9
Width/depth ratio =	9.8
Entrenchment ratio =	4.0



17. Nonconnah Creek
Ecoregion 74, Tennessee

Latitude: 35.049389
Longitude: -89.818276
Drainage area: 68.2 square miles
Median particle size: sand
Longitudinal slope: 0.00390 feet/foot
Stream classification: B5c

	X1
Area (square feet) =	698.8
Width (feet) =	99.7
Mean depth =	7.0
Max depth =	9.1
Width/depth ratio =	14.2
Entrenchment ratio =	1.7



APPENDIX F

Large Woody Debris Data

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous		
Date	6/16/17		County				Forest Age (yrs)	30 to 50		
Stream Name	False Gap Prong		Phys. Province	66			Latitude (dd)	35.70658		
Reach ID	1		Drainage Area (mi^2)	0.28			Longitude (dd)	-83.38217		
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory						
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	8			Slope (ft/ft)	0.04740		
Stream Classification	Perennial		BKF Mean Depth (ft)	0.7			Bed material	Gravel		
Stream Condition	Reference		Floodprone Width (ft)	20			Rosgen Type	E4a		
Field Notes:										

	SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	1	> 1.0	6	36
Diameter (cm)	10 to 20	1	20 to 30	3	30 to 40	3	40 to 50		>50	1	21
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		10
Type	Bridge	4			Ramp	4	Submersed		Buried		16
Structure	Plain	6	Plain/Int		Intermediate	2	Int/Sticky		Sticky		12
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	5	Secured	2	33
Orientation (deg)	0 to 20	2	20 to 40		40 to 60	1	60 to 80	1	80 to 90	4	29
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous		
Date	6/16/17		County				Forest Age (yrs)	50 to 80		
Stream Name	Catron Branch		Phys. Province	66			Latitude (dd)	35.66377		
Reach ID	2		Drainage Area (mi^2)	0.37			Longitude (dd)	-83.58746		
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory						
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	12			Slope (ft/ft)	0.05050		
Stream Classification	Perennial		BKF Mean Depth (ft)	1			Bed material	Cobble		
Stream Condition	Reference		Floodprone Width (ft)	15			Rosgen Type	B3a		
Field Notes:										

	SCORE										
	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	2	0.6 to 0.8	4	0.8 to 1.0	3	> 1.0	4	48
Diameter (cm)	10 to 20	3	20 to 30	3	30 to 40	3	40 to 50	2	>50	2	36
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	4	38
Type	Bridge	2			Ramp	9	Submersed	2	Buried		37
Structure	Plain	3	Plain/Int	5	Intermediate	5	Int/Sticky		Sticky		28
Stability	Moveable	3	Mov/Int		Intermediate	3	Int/Sec		Secured	7	47
Orientation (deg)	0 to 20	3	20 to 40		40 to 60	1	60 to 80	2	80 to 90	7	49
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	6/16/17		County			Forest Age (yrs)	30 to 50
Stream Name	Bearwallow Branch		Phys. Province	66		Latitude (dd)	35.65227
Reach ID	3		Drainage Area (m^2)	0.42		Longitude (dd)	-83.57473
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	10		Slope (ft/ft)	0.01414
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	25		Rosgen Type	E4
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	3	0.8 to 1.0		> 1.0	4	31
Diameter (cm)	10 to 20	3	20 to 30	2	30 to 40		40 to 50	3	>50		19
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	29
Type	Bridge				Ramp	5	Submersed	3	Buried		27
Structure	Plain		Plain/Int	1	Intermediate	7	Int/Sticky		Sticky		23
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured	6	37
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	1	60 to 80	1	80 to 90	5	33
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	6/17/17		County			Forest Age (yrs)	30 to 50
Stream Name	UT Laurel Creek		Phys. Province	66		Latitude (dd)	35.34519
Reach ID	4		Drainage Area (m^2)	0.42		Longitude (dd)	-84.19332
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	13		Slope (ft/ft)	0.05530
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	20		Rosgen Type	B4a
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0		> 1.0	3	25
Diameter (cm)	10 to 20	4	20 to 30		30 to 40	2	40 to 50		>50	2	20
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		13
Type	Bridge	3			Ramp	4	Submersed		Buried	1	20
Structure	Plain	1	Plain/Int	3	Intermediate	3	Int/Sticky		Sticky	1	21
Stability	Moveable	1	Mov/Int	1	Intermediate	1	Int/Sec		Secured	5	31
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	2	60 to 80		80 to 90	2	21
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine	1	5
Location	Partially high flow		In high flow	1	Partially low flow		Mid low flow		In low flow		2
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec		Secured		3

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	6/16/17		County			Forest Age (yrs)	50 - 80
Stream Name	Mids Branch		Phys. Province	66		Latitude (dd)	35.65779
Reach ID	5		Drainage Area (m^2)	0.69		Longitude (dd)	-83.57955
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	13		Slope (ft/ft)	0.02677
Stream Classification	Perennial		BKF Mean Depth (ft)	1.3		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	60		Rosgen Type	E4b
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	4	0.4 to 0.6		0.6 to 0.8		0.8 to 1.0		> 1.0	3	19
Diameter (cm)	10 to 20	4	20 to 30	1	30 to 40	1	40 to 50		>50	1	14
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	3	25
Type	Bridge	2			Ramp	2	Submersed	3	Buried		20
Structure	Plain	3	Plain/Int		Intermediate	4	Int/Sticky		Sticky		15
Stability	Moveable	1	Mov/Int		Intermediate		Int/Sec		Secured	6	31
Orientation (deg)	0 to 20		20 to 40		40 to 60	2	60 to 80		80 to 90	5	31
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	6/16/17		County			Forest Age (yrs)	50 to 80
Stream Name	Bearwallow Creek		Phys. Province	66		Latitude (dd)	36.15820
Reach ID	6		Drainage Area (m^2)	0.8		Longitude (dd)	-82.10341
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	14		Slope (ft/ft)	0.05760
Stream Classification	Perennial		BKF Mean Depth (ft)	1.1		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	25		Rosgen Type	B4a
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	3	0.6 to 0.8	5	0.8 to 1.0	4	> 1.0	2	48
Diameter (cm)	10 to 20	5	20 to 30	3	30 to 40	2	40 to 50	5	>50		37
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	6	**Zone 1** (Below WS)	4	55
Type	Bridge	2			Ramp	9	Submersed	3	Buried	1	46
Structure	Plain	3	Plain/Int	4	Intermediate	5	Int/Sticky	3	Sticky		38
Stability	Moveable	2	Mov/Int	1	Intermediate	3	Int/Sec	6	Secured	3	52
Orientation (deg)	0 to 20	4	20 to 40	2	40 to 60	4	60 to 80	4	80 to 90	1	41
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	1	In low flow		4
Stability	Moveable		Mov/Int		Intermediate		Int/Sec	1	Secured		4

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/18/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Sill Branch		Phys. Province	66		Latitude (dd)	36.12788	
Reach ID	7		Drainage Area (mi^2)	1.3		Longitude (dd)	-82.53314	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	15		Slope (ft/ft)	0.06040	
Stream Classification	Perennial		BKF Mean Depth (ft)	1		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	20		Rosgen Type	B3a	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0	2	20
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	2	40 to 50		>50		12
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	23
Type	Bridge	2			Ramp	3	Submersed	1	Buried		15
Structure	Plain	1	Plain/Int	2	Intermediate	2	Int/Sticky	1	Sticky		15
Stability	Moveable		Mov/Int	2	Intermediate	2	Int/Sec	2	Secured		18
Orientation (deg)	0 to 20		20 to 40		40 to 60	2	60 to 80	1	80 to 90	3	25
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80	1	80 to 100		7
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100	1	8
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine	1	Fine		7
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow	1	In low flow		7
Stability	Moveable		Mov/Int		Intermediate	2	Int/Sec		Secured		6
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/16/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Laurel Creek		Phys. Province	66		Latitude (dd)	35.34526	
Reach ID	8		Drainage Area (mi^2)	1.3		Longitude (dd)	-84.19428	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	18		Slope (ft/ft)	0.01700	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.2		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	80		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8	1	0.8 to 1.0	1	> 1.0	2	17
Diameter (cm)	10 to 20	2	20 to 30		30 to 40	1	40 to 50		>50	1	10
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		9
Type	Bridge	2			Ramp	2	Submersed		Buried		8
Structure	Plain	1	Plain/Int	3	Intermediate		Int/Sticky		Sticky		7
Stability	Moveable		Mov/Int	1	Intermediate	1	Int/Sec	1	Secured	1	14
Orientation (deg)	0 to 20	2	20 to 40		40 to 60		60 to 80		80 to 90	2	12
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine	1	5
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	1	5
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	6/17/17		County		Forest Age (yrs)	30 to 50	
Stream Name	UT Little Stony Creek		Phys. Province	66	Latitude (dd)	36.28384	
Reach ID	9		Drainage Area (mi^2)	1.6	Longitude (dd)	82.06792	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	17	Slope (ft/ft)	0.04156	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.2	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	60	Rosgen Type	C3a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	5	0.8 to 1.0	3	> 1.0	1	34
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	3	40 to 50	1	>50	2	29
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	1	34
Type	Bridge	2			Ramp	5	Submersed	2	Buried	1	30
Structure	Plain		Plain/Int	2	Intermediate	2	Int/Sticky	4	Sticky	2	36
Stability	Moveable		Mov/Int	3	Intermediate	2	Int/Sec	2	Secured	3	35
Orientation (deg)	0 to 20	1	20 to 40	4	40 to 60	1	60 to 80	3	80 to 90	1	29
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	6/18/17		County		Forest Age (yrs)	80 to 100	
Stream Name	Little Slickrock Creek		Phys. Province	66	Latitude (dd)	35.44846	
Reach ID	10		Drainage Area (mi^2)	2	Longitude (dd)	-83.98223	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Ash, Birch, Hickory			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23	Slope (ft/ft)	0.03220	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.3	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	60	Rosgen Type	C4b	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	5	0.8 to 1.0	4	> 1.0	4	53
Diameter (cm)	10 to 20		20 to 30	3	30 to 40	3	40 to 50	5	>50	3	50
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	3	50
Type	Bridge	1			Ramp	8	Submersed	5	Buried		45
Structure	Plain	2	Plain/Int	2	Intermediate	3	Int/Sticky	4	Sticky	3	46
Stability	Moveable		Mov/Int	2	Intermediate	3	Int/Sec	5	Secured	4	53
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	6	60 to 80	3	80 to 90	4	52
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40	1	40 to 60		60 to 80	1	80 to 100	2	16
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	2	60 to 80		80 to 100	2	16
Structure	Coarse	1	Coarse/Int	1	Intermediate	2	Int/Fine		Fine		9
Location	Partially high flow	1	In high flow		Partially low flow	1	Mid low flow	2	In low flow		12
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured	2	17

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/17/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Little Stony Creek		Phys. Province	66		Latitude (dd)	36.28646	
Reach ID	11		Drainage Area (mi^2)	2.3		Longitude (dd)	-82.06631	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	28		Slope (ft/ft)	0.05175	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.1		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	60		Rosgen Type	B3a	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0		> 1.0	1	16
Diameter (cm)	10 to 20	4	20 to 30	2	30 to 40	1	40 to 50		>50		11
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		19
Type	Bridge	1			Ramp	6	Submersed		Buried		19
Structure	Plain	5	Plain/Int	2	Intermediate		Int/Sticky		Sticky		9
Stability	Moveable	3	Mov/Int	3	Intermediate		Int/Sec	1	Secured		13
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	2	60 to 80	2	80 to 90	1	22
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Height (% of BKF Depth)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int	1	Intermediate		Int/Sec		Secured		2
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/17/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Lower Higgins Creek		Phys. Province	66		Latitude (dd)	36.08634	
Reach ID	12		Drainage Area (mi^2)	3.2		Longitude (dd)	-82.52253	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	33		Slope (ft/ft)	0.04820	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.4		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	40		Rosgen Type	B3a	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8	4	0.8 to 1.0	2	> 1.0	1	29
Diameter (cm)	10 to 20		20 to 30	1	30 to 40	3	40 to 50	4	>50	2	37
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	29
Type	Bridge				Ramp	7	Submersed	3	Buried		33
Structure	Plain	1	Plain/Int	2	Intermediate	3	Int/Sticky	2	Sticky	1	27
Stability	Moveable	1	Mov/Int	2	Intermediate	4	Int/Sec	1	Secured	2	31
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	5	60 to 80	1	80 to 90	3	36
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	6/18/17	County			Forest Age (yrs)	80 to 100	
Stream Name	Slickrock Creek	Phys. Province	66		Latitude (dd)	35.43155	
Reach ID	13	Drainage Area (mi^2)	9		Longitude (dd)	-83.99925	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Ash, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	47		Slope (ft/ft)	0.01960	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.9		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	120		Rosgen Type	B3c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	3	0.6 to 0.8	4	0.8 to 1.0	7	> 1.0	5	71
Diameter (cm)	10 to 20		20 to 30	4	30 to 40	5	40 to 50	4	>50	6	69
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	9	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)	3	64
Type	Bridge	1			Ramp	7	Submersed	7	Buried	4	70
Structure	Plain	3	Plain/Int	2	Intermediate	5	Int/Sticky	4	Sticky	5	63
Stability	Moveable		Mov/Int		Intermediate	3	Int/Sec	7	Secured	9	82
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60	5	60 to 80	4	80 to 90	6	67
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	2	60 to 80	2	80 to 100	1	19
Height (% of BKF Depth)	0 to 20		20 to 40	1	40 to 60	1	60 to 80	1	80 to 100	2	19
Structure	Coarse	1	Coarse/Int	2	Intermediate		Int/Fine	2	Fine		13
Location	Partially high flow		In high flow	2	Partially low flow		Mid low flow		In low flow	3	19
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured	3	22

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	6/18/17	County	Carter		Forest Age (yrs)	30 to 50	
Stream Name	Clark Creek	Phys. Province	66		Latitude (dd)	36.14786	
Reach ID	14	Drainage Area (mi^2)	9.5		Longitude (dd)	-82.52840	
Watershed Name		Dominant Species	Rhododendron, Ash, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	39		Slope (ft/ft)	0.01676	
Stream Classification	Perennial	BKF Mean Depth (ft)	2		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	100		Rosgen Type	C3	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	3	0.6 to 0.8	3	0.8 to 1.0	7	> 1.0	2	53
Diameter (cm)	10 to 20		20 to 30		30 to 40	7	40 to 50	6	>50	2	55
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	6	**Zone 1** (Below WS)	3	57
Type	Bridge				Ramp	12	Submersed	3	Buried		48
Structure	Plain		Plain/Int	4	Intermediate	6	Int/Sticky	5	Sticky		46
Stability	Moveable		Mov/Int	4	Intermediate	5	Int/Sec	4	Secured	2	49
Orientation (deg)	0 to 20		20 to 40	2	40 to 60	3	60 to 80	4	80 to 90	6	59
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100	1	9
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100	1	9
Structure	Coarse		Coarse/Int		Intermediate	2	Int/Fine		Fine		6
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	2	In low flow		8
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured		7

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous			
Date	6/17/17		County				Forest Age (yrs)	30 to 50			
Stream Name	Doe River		Phys. Province	66			Latitude (dd)	36.15732			
Reach ID	15		Drainage Area (mi^2)	10			Longitude (dd)	82.10060			
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine							
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	40			Slope (ft/ft)	0.01514			
Stream Classification	Perennial		BKF Mean Depth (ft)	2.2			Bed material	Cobble			
Stream Condition	Reference		Floodprone Width (ft)	125			Rosgen Type	C3			
Field Notes:											

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		15
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	2	40 to 50	1	>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	18
Type	Bridge				Ramp	4	Submersed	2	Buried	1	25
Structure	Plain	3	Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		13
Stability	Moveable	1	Mov/Int	2	Intermediate	2	Int/Sec	1	Secured	1	20
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	2	60 to 80	3	80 to 90	1	25
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous			
Date	6/17/17		County				Forest Age (yrs)	30 to 50			
Stream Name	Laurel Fork		Phys. Province	66			Latitude (dd)	36.25586			
Reach ID	16		Drainage Area (mi^2)	17.4			Longitude (dd)	-82.10988			
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine							
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	60			Slope (ft/ft)	0.00470			
Stream Classification	Perennial		BKF Mean Depth (ft)	2.1			Bed material	Gravel			
Stream Condition	Reference		Floodprone Width (ft)	100			Rosgen Type	B4c			
Field Notes:											

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	5	0.6 to 0.8	4	0.8 to 1.0	1	> 1.0		29
Diameter (cm)	10 to 20	8	20 to 30	3	30 to 40	2	40 to 50		>50		20
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	5	48
Type	Bridge				Ramp	4	Submersed	5	Buried	4	52
Structure	Plain	4	Plain/Int	4	Intermediate	5	Int/Sticky		Sticky		27
Stability	Moveable		Mov/Int	3	Intermediate	3	Int/Sec	3	Secured	4	47
Orientation (deg)	0 to 20	1	20 to 40	3	40 to 60	2	60 to 80	4	80 to 90	3	44
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/16/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Porters Creek		Phys. Province	66		Latitude (dd)	35.70623	
Reach ID	17		Drainage Area (mi^2)	17.7		Longitude (dd)	-83.38326	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	66		Slope (ft/ft)	0.03040	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.6		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	150		Rosgen Type	B3	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	4	0.6 to 0.8		0.8 to 1.0		> 1.0		11
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40		40 to 50	1	>50	2	19
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	1	23
Type	Bridge				Ramp	7	Submersed		Buried		21
Structure	Plain	3	Plain/Int	2	Intermediate	1	Int/Sticky	1	Sticky		14
Stability	Moveable	7	Mov/Int		Intermediate		Int/Sec		Secured		7
Orientation (deg)	0 to 20	4	20 to 40	1	40 to 60		60 to 80	2	80 to 90		14
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 1C

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/16/17		County	Sevier		Forest Age (yrs)	30 to 50	
Stream Name	Middle Prong Pigeon		Phys. Province	66		Latitude (dd)	35.70728	
Reach ID	18		Drainage Area (mi^2)	19.5		Longitude (dd)	-83.38005	
Watershed Name	Pigeon		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	53		Slope (ft/ft)	0.04170	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.9		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	120		Rosgen Type	B3a	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	6	0.4 to 0.6	7	0.6 to 0.8		0.8 to 1.0		> 1.0		20
Diameter (cm)	10 to 20	5	20 to 30	5	30 to 40		40 to 50	3	>50		27
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)		29
Type	Bridge				Ramp	11	Submersed		Buried		33
Structure	Plain	8	Plain/Int	2	Intermediate	1	Int/Sticky	2	Sticky		23
Stability	Moveable	5	Mov/Int	4	Intermediate	4	Int/Sec		Secured		25
Orientation (deg)	0 to 20	4	20 to 40	2	40 to 60	2	60 to 80	1	80 to 90	4	38
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	1	In low flow		4
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec		Secured		3

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/16/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Little River		Phys. Province	66		Latitude (dd)	35.65277	
Reach ID	19		Drainage Area (mi^2)	31.3		Longitude (dd)	-83.57321	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	86		Slope (ft/ft)	0.02900	
Stream Classification	Perennial		BKF Mean Depth (ft)	3		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	130		Rosgen Type	B3	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	4	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0	1	22
Diameter (cm)	10 to 20	2	20 to 30		30 to 40	4	40 to 50	2	>50	1	27
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)		22
Type	Bridge				Ramp	8	Submersed	1	Buried		28
Structure	Plain	7	Plain/Int	1	Intermediate		Int/Sticky		Sticky	1	14
Stability	Moveable	7	Mov/Int		Intermediate	2	Int/Sec		Secured		13
Orientation (deg)	0 to 20	4	20 to 40	1	40 to 60	1	60 to 80	2	80 to 90	1	22
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100	1	8
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100	1	9
Structure	Coarse	1	Coarse/Int		Intermediate	1	Int/Fine		Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	2	10
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	2	10
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	6/17/17		County			Forest Age (yrs)	50 to 80	
Stream Name	Citico Creek		Phys. Province	66		Latitude (dd)	35.50661	
Reach ID	20		Drainage Area (mi^2)	61		Longitude (dd)	-84.10628	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	94		Slope (ft/ft)	0.00251	
Stream Classification	Perennial		BKF Mean Depth (ft)	3.6		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	150		Rosgen Type	B4c	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		16
Diameter (cm)	10 to 20	3	20 to 30	2	30 to 40		40 to 50	1	>50	2	21
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	1	24
Type	Bridge				Ramp	7	Submersed	1	Buried		25
Structure	Plain	5	Plain/Int	1	Intermediate	2	Int/Sticky		Sticky		13
Stability	Moveable	7	Mov/Int		Intermediate		Int/Sec		Secured	1	12
Orientation (deg)	0 to 20	3	20 to 40		40 to 60	5	60 to 80		80 to 90		18
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Forks Creek (3)	Phys. Province	67		Latitude (dd)	35.93751	
Reach ID	1	Drainage Area (mi^2)	0.04		Longitude (dd)	-83.84819	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	7.6		Slope (ft/ft)	0.00700	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.6		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	80		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		9
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40		40 to 50		>50		4
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		11
Type	Bridge				Ramp	1	Submersed	2	Buried		11
Structure	Plain		Plain/Int	1	Intermediate	2	Int/Sticky		Sticky		8
Stability	Moveable		Mov/Int	1	Intermediate	1	Int/Sec	1	Secured		9
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	1	60 to 80	1	80 to 90		9
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Ijams Creek	Phys. Province	67		Latitude (dd)	35.95655	
Reach ID	2	Drainage Area (mi^2)	0.05		Longitude (dd)	-83.86869	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	8		Slope (ft/ft)	0.00850	
Stream Classification	Perennial	BKF Mean Depth (ft)	0.2		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	15		Rosgen Type	B5c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0		> 1.0		9
Diameter (cm)	10 to 20	1	20 to 30	1	30 to 40	2	40 to 50		>50		9
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)		13
Type	Bridge				Ramp	4	Submersed		Buried		12
Structure	Plain		Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		10
Stability	Moveable		Mov/Int	2	Intermediate	2	Int/Sec		Secured		10
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	1	60 to 80	1	80 to 90		10
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	11/13/17		County			Forest Age (yrs)	30 to 50
Stream Name	Forks Creek (2)		Phys. Province	67		Latitude (dd)	35.94969
Reach ID	3		Drainage Area (mi^2)	0.29		Longitude (dd)	-83.85373
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Birch, Beech			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	11		Slope (ft/ft)	0.00410
Stream Classification	Perennial		BKF Mean Depth (ft)	0.7		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	60		Rosgen Type	C4
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		15
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40		40 to 50	2	>50	1	18
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	2	24
Type	Bridge	1			Ramp	4	Submersed	2	Buried		21
Structure	Plain	2	Plain/Int	1	Intermediate	3	Int/Sticky	1	Sticky		17
Stability	Moveable		Mov/Int		Intermediate	5	Int/Sec		Secured	2	25
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	2	60 to 80	4	80 to 90		24
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous
Date	11/13/17		County			Forest Age (yrs)	30 to 50
Stream Name	UT White Creek		Phys. Province	67		Latitude (dd)	36.34901
Reach ID	4		Drainage Area (mi^2)	0.33		Longitude (dd)	-83.89973
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Birch, Beech			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	10		Slope (ft/ft)	0.02530
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	50		Rosgen Type	E4b
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0		> 1.0		8
Diameter (cm)	10 to 20	4	20 to 30		30 to 40		40 to 50		>50		4
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		14
Type	Bridge	1			Ramp	2	Submersed	1	Buried		11
Structure	Plain		Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		10
Stability	Moveable		Mov/Int	2	Intermediate	2	Int/Sec		Secured		10
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	1	60 to 80	1	80 to 90		10
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Forks Creek (1)	Phys. Province	67		Latitude (dd)	35.93692	
Reach ID	5	Drainage Area (mi^2)	0.35		Longitude (dd)	-83.84955	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	16		Slope (ft/ft)	0.01210	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.3		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	50		Rosgen Type	C3	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8		0.8 to 1.0		> 1.0		6
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40		40 to 50		>50		5
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	2	18
Type	Bridge	1			Ramp	1	Submersed	2	Buried		12
Structure	Plain	2	Plain/Int	1	Intermediate	1	Int/Sticky		Sticky		7
Stability	Moveable		Mov/Int		Intermediate	3	Int/Sec		Secured	1	14
Orientation (deg)	0 to 20		20 to 40		40 to 60	4	60 to 80		80 to 90		12
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Big Ridge Creek	Phys. Province	67		Latitude (dd)	36.24618	
Reach ID	6	Drainage Area (mi^2)	0.38		Longitude (dd)	-83.92184	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	11		Slope (ft/ft)	0.01190	
Stream Classification	Perennial	BKF Mean Depth (ft)	0.8		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	60		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0		> 1.0	1	15
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40	2	40 to 50		>50		11
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		20
Type	Bridge				Ramp	5	Submersed	1	Buried		19
Structure	Plain	2	Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		12
Stability	Moveable	1	Mov/Int	4	Intermediate	1	Int/Sec		Secured		12
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	3	60 to 80	1	80 to 90	1	20
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/13/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Big Spring Creek		Phys. Province	67		Latitude (dd)	36.30358	
Reach ID	7		Drainage Area (mi^2)	0.79		Longitude (dd)	-83.94490	
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Beech				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	8		Slope (ft/ft)	0.03310	
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	50		Rosgen Type	E4b	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8	2	0.8 to 1.0	3	> 1.0	1	29
Diameter (cm)	10 to 20	5	20 to 30	3	30 to 40	2	40 to 50		>50		17
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	31
Type	Bridge	1			Ramp	6	Submersed	3	Buried		31
Structure	Plain	4	Plain/Int	2	Intermediate	3	Int/Sticky	1	Sticky		21
Stability	Moveable	2	Mov/Int	2	Intermediate	4	Int/Sec	1	Secured	1	27
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	3	60 to 80	2	80 to 90	4	39
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int	1	Intermediate		Int/Sec		Secured		2
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/13/17		County			Forest Age (yrs)	30 to 50	
Stream Name	White Creek		Phys. Province	67		Latitude (dd)	36.34810	
Reach ID	8		Drainage Area (mi^2)	0.9		Longitude (dd)	-83.90160	
Watershed Name			Dominant Species	Oak, Maple, Beech				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	16		Slope (ft/ft)	0.01870	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.2		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	50		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	2	0.8 to 1.0	1	> 1.0	1	20
Diameter (cm)	10 to 20	3	20 to 30		30 to 40	2	40 to 50	1	>50	1	18
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	22
Type	Bridge	1			Ramp	5	Submersed	1	Buried		20
Structure	Plain	1	Plain/Int	2	Intermediate	4	Int/Sticky		Sticky		17
Stability	Moveable	1	Mov/Int	4	Intermediate	2	Int/Sec		Secured		15
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	1	60 to 80	3	80 to 90	2	26
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	15 to 30	
Stream Name	Mill Creek	Phys. Province	67		Latitude (dd)	35.98833	
Reach ID	9	Drainage Area (mi^2)	1.1		Longitude (dd)	-84.28888	
Watershed Name		Dominant Species	Oak, Maple, Birch				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23	Slope (ft/ft)	0.00390	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.7	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	70	Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8	2	0.8 to 1.0		> 1.0	1	11
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40		40 to 50		>50		4
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		7
Type	Bridge	1			Ramp	2	Submersed		Buried		7
Structure	Plain	1	Plain/Int	1	Intermediate	1	Int/Sticky		Sticky		6
Stability	Moveable	1	Mov/Int	1	Intermediate	1	Int/Sec		Secured		6
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	1	60 to 80	1	80 to 90		9
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Toll Creek	Phys. Province	67		Latitude (dd)	35.95216	
Reach ID	10	Drainage Area (mi^2)	1.7		Longitude (dd)	-83.86466	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23	Slope (ft/ft)	0.01740	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.1	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	80	Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	3	0.6 to 0.8	2	0.8 to 1.0	1	> 1.0	1	24
Diameter (cm)	10 to 20	4	20 to 30	2	30 to 40	3	40 to 50	1	>50		21
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	31
Type	Bridge	3			Ramp	3	Submersed	4	Buried		28
Structure	Plain	2	Plain/Int	2	Intermediate	3	Int/Sticky	2	Sticky	1	28
Stability	Moveable	4	Mov/Int	2	Intermediate	2	Int/Sec	2	Secured		22
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60	2	60 to 80	2	80 to 90	2	30
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Forks Creek (4)	Phys. Province	67		Latitude (dd)	35.93708	
Reach ID	11	Drainage Area (mi^2)	1.8		Longitude (dd)	-83.84837	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	17		Slope (ft/ft)	0.00184	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.3		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	70		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		14
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	2	40 to 50	1	>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		17
Type	Bridge				Ramp	4	Submersed	3	Buried		24
Structure	Plain	1	Plain/Int	2	Intermediate	2	Int/Sticky	2	Sticky		19
Stability	Moveable	1	Mov/Int	1	Intermediate	2	Int/Sec	3	Secured		21
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	2	60 to 80	2	80 to 90	1	22
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Clear Creek (1)	Phys. Province	67		Latitude (dd)	36.32275	
Reach ID	12	Drainage Area (mi^2)	2.6		Longitude (dd)	-83.91381	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	22		Slope (ft/ft)	0.01330	
Stream Classification	Perennial	BKF Mean Depth (ft)	1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	50		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	2	0.6 to 0.8	5	0.8 to 1.0	3	> 1.0		31
Diameter (cm)	10 to 20	1	20 to 30	4	30 to 40	5	40 to 50		>50		24
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)		30
Type	Bridge	1			Ramp	7	Submersed	2	Buried		30
Structure	Plain	1	Plain/Int	5	Intermediate	3	Int/Sticky	1	Sticky		24
Stability	Moveable	2	Mov/Int	5	Intermediate	3	Int/Sec		Secured		21
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	3	60 to 80	2	80 to 90	3	35
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	11/13/17		County		Forest Age (yrs)	30 to 50	
Stream Name	Clear Creek (2)		Phys. Province	67	Latitude (dd)	36.21359	
Reach ID	13		Drainage Area (mi^2)	2.8	Longitude (dd)	-84.05933	
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Beech			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23	Slope (ft/ft)	0.00480	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.6	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	60	Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	4	0.6 to 0.8	2	0.8 to 1.0	2	> 1.0	5	49
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40	6	40 to 50	3	>50	2	45
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	7	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	3	50
Type	Bridge	2			Ramp	6	Submersed	3	Buried	4	52
Structure	Plain	2	Plain/Int	4	Intermediate	7	Int/Sticky	2	Sticky		39
Stability	Moveable		Mov/Int	4	Intermediate	8	Int/Sec	3	Secured		44
Orientation (deg)	0 to 20	2	20 to 40	4	40 to 60	3	60 to 80	2	80 to 90	4	47
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100	1	9
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine	1	Fine		7
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow	1	In low flow		7
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured		7
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	11/13/17		County		Forest Age (yrs)	30 to 50	
Stream Name	Crockett Creek		Phys. Province	67	Latitude (dd)	36.37982	
Reach ID	14		Drainage Area (mi^2)	4.7	Longitude (dd)	-83.04655	
Watershed Name			Dominant Species	Oak, Maple, Sycamore			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23	Slope (ft/ft)	0.00250	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.9	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	40	Rosgen Type	B4c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8	2	0.8 to 1.0	1	> 1.0		16
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40	1	40 to 50	2	>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	1	23
Type	Bridge	2			Ramp	3	Submersed	1	Buried	1	20
Structure	Plain		Plain/Int	2	Intermediate	4	Int/Sticky	1	Sticky		20
Stability	Moveable	2	Mov/Int	1	Intermediate	3	Int/Sec	1	Secured		17
Orientation (deg)	0 to 20		20 to 40	3	40 to 60	1	60 to 80	1	80 to 90	2	23
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Beaver Creek	Phys. Province	67		Latitude (dd)	36.05927	
Reach ID	15	Drainage Area (mi^2)	36.4		Longitude (dd)	-83.97222	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch, Beech				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	59	Slope (ft/ft)	0.00100	
Stream Classification	Perennial		BKF Mean Depth (ft)	3.8	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	200	Rosgen Type	C3	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	4	0.4 to 0.6	2	0.6 to 0.8	3	0.8 to 1.0	1	> 1.0		21
Diameter (cm)	10 to 20	5	20 to 30	3	30 to 40	2	40 to 50		>50		17
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)	4	43
Type	Bridge	1			Ramp	3	Submersed	4	Buried	2	36
Structure	Plain	5	Plain/Int	2	Intermediate	2	Int/Sticky	1	Sticky		19
Stability	Moveable	6	Mov/Int	2	Intermediate	2	Int/Sec		Secured		16
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60	3	60 to 80	2	80 to 90	1	28
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec		Secured		3

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT1 New River	Phys. Province	69		Latitude (dd)	36.12071	
Reach ID	1	Drainage Area (mi^2)	0.02		Longitude (dd)	-84.43234	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	5	Slope (ft/ft)	0.14000	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.6	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	7	Rosgen Type	A4a+	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	3	> 1.0	5	42
Diameter (cm)	10 to 20	8	20 to 30	4	30 to 40		40 to 50		>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	5	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		22
Type	Bridge	4			Ramp	6	Submersed	2	Buried		30
Structure	Plain	6	Plain/Int	4	Intermediate	2	Int/Sticky		Sticky		20
Stability	Moveable	3	Mov/Int	4	Intermediate	5	Int/Sec		Secured		26
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60		60 to 80	5	80 to 90	3	41
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT Groom Branch	Phys. Province	68		Latitude (dd)	36.45019	
Reach ID	2	Drainage Area (mi^2)	0.05		Longitude (dd)	-84.70811	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	5		Slope (ft/ft)	0.00510	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.4		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	25		Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	5	43
Diameter (cm)	10 to 20	7	20 to 30	4	30 to 40		40 to 50		>50		15
Location	**Zone 4** (Above BKF/Hanging into Ch)	5			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)	3	29
Type	Bridge	1			Ramp	5	Submersed	2	Buried	3	39
Structure	Plain	6	Plain/Int	5	Intermediate		Int/Sticky		Sticky		16
Stability	Moveable	2	Mov/Int	6	Intermediate	3	Int/Sec		Secured		23
Orientation (deg)	0 to 20	1	20 to 40	3	40 to 60	1	60 to 80	2	80 to 90	4	38
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT2 New River	Phys. Province	69		Latitude (dd)	36.12106	
Reach ID	3	Drainage Area (mi^2)	0.06		Longitude (dd)	-84.43043	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	7.0		Slope (ft/ft)	0.09280	
Stream Classification	Intermittent	BKF Mean Depth (ft)	1.0		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	30		Rosgen Type	E4a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	4	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	7	56
Diameter (cm)	10 to 20	8	20 to 30	6	30 to 40	3	40 to 50		>50		29
Location	**Zone 4** (Above BKF/Hanging into Ch)	10			**Zone 3** (Above BKF/Within Streambanks)	5	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		33
Type	Bridge	5			Ramp	9	Submersed	3	Buried		44
Structure	Plain	7	Plain/Int	7	Intermediate	3	Int/Sticky		Sticky		30
Stability	Moveable	8	Mov/Int	6	Intermediate	3	Int/Sec		Secured		29
Orientation (deg)	0 to 20	3	20 to 40		40 to 60	2	60 to 80	6	80 to 90	6	63
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	UT West Fork Coyte Branch		Phys. Province	68		Latitude (dd)	36.46331	
Reach ID	4		Drainage Area (mi^2)	0.08		Longitude (dd)	-84.71456	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	6		Slope (ft/ft)	0.00710	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.6		Bed material	Sand	
Stream Condition	Reference		Floodprone Width (ft)	30		Rosgen Type	E5	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0	5	> 1.0	5	53
Diameter (cm)	10 to 20	8	20 to 30	5	30 to 40		40 to 50		>50		18
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	5	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	2	33
Type	Bridge	3			Ramp	6	Submersed	2	Buried	2	39
Structure	Plain	5	Plain/Int	6	Intermediate	2	Int/Sticky		Sticky		23
Stability	Moveable	6	Mov/Int	3	Intermediate	2	Int/Sec	1	Secured	1	27
Orientation (deg)	0 to 20	2	20 to 40	3	40 to 60	1	60 to 80	3	80 to 90	4	43
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	1	In low flow		4
Stability	Moveable		Mov/Int		Intermediate		Int/Sec	1	Secured		4

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	UT Weaver Branch		Phys. Province	68		Latitude (dd)	35.93443	
Reach ID	5		Drainage Area (mi^2)	0.09		Longitude (dd)	-84.85992	
Watershed Name			Dominant Species	Oak, Maple, Beech				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	9		Slope (ft/ft)	0.01080	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.6		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	30		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8		0.8 to 1.0	1	> 1.0	2	19
Diameter (cm)	10 to 20	4	20 to 30	2	30 to 40		40 to 50		>50		8
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		12
Type	Bridge	3			Ramp	3	Submersed		Buried		12
Structure	Plain	2	Plain/Int	3	Intermediate	1	Int/Sticky		Sticky		11
Stability	Moveable		Mov/Int	2	Intermediate	3	Int/Sec	1	Secured		17
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	1	60 to 80	2	80 to 90	2	23
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	11/14/17		County		Forest Age (yrs)	30 to 50	
Stream Name	UT Bee Ridge Creek		Phys. Province	68	Latitude (dd)	36.07508	
Reach ID	6		Drainage Area (mi^2)	0.11	Longitude (dd)	-84.93161	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	8	Slope (ft/ft)	0.00500	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.5	Bed material	Sand	
Stream Condition	Reference		Floodprone Width (ft)	40	Rosgen Type	C5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	1	> 1.0	4	26
Diameter (cm)	10 to 20	4	20 to 30	2	30 to 40		40 to 50		>50		8
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		10
Type	Bridge	3			Ramp	2	Submersed	1	Buried		13
Structure	Plain	3	Plain/Int	2	Intermediate	1	Int/Sticky		Sticky		10
Stability	Moveable	3	Mov/Int	3	Intermediate		Int/Sec		Secured		9
Orientation (deg)	0 to 20		20 to 40		40 to 60	2	60 to 80	1	80 to 90	3	25
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	11/14/17		County		Forest Age (yrs)	30 to 50	
Stream Name	UT Slave Falls		Phys. Province	68	Latitude (dd)	36.53137	
Reach ID	7		Drainage Area (mi^2)	0.29	Longitude (dd)	-84.76952	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Sycamore			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	10	Slope (ft/ft)	0.00380	
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9	Bed material	Sand	
Stream Condition	Reference		Floodprone Width (ft)	60	Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	4	0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	3	> 1.0		18
Diameter (cm)	10 to 20	6	20 to 30	2	30 to 40		40 to 50		>50		10
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	2	31
Type	Bridge				Ramp	2	Submersed	4	Buried	2	32
Structure	Plain	2	Plain/Int	5	Intermediate	1	Int/Sticky		Sticky		15
Stability	Moveable	1	Mov/Int	5	Intermediate	2	Int/Sec		Secured		17
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	3	60 to 80	2	80 to 90	2	28
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Underwood Branch	Phys. Province	68		Latitude (dd)	36.07906	
Reach ID	8	Drainage Area (mi^2)	0.34		Longitude (dd)	-84.91197	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	12		Slope (ft/ft)	0.02820	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.2		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	40		Rosgen Type	E3b	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		12
Diameter (cm)	10 to 20	4	20 to 30	1	30 to 40		40 to 50		>50		6
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		14
Type	Bridge				Ramp	3	Submersed	2	Buried		17
Structure	Plain		Plain/Int	2	Intermediate	3	Int/Sticky		Sticky		13
Stability	Moveable		Mov/Int		Intermediate	2	Int/Sec	3	Secured		18
Orientation (deg)	0 to 20	1	20 to 40	2	40 to 60		60 to 80	1	80 to 90	1	14
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	West Fork Coyte Branch	Phys. Province	68		Latitude (dd)	36.46314	
Reach ID	9	Drainage Area (mi^2)	0.43		Longitude (dd)	-84.71458	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Beech				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	10		Slope (ft/ft)	0.00400	
Stream Classification	Perennial	BKF Mean Depth (ft)	1		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	50		Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0	2	> 1.0	3	32
Diameter (cm)	10 to 20	6	20 to 30	3	30 to 40		40 to 50		>50		12
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	1	33
Type	Bridge	1			Ramp	5	Submersed	3	Buried	1	33
Structure	Plain	2	Plain/Int	4	Intermediate	3	Int/Sticky		Sticky		19
Stability	Moveable	2	Mov/Int	3	Intermediate	2	Int/Sec	2	Secured		22
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60		60 to 80	3	80 to 90	2	28
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Coon Creek	Phys. Province	68		Latitude (dd)	35.66606	
Reach ID	10	Drainage Area (m^2)	0.5		Longitude (dd)	-85.35684	
Watershed Name		Dominant Species	Oak, Maple, Sycamore, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	13		Slope (ft/ft)	0.02720	
Stream Classification	Perennial	BKF Mean Depth (ft)	1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	25		Rosgen Type	B3	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	1	21
Diameter (cm)	10 to 20	4	20 to 30	1	30 to 40	1	40 to 50	1	>50		13
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		16
Type	Bridge	1			Ramp	4	Submersed	1	Buried	1	22
Structure	Plain	1	Plain/Int	1	Intermediate	1	Int/Sticky	2	Sticky	2	24
Stability	Moveable		Mov/Int	3	Intermediate	2	Int/Sec	2	Secured		20
Orientation (deg)	0 to 20		20 to 40		40 to 60	4	60 to 80	2	80 to 90	1	25
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100	1	8
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80	1	80 to 100		7
Structure	Coarse		Coarse/Int	1	Intermediate		Int/Fine	1	Fine		6
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow	1	In low flow		7
Stability	Moveable		Mov/Int	1	Intermediate		Int/Sec	1	Secured		6

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Weaver Branch	Phys. Province	68		Latitude (dd)	35.93613	
Reach ID	11	Drainage Area (m^2)	0.51		Longitude (dd)	-84.85764	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	11		Slope (ft/ft)	0.00670	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	20		Rosgen Type	B4c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	3	35
Diameter (cm)	10 to 20	7	20 to 30	4	30 to 40	1	40 to 50		>50		18
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	2	38
Type	Bridge				Ramp	8	Submersed	2	Buried	2	42
Structure	Plain	1	Plain/Int	4	Intermediate	5	Int/Sticky	2	Sticky		32
Stability	Moveable	2	Mov/Int	2	Intermediate	5	Int/Sec	3	Secured		33
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	2	60 to 80	2	80 to 90	6	47
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate	2	Int/Fine		Fine		6
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	2	In low flow		8
Stability	Moveable		Mov/Int		Intermediate		Int/Sec	2	Secured		8

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Flatrock Branch	Phys. Province	69		Latitude (dd)	36.12356	
Reach ID	12	Drainage Area (mi^2)	0.71		Longitude (dd)	-84.42482	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	12		Slope (ft/ft)	0.02620	
Stream Classification	Perennial	BKF Mean Depth (ft)	1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	60		Rosgen Type	E4b	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0		> 1.0		4
Diameter (cm)	10 to 20	3	20 to 30		30 to 40		40 to 50		>50		3
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		10
Type	Bridge				Ramp	2	Submersed	1	Buried		10
Structure	Plain	1	Plain/Int	1	Intermediate	1	Int/Sticky		Sticky		6
Stability	Moveable	2	Mov/Int	1	Intermediate		Int/Sec		Secured		4
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60		60 to 80	1	80 to 90		7
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Bandy Creek	Phys. Province	68		Latitude (dd)	36.48906	
Reach ID	13	Drainage Area (mi^2)	0.76		Longitude (dd)	-84.71003	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	12		Slope (ft/ft)	0.00180	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.6		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	45		Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	3	0.8 to 1.0	4	> 1.0	3	45
Diameter (cm)	10 to 20	5	20 to 30	4	30 to 40	3	40 to 50	1	>50		26
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)	2	42
Type	Bridge	2			Ramp	8	Submersed	3	Buried		38
Structure	Plain	3	Plain/Int	6	Intermediate	3	Int/Sticky	1	Sticky		28
Stability	Moveable	2	Mov/Int	1	Intermediate	5	Int/Sec	2	Secured	3	42
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	2	60 to 80	2	80 to 90	5	44
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	1	In low flow		4
Stability	Moveable		Mov/Int		Intermediate		Int/Sec	1	Secured		4

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Black House Branch		Phys. Province	68		Latitude (dd)	36.51539	
Reach ID	14		Drainage Area (mi^2)	2		Longitude (dd)	-84.71694	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23		Slope (ft/ft)	0.00440	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.5		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	100		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	7	0.4 to 0.6	3	0.6 to 0.8		0.8 to 1.0		> 1.0		13
Diameter (cm)	10 to 20	5	20 to 30	4	30 to 40	1	40 to 50		>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	7	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)		33
Type	Bridge				Ramp	8	Submersed	2	Buried		32
Structure	Plain	4	Plain/Int	3	Intermediate	3	Int/Sticky		Sticky		19
Stability	Moveable	3	Mov/Int	5	Intermediate	2	Int/Sec		Secured		19
Orientation (deg)	0 to 20		20 to 40		40 to 60	3	60 to 80	3	80 to 90	4	41
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Flat Fork		Phys. Province	69		Latitude (dd)	36.13679	
Reach ID	15		Drainage Area (mi^2)	2.4		Longitude (dd)	-84.48720	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	28		Slope (ft/ft)	0.01650	
Stream Classification	Perennial		BKF Mean Depth (ft)	1		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	40		Rosgen Type	B3c	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	3	> 1.0	4	43
Diameter (cm)	10 to 20	7	20 to 30	3	30 to 40	2	40 to 50	1	>50		23
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)	2	48
Type	Bridge				Ramp	8	Submersed	4	Buried	1	45
Structure	Plain	4	Plain/Int	5	Intermediate	4	Int/Sticky		Sticky		26
Stability	Moveable	5	Mov/Int	4	Intermediate	2	Int/Sec	2	Secured		27
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	3	60 to 80	4	80 to 90	2	40
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Rockhouse Creek		Phys. Province	68		Latitude (dd)	35.66349	
Reach ID	16		Drainage Area (mi^2)	3.1		Longitude (dd)	-85.34658	
Watershed Name			Dominant Species	Beech, Oak, Maple, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23		Slope (ft/ft)	0.01240	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.1		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	150		Rosgen Type	E4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0		15
Diameter (cm)	10 to 20		20 to 30		30 to 40	3	40 to 50	1	>50	1	18
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	20
Type	Bridge				Ramp	4	Submersed	1	Buried		16
Structure	Plain		Plain/Int	2	Intermediate	1	Int/Sticky	1	Sticky	1	16
Stability	Moveable		Mov/Int	1	Intermediate	1	Int/Sec	2	Secured	1	18
Orientation (deg)	0 to 20		20 to 40		40 to 60	4	60 to 80	1	80 to 90		16
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec		Secured		3
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	New River		Phys. Province	69		Latitude (dd)	36.12532	
Reach ID	17		Drainage Area (mi^2)	4.2		Longitude (dd)	-84.42090	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	36		Slope (ft/ft)	0.00800	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.7		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	200		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8		0.8 to 1.0		> 1.0		6
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40		40 to 50		>50		5
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		12
Type	Bridge				Ramp	2	Submersed	2	Buried		14
Structure	Plain	2	Plain/Int	2	Intermediate		Int/Sticky		Sticky		6
Stability	Moveable	1	Mov/Int	1	Intermediate	2	Int/Sec		Secured		9
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	1	60 to 80		80 to 90	2	14
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Basses Creek	Phys. Province	68		Latitude (dd)	35.85089	
Reach ID	18	Drainage Area (mi^2)	8		Longitude (dd)	-85.05525	
Watershed Name		Dominant Species	Oak, Maple, Sycamore				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	26	Slope (ft/ft)	0.00120	
Stream Classification	Perennial		BKF Mean Depth (ft)	3.9	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	150	Rosgen Type	E4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0		> 1.0		7
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40		40 to 50		>50		6
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	2	18
Type	Bridge				Ramp		Submersed	3	Buried	1	17
Structure	Plain		Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		10
Stability	Moveable		Mov/Int		Intermediate	3	Int/Sec	1	Secured		13
Orientation (deg)	0 to 20		20 to 40	2	40 to 60	1	60 to 80	1	80 to 90		11
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	11/14/17	County	Carter		Forest Age (yrs)	30 to 50	
Stream Name	Laurel Fork	Phys. Province	68		Latitude (dd)	36.51378	
Reach ID	19	Drainage Area (mi^2)	13		Longitude (dd)	-84.71543	
Watershed Name		Dominant Species	Rhododendron, Oak, Maple, Birch, Hickory, Pine				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	44	Slope (ft/ft)	0.00470	
Stream Classification	Perennial		BKF Mean Depth (ft)	3.4	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	120	Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	6	0.4 to 0.6	4	0.6 to 0.8	2	0.8 to 1.0		> 1.0		20
Diameter (cm)	10 to 20	6	20 to 30	3	30 to 40	3	40 to 50		>50		21
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	10	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	39
Type	Bridge	3			Ramp	7	Submersed	1	Buried	1	33
Structure	Plain	5	Plain/Int	3	Intermediate	4	Int/Sticky		Sticky		23
Stability	Moveable	2	Mov/Int	2	Intermediate	3	Int/Sec	3	Secured	2	37
Orientation (deg)	0 to 20	3	20 to 40	2	40 to 60	3	60 to 80	1	80 to 90	3	35
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	11/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Otter Creek		Phys. Province	68		Latitude (dd)	36.05353	
Reach ID	20		Drainage Area (mi^2)	17		Longitude (dd)	-84.85622	
Watershed Name			Dominant Species	Rhododendron, Oak, Maple, Beech, Sycamore				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	53		Slope (ft/ft)	0.00650	
Stream Classification	Perennial		BKF Mean Depth (ft)	2.2		Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	150		Rosgen Type	C3	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8	3	0.8 to 1.0	1	> 1.0		17
Diameter (cm)	10 to 20	2	20 to 30	3	30 to 40	2	40 to 50		>50		14
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		15
Type	Bridge				Ramp	3	Submersed	3	Buried	1	26
Structure	Plain	2	Plain/Int	3	Intermediate	1	Int/Sticky	1	Sticky		15
Stability	Moveable		Mov/Int	2	Intermediate	3	Int/Sec	2	Secured		21
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	3	60 to 80	2	80 to 90	1	24
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	12/15/17		County	Overton		Forest Age (yrs)	30 to 50	
Stream Name	Bryans Fork, SSSP		Phys. Province	71		Latitude (dd)	36.45748	
Reach ID	23		Drainage Area (mi^2)	2.53		Longitude (dd)	-85.42583	
Watershed Name	Wet Mill Creek, Cumberland River		Dominant Species	Sycamore, Oak, Maple, Birch				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	28		Slope (ft/ft)	0.00460	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.8		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	150		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0		> 1.0	1	17
Diameter (cm)	10 to 20	5	20 to 30	3	30 to 40		40 to 50		>50		11
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	23
Type	Bridge	1			Ramp	6	Submersed	1	Buried		23
Structure	Plain	6	Plain/Int	2	Intermediate		Int/Sticky		Sticky		10
Stability	Moveable	3	Mov/Int	3	Intermediate	1	Int/Sec	1	Secured		16
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	0	60 to 80	2	80 to 90	2	23
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	12/15/17	County	Overton		Forest Age (yrs)	30 to 50	
Stream Name	UT Morgan Creek, SSSP	Phys. Province	71		Latitude (dd)	36.44931	
Reach ID	14	Drainage Area (m^2)	0.32		Longitude (dd)	-85.39204	
Watershed Name	Wet Mill Creek, Cumberland River	Dominant Species	Sycamore, Oak, Maple, Birch				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	11		Slope (ft/ft)	0.02600	
Stream Classification	Perennial	BKF Mean Depth (ft)	1		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	18		Rosgen Type	B3	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8		0.8 to 1.0	3	> 1.0	2	22
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	1	40 to 50		>50		9
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		11
Type	Bridge	5			Ramp		Submersed		Buried		5
Structure	Plain	3	Plain/Int	2	Intermediate		Int/Sticky		Sticky		7
Stability	Moveable		Mov/Int	2	Intermediate	2	Int/Sec	1	Secured		14
Orientation (deg)	0 to 20		20 to 40		40 to 60		60 to 80	2	80 to 90	3	23
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	12/15/17	County	Overton		Forest Age (yrs)	30 to 50	
Stream Name	UT1 Bryans Fork, SSSP	Phys. Province	71		Latitude (dd)	36.45870	
Reach ID	12	Drainage Area (m^2)	0.24		Longitude (dd)	-85.42677	
Watershed Name		Dominant Species	Sycamore, Oak, Maple, Birch				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	14		Slope (ft/ft)	0.03390	
Stream Classification	Perennial	BKF Mean Depth (ft)	0.8		Bed material	Cobble	
Stream Condition	Reference	Floodprone Width (ft)	40		Rosgen Type	C3b	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	5	0.6 to 0.8	4	0.8 to 1.0	1	> 1.0		29
Diameter (cm)	10 to 20	8	20 to 30	3	30 to 40	2	40 to 50		>50		20
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	5	48
Type	Bridge				Ramp	4	Submersed	5	Buried	4	52
Structure	Plain	4	Plain/Int	4	Intermediate	5	Int/Sticky		Sticky		27
Stability	Moveable		Mov/Int	3	Intermediate	3	Int/Sec	3	Secured	4	47
Orientation (deg)	0 to 20	1	20 to 40	3	40 to 60	2	60 to 80	4	80 to 90	3	44
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN	Forest Type	Deciduous	
Date	12/15/17		County	Overton	Forest Age (yrs)	30 to 50	
Stream Name	UT2 Bryans Fork, SSSP		Phys. Province	71	Latitude (dd)	36.45619	
Reach ID	11		Drainage Area (mi^2)	0.23	Longitude (dd)	-85.42077	
Watershed Name			Dominant Species	Sycamore, Oak, Maple, Birch			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	16	Slope (ft/ft)	0.04550	
Stream Classification	Perennial		BKF Mean Depth (ft)	0.7	Bed material	Cobble	
Stream Condition	Reference		Floodprone Width (ft)	25	Rosgen Type	B3a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0		15
Diameter (cm)	10 to 20	2	20 to 30	2	30 to 40	2	40 to 50	1	>50		16
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	1	18
Type	Bridge				Ramp	4	Submersed	2	Buried	1	25
Structure	Plain	3	Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		13
Stability	Moveable	1	Mov/Int	2	Intermediate	2	Int/Sec	1	Secured	1	20
Orientation (deg)	0 to 20		20 to 40	1	40 to 60	2	60 to 80	3	80 to 90	1	25
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ		State	TN	Forest Type	Deciduous	
Date	12/14/17		County		Forest Age (yrs)	30 to 50	
Stream Name	UT UT1 Woodhaven Lake, MBSP		Phys. Province	71	Latitude (dd)	36.07605	
Reach ID	9		Drainage Area (mi^2)	0.1	Longitude (dd)	-87.27532	
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	7.3	Slope (ft/ft)	0.03100	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.7	Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	80	Rosgen Type	E4b	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8	3	0.8 to 1.0	3	> 1.0	8	61
Diameter (cm)	10 to 20	4	20 to 30	4	30 to 40	3	40 to 50	2	>50	1	34
Location	**Zone 4** (Above BKF/Hanging into Ch)	9			**Zone 3** (Above BKF/Within Streambanks)	5	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		24
Type	Bridge	5			Ramp	9	Submersed		Buried		32
Structure	Plain	5	Plain/Int	7	Intermediate	2	Int/Sticky		Sticky		25
Stability	Moveable	3	Mov/Int	6	Intermediate	2	Int/Sec	1	Secured	2	35
Orientation (deg)	0 to 20	5	20 to 40	2	40 to 60	2	60 to 80	4	80 to 90	1	36
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	2	Fine		8
Location	Partially high flow		In high flow	1	Partially low flow	1	Mid low flow		In low flow		5
Stability	Moveable		Mov/Int		Intermediate		Int/Sec	2	Secured		8

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT UT2 Woodhave Lake, MBSP	Phys. Province	71		Latitude (dd)	36.07343	
Reach ID	4	Drainage Area (mi^2)	0.04		Longitude (dd)	-87.28314	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	4.2		Slope (ft/ft)	0.01080	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.5		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	50		Rosgen Type	E4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8		0.8 to 1.0		> 1.0	2	10
Diameter (cm)	10 to 20	2	20 to 30		30 to 40		40 to 50		>50		2
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		4
Type	Bridge				Ramp	2	Submersed		Buried		6
Structure	Plain	2	Plain/Int		Intermediate		Int/Sticky		Sticky		2
Stability	Moveable	2	Mov/Int		Intermediate		Int/Sec		Secured		2
Orientation (deg)	0 to 20	1	20 to 40		40 to 60		60 to 80	1	80 to 90		5
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT1 Woodhaven Lake, MBSP	Phys. Province	71		Latitude (dd)	36.07619	
Reach ID	13	Drainage Area (mi^2)	0.27		Longitude (dd)	-87.27573	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	12.8		Slope (ft/ft)	0.01170	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	150		Rosgen Type	E4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	2	23
Diameter (cm)	10 to 20	3	20 to 30		30 to 40		40 to 50	3	>50		15
Location	**Zone 4** (Above BKF/Hanging into Ch)	5			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		8
Type	Bridge	1			Ramp	5	Submersed		Buried		16
Structure	Plain	5	Plain/Int	1	Intermediate		Int/Sticky		Sticky		7
Stability	Moveable	2	Mov/Int		Intermediate	4	Int/Sec		Secured		14
Orientation (deg)	0 to 20		20 to 40		40 to 60	4	60 to 80	2	80 to 90		20
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine	1	Fine		7
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	2	10
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	2	10
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ		State	TN		Forest Type	Deciduous
Date	12/14/17		County			Forest Age (yrs)	30 to 50
Stream Name	UT2 Woodhaven Lake, MBSP		Phys. Province	71		Latitude (dd)	36.07383
Reach ID	16		Drainage Area (mi^2)	0.44		Longitude (dd)	-87.28317
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	10.3		Slope (ft/ft)	0.00700
Stream Classification	Perennial		BKF Mean Depth (ft)	1		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	120		Rosgen Type	E4
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8		0.8 to 1.0	1	> 1.0	1	9
Diameter (cm)	10 to 20		20 to 30	2	30 to 40		40 to 50		>50		4
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		2
Type	Bridge				Ramp	2	Submersed		Buried		6
Structure	Plain	1	Plain/Int	1	Intermediate		Int/Sticky		Sticky		3
Stability	Moveable	2	Mov/Int		Intermediate		Int/Sec		Secured		2
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	1	60 to 80		80 to 90		4
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	1	5
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2

Investigator(s)	VJ, GJ		State	TN		Forest Type	Deciduous
Date	12/13/17		County			Forest Age (yrs)	30 to 50
Stream Name	UT3 Woodhaven Lake, MBSP		Phys. Province	71		Latitude (dd)	36.08115
Reach ID	18		Drainage Area (mi^2)	0.66		Longitude (dd)	-87.29423
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	17.7		Slope (ft/ft)	0.00860
Stream Classification	Perennial		BKF Mean Depth (ft)	1.1		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	250		Rosgen Type	C4
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0		> 1.0		10
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40	3	40 to 50		>50		13
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		12
Type	Bridge				Ramp	4	Submersed	2	Buried		20
Structure	Plain	6	Plain/Int		Intermediate		Int/Sticky		Sticky		6
Stability	Moveable	5	Mov/Int		Intermediate	1	Int/Sec		Secured		8
Orientation (deg)	0 to 20	5	20 to 40		40 to 60	1	60 to 80		80 to 90		8
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/13/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Will Hall Creek, MBSP	Phys. Province	71		Latitude (dd)	36.07161	
Reach ID	22	Drainage Area (mi^2)	2.34		Longitude (dd)	-87.29421	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	23.8		Slope (ft/ft)	0.00790	
Stream Classification	Perennial	BKF Mean Depth (ft)	1.4		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	400		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	6	0.4 to 0.6		0.6 to 0.8		0.8 to 1.0		> 1.0		6
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40	1	40 to 50	1	>50		12
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)		18
Type	Bridge				Ramp	5	Submersed	1	Buried		19
Structure	Plain	5	Plain/Int		Intermediate	1	Int/Sticky		Sticky		8
Stability	Moveable	5	Mov/Int		Intermediate		Int/Sec		Secured	1	10
Orientation (deg)	0 to 20	1	20 to 40	1	40 to 60	2	60 to 80	2	80 to 90		17
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT2 Little Swan, NTP	Phys. Province	71		Latitude (dd)	35.51957	
Reach ID	2	Drainage Area (mi^2)	0.03		Longitude (dd)	-87.45677	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	6.4		Slope (ft/ft)	0.05970	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.3		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	18		Rosgen Type	C4a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	2	0.6 to 0.8		0.8 to 1.0	2	> 1.0	7	47
Diameter (cm)	10 to 20	6	20 to 30		30 to 40	1	40 to 50		>50	4	29
Location	**Zone 4** (Above BKF/Hanging into Ch)	5			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)		26
Type	Bridge	6			Ramp	5	Submersed		Buried		21
Structure	Plain	5	Plain/Int	1	Intermediate	5	Int/Sticky		Sticky		22
Stability	Moveable	5	Mov/Int		Intermediate	1	Int/Sec		Secured	5	33
Orientation (deg)	0 to 20	1	20 to 40	2	40 to 60	1	60 to 80	4	80 to 90	3	39
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT5 Little Swan, NTP	Phys. Province	71		Latitude (dd)	35.52554	
Reach ID	7	Drainage Area (mi^2)	0.06		Longitude (dd)	-87.45789	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	4.9		Slope (ft/ft)	0.04060	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.8		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	12		Rosgen Type	E4a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	3	> 1.0		15
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40		40 to 50	2	>50		12
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		11
Type	Bridge				Ramp	5	Submersed		Buried		15
Structure	Plain	1	Plain/Int	2	Intermediate	2	Int/Sticky		Sticky		11
Stability	Moveable	2	Mov/Int	2	Intermediate	1	Int/Sec		Secured		9
Orientation (deg)	0 to 20		20 to 40		40 to 60		60 to 80	2	80 to 90	3	23
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate	2	Int/Fine		Fine		6
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	2	10
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	2	10

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ	State	TN		Forest Type	Deciduous	
Date	12/14/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT4 Little Swan, NTP	Phys. Province	71		Latitude (dd)	35.51396	
Reach ID	8	Drainage Area (mi^2)	0.06		Longitude (dd)	-87.45585	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	5.7		Slope (ft/ft)	0.07140	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.3		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	12		Rosgen Type	B4a	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	4	> 1.0	6	48
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40	1	40 to 50	3	>50	4	39
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		23
Type	Bridge	1			Ramp	8	Submersed	2	Buried		33
Structure	Plain	3	Plain/Int	5	Intermediate	1	Int/Sticky	2	Sticky		24
Stability	Moveable	4	Mov/Int	2	Intermediate		Int/Sec		Secured	5	33
Orientation (deg)	0 to 20	3	20 to 40	2	40 to 60	2	60 to 80		80 to 90	4	33
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	VJ, GJ		State	TN		Forest Type	Deciduous	
Date	12/14/17		County			Forest Age (yrs)	30 to 50	
Stream Name	UT1 Little Swan, NTP		Phys. Province	71		Latitude (dd)	35.52790	
Reach ID	19		Drainage Area (mi^2)	1.18		Longitude (dd)	-87.45664	
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	25.8		Slope (ft/ft)	0.00900	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.6		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	100		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	2	25
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40		40 to 50		>50	5	29
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		10
Type	Bridge	2			Ramp	6	Submersed		Buried		20
Structure	Plain	5	Plain/Int	3	Intermediate		Int/Sticky		Sticky		11
Stability	Moveable	4	Mov/Int		Intermediate		Int/Sec	1	Secured	3	23
Orientation (deg)	0 to 20	1	20 to 40	2	40 to 60	2	60 to 80		80 to 90	3	26
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	1	5
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	10/15/17		County			Forest Age (yrs)	30 to 50	
Stream Name	UT Little Buffalo, LHWMA		Phys. Province	71		Latitude (dd)	35.35208	
Reach ID	5		Drainage Area (mi^2)	0.05		Longitude (dd)	-87.50536	
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	5.5		Slope (ft/ft)	0.04190	
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.3		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	20		Rosgen Type	E4a	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0	1	16
Diameter (cm)	10 to 20	4	20 to 30	1	30 to 40		40 to 50		>50		6
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	20
Type	Bridge				Ramp	2	Submersed	2	Buried	1	19
Structure	Plain	3	Plain/Int	2	Intermediate		Int/Sticky		Sticky		7
Stability	Moveable	1	Mov/Int	4	Intermediate		Int/Sec		Secured		9
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	2	60 to 80		80 to 90	2	17
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	12/15/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Hams Branch, LHWMA		Phys. Province	71		Latitude (dd)	35.35658	
Reach ID	10		Drainage Area (mi^2)	0.22		Longitude (dd)	-87.51269	
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	12		Slope (ft/ft)	0.01660	
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	50		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	2	0.6 to 0.8	3	0.8 to 1.0	2	> 1.0	1	29
Diameter (cm)	10 to 20	7	20 to 30	4	30 to 40		40 to 50		>50		15
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	3	38
Type	Bridge				Ramp	5	Submersed	4	Buried	2	41
Structure	Plain	6	Plain/Int	4	Intermediate	1	Int/Sticky		Sticky		17
Stability	Moveable	2	Mov/Int	5	Intermediate	2	Int/Sec	1	Secured	1	27
Orientation (deg)	0 to 20	3	20 to 40	3	40 to 60		60 to 80	1	80 to 90	4	33
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN		Forest Type	Deciduous	
Date	12/15/17		County			Forest Age (yrs)	30 to 50	
Stream Name	Weaver Branch, LHWMA		Phys. Province	71		Latitude (dd)	35.35544	
Reach ID	20		Drainage Area (mi^2)	1.44		Longitude (dd)	-87.50205	
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	17.4		Slope (ft/ft)	0.00900	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.2		Bed material	Gravel	
Stream Condition	Reference		Floodprone Width (ft)	100		Rosgen Type	C4	
Field Notes:								

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	1	0.6 to 0.8	2	0.8 to 1.0		> 1.0	3	26
Diameter (cm)	10 to 20	7	20 to 30	1	30 to 40	1	40 to 50		>50		12
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	28
Type	Bridge				Ramp	6	Submersed	2	Buried	1	31
Structure	Plain	4	Plain/Int	4	Intermediate		Int/Sticky	1	Sticky		16
Stability	Moveable	2	Mov/Int	5	Intermediate	2	Int/Sec		Secured		18
Orientation (deg)	0 to 20	1	20 to 40	2	40 to 60	3	60 to 80	1	80 to 90	2	28
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous			
Date	12/14/17		County				Forest Age (yrs)	30 to 50			
Stream Name	Little Buffalo, LHWMA		Phys. Province	71			Latitude (dd)	35.35270			
Reach ID	28		Drainage Area (mi^2)	13.2			Longitude (dd)	-87.50393			
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory							
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	55			Slope (ft/ft)	0.00720			
Stream Classification	Perennial		BKF Mean Depth (ft)	2.8			Bed material	Gravel			
Stream Condition	Reference		Floodprone Width (ft)	200			Rosgen Type	C4			
Field Notes:											

SCORE										
	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	2	0.6 to 0.8	2	0.8 to 1.0	1	> 1.0	4	35
Diameter (cm)	10 to 20	3	20 to 30	7	30 to 40		40 to 50		>50		17
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	6	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)		28
Type	Bridge	3			Ramp	5	Submersed	2	Buried		26
Structure	Plain	4	Plain/Int	5	Intermediate	1	Int/Sticky		Sticky		17
Stability	Moveable	4	Mov/Int	1	Intermediate	3	Int/Sec	2	Secured		23
Orientation (deg)	0 to 20	2	20 to 40	3	40 to 60	1	60 to 80	1	80 to 90	3	30
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ		State	TN			Forest Type	Deciduous			
Date	10/15/17		County				Forest Age (yrs)	30 to 50			
Stream Name	East Fork Hurricane, TDEC		Phys. Province	71			Latitude (dd)	36.05569			
Reach ID	15		Drainage Area (mi^2)	0.36			Longitude (dd)	-86.27749			
Watershed Name			Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory							
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	12.7			Slope (ft/ft)	0.01470			
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9			Bed material	Gravel			
Stream Condition	Reference		Floodprone Width (ft)	75			Rosgen Type	C4			
Field Notes:											

SCORE										
	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	4	0.6 to 0.8	3	0.8 to 1.0		> 1.0		19
Diameter (cm)	10 to 20	6	20 to 30	2	30 to 40	1	40 to 50		>50		13
Location	**Zone 4** (Above BKF/Hanging into Ch)	1			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	5	**Zone 1** (Below WS)		30
Type	Bridge	1			Ramp	6	Submersed	1	Buried	1	28
Structure	Plain	2	Plain/Int	3	Intermediate	4	Int/Sticky		Sticky		20
Stability	Moveable		Mov/Int	3	Intermediate	4	Int/Sec	2	Secured		26
Orientation (deg)	0 to 20	2	20 to 40	1	40 to 60	2	60 to 80	3	80 to 90	1	27
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	10/15/17	County			Forest Age (yrs)	30 to 50	
Stream Name	UT Little Marrowbone, TDEC	Phys. Province	71		Latitude (dd)	36.27215	
Reach ID	17	Drainage Area (mi^2)	0.66		Longitude (dd)	-86.90268	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	24.5		Slope (ft/ft)	0.00840	
Stream Classification	Perennial	BKF Mean Depth (ft)	0.8		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	35		Rosgen Type	B4c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	4	0.4 to 0.6	1	0.6 to 0.8	1	0.8 to 1.0		> 1.0		9
Diameter (cm)	10 to 20	3	20 to 30	2	30 to 40	1	40 to 50		>50		10
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)		15
Type	Bridge				Ramp	4	Submersed	2	Buried		20
Structure	Plain	3	Plain/Int	2	Intermediate	1	Int/Sticky		Sticky		10
Stability	Moveable	3	Mov/Int	1	Intermediate	1	Int/Sec	1	Secured		12
Orientation (deg)	0 to 20	1	20 to 40		40 to 60	2	60 to 80	1	80 to 90	2	21
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ	State	TN		Forest Type	Deciduous	
Date	10/15/17	County			Forest Age (yrs)	30 to 50	
Stream Name	Little Swan, TDEC	Phys. Province	71		Latitude (dd)	35.52947	
Reach ID	26	Drainage Area (mi^2)	8.82		Longitude (dd)	-87.45397	
Watershed Name		Dominant Species	Sycamore, Beech, Oak, Maple, Birch, Hickory				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	48		Slope (ft/ft)	0.00550	
Stream Classification	Perennial	BKF Mean Depth (ft)	2.1		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	120		Rosgen Type	C4	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0		> 1.0		5
Diameter (cm)	10 to 20	3	20 to 30	1	30 to 40		40 to 50		>50		5
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		8
Type	Bridge				Ramp	4	Submersed		Buried		12
Structure	Plain	2	Plain/Int	2	Intermediate		Int/Sticky		Sticky		6
Stability	Moveable	1	Mov/Int	2	Intermediate	1	Int/Sec		Secured		8
Orientation (deg)	0 to 20	2	20 to 40	1	40 to 60	1	60 to 80		80 to 90		7
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN		Forest Type	Deciduous	
Date	3/21/17	County	Henderson		Forest Age (yrs)	30 to 50	
Stream Name	UT North Fork Cub Creek	Phys. Province	65		Latitude (dd)	35.78522	
Reach ID	14a	Drainage Area (mi^2)	0.16		Longitude (dd)	-88.26468	
Watershed Name		Dominant Species	Oak, Maple, Birch, Holly				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	6.1		Slope (ft/ft)	0.01164	
Stream Classification	Intermittent	BKF Mean Depth (ft)	0.7		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	65		Rosgen Type	E5	
Field Notes:	Hill Slope Seep						

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	0	0.4 to 0.6	0	0.6 to 0.8	0	0.8 to 1.0	2	> 1.0	5	33
Diameter (cm)	10 to 20	6	20 to 30	0	30 to 40	0	40 to 50	1	>50	0	10
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	0	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	2	18
Type	Bridge	1			Ramp	3	Submersed	3	Buried	0	22
Structure	Plain	6	Plain/Int	0	Intermediate	1	Int/Sticky	0	Sticky	0	9
Stability	Moveable	1	Mov/Int	0	Intermediate	0	Int/Sec	1	Secured	5	30
Orientation (deg)	0 to 20	1	20 to 40	3	40 to 60	1	60 to 80	1	80 to 90	1	19
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Height (% of BKF Depth)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Structure	Coarse	0	Coarse/Int	0	Intermediate	0	Int/Fine	0	Fine	0	0
Location	Partially high flow	0	In high flow	0	Partially low flow	0	Mid low flow	0	In low flow	0	0
Stability	Moveable	0	Mov/Int	0	Intermediate	0	Int/Sec	0	Secured	0	0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN		Forest Type	Deciduous	
Date	3/22/17	County	Madison		Forest Age (yrs)	30	
Stream Name	Spring Creek	Phys. Province	65		Latitude (dd)	35.77013	
Reach ID	1	Drainage Area (mi^2)	8.47		Longitude (dd)	-88.69193	
Watershed Name		Dominant Species	Sycamore, Oak, Elderberry, Maple				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	21.2		Slope (ft/ft)	0.00283	
Stream Classification	Perennial	BKF Mean Depth (ft)	2		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	212		Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	3	0.6 to 0.8	2	0.8 to 1.0	2	> 1.0		22
Diameter (cm)	10 to 20	5	20 to 30	4	30 to 40		40 to 50		>50		13
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	6	40
Type	Bridge				Ramp	3	Submersed	6	Buried		33
Structure	Plain	9	Plain/Int		Intermediate		Int/Sticky		Sticky		9
Stability	Moveable	1	Mov/Int	1	Intermediate	3	Int/Sec		Secured	4	32
Orientation (deg)	0 to 20	3	20 to 40	1	40 to 60	3	60 to 80		80 to 90	2	24
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	1	20 to 40		40 to 60		60 to 80		80 to 100	1	6
Height (% of BKF Depth)	0 to 20	1	20 to 40		40 to 60		60 to 80		80 to 100	1	6
Structure	Coarse		Coarse/Int		Intermediate	2	Int/Fine		Fine		6
Location	Partially high flow		In high flow		Partially low flow		Mid low flow	2	In low flow		8
Stability	Moveable		Mov/Int		Intermediate	2	Int/Sec		Secured		6
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/22/17		County			Forest Age (yrs)	10 to 30
Stream Name	UT Little Sugar Creek		Phys. Province	65		Latitude (dd)	35.37627
Reach ID	22a		Drainage Area (mi^2)	0.1		Longitude (dd)	-88.74710
Watershed Name			Dominant Species	Oak, Beech, Maple, Holly			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	3		Slope (ft/ft)	0.01000
Stream Classification	Intermittent		BKF Mean Depth (ft)	0.5		Bed material	Sand
Stream Condition	Reference		Floodprone Width (ft)	100		Rosgen Type	E5
Field Notes:	Near road, very stable pattern, cross-section, no wood, young forest, adjacent wetlands, not included in regional curve survey						

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	0	0.4 to 0.6	0	0.6 to 0.8	0	0.8 to 1.0	0	> 1.0	7	35
Diameter (cm)	10 to 20	5	20 to 30	2	30 to 40	0	40 to 50	0	>50	0	9
Location	**Zone 4** (Above BKF/Hanging into Ch)	7			**Zone 3** (Above BKF/Within Streambanks)	0	**Zone 2** (Above WS/Below BKF)	0	**Zone 1** (Below WS)	0	7
Type	Bridge	4			Ramp	3	Submersed	0	Buried	0	13
Structure	Plain	2	Plain/Int	2	Intermediate	2	Int/Sticky	1	Sticky	0	16
Stability	Moveable	1	Mov/Int	0	Intermediate	2	Int/Sec	0	Secured	4	27
Orientation (deg)	0 to 20	0	20 to 40	0	40 to 60	2	60 to 80	1	80 to 90	4	30
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Height (% of BKF Depth)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Structure	Coarse	0	Coarse/Int	0	Intermediate	0	Int/Fine	0	Fine	0	0
Location	Partially high flow	0	In high flow	0	Partially low flow	0	Mid low flow	0	In low flow	0	0
Stability	Moveable	0	Mov/Int	0	Intermediate	0	Int/Sec	0	Secured	0	0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/22/17		County	Hardeman		Forest Age (yrs)	10 to 30
Stream Name	Cypress Creek		Phys. Province	65		Latitude (dd)	35.37640
Reach ID	10		Drainage Area (mi^2)	1.42		Longitude (dd)	-88.85228
Watershed Name			Dominant Species	Oak, Beech, Maple, Holly			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	9.9		Slope (ft/ft)	0.00111
Stream Classification	Perennial		BKF Mean Depth (ft)	1.4		Bed material	Sand
Stream Condition	Reference		Floodprone Width (ft)	99		Rosgen Type	E5
Field Notes:	Near road, very stable pattern, cross-section, no wood, young forest, adjacent wetlands						

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	0	0.4 to 0.6	0	0.6 to 0.8	1	0.8 to 1.0	0	> 1.0	0	3
Diameter (cm)	10 to 20	1	20 to 30	0	30 to 40	0	40 to 50	0	>50	0	1
Location	**Zone 4** (Above BKF/Hanging into Ch)	0			**Zone 3** (Above BKF/Within Streambanks)	0	**Zone 2** (Above WS/Below BKF)	1	**Zone 1** (Below WS)	0	4
Type	Bridge	0			Ramp	1	Submersed	0	Buried	0	3
Structure	Plain	1	Plain/Int	0	Intermediate	0	Int/Sticky	0	Sticky	0	1
Stability	Moveable	0	Mov/Int	0	Intermediate	1	Int/Sec	0	Secured	0	3
Orientation (deg)	0 to 20	0	20 to 40	0	40 to 60	1	60 to 80	0	80 to 90	0	3
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Height (% of BKF Depth)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Structure	Coarse	0	Coarse/Int	0	Intermediate	0	Int/Fine	0	Fine	0	0
Location	Partially high flow	0	In high flow	0	Partially low flow	0	Mid low flow	0	In low flow	0	0
Stability	Moveable	0	Mov/Int	0	Intermediate	0	Int/Sec	0	Secured	0	0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ			State	TN			Forest Type	Deciduous		
Date	3/22/17			County	Chester			Forest Age (yrs)	30		
Stream Name	UT Piney Creek			Phys. Province	65			Latitude (dd)	35.38999		
Reach ID	71			Drainage Area (mi^2)	0.09			Longitude (dd)	-88.78954		
Watershed Name				Dominant Species	Oak, Beech, Maple, Holly						
Survey Length (ft)	328	Survey Length = 328 ft/1		BKF Width (ft)	7.5			Slope (ft/ft)	0.00863		
Stream Classification	Perennial			BKF Mean Depth (ft)	0.7			Bed material	Sand		
Stream Condition	Reference			Floodprone Width (ft)	35			Rosgen Type	E5		
Field Notes:	South of HWY 100 at Golf Course, downstream reach is braided										

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	0	0.4 to 0.6	0	0.6 to 0.8	0	0.8 to 1.0	4	> 1.0	6	46
Diameter (cm)	10 to 20	5	20 to 30	1	30 to 40	0	40 to 50	4	>50	0	23
Location	**Zone 4** (Above BKF/Hanging into Ch)	5			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	0	24
Type	Bridge	4			Ramp	2	Submersed	4	Buried	0	26
Structure	Plain	4	Plain/Int	2	Intermediate	0	Int/Sticky	4	Sticky	0	24
Stability	Moveable	1	Mov/Int	0	Intermediate	3	Int/Sec	4	Secured	2	36
Orientation (deg)	0 to 20	2	20 to 40	0	40 to 60	0	60 to 80	4	80 to 90	4	38
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Height (% of BKF Depth)	0 to 20	0	20 to 40	0	40 to 60	0	60 to 80	0	80 to 100	0	0
Structure	Coarse	0	Coarse/Int	0	Intermediate	0	Int/Fine	0	Fine	0	0
Location	Partially high flow	0	In high flow	0	Partially low flow	0	Mid low flow	0	In low flow	0	0
Stability	Moveable	0	Mov/Int	0	Intermediate	0	Int/Sec	0	Secured	0	0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ			State	TN			Forest Type	Deciduous		
Date	3/22/17			County	Madison			Forest Age (yrs)	30		
Stream Name	Harris Creek			Phys. Province	65			Latitude (dd)	35.62607		
Reach ID	19			Drainage Area (mi^2)	20.2			Longitude (dd)	-88.69444		
Watershed Name				Dominant Species	Oak, Beech, Maple, Holly						
Survey Length (ft)	328	Survey Length = 328 ft/1		BKF Width (ft)	46			Slope (ft/ft)	0.00206		
Stream Classification	Perennial			BKF Mean Depth (ft)	4.3			Bed material	Sand		
Stream Condition	Reference			Floodprone Width (ft)	267			Rosgen Type	E5		
Field Notes:											

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	2	0.6 to 0.8	0	0.8 to 1.0	0	> 1.0	2	17
Diameter (cm)	10 to 20	0	20 to 30	2	30 to 40	3	40 to 50	1	>50	1	22
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)	2	**Zone 2** (Above WS/Below BKF)	0	**Zone 1** (Below WS)	3	23
Type	Bridge	1			Ramp	3	Submersed	3	Buried	0	22
Structure	Plain	5	Plain/Int	0	Intermediate	1	Int/Sticky	0	Sticky	1	13
Stability	Moveable	2	Mov/Int	0	Intermediate	4	Int/Sec	0	Secured	1	19
Orientation (deg)	0 to 20	2	20 to 40	3	40 to 60	0	60 to 80	0	80 to 90	2	18
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20	1	20 to 40	1	40 to 60	0	60 to 80	0	80 to 100	0	3
Height (% of BKF Depth)	0 to 20	0	20 to 40	0	40 to 60	1	60 to 80	0	80 to 100	1	8
Structure	Coarse	2	Coarse/Int	0	Intermediate	0	Int/Fine	0	Fine	0	2
Location	Partially high flow	0	In high flow	0	Partially low flow	0	Mid low flow	1	In low flow	1	9
Stability	Moveable	0	Mov/Int	0	Intermediate	1	Int/Sec	0	Secured	1	8
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN		Forest Type	Deciduous	
Date	3/22/17	County	Madison		Forest Age (yrs)	30	
Stream Name	Trace Creek	Phys. Province	65		Latitude (dd)	35.66294	
Reach ID	21	Drainage Area (mi^2)	5.57		Longitude (dd)	-88.66867	
Watershed Name		Dominant Species	Oak, Beech, Maple, Holly				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	21.7		Slope (ft/ft)	0.00341	
Stream Classification	Perennial	BKF Mean Depth (ft)	3.1		Bed material	Sand	
Stream Condition	Reference	Floodprone Width (ft)	217		Rosgen Type	E5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	3	0.6 to 0.8		0.8 to 1.0	1	> 1.0	1	18
Diameter (cm)	10 to 20	3	20 to 30	2	30 to 40	2	40 to 50		>50	1	18
Location	**Zone 4** (Above BKF/Hanging into Ch)				**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	5	36
Type	Bridge				Ramp	1	Submersed	7	Buried		31
Structure	Plain	2	Plain/Int	1	Intermediate	4	Int/Sticky		Sticky	1	21
Stability	Moveable		Mov/Int	2	Intermediate	1	Int/Sec		Secured	5	32
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60		60 to 80	3	80 to 90	1	23
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80	1	80 to 100		4
Height (% of BKF Depth)	0 to 20		20 to 40	1	40 to 60		60 to 80		80 to 100		2
Structure	Coarse	1	Coarse/Int		Intermediate		Int/Fine		Fine		1
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	1	5
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN		Forest Type	Deciduous	
Date	3/23/17	County	Shelby		Forest Age (yrs)	30	
Stream Name	UT1 Barnishee Bayou	Phys. Province	74		Latitude (dd)	35.35131	
Reach ID	17A	Drainage Area (mi^2)	0.09		Longitude (dd)	-90.04634	
Watershed Name		Dominant Species	Oak, Beech, Maple, Sycamore				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	9.2		Slope (ft/ft)	0.00966	
Stream Classification	Perennial	BKF Mean Depth (ft)	0.6		Bed material	Gravel	
Stream Condition	Reference	Floodprone Width (ft)	39		Rosgen Type	B4c	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	*** PIECES ***										**PIECE SCORES**
Length/BKF Width	0 to 0.4	8	0.4 to 0.6	3	0.6 to 0.8	2	0.8 to 1.0	3	> 1.0	3	47
Diameter (cm)	10 to 20	7	20 to 30	6	30 to 40	3	40 to 50	2	>50	1	41
Location	**Zone 4** (Above BKF/Hanging into Ch)	10			**Zone 3** (Above BKF/Within Streambanks)	4	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	2	44
Type	Bridge				Ramp	17	Submersed	1	Buried	1	60
Structure	Plain	2	Plain/Int	9	Intermediate	8	Int/Sticky		Sticky		44
Stability	Moveable	7	Mov/Int	8	Intermediate	1	Int/Sec	1	Secured	2	40
Orientation (deg)	0 to 20	9	20 to 40	1	40 to 60	1	60 to 80	1	80 to 90	7	53
CATEGORY	**** DEBRIS DAMS ****										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	4	20
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	2	60 to 80		80 to 100	2	16
Structure	Coarse	4	Coarse/Int		Intermediate		Int/Fine		Fine		4
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow	4	20
Stability	Moveable		Mov/Int		Intermediate	1	Int/Sec	1	Secured	2	17

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN	Forest Type	Deciduous	
Date	3/23/17		County	Shelby	Forest Age (yrs)	30	
Stream Name	Barnishee Bayou		Phys. Province	74	Latitude (dd)	35.35219	
Reach ID	17		Drainage Area (mi^2)	0.86	Longitude (dd)	-90.04647	
Watershed Name			Dominant Species	]			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23.5	Slope (ft/ft)	0.00560	
Stream Classification	Perennial		BKF Mean Depth (ft)	1.2	Bed material	Sand	
Stream Condition	Reference		Floodprone Width (ft)	31	Rosgen Type	F5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	5	0.6 to 0.8	3	0.8 to 1.0	2	> 1.0	4	50
Diameter (cm)	10 to 20	3	20 to 30	5	30 to 40	1	40 to 50	1	>50	7	55
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	9	**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	1	48
Type	Bridge	4			Ramp	12	Submersed	1	Buried		44
Structure	Plain	4	Plain/Int	6	Intermediate	5	Int/Sticky	2	Sticky		39
Stability	Moveable	4	Mov/Int	1	Intermediate	4	Int/Sec		Secured	8	58
Orientation (deg)	0 to 20	1	20 to 40	5	40 to 60	3	60 to 80	3	80 to 90	5	57
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN	Forest Type	Deciduous	
Date	3/24/17		County	Shelby	Forest Age (yrs)	30	
Stream Name	UT Poplar Tree Lake		Phys. Province	74	Latitude (dd)	35.31500	
Reach ID	72		Drainage Area (mi^2)	0.22	Longitude (dd)	-90.05808	
Watershed Name			Dominant Species	Oak, Beech, Maple, Holly			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	14.1	Slope (ft/ft)	0.00495	
Stream Classification	Perennial		BKF Mean Depth (ft)	0.9	Bed material	Sand	
Stream Condition	Reference		Floodprone Width (ft)	55	Rosgen Type	C5	
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	2	0.4 to 0.6	2	0.6 to 0.8	1	0.8 to 1.0	2	> 1.0	6	47
Diameter (cm)	10 to 20	4	20 to 30	5	30 to 40	1	40 to 50		>50	3	32
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	2	35
Type	Bridge	4			Ramp	7	Submersed	1	Buried	1	34
Structure	Plain	5	Plain/Int		Intermediate	8	Int/Sticky		Sticky		29
Stability	Moveable	3	Mov/Int		Intermediate	1	Int/Sec		Secured	9	51
Orientation (deg)	0 to 20	6	20 to 40	2	40 to 60	1	60 to 80	2	80 to 90	2	31
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine	1	Fine		4
Location	Partially high flow		In high flow	1	Partially low flow		Mid low flow		In low flow		2
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN	Forest Type	Deciduous		
Date	3/24/17	County	Shelby	Forest Age (yrs)	30		
Stream Name	UT2 Barnishee Bayou	Phys. Province	74	Latitude (dd)	35.36536		
Reach ID	73	Drainage Area (mi^2)	0.23	Longitude (dd)	-90.03369		
Watershed Name		Dominant Species	Oak, Sycamore, Maple, Privet				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	6.5	Slope (ft/ft)	0.01040		
Stream Classification	Perennial	BKF Mean Depth (ft)	0.6	Bed material	Sand		
Stream Condition	Reference	Floodprone Width (ft)	65	Rosgen Type	E5		
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	6	0.6 to 0.8	2	0.8 to 1.0	1	> 1.0	6	52
Diameter (cm)	10 to 20	5	20 to 30	1	30 to 40	5	40 to 50	2	>50	2	40
Location	**Zone 4** (Above BKF/Hanging into Ch)	9			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	3	**Zone 1** (Below WS)	3	36
Type	Bridge	3			Ramp	9	Submersed	2	Buried	1	43
Structure	Plain	3	Plain/Int	2	Intermediate	9	Int/Sticky	1	Sticky		38
Stability	Moveable	2	Mov/Int		Intermediate	1	Int/Sec	1	Secured	11	64
Orientation (deg)	0 to 20	2	20 to 40		40 to 60	5	60 to 80	2	80 to 90	6	55
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	2	10
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine	1	Fine		7
Location	Partially high flow		In high flow	1	Partially low flow		Mid low flow		In low flow	1	7
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	2	10
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ	State	TN	Forest Type	Deciduous		
Date	3/24/17	County	Shelby	Forest Age (yrs)	30		
Stream Name	UT3 Barnishee Bayou	Phys. Province	74	Latitude (dd)	35.37164		
Reach ID	74	Drainage Area (mi^2)	0.13	Longitude (dd)	-90.02683		
Watershed Name		Dominant Species	Oak, Maple, Sycamore, Privet				
Survey Length (ft)	328 Survey Length = 328 ft/1	BKF Width (ft)	11	Slope (ft/ft)	0.00755		
Stream Classification	Perennial	BKF Mean Depth (ft)	0.6	Bed material	Sand		
Stream Condition	Reference	Floodprone Width (ft)	110	Rosgen Type	C5		
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	1	0.4 to 0.6	4	0.6 to 0.8	2	0.8 to 1.0	4	> 1.0		31
Diameter (cm)	10 to 20		20 to 30	5	30 to 40	2	40 to 50	2	>50	2	34
Location	**Zone 4** (Above BKF/Hanging into Ch)	3			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)	4	**Zone 1** (Below WS)	3	37
Type	Bridge				Ramp	6	Submersed	2	Buried	3	41
Structure	Plain	1	Plain/Int	1	Intermediate	8	Int/Sticky		Sticky	1	32
Stability	Moveable	1	Mov/Int		Intermediate	1	Int/Sec		Secured	9	49
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60	4	60 to 80	1	80 to 90	2	32
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0
Additional Notes:											

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/24/17		County	Shelby		Forest Age (yrs)	30
Stream Name	Scotts Creek		Phys. Province	74		Latitude (dd)	35.26775
Reach ID	29		Drainage Area (mi^2)	2.53		Longitude (dd)	-89.74049
Watershed Name			Dominant Species	Oak, Maple			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	22.8		Slope (ft/ft)	0.00188
Stream Classification	Perennial		BKF Mean Depth (ft)	2.1		Bed material	Gravel
Stream Condition	Reference		Floodprone Width (ft)	39		Rosgen Type	B4c
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8	1	0.8 to 1.0		> 1.0	4	23
Diameter (cm)	10 to 20		20 to 30		30 to 40		40 to 50	1	>50	4	24
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)	1	**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)		7
Type	Bridge	3			Ramp	2	Submersed		Buried		9
Structure	Plain		Plain/Int		Intermediate	2	Int/Sticky		Sticky	3	21
Stability	Moveable	1	Mov/Int		Intermediate		Int/Sec		Secured	4	21
Orientation (deg)	0 to 20		20 to 40	1	40 to 60		60 to 80	1	80 to 90	3	21
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100	1	5
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60	1	60 to 80		80 to 100		3
Structure	Coarse		Coarse/Int		Intermediate	1	Int/Fine		Fine		3
Location	Partially high flow		In high flow		Partially low flow	1	Mid low flow		In low flow		3
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured	1	5

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/24/17		County	Hardeman		Forest Age (yrs)	30
Stream Name	Marshall Creek		Phys. Province	65		Latitude (dd)	35.16092
Reach ID	20		Drainage Area (mi^2)	6.4		Longitude (dd)	-89.06761
Watershed Name			Dominant Species	Maple			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	23.8		Slope (ft/ft)	0.00111
Stream Classification	Perennial		BKF Mean Depth (ft)	1.6		Bed material	Sand
Stream Condition	Reference		Floodprone Width (ft)	238		Rosgen Type	C5
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4	3	0.4 to 0.6	6	0.6 to 0.8	1	0.8 to 1.0	1	> 1.0	2	32
Diameter (cm)	10 to 20	2	20 to 30	1	30 to 40	3	40 to 50	2	>50	5	46
Location	**Zone 4** (Above BKF/Hanging into Ch)	4			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)		**Zone 1** (Below WS)	9	49
Type	Bridge	3			Ramp	1	Submersed	3	Buried	6	48
Structure	Plain	1	Plain/Int	1	Intermediate	7	Int/Sticky	2	Sticky	2	42
Stability	Moveable		Mov/Int		Intermediate	2	Int/Sec	1	Secured	10	60
Orientation (deg)	0 to 20	2	20 to 40	2	40 to 60	4	60 to 80	2	80 to 90	3	41
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/24/17		County	McNairy		Forest Age (yrs)	40
Stream Name	UT1 Tuscumbia River		Phys. Province	65		Latitude (dd)	35.05116
Reach ID	75		Drainage Area (m^2)	0.12		Longitude (dd)	-88.75044
Watershed Name			Dominant Species	Oak, Beech, Maple, Cane			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	8.1		Slope (ft/ft)	0.01257
Stream Classification	Perennial		BKF Mean Depth (ft)	0.8		Bed material	Sand
Stream Condition	Reference		Floodprone Width (ft)	36		Rosgen Type	E5
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6	1	0.6 to 0.8		0.8 to 1.0	3	> 1.0	2	24
Diameter (cm)	10 to 20	1	20 to 30	2	30 to 40	2	40 to 50		>50	1	16
Location	**Zone 4** (Above BKF/Hanging into Ch)	2			**Zone 3** (Above BKF/Within Streambanks)		**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	2	20
Type	Bridge				Ramp	3	Submersed	3	Buried		21
Structure	Plain	1	Plain/Int	2	Intermediate	1	Int/Sticky	1	Sticky	1	17
Stability	Moveable	1	Mov/Int		Intermediate	1	Int/Sec		Secured	4	24
Orientation (deg)	0 to 20	1	20 to 40	2	40 to 60		60 to 80	1	80 to 90	2	19
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes:

LARGE WOODY DEBRIS FIELD FORM

Revised: 10/18/2016

Investigator(s)	GJ, VJ		State	TN		Forest Type	Deciduous
Date	3/24/17		County	McNairy		Forest Age (yrs)	30
Stream Name	UT2 Tuscumbia River		Phys. Province	65		Latitude (dd)	35.05033
Reach ID	76		Drainage Area (m^2)	0.05		Longitude (dd)	-88.74894
Watershed Name			Dominant Species	Oak, Sycamore, Maple			
Survey Length (ft)	328	Survey Length = 328 ft/1	BKF Width (ft)	4		Slope (ft/ft)	0.00500
Stream Classification	Perennial		BKF Mean Depth (ft)	0.5		Bed material	Sand
Stream Condition	Reference		Floodprone Width (ft)	200		Rosgen Type	E5
Field Notes:							

SCORE

	1		2		3		4		5		
CATEGORY	* PIECES *										**PIECE SCORES**
Length/BKF Width	0 to 0.4		0.4 to 0.6		0.6 to 0.8	4	0.8 to 1.0	2	> 1.0	9	65
Diameter (cm)	10 to 20	2	20 to 30	3	30 to 40	4	40 to 50	3	>50	3	47
Location	**Zone 4** (Above BKF/Hanging into Ch)	6			**Zone 3** (Above BKF/Within Streambanks)	3	**Zone 2** (Above WS/Below BKF)	2	**Zone 1** (Below WS)	4	43
Type	Bridge	4			Ramp	4	Submersed	6	Buried	1	45
Structure	Plain	5	Plain/Int	2	Intermediate	7	Int/Sticky		Sticky	1	35
Stability	Moveable		Mov/Int	2	Intermediate	2	Int/Sec		Secured	11	65
Orientation (deg)	0 to 20	3	20 to 40	2	40 to 60	5	60 to 80	1	80 to 90	4	46
CATEGORY	** DEBRIS DAMS **										**DAM SCORES**
Length (% of BKF Width)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Height (% of BKF Depth)	0 to 20		20 to 40		40 to 60		60 to 80		80 to 100		0
Structure	Coarse		Coarse/Int		Intermediate		Int/Fine		Fine		0
Location	Partially high flow		In high flow		Partially low flow		Mid low flow		In low flow		0
Stability	Moveable		Mov/Int		Intermediate		Int/Sec		Secured		0

Additional Notes: