Blount County and Little River Basin Nonpoint Source Pollution Inventories and Pollutant Load Estimates

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Executive Summary

The Tennessee Valley Authority (TVA) has developed an Integrated Pollutant Source Identification (IPSI) system for Blount County and its associated watersheds. IPSI is a geographic information system (GIS) database and set of analysis tools developed by TVA environmental engineers and remote sensing specialists to help plan and implement watershed restoration efforts. The Blount County IPSI was developed based on interpretation of color infrared photography obtained on February 21, 2000. The geographic database consists of information on watershed features, such as land use/land cover, streambank erosion sites, livestock operations, and urban development areas which are known or suspected to be sources of nonpoint pollution. Analysis tools include a nonpoint source (NPS) pollution inventory and atlas, desktop GIS, and computer models for estimating pollutant loads by source and watershed. This report summarizes NPS inventory and pollution model results.

The study area included Blount County's three river basins: Little River, Little Tennessee River, and Tennessee River. The Little River Basin was subdivided into 18 watersheds. The Little Tennessee River and Tennessee River Basins were each subdivided into 6 watersheds. The Little River Basin included parts of Blount, Sevier and Knox Counties. Only the Blount County portions of the Little Tennessee River and the Tennessee River Basins were included in this study.

Annual loads of total phosphorous (TP), total nitrogen (TN), total suspended solids (TSS), and zinc were estimated for 28 NPS categories for each watershed. Three to five out of 28 NPS categories accounted for over 60% of each pollutant. Dominant pollution sources varied among pollutants. Residential, commercial, and industrial land, low and medium residue crop land, heavily overgrazed and fair pastures, and livestock with unrestricted stream access contributed significant amounts of at least one pollutant. Per-acre pollution loads from feedlots, loafing areas and disturbed areas were also very high. Since these pollution sources made up a very small percentage of the total area, the total pollution loads from these NPS categories were not as high as other categories.

Within each basin, two to four watersheds accounted for the majority of each pollutant. All of these watersheds, with one exception, are classified by the Tennessee Department of Environment and Conservation (TDEC) as being impaired (2000 305 (b) report). Since these watersheds account for the majority of each pollutant, it is recommended that water quality improvement plans include restoration efforts targeted to these impaired streams. More detailed analysis of the IPSI database could assist partners in developing restoration plans for these impaired streams.

On a per-acre basis, pollution loads were lowest in forested areas and highest in commercial and industrial land areas. Per-acre TP, TN, and TSS loads were generally comparable between agricultural and residential lands. Residential areas contributed higher per-acre zinc loads than agricultural areas.

Forested areas comprise the greatest portion in the study area, followed by agriculture, residential, and commercial. The pollutant loading model shows that agriculture contributed the highest total annual loads of TP, TN, and TSS. Residential areas contributed the highest zinc loads and also showed the second highest annual loading of TP, TN, and TSS.

Projected changes in the land use between 2000 and 2020 occur most dramatically in the residential land use class, with an expected 40% increase across the study area. Commercial and industrial acreage also is expected to increase by 20%, with agriculture experiencing the greatest decrease (15%) and forested areas decreasing by 3%. Pollution models predict that TP, TN, and zinc loads will increase by 6%, 2%, and 31% respectively, and that TSS load will decrease by 10%.

Agriculture currently contributes over 50% of TP, TN, and TSS loads from each basin. In the short term, the most cost-effective strategy to reduce TP, TN, and TSS would probably be to focus on agricultural NPS pollution. A follow-up analysis of costs and water quality benefits of several scenarios to address agricultural impacts is underway. This analysis will enable partner agencies to make efficient use of future cost-share funds by strategically targeting watershed improvement efforts.

By 2020 the majority of TP and TN will originate from urban sources. Urban areas currently account for 92% of zinc. By 2020 over 95% of zinc will originate from urban sources. As

this area develops, the need to manage development to minimize growth impacts on water quality will increase. It is far more effective and economically efficient to prevent water resource degradation through good planning and growth management strategies than it is to restore degraded rivers and streams after development impacts have occurred.

This project was undertaken to assist Blount County and Little River Water Quality Forum (LRWQF) with efforts to influence practices that adversely impact water resources, to restore impaired streams, and to keep additional streams from becoming degraded. While IPSI development represents a significant financial investment, it is only a first step of a long-term effort to improve and protect water quality and water supplies in Blount County and the Little River Basin. IPSI inventory, database, atlas, and NPS model results will be used to assist partners in accomplishing ongoing or planned activities including: development of a Blount County water quality policy; planning and implementing stormwater management programs; review of current planning and zoning ordinances; identification of NPS pollution sources contributing large pollution loads; identification of watersheds contributing large pollution loads; planning, targeting, and managing watershed restoration initiatives; education of citizens and officials; and assisting the State of Tennessee in development and implementation of their watershed approach to water quality protection. These activities address many of the factors impacting the areas water resources. Currently, activities are being planned separately without clear, resource-based pollution reduction goals and without a comprehensive strategy for attaining these goals. The IPSI database and pollution models can provide information to aid citizens and decision makers in determining the right combination of practices to form the most effective plan to achieve water quality goals.

Introduction

The 1999 Blount County Policies Plan identified water quality protection and improvement to be a high priority. A process is underway to develop a general water quality plan for the county. Between April 15, 2002 and July 2, 2002, 22 citizen input workshops were held to involve citizens in identifying goals and implementation strategies to address water quality concerns. A Citizen Advisory Committee has been formed to assist in water quality planning.

The Little River is an area of special concern. The Little River supports several state and federally protected species, and is heavily used for recreational purposes. It also provides drinking water to thousands of residents in Blount County and is viewed by most county residents as a valuable resource. Little River Water Quality Forum (LRWQF), a consortium of 21 local, state, and federal agencies and private organizations was formed to plan and coordinate water quality improvement and protection initiatives.

The Tennessee Valley Authority (TVA) has developed an Integrated Pollutant Source Identification (IPSI) system for Blount County and its associated watersheds. This system was developed to support development of the county-wide general water quality plan and LRWQF efforts to improve and protect the Little River. IPSI is a geographic database and set of tools designed to aid in planning and implementing water quality improvement and protection initiatives. It is also designed to aid water quality agencies in implementing a watershed based approach to pollution control. The geographic database consists of information on watershed features, which are known or suspected to be sources of nonpoint pollution. This information is generated by interpretation of low-altitude color infrared aerial photography. The data is managed using commercially available software. The corresponding set of tools include a nonpoint source (NPS) pollution inventory and atlas that summarize and display nonpoint pollution sources information, a desktop geographic information system (GIS) that allows access to the database, and computer models for estimating pollutant loads by source and watershed.

This report is a summary of the NPS inventory and pollution model results. The NPS inventory section describes watershed features, such as land use/land cover, streambank

erosion sites, livestock operations, and urban development areas that are known or suspected to be sources of nonpoint pollution. The pollution model section presents total phosphorous (TP), total nitrogen (TN), total suspended solids (TSS), and zinc load estimates for Blount County watersheds. Pollution loads were calculated for the year 2000, based on the NPS inventory, and for year 2020, based on projected population growth and changes in land use.

The objective of this project is to influence practices that are adversely impacting water resources in Blount County watersheds, to restore impaired streams, and to keep additional streams from becoming degraded. IPSI database and analytical tools will assist Blount County and LRWQF in accomplishing this objective by:

- providing objective information that will assist the county in developing its general water quality plan
- assisting municipal and county governments in developing Phase II stormwater plans
- assisting municipal and county governments with ongoing review of codes and ordinances
- identifying primary sources of pollutants that are impairing streams
- identifying watersheds with high pollution loads
- enabling partners to develop realistic restoration plans and to make efficient use of future funds by strategically targeting watershed improvement efforts
- educating citizens and officials about sources and impacts of nonpoint source pollution
- assisting Tennessee Department of Environment and Conservation (TDEC) in development and implementation of their watershed approach to water quality protection

Funding for this project was provided by TVA, Blount County, Knox County and the Environmental Protection Agency's 319(h) grant program (managed by the Tennessee Department of Agriculture (TDA)). This report is submitted to fulfill the requirements of contract number 000004441 between TVA and TDA (TDA contract number Z-01-004420-00), contract number 00003714 between TVA and Blount County, and contract number 01RE3-272411 between TVA and Knox County.

Description of the Study Area

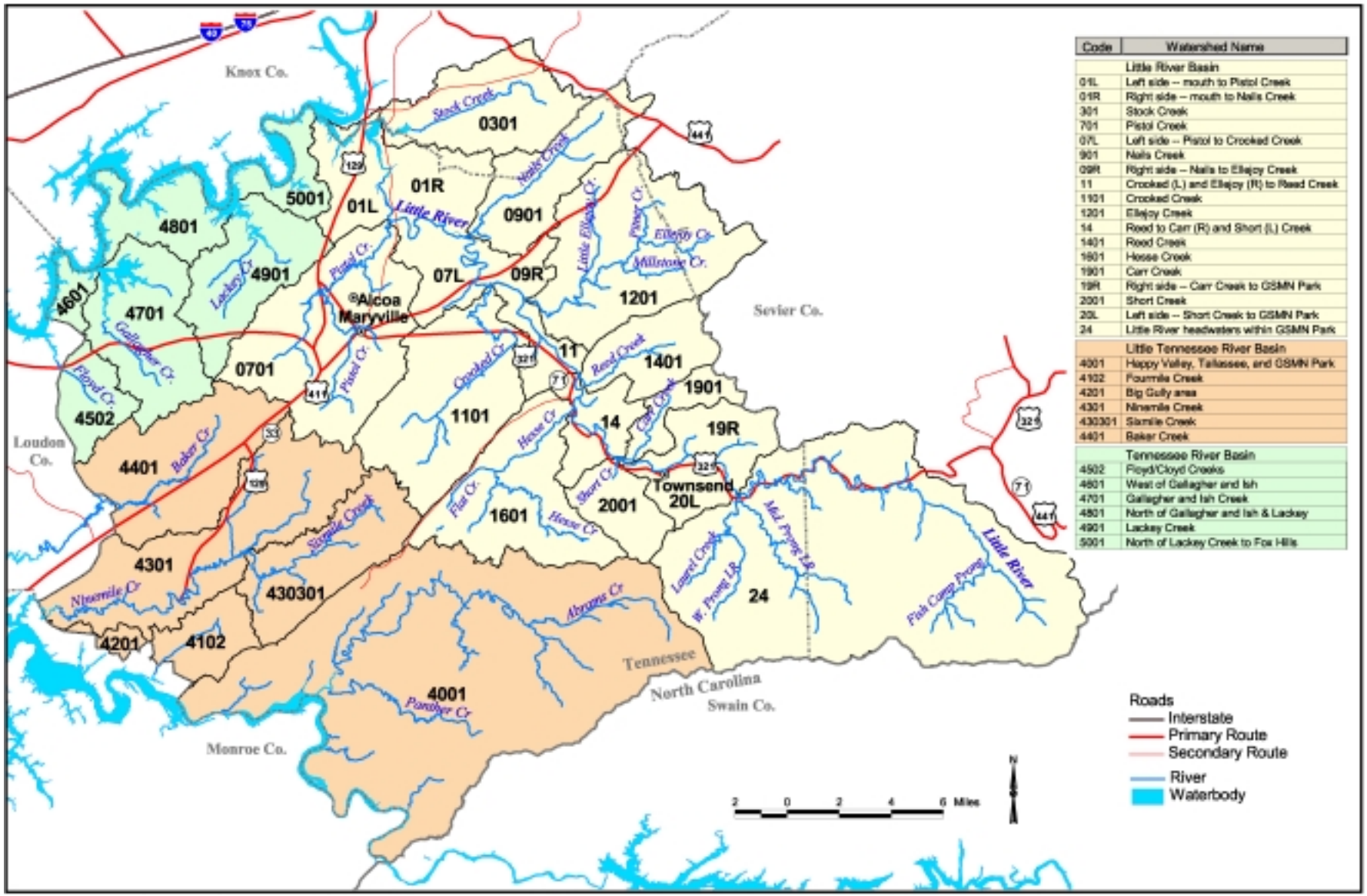
Located in the eastern portion of Tennessee, Blount County covers approximately 362,409 acres and is one of the fastest growing areas in the state. In 2000, the population of the county was approximately 100,000. The county seat of Maryville has a population of about 20,000. The city of Alcoa has a population of about 7,000. Three drainage basins* are associated with Blount County: Little River, Little Tennessee River, and Tennessee River (Figure 1).

The Little River originates in the Great Smoky Mountains National Park where it is an ecoregion reference stream and classified as an outstanding national resource. The Little River Basin drains 242,207 acres including parts of Blount, Knox, and Sevier Counties. Most of the basin (173,447 acres) is in Blount County. The Little River Basin is subdivided into 18 watersheds.

Section 305(b) of the Clean Water Act requires each state to prepare a report, every other year, describing the quality of its waters and identifying causes and sources of water pollution. In 2000, TDEC classified the Little River as threatened. This threatened designation means that if current trends continue, the Little River will be impaired within five years. This report also classified several Little River tributaries, including Pistol Creek, Crooked Creek, Ellejoy Creek, Short Creek, Nails Creek, Roddy Branch, Russell Branch, and the Little River embayment of Fort Loudoun Reservoir impaired due to poor water quality.

The Little Tennessee River Basin drains a 141,710 acre area in the southwestern part of Blount County. The basin includes 61,117 acres of the Great Smoky Mountains National Park. The basin is divided into six watersheds. The primary tributaries are Abrams Creek, Baker Creek and Ninemile Creek. Baker and Ninemile Creek are classified as impaired.

* This report uses the term **basins** to refer to watersheds of large rivers. Watersheds of the Little River, the Little Tennessee River and the Tennessee River are referred to as basins. Basins are subdivided into 6 to 18 tributary watersheds, which are referred to as watersheds.



Code	Watershed Name
	Little River Basin
01L	Left side -- mouth to Pistol Creek
01R	Right side -- mouth to Nails Creek
301	Stock Creek
701	Pistol Creek
07L	Left side -- Pistol to Crooked Creek
901	Nails Creek
09R	Right side -- Nails to Ellejoy Creek
11	Crooked (L) and Ellejoy (R) to Reed Creek
1101	Crooked Creek
1201	Ellejoy Creek
14	Reed to Carr (R) and Short (L) Creek
1401	Reed Creek
1601	Hosse Creek
1901	Carr Creek
19R	Right side -- Carr Creek to GSMN Park
2001	Short Creek
20L	Left side -- Short Creek to GSMN Park
24	Little River headwaters within GSMN Park
	Little Tennessee River Basin
4001	Happy Valley, Tallassee, and GSMN Park
4102	Fourmile Creek
4201	Big Gully area
4301	Ninemile Creek
430301	Slamile Creek
4401	Baker Creek
	Tennessee River Basin
4502	Floyd/Cloyd Creeks
4601	West of Gallagher and Ish
4701	Gallagher and Ish Creek
4801	North of Gallagher and Ish & Lackey
4901	Lackey Creek
5001	North of Lackey Creek to Fox Hills

Figure 1. Watersheds of Blount County and Little River Basin

The Tennessee River Basin drains a 47,253 acres area in the northwestern part of Blount County and is subdivided into six watersheds. The communities of Louisville and Friendsville are located in this basin. The primary tributaries are Lackey Creek, Gallagher and Ish Creek and Floyd/Cloyd Creeks. Gallagher and Ish and Floyd/Cloyd Creeks are classified as impaired.

Methods

This section describes remote sensing techniques used to acquire and interpret aerial photography and develop the NPS inventory and atlas. The structure of the GIS database and assumptions and equations used in the pollutant loading modeling are also described.

Nonpoint Source Inventory

Aerial Photography Acquisition

The NPS inventory was based on color infrared aerial photography taken on February 21, 2000. The flight plan parameters were determined by analysis of project requirements. The photograph scale was 1:24,000. The exposures were overlapping to enable the interpreter to use specialized equipment to view the landscape in three dimensions. The film type or emulsion was color infrared. The makeup of color infrared film is unique in that one of the three layers of the film's emulsion is sensitive to the near infrared portion of the light spectrum. Chlorophyll of plants is highly reflective in the near infrared. This characteristic allows the interpreter to make inferences about vigor and type of vegetation not possible with color or black and white film.

Hydrologic Unit and Watershed Mapping

Blount County's three river basins were subdivided into hydrologic units that ranged in size from 1,249 acres to 67,794 acres (Figure 1). Many of these hydrologic units are watersheds (areas contributing surface runoff to a defined point on a stream). Other hydrologic units are groups of small tributaries and land draining directly to one of the three primary rivers. For convenience all hydrologic units are referred to as watersheds in this report. Watershed configurations used in this study were determined based on input from state and local agencies and organizations. The Little River Basin was subdivided into 18 watersheds. The Little Tennessee and Tennessee Basins were each subdivided into 6 watersheds.

Land Use Classification

The study area was divided into unique polygons based on land use characteristics as interpreted from aerial photography. Each polygon was assigned a land use code. The

coding scheme used in this study was adapted from a hierarchical system developed by the United States Geological Survey (USGS) for use with remotely sensed data (Anderson et al., 1978). Land use classes and codes used in this project are listed in Table 1. Land use classes were grouped into 22 land use categories and into four major land use categories (residential, commercial and industrial, agriculture, and forest and wetland) for analysis and summarization (Table 1).

Projected Land Use in Year 2020

Pollution loads in the year 2020 were estimated based on projected future land use. Projected land use data was entered in the inventory of the model and used to estimate pollutant loadings for the year 2020. John Lamb, Director of Planning for Blount County, estimated that the population in Blount County will grow by 36,500 by 2020. This projection was based on a modified cohort survival model, assuming current rate of net migration.

Mr. Lamb used his knowledge of current land use and growth patterns, along with consultation with the Blount County Planning Commission, to distribute the projected population increase among watersheds. Increased residential land area was calculated assuming a population density of 4.5 people per-acre in urban areas of Alcoa and Maryville and 2.5 people per-acre in rural areas of the county. The present ratio of commercial and industrial area to residential area was used as guide to project increased commercial and industrial area. An assumption of slightly greater regional concentration of the two land uses as urbanization increases in the county also contributed to the projected land use estimates. Transportation projection used the same ratio approach, plus assumptions about planned major infrastructure improvements.

The sum of increased residential, commercial, industrial and transportation area was subtracted from current forest and agricultural acreage. In lowland areas, 80% of the change came from agricultural land and 20% from forested land. In more mountainous areas, 40% came from agricultural land and 60% from forested land.

Table 1. Land use classification scheme used in analysis of Blount County watersheds. Land use polygons were classified (Land use Classes) and coded (Land Use Codes) based a system developed by Anderson et al. Land use classes were grouped for analysis.

Major Land Use Category	Land Use Category	Land Use Code	Land Use Class
Residential	Residential	111	Single family, medium density (2-5 per acre)
		112	Single family, low density (fewer than 2/acre)
		115	Apartment/condominium complex
		117	Mobile home park
		118	Farmstead with accompanying structures
	Subdivisions under construction	1111	Subdivision under construction
		1121	Subdivision under construction (roads, some home construction)
Commercial / Industrial	Commercial	12	Commercial, service, institutional
		1204	Auto junkyard
		1210	Race course
		1213	Campground
		1218	Boat ramp
		1224	Commercial, service, institutional
		12341	Landfill
		1235	Water treatment
		1236	Sewage treatment
		1251	Educational
		1253	Religious
		1255	Cemetery
		1258	Archaeological site
	Transportation, communication, utility	14	Transportation, Communication, Utility
		140	Airport
		1401	Airport, grass - runway
		142	Major highway right of way
		144	Dam
		145	Electric transmission right of way
		1461	Transmission facility, substation
	Green	PK-OPEN	Park - Open areas
		1207	Golf course
		1221	Athletic field
		1232	Park
		12321	Scenic overlook
	Industrial	13	Industrial
		1311	Saw mill
		132	Industry under construction
	Mine/ quarry/ borrow	75	Mining, quarries and borrow areas
	Disturbed areas	76	Disturbed area
Agriculture	High residue crops	2102	Row crop: with residue, (>30%)
	Low residue crops	2101	Row crop: no residue, (0 to 10%)
	Strip cropped	2103	Strip cropped: alternating strips of cultivated and non-cultivated
	Medium residue crops	2104	Row crop: medium residue (10 to 30%)
	Orchard	22	Orchards, vineyards, and nurseries
	Fair pasture	213	Fair pasture: uneven growth and condition, minimal maintenance
	Feedlot loafing area	217	Feedlot or loafing areas
	Good pasture	212	Good pasture: well maintained
	Heavily overgrazed pasture	215	Heavily overgrazed pasture
		214	Woodland pasture: 10% or greater crown cover
Forest and wetland	Scrub/ shrub	32	Shrub and brush: old field with volunteer woody growth
	Forest	4	Forest land
		GSMNP	Great Smoky Mountains National Park
	Clearcut	45	Forest land: clear cut
	Wetland	PEM	Palustrine emergent
		PFO/SS	Palustrine forested/scrub-shrub
		PSS	Palustrine scrub-shrub
		PSS/EM	Palustrine scrub-shrub/emergent
Water	Water	5	Water

TVA distributed Mr. Lamb's projected changes across agricultural land use classifications, with approximately 80% of the reduction coming from pasture and 20% from row crop. In some watersheds there was not enough row crop land to account for 20% of the change, so reductions in pasture made up the difference. Where possible, acreage reductions were made equally across the row crop and pasture categories.

Livestock Operations

Livestock operations were mapped by interpretation of facilities and their associations with features such as soil compaction, soil staining, soil moisture content, size and presence of barns and other structures, presence of hay bales, animal trails, water sources, fencing, and feedlots. These relationships and associated land cover were used to determine the relative size and type of livestock operation. The type of operation was identified by looking at clues such as exercise rings for horse operations, silos and loafing areas for dairies, and large open pastures for beef cattle operations. Also included in the database was the proximity to stream for each livestock operation.

Stream Network and Order

The stream network was based on the blueline streams from the 7½ minute USGS maps. The streams were entered into the GIS either by loading USGS Digital Line Graphics (DLG) or by digitizing the stream network from the maps. This base level of streams was then enhanced based on photo interpretation. Streams were added or modified as appropriate to accommodate loading of the photo-interpreted information.

Stream order of each stream segment was recorded. Stream order is a number representing the relationship of the stream segment to the overall stream network of a watershed. Headwater tributaries are first-order streams. The convergence of two first-order streams creates a second-order stream. A third-order stream results when two second-order streams converge. This numbering continues until all the streams of a watershed are ordered.

Drainage Conditions

Pollutants from nonpoint sources enter the aquatic environment through surface runoff and groundwater seepage. Drainage conditions associated with various land uses and livestock operations were mapped and classified using categories described in Table 2.

Table 2. Drainage features mapped for Blount County area.

Feature	Description
Perennial stream	Water is present throughout most years. Stream usually has a base flow.
Intermittent stream	Water is not present at all times. Stream does not have a base flow throughout most years. The stream has a well-defined channel.
Ephemeral stream	Drainage ways that flow during an individual storm event. There is not a well-defined channel.
Channelized stream	Perennial or intermittent stream altered by straightening or dredging.
Eroded streambank	Stream segments that are eroding with visible collapsed banks.
Grassed waterway	Stream channel that has been planted in vegetation as an erosion control measure or practice.
Animal access	Stream segments where livestock have direct, constant access. Animals are not restricted from the stream by natural or artificial constraints, and there is evidence that animals are entering the stream. Such segments may be small sites where the animals drink or longer segments such as streams through confined feedlots.
Probable animal access	Stream segments through areas where there is direct evidence of presence of animals, and there is no physical barrier to the stream. Livestock have access to the entire segment but, in most instances, are using isolated access points for entry to the stream.
Potential animal access	Stream segment through areas that exhibit no direct evidence of current animal activity. An example is a hay field that may be used in a pasture rotation. The stream has no physical barrier to livestock.

Road Conditions

Base information for road coverage was obtained from standard 1:24,000 USGS topographic maps. The road network was updated to the date of the photography (February 21, 2000). Road conditions interpreted for the NPS inventory were surface type and significant erosion features associated with the road. Road surfaces were classified as either paved (impervious) or unpaved. Unpaved roads included all classes of unpaved surfaces from well-maintained gravel roads to off-road vehicle trails. Significant erosion features associated with roads included eroding cuts and fills, eroding road banks, and eroding road-side ditches.

On-Site Septic Systems

Stressed on-site septic systems can contribute contaminants to surface water through overland flow, particularly when saturated soil conditions exist. The NPS inventory identified signatures associated with on-site septic systems. The four conditions identified are listed in Table 3. These conditions indicate a stressed or potentially stressed system.

Riparian Features and Conditions

Riparian condition in the NPS inventory is a characterization of the land cover buffer adjacent to a stream. Benefits of a well-managed riparian buffer include: reducing streambank erosion; filtering nutrients, soil, and pesticides from runoff; providing food and habitat for stream life; and contributing to the microclimate within the waterway by providing shade.

The riparian conditions are mapped in two categories. The first category consists of riparian areas lacking woody vegetation. This category includes stream segments adjacent to grass, bare ground, or urban land cover. The second category consists of riparian areas dominated by woody vegetation.

Table 3. On-site septic system conditions mapped for Blount County area.

Condition	Feature observed	Description / Implication
1	Distinctive moisture pattern	Effluent plume from visible drain field pattern or prominent ponding down slope from the drain field.
2	Suspicious moisture pattern	Visible plume pattern, but no drain field apparent; can be straight-pipe from septic system, roof drainage, gray water disposal or natural seepage/spring.
3	Distinctive drain field	Visible drain field pattern, but no plume evident; may indicate slow leaching, but no apparent breakout of a seasonally- or hydraulically-stressed system, or evapotranspiration characteristics of a functioning system or newly-installed system.
4	Suspect location	No plume or drain field visible; home sites on very steep slopes, small lots, visible rock outcrops, or in close proximity to streams or reservoirs, especially those on heavily-wooded lots.

The following riparian buffer features were mapped for both the left and right (looking downstream) banks of perennial streams:

- Vegetative type identified as either woody, grass, or bare.
- Percent of coverage coded as 0 to 33%, 34 to 66%, or 67 to 100% for woody vegetation.
- Grass cover quality rated as poor, moderate, or good.
- Width of vegetation coded as 0 to 25 feet, 26 to 100 feet, or greater than 100 feet.

Photo-identifiable physical features in the stream such as riffles, falls, ponds, and pools were also mapped.

A riparian buffer classification matrix was used to rate the ability of the riparian buffer to filter runoff before entering the stream (Table 4). The assumption is that the quality and extent of the buffer zone has a direct relationship to the potential ecological health and water quality of a stream by reducing nonpoint source pollutants entering the stream. The riparian buffer was rated adequate, marginal, or inadequate with regard to the ability to remove pollutants.

Impervious Cover

The natural surface runoff characteristics of a watershed can be altered by impervious surfaces. Impervious surfaces prevent rainfall from infiltrating the soil and result in greater surface runoff. Impervious surfaces include roads, parking lots, sidewalks, rooftops, and other impermeable surfaces of the urban landscape. Imperviousness is defined as the percentage of total area of the mapped unit covered by impervious surfaces. A percent imperviousness, excluding paved roads, was assigned to each land use/land cover polygon based on interpretation of the photography. For example, a low-density residential area might have a percent imperviousness of 5% based on the estimated coverage of structures, driveways, and sidewalks. The percentage of area covered by paved roads was calculated from the roads' coverage layer in the database.

Percent imperviousness for each watershed was calculated by multiplying the imperviousness for each polygon by the area for each polygon. The products for each polygon were then summed and divided by the total watershed area.

Table 4. Riparian buffer classifications for woody and grass vegetation for Blount County area.

Riparian buffer classification			
	Woody vegetation		
Width/Cover	0 to 33 percent	34 to 66 percent	67 to 100 percent
0 to 25 feet	Inadequate	Marginal	Marginal
26 to 100 feet	Marginal	Marginal	Adequate
over 100 feet	Marginal	Adequate	Adequate
	Grass vegetation		
Width/Cover	Poor quality	Moderate quality	Good quality
0 to 25 feet	Inadequate	Marginal	Marginal
26 to 100 feet	Inadequate	Marginal	Adequate
over 100 feet	Inadequate	Adequate	Adequate

Soil Loss Estimates

Soil loss for selected land use classes and other high impact erosion features was calculated. The amount of soil loss estimated was the total potential soil movement for the feature. For example, the soil loss for a particular agricultural field was an estimate of the amount of soil movement on the field, in tons per-acre per year, based on the Universal Soil Loss Equation (USLE). The soil loss from unpaved roads was calculated by estimating an average erosion rate and assuming an average road width.

Pollutant Loading Model

Models were developed to estimate NPS pollutant loads of TSS, TN, TP, and zinc based on the NPS inventory. The models estimated pollution loads to each watershed from sources such as residential, commercial, industrial, transportation, cropland, pasture, and livestock. Pollutant load, as it applies to the model, refers to the amount of pollutant exiting the watershed. The models used Excel spreadsheet software developed by Microsoft for Windows XP to perform calculations and display results in tabular and graphical form. The workbook consists of sheets for the land use inventory, USLE factors, other loading parameters, and calculation sheet for each loading parameter, accompanied by graphs to display results. Models were calibrated using procedures described in Appendix A. These models can also be used to demonstrate the effect of potential nonpoint source management strategies on pollutant loads.

Separate spreadsheets were developed for Blount County and the Little River Basin, using same technique. The Blount County spreadsheet included portions of the three basins within Blount County. Little Tennessee River Basin and Tennessee River Basin were both subdivided into 6 watersheds. The Little River Basin within Blount County was treated as a single large watershed. The Little River spreadsheet included portions of the Little River Basin outside of Blount County.

Pollutant Loads from Urban Land Classes

Pollutant loads from urban land uses (residential, subdivisions under construction, commercial, green space, industrial, and transportation) were estimated using a method described by United States Environmental Protection Agency (USEPA) (1990). This USEPA method uses the following equation:

$$M = RainV \times Rv \times Area \times Conc \times 0.227 \qquad \text{Equation (1)}$$

Where:

M	=	mass load (pounds)
RainV	=	average annual rainfall (inches)
Rv	=	runoff coefficient (unitless)
Area	=	drainage area (acres), derived from the NSP inventory
Conc	=	average runoff concentration (mg/L)
0. 227	=	unit conversion factor

Average annual rainfall for each watershed (Table 5) was estimated from the Spatial Climate Analysis Service (Oregon Climate Center, 2000).

Average runoff concentrations (Table 6) were adapted from Schueler (1994a) to fit local conditions as described in the Appendix A.

$$Rv = 0.050 + 0.009 (PI) \qquad \text{Equation (2)}$$

Where PI is percent imperviousness by land use class estimated from the remote sensing process (Table 6).

Pollutant Loads from Streambanks, Road banks and Roads

Pollutant loads from streambanks, road banks, and roads are directly related to the soil loss. Soil loss for streambanks, road banks, and roads was calculated using the formula:

$$A = ER \times EA \qquad \text{Equation (3)}$$

Where:

A	=	soil loss from streambanks, road banks, or roads (tons/year)
ER	=	erosion rate for streambanks or road banks (measured in tons/foot/year) and unpaved roads (measured in tons/acre/year)
EA	=	eroding area from inventory for streambanks or road banks (measured in feet) and unpaved roads (measured in acres)

Values for streambank and road bank erosion rates were estimated from calculations based on the average bank height and average recession rates of eroding banks. Values for each

Table 5. Annual rainfall and sediment delivery ratios for each Blount County watershed.

Watershed Name	Rainfall (inches)	Sediment delivery ratio (unitless)
Little River Basin		
Left side -- mouth to Pistol Creek	48	0.181
Right side -- mouth to Nails Creek	48	0.169
Stock Creek	48	0.149
Pistol Creek	48	0.128
Left side -- Pistol to Crooked Creek	48	0.184
Nails Creek	48	0.156
Right side -- Nails to Ellejoy Creek	48	0.210
Crooked (L) and Ellejoy (R) to Reed Creek	48	0.198
Crooked Creek	49	0.135
Ellejoy Creek	48	0.128
Reed to Carr (R) and Short (L) Creek	51	0.183
Reed Creek	51	0.170
Hesse Creek	54	0.140
Carr Creek	52	0.198
Right side -- Carr Creek to GSMN Park	53	0.179
Short Creek	55	0.183
Left side -- Short Creek to GSMN Park	52	0.198
Little River headwaters within GSMN Park	58	0.096
Little River within Blount County	49	0.069
Little Tennessee River Basin		
Happy Valley, Tallassee and GSMN Park	58	0.091
Fourmile Creek	52	0.184
Big Gully area	52	0.255
Ninemile Creek	51	0.129
Sixmile Creek	52	0.150
Baker Creek	51	0.139
Tennessee River Basin		
Floyd/Cloyd Creeks	52	0.186
West of Gallagher and Ish	52	0.227
Gallagher and Ish Creek	50	0.147
North of Gallagher and Ish & Lackey	49	0.171
Lackey Creek	48	0.153
North of Lackey Creek to Fox Hills	48	0.192

Table 6. Values used to estimate pollutant loads from urban land classes.

		Residential	Subdivision under construction	Commercial	Green space	Industrial	Transportation
Runoff coefficient	unitless	0.276	0.208	0.550	0.094	0.693	0.270
TP concentration	mg/L	0.200	0.200	0.200	0.100	0.200	0.200
TN concentration	mg/L	1.800	5.000	3.000	0.500	4.000	2.000
TSS concentration	mg/L	100	1500	100	50	150	100
Zn concentration	mg/L	0.285	0.054	0.508	0.059	0.525	0.051
Imperviousness	percent	25%	18%	56%	5%	71%	24%

of these parameters were obtained by consultation with Natural Resources Conservation Service (NRCS) and Blount County Soil Conservation District (SCD), using critical erosion rates for each ecoregion (level IV) and are listed in Appendix B. Road surface erosion rates were estimated from literature values and advice from NRCS personnel. Watershed specific erosion rates and eroding area estimates are listed on Table 7.

Pollutant loads from streambanks, road banks, and roads were determined by the following equation:

$$M = A \times PC \times DR \times 2000 \qquad \text{Equation (4)}$$

Where:

M = mass load (pounds/year)
A = soil loss (tons/year)
PC = pollutant coefficient (ton pollutant/ton soil)
DR = delivery ratio (unitless)
2000 = unit conversion factor

Pollutant Loads from Crop, Pasture, Forest, Mining, and Disturbed Lands

The first step in estimating pollutant loads from crop, pasture, forest, mining and disturbed lands was determining the soil loss for each land class using the USLE:

$$A = R \times K \times LS \times C \times P \qquad \text{Equation (5)}$$

Where:

A = soil loss (tons/acre/year)
R = rainfall energy factor
K = soil erodibility factor
LS = slope-length factor
C = cropping management factor
P = erosion control practice factor

The USLE factors for Blount County watersheds were established through consultation with the NRCS and SCD personnel. The USLE factors are listed in Table 8. Separate soil erodibility and slope-length factors were established for each ecoregion (Appendix B).

Table 7. Estimates of erosion rates and amount of eroding banks for streambanks, roadbanks, and unpaved roads for each Blount County watershed.

Watershed Name	Eroding streambank (feet)	Eroding roadbank (feet)	Unpaved roads (acres)	Road width (feet)	Stream bank (tons/ft/yr)	Road bank (tons/ft/yr)	Unpaved road (tons/ac/yr)
				Little River Basin			
Left side -- mouth to Pistol Creek	25,990	23,511	11	14	0.0030	0.0090	25
Right side -- mouth to Nails Creek	44,057	14,167	29	14	0.0116	0.0090	25
Stock Creek	41,255	62,009	37	14	0.0146	0.0090	25
Pistol Creek	76,290	110,603	49	14	0.0036	0.0090	25
Left side -- Pistol to Crooked Creek	27,411	4,730	13	14	0.0033	0.0090	25
Nails Creek	68,762	27,894	32	14	0.0077	0.0090	25
Right side -- Nails to Ellejoy Creek	9,942	12,259	5	14	0.0027	0.0090	25
Crooked (L) and Ellejoy (R) to Reed	7,503	24,536	23	14	0.0127	0.0103	25
Crooked Creek	66,539	77,494	85	14	0.0101	0.0097	25
Ellejoy Creek	97,754	75,123	114	14	0.0103	0.0097	25
Reed to Carr (R) and Short (L) Creek	8,174	14,102	15	14	0.0006	0.0038	25
Reed Creek	7,727	4,777	54	14	0.0029	0.0076	25
Hesse Creek	8,784	8,947	40	14	0.0020	0.0062	25
Carr Creek	13,911	19,479	26	14	0.0005	0.0033	25
Right side -- Carr Creek to GSMN Park	27,809	33,209	55	14	0.0015	0.0033	25
Short Creek	15,261	21,723	38	14	0.0017	0.0034	25
Left side -- Short Creek to GSMN Park	9,088	6,199	18	14	0.0014	0.0033	25
Little River headwaters within GSMN	0	0	0	14	0.0000	0.0033	25
Total	556,257	540,762	646				
Little River within Blount County	483,632	463,571	572	14	0.0046	0.0067	25
				Little Tennessee River Basin			
Happy Valley, Tallassee and GSMN Park	7,046	146,521	92	14	0.0007	0.0042	25
Fourmile Creek	8,408	23,198	31	14	0.0164	0.0112	25
Big Gully area	6,917	8,109	10	14	0.0124	0.0090	25
Ninemile Creek	87,001	111,422	102	14	0.0060	0.0090	25
Sixmile Creek	40,280	82,530	85	14	0.0162	0.0112	25
Baker Creek	61,274	94,624	47	14	0.0033	0.0090	25
Total	210,926	466,404	366	14			
				Tennessee River Basin			
Floyd/Cloyd Creeks	19,861	59,535	31	14	0.0159	0.0090	25
West of Gallagher and Ish	7,993	5,892	5	14	0.0027	0.0090	25
Gallagher and Ish Creek	31,187	80,493	57	14	0.0069	0.0090	25
North of Gallagher and Ish & Lackey	27,805	26,960	19	14	0.0027	0.0090	25
Lackey Creek	41,876	64,392	32	14	0.0027	0.0090	25
North of Lackey Creek to Fox Hills	15,169	13,772	18	14	0.0027	0.0090	25
Total	143,891	251,044					
		Total					
Blount County	838,449	1,181,019	938				
Study area	911,074	1,258,210	1,012				

Table 8. Values used for USLE (Universal Soil Loss Equation) for each Blount County watershed.

Watershed Name	R	K	LS	C Low residue	C High residue	C Strip cropped	C Medium residue	C Good pasture	C Fair pasture	C Heavily overgrazed pasture	C Feedlot loafing	C Orchard	C Scrub/ shrub	C Forest	C Clearcut	C Mine/ quarry/	C Disturbed areas	P Mine/ quarry/	P Other land
Little River Basin																			
Left side -- mouth to Pistol Creek	190	0.35	1.26	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Right side -- mouth to Nails Creek	190	0.31	1.38	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Stock Creek	190	0.31	1.36	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Pistol Creek	190	0.30	1.41	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Left side -- Pistol to Crooked Creek	190	0.33	1.33	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Nails Creek	190	0.32	1.34	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Right side -- Nails to Ellejoy Creek	190	0.37	1.19	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Crooked (L) and Ellejoy (R) to Reed Creek	190	0.26	1.44	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Crooked Creek	190	0.28	1.41	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Ellejoy Creek	190	0.28	1.44	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Reed to Carr (R) and Short (L) Creek	190	0.18	10.97	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Reed Creek	190	0.19	6.07	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Hesse Creek	190	0.18	7.93	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Carr Creek	190	0.18	10.59	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Right side -- Carr Creek to GSMN Park	190	0.20	7.20	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Short Creek	190	0.21	6.55	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Left side -- Short Creek to GSMN Park	190	0.20	7.45	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Little River Headwaters within GSMN Park	190	0.17	12.50	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Little River within Blount County	190	0.24	5.89	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Little Tennessee River Basin																			
Happy Valley, Tallassee and GSMN Park	190	0.17	10.93	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Fourmile Creek	190	0.23	1.51	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Big Gully area	190	0.33	1.26	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Ninemile Creek	190	0.34	1.27	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Sixmile Creek	190	0.23	1.51	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Baker Creek	190	0.32	1.34	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Tennessee River Basin																			
Floyd/Cloyd Creeks	190	0.32	1.29	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
West of Gallagher and Ish	190	0.37	1.19	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Gallagher and Ish Creek	190	0.35	1.22	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
North of Gallagher and Ish & Lackey	190	0.37	1.19	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
Lackey Creek	190	0.37	1.19	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1
North of Lackey Creek to Fox Hills	190	0.37	1.19	0.551	0.149	0.125	0.3	0.003	0.015	0.15	0.75	0.003	0.003	0.00003	0.15	1	1	0.1	1

Watershed-specific soil erodibility and slope-length factors were area-weighted averages based on each ecoregion within the watershed.

The pollutant loads from these lands within Blount County and the Little River Basin watersheds were estimated using the soil loss values calculated from Equation (3) and the following equation:

$$M = A \times Area \times DR \times PC \times 2000 \qquad \text{Equation (6)}$$

Where:

M	=	pollutant loading (pounds/ year)
A	=	soil loss (tons/acre/year) determined from the NPS inventory
Area	=	land class area (acre)
DR	=	sediment delivery ratio (unitless)
PC	=	pollutant coefficient (tons pollutant/ton soil)
2000	=	unit conversion factor

The sediment delivery ratio was estimated based on the following equation (USDA, 1978):

$$DR = 0.417762*(A^{-0.134958}) - 0.127097 \qquad \text{Equation (7)}$$

Where:

DR	=	Delivery Ratio (unitless)
A	=	Area (sq miles)

Table 5 lists the sediment delivery ratio used for each watershed.

Most soil pollutant coefficients used in the models for Blount County and the Little River Basin varied with land use. Several land use classes utilized the same coefficient values for a pollutant. The soil pollutant coefficient for TSS is 0.04 tons pollutant /tons soil for all agricultural, forest, orchard, mining and disturbed area land uses. TSS values were estimated to be 40% of the eroded soil that reaches the stream. Soil pollutant coefficients for TN varied, with a value of 0.003 tons pollutant /tons soil for most agricultural land uses and orchards, 0.015 for animal feedlots and loafing areas, and 0.001 for forests, mining, disturbed areas. TP soil pollutant coefficient value for orchards and all agricultural land uses is 0.0002, and 0.0001 for forests, mining, disturbed area land uses. Nutrient characteristics were initially based on Mills et al. (1985). Zinc soil pollutant coefficient is 0.000036 for all land uses. These levels were used as calibration parameters.

Pollutant Loads from Livestock Operations

The pollutant loads from beef cattle, dairy, and horse operations identified within Blount County and the Little River Basin were estimated using the following equation:

$$M_n = NA_n \times WT_n \times PR_n \times 0.365 \times DR_n \times NS_n \qquad \text{Equation (8)}$$

Where:

M	=	pollutant loading (pounds/ year)
NA	=	number of animals (number/site)
WT	=	animal weight (pounds)
PR	=	pollutant production rate (lb pollutant/day/1000 lb live wt)
0.365	=	unit conversion factor
DR	=	delivery ratio (unitless)
NS	=	number of sites of type n
n	=	type of livestock operation

The values used to calculate the pollutant loads for each type of livestock are given in Table 9. The number and type of livestock sites within the study area were identified by the nonpoint source inventory. The sites were identified as small, medium, or large and adjacent or nonadjacent to the stream. The (as excreted) pollutant production rates (PR) for total nitrogen, and total phosphorous were obtained from United States Department of Agricultural (USDA) (1996). The production rate for TSS was based on values derived from Barker et al. (1990).

This component of the loading model primarily accounts for the direct deposition of animal waste into streams. Nutrient-rich material on pastures that is available for washoff is also accounted for by this component. Differences in animal weights and size of individual operations were considered in pollutant load calculations. Livestock calculations differed in delivery ratios for each pollutant for adjacent to stream sites and estimated time spent in streams. While these differences exist, the process used to estimate delivery of horse waste was similar to that used for beef and dairy cattle. The delivery ratio calculations for each pollutant were based on local conditions and consultation of local Soil District Conservation staff.

Table 9. Values used to estimate pollutant loadings from livestock operations.

			Livestock type		
		Units	Beef Cattle	Dairy	Horse
Number of animals per site	Large	number	100	100	20
	Medium	number	50	50	10
	Small	number	25	25	5
Animal weight		lbs/animal	1000	1200	1000
Delivery Ratio - adjacent	TP	unitless	0.035	0.063	0.01
	TN	unitless	0.035	0.063	0.01
	TSS	unitless	0.035	0.063	0.01
Delivery Ratio - non-adjacent	TP	unitless	0.001	0.001	0.001
	TN	unitless	0.001	0.001	0.001
	TSS	unitless	0.001	0.001	0.001
Pollutant production	TP	lb/day/1000 lb live wt	0.11	0.07	0.16
	TN	lb/day/1000 lb live wt	0.31	0.45	0.31
	TSS	lb/day/1000 lb live wt	3.39	5.00	6.20

Estimating the amount of time livestock spent loafing or drinking in or immediately adjacent to streams provided a basis for estimation of the direct delivery of waste. Discussions with NRCS professionals provided the following estimates of time in the creek for dairy and beef cattle with access to streams: 15 minutes per day from November through March; 30 minutes per day in April; one hour per day in May; 1.5 hours per day in June and July; 2 hours per day in August; 1 hour per day in September; and 45 minutes per day in October. This translates to 3.2% of a year, or 3.2% of cattle waste directly deposited into streams. A factor of 0.1% was used to estimate direct washoff of cattle waste in pastures that are not adjacent to streams.

According to observers, horses spend only long enough in the stream to drink, and their time in the stream does not change seasonally. Time in the stream for horses was estimated at 15 minutes per day, or 1% of time on an annual basis. A 0.1% factor was used for washoff from operations that are not adjacent to a stream, as in the case of cattle.

Nonpoint Source Inventory Summary

A NPS inventory is a geographic database of land use and features that contribute or have potential to contribute NPS pollution. The database was generated from the interpretation of low-altitude, color-infrared aerial photography. The data generated for this study were managed using ESRI's ARC/INFO and ArcView software. A copy of the database and desktop GIS was provided to Blount County, City of Maryville, City of Alcoa, Knox County and TDEC. Additional information was provided to Blount County Planning Department and Blount County Soil Conservation District offices in the form of a GIS Atlas. This section of this report provides a summary of the NPS inventory.

Land Use

Major Land Use

Figure 2 summarizes general land use patterns in Blount County and its three river basins. Blount County (61%) as a whole as well as the Little River Basin (65%) and the Little Tennessee River Basin (74%) are predominately forested. Great Smoky Mountains National Park land makes up 50% of the forested acreage in the Little River Basin and 58% of the forested acreage in the Little Tennessee River Basin. The dominant land use in the Tennessee River Basin is agriculture (38%).

The Blue Ridge Mountains and steeper areas of the Ridge and Valley province are primarily forested (Figure 3). Agriculture is the dominant land use in the lower and flatter portions of the Ridge and Valley province. Urban areas are concentrated around the cities of Maryville and Alcoa, in the Pistol Creek Watershed (37% residential and 21% commercial/industrial) and the left side of the Little River from its mouth to Pistol Creek (33% commercial/industrial and 25% residential).

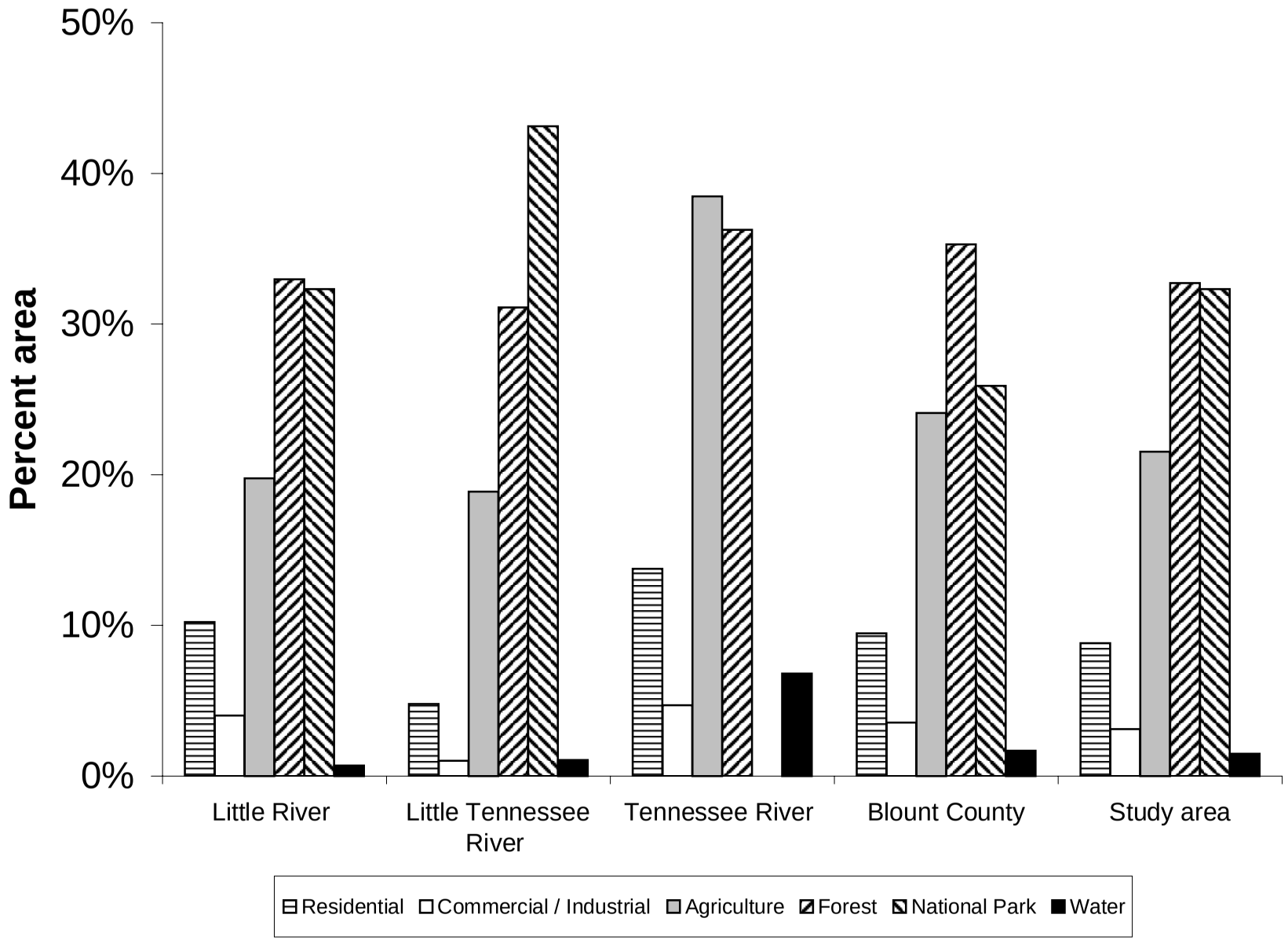


Figure 2. Percent area for each major land use category.

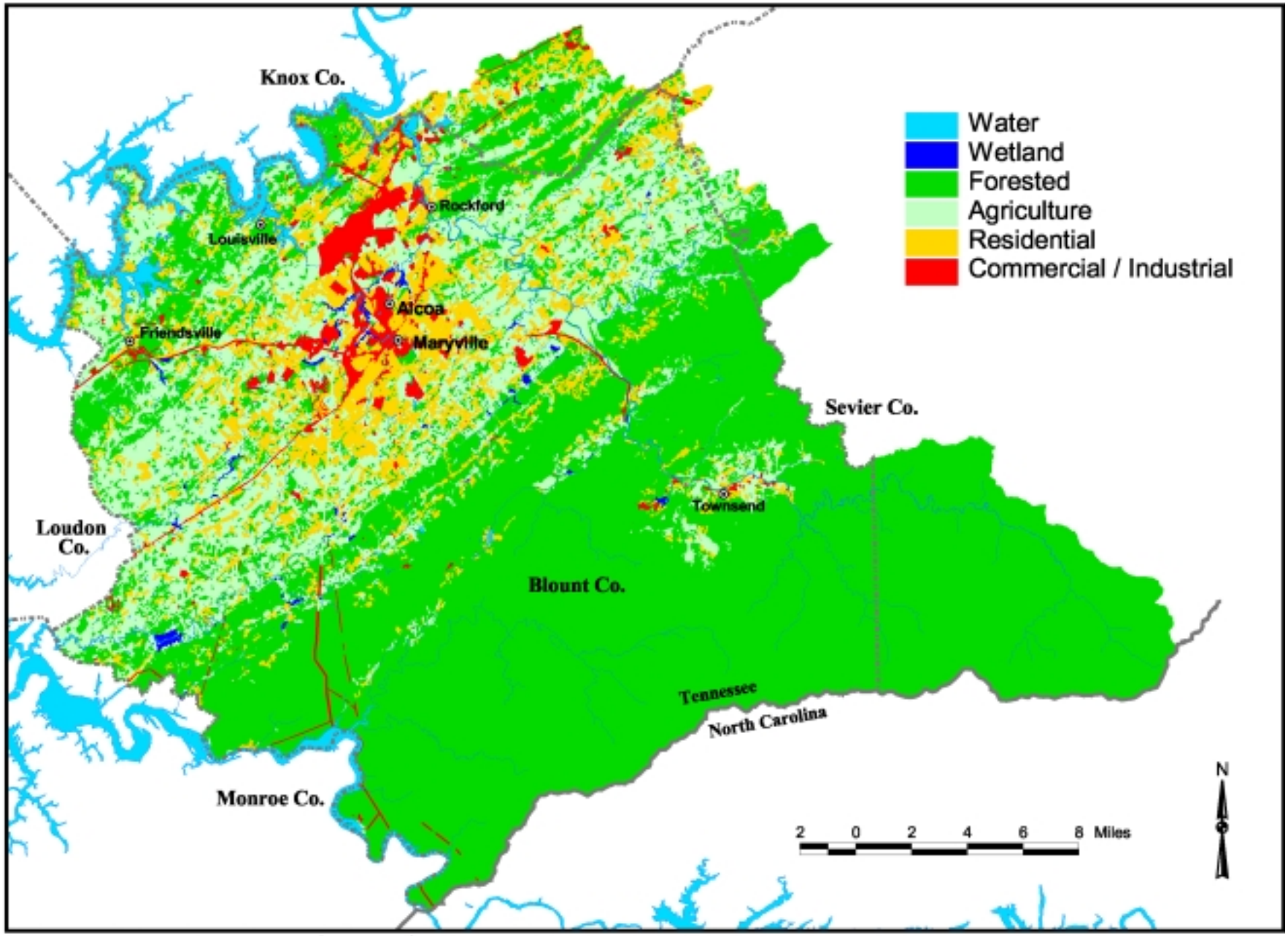


Figure 3. Major Land Uses of Blount County and Little River Basin

Pasture

Table 10 shows a breakdown of pasture by condition as determined by the photo interpreter. The following watersheds have the greatest amount of pasture: Ellejoy Creek in the Little River Basin (9,091 acres), Ninemile Creek (11,405 acres) and Baker Creek (110,553 acres) both in the Little Tennessee River Basin. Within Blount County, the majority (77%) of the pasture was in fair condition. Only 15% was heavily overgrazed and 8% was classified as good. The Little River Basin pasture conditions were similar to the Blount County inventory, with 78% of the pasture reported as fair, 15% was heavily overgrazed, and 7% was classified as good pasture.

Cropland

Table 11 shows acreage of high residue crops, strip crops, medium residue crops, low residue crops and the sum of all cropland by watershed. Total cropland acreage for the study area was 8,045, with 7,936 acres of this land within Blount County. Little River Basin had the highest amount of cropland acreage (4,327 acres), with 82% of the cropland in high (1,981 acres) or medium (1,558 acres) residue crops. Ellejoy Creek (819 acres), Nails Creek (744 acres), and the left side of Little River from Pistol Creek to Crooked Creek (713 acres) Watersheds have the greatest number of acres in cropland. Cropland in the Little Tennessee River Basin is distributed with 55% high residue crops, 24% medium residue crops, and 21% low residue crops. Ninemile Creek (1,214 acres) and Baker Creek (866 acres) Watersheds contain most of the cropland in the Little Tennessee Basin. The Tennessee River Basin also has the greatest percent of cropland as high residue crops (49%), followed by medium residue (38%), low residue (10%), and strip crops (3%). In the Tennessee River Basin, Lackey Creek (748 acres), the area north of Gallagher and Ish and Lackey (365 acres), and Gallagher and Ish Creek (313 acres) Watersheds have the highest amount of cropland.

Livestock Operations

Tables 12-14 show the number and type (small, medium, or large and adjacent or nonadjacent to the stream) of beef cattle, dairy, and horse sites for watersheds in Blount County and the Little River Basin. The classification of small, medium, or large as reported here is a relative relationship among sites within the study area (Table 9). The classification is assigned by the photo interpreter and is for the purpose of comparing potential water

Table 10. Pasture conditions within each Blount County watershed.

Watershed Name	Total pasture (acres)	Good pasture (acres)	Fair pasture (acres)	Heavily overgrazed pasture (acres)	Feedlot loafing areas (acres)
Little River Basin					
Left side -- mouth to Pistol Creek	1,011	114	735	162	0
Right side -- mouth to Nails Creek	3,088	472	2,128	486	3
Stock Creek	3,277	7	2,646	624	0
Pistol Creek	6,185	257	4,931	998	0
Left side -- Pistol to Crooked Creek	2,807	144	2,151	512	0
Nails Creek	4,483	390	3,310	773	10
Right side -- Nails to Ellejoy Creek	1,617	188	1,201	226	2
Crooked (L) and Ellejoy (R) to Reed Creek	808	82	613	113	0
Crooked Creek	6,374	258	5,045	1,066	5
Ellejoy Creek	9,091	918	7,076	1,090	7
Reed to Carr (R) and Short (L) Creek	118	9	102	7	0
Reed Creek	439	11	363	65	0
Hesse Creek	965	0	786	179	0
Carr Creek	389	0	370	15	4
Right side -- Carr Creek to GSMN Park	1,200	21	1,058	115	6
Short Creek	977	0	885	86	6
Left side -- Short Creek to GSMN Park	712	13	664	31	4
Little River headwaters within GSMN Park	0	0	0	0	0
Total	43,542	2,886	34,061	6,548	46
Little River within Blount County	38,171	2,710	29,841	5,575	46
Little Tennessee River Basin					
Happy Valley, Tallassee and GSMN Park	425	0	338	86	0
Fourmile Creek	321	0	307	13	0
Big Gully area	211	6	159	45	0
Ninemile Creek	11,405	1,103	9,042	1,249	10
Sixmile Creek	1,712	51	1,349	311	0
Baker Creek	10,553	913	8,000	1,638	2
Total	24,626	2,074	19,197	3,344	12
Tennessee River Basin					
Floyd/Cloyd Creeks	2,201	76	1,573	552	0
West of Gallagher and Ish	869	7	687	175	0
Gallagher and Ish Creek	5,480	546	4,179	754	0
North of Gallagher and Ish & Lackey	2,718	163	1,978	577	0
Lackey Creek	4,329	431	3,282	616	0
North of Lackey Creek to Fox Hills	949	19	775	154	0
Total	16,545	1,241	12,475	2,829	0
Total					
Blount County	79,341	6,025	61,512	11,747	58
Study area	84,712	6,201	65,733	12,721	58

Table 11. Row crop conditions within each Blount County watershed.

Watershed Name	Total row crop land (acres)	High residue (acres)	Strip cropped (acres)	Medium residue (acres)	Low residue (acres)
		Little River Basin			
Left side -- mouth to Pistol Creek	120	104	0	0	16
Right side -- mouth to Nails Creek	221	77	0	144	0
Stock Creek	82	64	0	18	0
Pistol Creek	518	66	81	339	32
Left side -- Pistol to Crooked Creek	713	387	0	207	119
Nails Creek	744	307	0	244	193
Right side -- Nails to Ellejoy Creek	100	83	0	10	8
Crooked (L) and Ellejoy (R) to Reed Creek	471	170	0	196	105
Crooked Creek	477	210	0	125	142
Ellejoy Creek	819	499	21	257	42
Reed to Carr (R) and Short (L) Creek	9	6	0	0	2
Reed Creek	0	0	0	0	0
Hesse Creek	13	7	0	0	6
Carr Creek	3	0	0	3	0
Right side -- Carr Creek to GSMN Park	14	1	0	0	13
Short Creek	18	0	0	8	10
Left side -- Short Creek to GSMN Park	4	0	0	4	0
Little River headwaters within GSMN Park	0	0	0	0	0
Total	4,327	1,981	102	1,558	687
Little River within Blount County	4,218	1,887	102	1,543	687
		Little Tennessee River Basin			
Happy Valley, Tallassee and GSMN Park	0	0	0	0	0
Fourmile Creek	1	0	0	0	1
Big Gully area	0	0	0	0	0
Ninemile Creek	1,214	614	0	355	245
Sixmile Creek	10	7	0	2	2
Baker Creek	886	536	0	158	191
Total	2,111	1,157	0	515	439
		Tennessee River Basin			
Floyd/Cloyd Creeks	91	34	0	53	4
West of Gallagher and Ish	91	91	0	0	0
Gallagher and Ish Creek	313	145	0	137	31
North of Gallagher and Ish & Lackey	365	180	0	185	0
Lackey Creek	748	343	54	229	123
North of Lackey Creek to Fox Hills	0	0	0	0	0
Total	1,608	792	54	604	158
		Total			
Blount County	7,936	3,836	155	2,661	1,284
Study area	8,045	3,930	155	2,676	1,284

Table 12. Number and type of beef cattle sites within each Blount County watershed.

Watershed Name	Total	Adjacent to stream				Nonadjacent to stream			
		Large	Medium	Small	Subtotal	Large	Medium	Small	Subtotal
Little River Basin									
Left side -- mouth to Pistol Creek	5	0	1	0	1	0	0	4	4
Right side -- mouth to Nails Creek	28	1	11	8	20	0	1	7	8
Stock Creek	42	0	7	19	26	0	2	14	16
Pistol Creek	57	1	11	16	28	0	6	23	29
Left side -- Pistol to Crooked Creek	33	0	8	6	14	0	5	14	19
Nails Creek	52	0	11	19	30	0	3	19	22
Right side -- Nails to Ellejoy Creek	14	0	3	4	7	0	1	6	7
Crooked (L) and Ellejoy (R) to Reed Creek	11	0	1	5	6	0	2	3	5
Crooked Creek	74	1	23	18	42	0	3	29	32
Ellejoy Creek	93	1	31	18	50	0	6	37	43
Reed to Carr (R) and Short (L) Creek	2	0	0	0	0	0	0	2	2
Reed Creek	6	0	1	1	2	0	1	3	4
Hesse Creek	15	0	3	6	9	0	2	4	6
Carr Creek	13	0	0	6	6	0	2	5	7
Right side -- Carr Creek to GSMN Park	20	0	4	8	12	0	2	6	8
Short Creek	18	0	1	0	1	0	5	12	17
Left side -- Short Creek to GSMN Park	6	1	0	1	2	0	0	4	4
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0
Total	489	5	116	135	256	0	41	192	233
Little River within Blount County	417	5	96	109	210	0	39	168	207
Little Tennessee River Basin									
Happy Valley, Tallassee and GSMN Park	4	0	0	4	4	0	0	0	0
Fourmile Creek	5	0	0	3	3	0	0	2	2
Big Gully area	7	0	0	6	6	0	0	1	1
Ninemile Creek	108	2	18	33	53	0	7	48	55
Sixmile Creek	27	0	2	17	19	0	0	8	8
Baker Creek	100	0	16	17	33	0	11	56	67
Total	251	2	36	80	118	0	18	115	133
Tennessee River Basin									
Floyd/Cloyd Creeks	18	0	1	6	7	0	2	9	11
West of Gallagher and Ish	8	0	0	0	0	0	2	6	8
Gallagher and Ish Creek	51	1	5	15	21	1	6	23	30
North of Gallagher and Ish & Lackey	22	0	3	6	9	0	4	9	13
Lackey Creek	36	0	10	8	18	0	0	18	18
North of Lackey Creek to Fox Hills	7	0	1	4	5	0	0	2	2
Total	142	1	20	39	60	1	14	67	82
Total									
Blount County	810	8	152	228	388	1	71	350	422
Study area	882	8	172	254	434	1	73	374	448

Table 13. Number and type of dairy sites within each Blount County watershed.

Watershed Name	Total	Adjacent to stream				Nonadjacent to stream			
		Large	Medium	Small	Subtotal	Large	Medium	Small	Subtotal
				Little River Basin					
Left side -- mouth to Pistol Creek	1	1	0	0	1	0	0	0	0
Right side -- mouth to Nails Creek	0	0	0	0	0	0	0	0	0
Stock Creek	0	0	0	0	0	0	0	0	0
Pistol Creek	0	0	0	0	0	0	0	0	0
Left side -- Pistol to Crooked Creek	0	0	0	0	0	0	0	0	0
Nails Creek	2	1	1	0	2	0	0	0	0
Right side -- Nails to Ellejoy Creek	0	0	0	0	0	0	0	0	0
Crooked (L) and Ellejoy (R) to Reed Creek	0	0	0	0	0	0	0	0	0
Crooked Creek	0	0	0	0	0	0	0	0	0
Ellejoy Creek	3	0	3	0	3	0	0	0	0
Reed to Carr (R) and Short (L) Creek	0	0	0	0	0	0	0	0	0
Reed Creek	0	0	0	0	0	0	0	0	0
Hesse Creek	0	0	0	0	0	0	0	0	0
Carr Creek	0	0	0	0	0	0	0	0	0
Right side -- Carr Creek to GSMN Park	0	0	0	0	0	0	0	0	0
Short Creek	0	0	0	0	0	0	0	0	0
Left side -- Short Creek to GSMN Park	0	0	0	0	0	0	0	0	0
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0
Total	6	2	4	0	6	0	0	0	0
Little River within Blount County	6	2	4	0	6	0	0	0	0
				Little Tennessee River Basin					
Happy Valley, Tallassee and GSMN Park	0	0	0	0	0	0	0	0	0
Fourmile Creek	0	0	0	0	0	0	0	0	0
Big Gully area	0	0	0	0	0	0	0	0	0
Ninemile Creek	1	1	0	0	1	0	0	0	0
Sixmile Creek	0	0	0	0	0	0	0	0	0
Baker Creek	1	0	1	0	1	0	0	0	0
Total	2	1	1	0	2	0	0	0	0
				Tennessee River Basin					
Floyd/Cloyd Creeks	0	0	0	0	0	0	0	0	0
West of Gallagher and Ish	0	0	0	0	0	0	0	0	0
Gallagher and Ish Creek	1	0	0	0	0	0	1	0	1
North of Gallagher and Ish & Lackey	0	0	0	0	0	0	0	0	0
Lackey Creek	0	0	0	0	0	0	0	0	0
North of Lackey Creek to Fox Hills	0	0	0	0	0	0	0	0	0
Total	1	0	0	0	0	0	1	0	1
				Total					
Blount County	9	3	5	0	8	0	1	0	1
Study area	9	3	5	0	8	0	1	0	1

Table 14. Number and type of horse sites within each Blount County watershed.

Watershed Name	Total	Adjacent to stream				Nonadjacent to stream			
		Large	Medium	Small	Subtotal	Large	Medium	Small	Subtotal
Little River Basin									
Left side -- mouth to Pistol Creek	2	0	0	0	0	0	0	2	2
Right side -- mouth to Nails Creek	7	0	0	1	1	0	0	6	6
Stock Creek	14	0	1	2	3	0	1	10	11
Pistol Creek	20	0	0	0	0	0	2	18	20
Left side -- Pistol to Crooked Creek	2	0	0	0	0	0	0	2	2
Nails Creek	15	0	1	1	2	0	0	13	13
Right side -- Nails to Ellejoy Creek	2	0	0	1	1	0	0	1	1
Crooked (L) and Ellejoy (R) to Reed Creek	3	0	0	0	0	0	0	3	3
Crooked Creek	27	1	2	2	5	0	2	20	22
Ellejoy Creek	26	0	2	1	3	0	0	23	23
Reed to Carr (R) and Short (L) Creek	0	0	0	0	0	0	0	0	0
Reed Creek	3	0	0	0	0	0	0	3	3
Hesse Creek	2	0	0	0	0	0	0	2	2
Carr Creek	1	0	0	0	0	0	0	1	1
Right side -- Carr Creek to GSMN Park	4	0	1	0	1	0	0	3	3
Short Creek	4	0	0	0	0	0	0	4	4
Left side -- Short Creek to GSMN Park	0	0	0	0	0	0	0	0	0
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0
Total	132	1	7	8	16	0	5	111	116
Little River within Blount County	116	1	6	6	13	0	4	99	103
Little Tennessee River Basin									
Happy Valley, Tallassee and GSMN Park	5	0	0	0	0	0	0	5	5
Fourmile Creek	1	0	0	0	0	0	0	1	1
Big Gully area	0	0	0	0	0	0	0	0	0
Ninemile Creek	22	0	0	1	1	0	3	18	21
Sixmile Creek	9	0	0	1	1	0	0	8	8
Baker Creek	14	0	1	0	1	0	0	13	13
Total	51	0	1	2	3	0	3	45	48
Tennessee River Basin									
Floyd/Cloyd Creeks	8	0	0	1	1	0	3	4	7
West of Gallagher and Ish	3	0	0	0	0	0	0	3	3
Gallagher and Ish Creek	11	0	0	1	1	0	0	10	10
North of Gallagher and Ish & Lackey	10	0	0	1	1	0	1	8	9
Lackey Creek	25	0	0	0	0	0	2	23	25
North of Lackey Creek to Fox Hills	4	0	0	0	0	0	0	4	4
Total	61	0	0	3	3	0	6	52	58
Total									
Blount County	228	1	7	11	19	0	13	196	209
Study area	244	1	8	13	22	0	14	208	222

quality impacts among sites and watersheds. It is not consistent with any regulatory definitions regarding livestock operations. Beef cattle sites (Table 12) were the most prevalent in the study area, outnumbering dairy and horse operations. A total of 882 beef cattle sites were identified in the study area, and 810 sites within Blount County. Most beef cattle operations were classified as small, with only eight of the sites classified as large operations within the study area. Cattle sites located adjacent to the stream (49%) and nonadjacent to the stream (51%) were fairly evenly distributed. The Little River Basin has 489 beef cattle sites, with 52% adjacent to streams. Ellejoy Creek Watershed contained the most beef cattle sites in the Little River Basin. The Little Tennessee River Basin contained 251 beef cattle sites. Most of these sites were concentrated in Ninemile Creek and Baker Creek Watersheds. Gallagher and Ish Creek Watershed contained the majority of the 142 beef cattle sites in the Tennessee River Basin.

Few dairy operations (Table 13) were identified in the study area. A total of nine sites were reported, with six of the sites located in the Little River Basin. Ellejoy Creek Watershed contained three dairy sites, Nails Creek Watershed contained two sites, and the left side of Little River from the mouth to Pistol Creek Watershed contained one site. Little Tennessee River Basin Watersheds, Ninemile Creek and Baker Creek, each contained one site. The Tennessee River Basin also had one site in the Gallagher and Ish Creek Watershed. Eight of the nine dairy sites identified in the study area were located adjacent to the stream.

The total number of horse site operations (Table 14) for the study area was 244, with 91% located on land not adjacent to the streams. The Little River Basin contained the most horse sites (132), 84% of which were small operations located on land not adjacent to streams. As seen with beef cattle and dairy operations, most of the horse sites in Little Tennessee River Basin are small operations located in Ninemile Creek and Baker Creek Watersheds. Tennessee River Basin contains horse sites in each watershed and most of the operations (95%) are nonadjacent to the stream.

Urban

Table 15 shows urban land use classes by watershed. Across the study area, 71% of the 50,905 acres was classified as residential. Urban land classes for the remaining portion of the study area were divided into 11.3% commercial, 6.5% transportation, communication,

Table 15. Distribution of urban land use classes by watershed for Blount County.

Watershed Name	Total (acres)	Residential (acres)	Subdivisions under construction (acres)	Commercial (acres)	Green space (acres)	Industrial (acres)	Transportation, communication, utility (acres)
				Little River Basin			
Left side -- mouth to Pistol Creek	3,581	1,562	0	718	342	425	533
Right side -- mouth to Nails Creek	926	808	30	41	0	46	2
Stock Creek	3,129	2,584	57	291	3	87	108
Pistol Creek	14,525	8,917	437	2,893	490	1,468	320
Left side -- Pistol to Crooked Creek	1,278	1,093	111	73	1	0	0
Nails Creek	2,432	2,026	69	203	110	8	16
Right side -- Nails to Ellejoy Creek	678	543	129	3	0	0	2
Crooked (L) and Ellejoy (R) to Reed Creek	790	591	9	78	37	1	74
Crooked Creek	3,403	2,831	64	230	226	13	39
Ellejoy Creek	1,628	1,398	144	68	4	4	9
Reed to Carr (R) and Short (L) Creek	200	162	0	5	0	0	33
Reed Creek	108	92	6	6	5	0	0
Hesse Creek	341	299	3	14	23	0	2
Carr Creek	58	55	1	1	1	0	0
Right side -- Carr Creek to GSMN Park	224	178	15	11	21	0	0
Short Creek	343	215	0	21	107	0	0
Left side -- Short Creek to GSMN Park	507	333	1	168	5	0	0
Little River headwaters within GSMN Park	0	0	0	0	0	0	0
Total	34,152	23,687	1,075	4,824	1,375	2,052	1,140
Little River within Blount County	29,926	20,043	988	4,454	1,372	2,052	1,017
				Little Tennessee River Basin			
Happy Valley, Tallassee and GSMN Park	597	183	3	22	24	0	366
Fourmile Creek	318	267	10	13	4	0	22
Big Gully area	136	95	6	2	0	0	34
Ninemile Creek	2,966	2,477	155	169	119	15	31
Sixmile Creek	942	694	27	23	28	0	169
Baker Creek	3,213	2,572	295	205	17	5	119
Total	8,172	6,288	495	435	193	20	742
				Tennessee River Basin			
Floyd/Cloyd Creeks	298	186	54	4	3	5	46
West of Gallagher and Ish	350	344	5	1	0	0	0
Gallagher and Ish Creek	2,323	1,774	176	90	5	61	218
North of Gallagher and Ish & Lackey	847	799	19	19	10	0	0
Lackey Creek	4,015	2,401	152	322	9	47	1,085
North of Lackey Creek to Fox Hills	748	590	6	61	0	12	80
Total	8,581	6,093	411	496	27	125	1,428
				Total			
Blount County	46,678	32,424	1,893	5,385	1,592	2,197	3,187
Study area	50,905	36,068	1,980	5,755	1,594	2,197	3,310

and utility, 4.3% industrial, 3.8% subdivisions under construction, and 3.1% green space. Pistol Creek Watershed (14,525 acres) in the Little River Basin, Baker Creek (3,213 acres) and Ninemile Creek (2,966 acres) Watersheds in the Little Tennessee River Basin, and Lackey Creek (4,015 acres) and Gallagher and Ish (2,323 acres)

Watersheds in the Tennessee River Basin have the greatest total acreage of urban land use. Urban land use class by basin shows 69.3% of the Little River Basin, 76.9% of the Little Tennessee River Basin, and 71% of the Tennessee River Basin are residential. Distributions of the other urban land use classes vary by watershed and basin.

Streambank Conditions

The remote sensing process identified 1,476 stream miles contained within Blount County and 1,625 miles of streams for the study area (Table 16). Streambank erosion was identified along 173 miles of perennial streams. This represents about 10.6% of the total length of perennial streams. Streambank erosion was greatest for the Tennessee River Basin (12.7%), followed by the Little River Basin (10.7%). The Little Tennessee River Basin had the lowest percent (9.3%) of eroding streambanks. The watershed with the greatest percentage (20.5%) of eroding streambank is the Nails Creek Watershed in the Little River Basin.

Livestock Access to Streams

One cause of stream and streambank degradation is livestock with unrestricted access to the streams. Areas with animal access, probable animal access, and potential animal access to perennial streams were identified during the remote sensing process (Table 17). Livestock have direct access to 4 miles or 0.25% of the streams throughout the study area. Livestock have probable access to an additional 115 miles or 7.1% of streams. Livestock have potential access to another 150 miles or 9.2% of streams in the study area. In summary, about 16.6% of the streams throughout the study area are, or could be, accessed by livestock.

Table 16. Total stream miles and miles of eroding streambanks for each Blount County watershed.

Watershed Name	Total stream (miles)	Eroding streambanks for perennial streams (miles)	Percent of streams that have eroding banks
Little River Basin			
Left side -- mouth to Pistol Creek	29	5	17%
Right side -- mouth to Nails Creek	48	8	17%
Stock Creek	74	8	11%
Pistol Creek	114	14	13%
Left side -- Pistol to Crooked Creek	26	5	20%
Nails Creek	64	13	21%
Right side -- Nails to Ellejoy Creek	16	2	12%
Crooked (L) and Ellejoy (R) to Reed Creek	29	1	5%
Crooked Creek	126	13	10%
Ellejoy Creek	178	19	10%
Reed to Carr (R) and Short (L) Creek	46	2	3%
Reed Creek	62	1	2%
Hesse Creek	55	2	3%
Carr Creek	31	3	9%
Right side -- Carr Creek to GSMN Park	41	5	13%
Short Creek	24	3	12%
Left side -- Short Creek to GSMN Park	21	2	8%
Little River headwaters within GSMN Park	ND*	ND*	ND*
Total	983	105	11%
Little River within Blount County	835	92	11%
Little Tennessee River Basin			
Happy Valley, Tallassee and GSMN Park	85	1	2%
Fourmile Creek	32	2	5%
Big Gully area	7	1	19%
Ninemile Creek	132	16	13%
Sixmile Creek	84	8	9%
Baker Creek	90	12	13%
Total	430	40	9%
Tennessee River Basin			
Floyd/Cloyd Creeks	27	4	14%
West of Gallagher and Ish	8	2	19%
Gallagher and Ish Creek	65	6	9%
North of Gallagher and Ish & Lackey	28	5	19%
Lackey Creek	61	8	13%
North of Lackey Creek to Fox Hills	22	3	13%
Total	212	27	13%
Total			
Blount County	1,476	159	11%
Study area	1,625	173	11%

ND* no data available.

Table 17. Animal access to streams for Blount County watersheds, including the number of sites identified and the length of the stream segment to which animals have access.

Watershed Name	Animal Access		Probable Animal Access		Potential Animal Access	
	Number of sites	Stream length (miles)	Number of sites	Stream length (miles)	Number of sites	Stream length (miles)
Little River Basin						
Left side -- mouth to Pistol Creek	1	0.00	15	1	10	1
Right side -- mouth to Nails Creek	14	0.06	45	4	56	5
Stock Creek	13	0.08	35	3	81	5
Pistol Creek	41	0.39	93	7	153	10
Left side -- Pistol to Crooked Creek	17	0.18	37	3	64	6
Nails Creek	26	0.19	115	9	136	8
Right side -- Nails to Ellejoy Creek	6	0.02	10	2	38	3
Crooked (L) and Ellejoy (R) to Reed Creek	3	0.01	16	1	32	2
Crooked Creek	29	0.30	203	14	195	13
Ellejoy Creek	39	0.49	231	18	251	19
Reed to Carr (R) and Short (L) Creek	0	0.00	3	0	7	0
Reed Creek	1	0.00	11	1	9	0
Hesse Creek	12	0.02	19	1	43	4
Carr Creek	0	0.00	41	3	13	1
Right side -- Carr Creek to GSMN Park	5	0.03	19	2	32	2
Short Creek	1	0.01	8	1	8	1
Left side -- Short Creek to GSMN Park	2	0.00	8	1	18	1
Little River headwaters within GSMN Park	0	0.00	0	0	0	0
Total	210	2	909	69	1,146	79
Little River within Blount County	187	2	778	60	1,006	71
Little Tennessee River Basin						
Happy Valley, Tallassee, and GSMN Park	1	0.00	6	0.43	14	1.00
Fourmile Creek	0	0.00	2	0.29	3	0.28
Big Gully area	1	0.00	8	0.43	17	1.22
Ninemile Creek	49	0.62	228	18.02	263	18.94
Sixmile Creek	13	0.26	46	3.81	40	1.90
Baker Creek	25	0.13	135	10.94	281	21.23
Total	89	1	425	34	618	45
Tennessee River Basin						
Floyd/Cloyd Creeks	8	0.04	29	2.14	61	4
West of Gallagher and Ish	0	0.00	2	0.12	13	1
Gallagher and Ish Creek	8	0.10	42	2.93	118	10
North of Gallagher and Ish & Lackey	13	0.81	25	2.56	43	3
Lackey Creek	10	0.11	46	2.88	114	7
North of Lackey Creek to Fox Hills	5	0.01	14	1.47	17	1
Total	44	1	158	12	366	26
Total						
Blount County	320	4	1,361	106	1,990	142
Study area	343	4	1,492	115	2,130	150

Riparian Buffer Classification

The riparian buffer was classified as adequate, marginal, or inadequate with regard to the ability of the riparian buffer to remove pollutants from runoff before it enters the adjacent stream. The length of each riparian buffer class is listed for the left (Table 18) and right (Table 19) streambank by watershed.

Approximately 35% of the perennial stream miles within the study area have adequate riparian buffer along the right and left bank. Approximately 50% of the streams have marginal riparian buffers. Twelve percent of the left bank and 13% of the right bank had inadequate riparian buffers. Ninemile Creek Watershed in the Little Tennessee Basin (14 miles), Pistol Creek Watershed in the Little River Basin (14 miles), Lackey Creek and Gallagher and Ish Creek Watersheds in the Tennessee River Basin (5 miles) have the most miles of inadequate stream riparian buffers.

Roads

The miles of unpaved and paved roads in each watershed are shown in Table 20. There are approximately 2,550 miles of road within the study area: 692 unpaved miles and 1,858 paved miles. The majority of the roads are paved in each of the basins: Little River Basin (76%), Little Tennessee River Basin (61%), and Tennessee River Basin (76%).

Suspect On-Site Septic Systems

Using the remote sensing process, 3,181 sites were identified with on-site septic systems that may contribute contaminants to the surface water through overland flow, particularly when saturated soil conditions exist. Field investigations should be conducted before concluding all systems are failing. A breakdown by watershed and reason for suspicion are given in Table 21 for mobile homes, houses, and commercial facilities. Most (89%) of the suspect sites serve residences.

Of the total suspect house sites, 16% exhibited a visible plume pattern, but no drain field was apparent. This may indicate a straight-pipe from a septic system, roof drainage, gray

Table 18. Classification of riparian buffers of the left streambanks for each Blount County watershed.

Watershed Name	Adequate (miles)	Adequate percent	Marginal (miles)	Marginal percent	Inadequate (miles)	Inadequate percent	Total (miles)
		Little River Basin					
Left side -- mouth to Pistol Creek	6	37%	7	46%	3	17%	16
Right side -- mouth to Nails Creek	2	18%	8	67%	2	15%	12
Stock Creek	9	38%	12	51%	3	12%	23
Pistol Creek	9	26%	20	57%	6	17%	36
Left side -- Pistol to Crooked Creek	4	32%	9	64%	1	4%	14
Nails Creek	4	21%	13	62%	3	17%	21
Right side -- Nails to Ellejoy Creek	1	28%	2	68%	0	4%	3
Crooked (L) and Ellejoy (R) to Reed Creek	1	17%	6	74%	1	10%	9
Crooked Creek	9	22%	27	65%	5	13%	42
Ellejoy Creek	14	32%	24	55%	5	13%	43
Reed to Carr (R) and Short (L) Creek	8	69%	3	28%	0	3%	12
Reed Creek	8	74%	3	22%	0	3%	11
Hesse Creek	9	60%	5	32%	1	8%	15
Carr Creek	4	47%	2	28%	2	25%	8
Right side -- Carr Creek to GSMN Park	1	15%	2	50%	2	36%	5
Short Creek	2	47%	1	39%	0	15%	3
Left side -- Short Creek to GSMN Park	1	17%	6	72%	1	11%	8
Little River headwaters within GSMN Park	0	0%	0	0%	0	0%	0
Total	93	33%	150	54%	36	13%	280
Little River within Blount County	79	32%	134	55%	32	13%	245
		Little Tennessee River Basin					
Happy Valley, Tallassee and GSMN Park	10	52%	7	39%	2	9%	19
Fourmile Creek	5	63%	3	32%	0	5%	8
Big Gully area	0	36%	1	55%	0	8%	1
Ninemile Creek	11	25%	26	59%	7	16%	43
Sixmile Creek	11	47%	12	48%	1	5%	24
Baker Creek	7	33%	12	56%	2	11%	21
Total	45	38%	60	51%	12	10%	117
		Tennessee River Basin					
Floyd/Cloyd Creeks	1	21%	4	66%	1	13%	7
West of Gallagher and Ish	5	51%	2	20%	3	29%	9
Gallagher and Ish Creek	9	45%	8	43%	2	13%	19
North of Gallagher and Ish & Lackey	13	50%	8	31%	5	19%	26
Lackey Creek	5	28%	11	60%	2	13%	19
North of Lackey Creek to Fox Hills	11	63%	4	24%	2	13%	18
Total	44	45%	38	39%	16	16%	98
		Total					
Blount County	168	37%	232	50%	60	13%	460
Study area	182	37%	248	50%	64	13%	494

Table 19. Classification of riparian buffers of the right streambanks for each Blount County watershed.

Watershed Name	Adequate (miles)	Adequate percent	Marginal (miles)	Marginal percent	Inadequate (miles)	Inadequate percent	Total (miles)
			Little River Basin				
Left side -- mouth to Pistol Creek	1	19%	3	62%	1	19%	5
Right side -- mouth to Nails Creek	6	25%	17	67%	2	8%	25
Stock Creek	5	23%	15	62%	3	15%	24
Pistol Creek	10	27%	18	52%	8	21%	36
Left side -- Pistol to Crooked Creek	1	36%	2	60%	0	5%	3
Nails Creek	3	17%	14	68%	3	15%	21
Right side -- Nails to Ellejoy Creek	4	37%	6	57%	1	6%	10
Crooked (L) and Ellejoy (R) to Reed Creek	1	11%	5	72%	1	17%	7
Crooked Creek	13	32%	22	53%	7	16%	42
Ellejoy Creek	11	25%	27	63%	5	11%	43
Reed to Carr (R) and Short (L) Creek	6	53%	5	42%	1	5%	12
Reed Creek	8	73%	2	19%	1	8%	11
Hesse Creek	10	70%	3	22%	1	8%	15
Carr Creek	3	37%	4	44%	1	19%	8
Right side -- Carr Creek to GSMN Park	3	27%	6	56%	2	17%	11
Short Creek	1	40%	2	46%	0	15%	3
Left side -- Short Creek to GSMN Park	1	27%	1	54%	0	19%	2
Little River headwaters within GSMN Park	0	0%	0	0%	0	0%	0
Total	88	32%	152	55%	37	13%	277
Little River within Blount County	77	32%	129	54%	33	14%	238
			Little Tennessee River Basin				
Happy Valley, Tallassee and GSMN Park	20	50%	18	43%	3	7%	40
Fourmile Creek	5	53%	4	43%	0	4%	9
Big Gully area	0	23%	1	68%	0	8%	1
Ninemile Creek	10	23%	27	62%	7	16%	44
Sixmile Creek	11	44%	12	50%	1	6%	24
Baker Creek	8	38%	11	52%	2	10%	21
Total	54	39%	72	52%	13	9%	139
			Tennessee River Basin				
Floyd/Cloyd Creeks	0	6%	6	86%	1	8%	7
West of Gallagher and Ish	0	0%	0	0%	0	0%	0
Gallagher and Ish Creek	11	44%	11	45%	2	10%	24
North of Gallagher and Ish & Lackey	0	13%	2	77%	0	11%	3
Lackey Creek	7	38%	8	46%	3	16%	17
North of Lackey Creek to Fox Hills	2	48%	1	32%	1	19%	3
Total	20	37%	28	52%	7	13%	54
			Total				
Blount County	150	35%	228	53%	53	12%	431
Study area	161	34%	251	53%	57	12%	470

Table 20. Miles of roads for each Blount County watershed.

Watershed Name	Unpaved road miles	Paved road miles	Total road miles
	Little River Basin		
Left side -- mouth to Pistol Creek	6	91	97
Right side -- mouth to Nails Creek	17	51	68
Stock Creek	22	99	121
Pistol Creek	29	402	431
Left side -- Pistol to Crooked Creek	8	35	43
Nails Creek	19	83	102
Right side -- Nails to Ellejoy Creek	3	24	27
Crooked (L) and Ellejoy (R) to Reed Creek	14	30	43
Crooked Creek	50	119	170
Ellejoy Creek	67	101	169
Reed to Carr (R) and Short (L) Creek	9	23	32
Reed Creek	32	22	54
Hesse Creek	24	31	55
Carr Creek	15	15	30
Right side -- Carr Creek to GSMN Park	33	23	55
Short Creek	22	38	60
Left side -- Short Creek to GSMN Park	11	30	41
Little River headwaters within GSMN Park	0	0	0
Total	381	1,216	1,597
Little River within Blount County	337	1,075	1,412
	Little Tennessee River Basin		
Happy Valley, Tallassee and GSMN Park	54	49	103
Fourmile Creek	18	18	36
Big Gully area	6	4	10
Ninemile Creek	60	122	182
Sixmile Creek	50	46	95
Baker Creek	28	102	130
Total	215	340	555
	Tennessee River Basin		
Floyd/Cloyd Creeks	18	20	38
West of Gallagher and Ish	3	17	19
Gallagher and Ish Creek	34	87	121
North of Gallagher and Ish & Lackey	11	46	57
Lackey Creek	19	100	119
North of Lackey Creek to Fox Hills	11	32	43
Total	95	301	397
	Total		
Blount County	648	1,716	2,364
Study area	692	1,858	2,549

Table 21. Conditions of septic systems for mobile homes, houses, and commercial buildings for each watershed.

Watershed Name	Total	Mobile homes Condition* 1	2	3	4	Subtotal	Houses Condition* 1	2	3	4	Subtotal	Commercial Condition* 1	2	3	4	Subtotal
Little River Basin																
Left side -- mouth to Pistol Creek	251	0	2	0	27	29	0	31	7	178	216	0	2	0	4	6
Right side -- mouth to Nails Creek	118	0	14	0	7	21	0	23	3	71	97	0	0	0	0	0
Stock Creek	69	0	0	0	3	3	0	37	0	28	65	0	0	0	1	1
Pistol Creek	581	0	1	0	21	22	0	34	4	513	551	0	1	0	7	8
Left side -- Pistol to Crooked Creek	34	0	0	0	0	0	0	9	2	22	33	0	0	0	1	1
Nails Creek	201	0	21	0	6	27	0	33	2	135	170	0	0	0	4	4
Right side -- Nails to Ellejoy Creek	24	0	1	0	4	5	0	8	0	11	19	0	0	0	0	0
Crooked (L) and Ellejoy (R) to Reed Creek	43	0	0	0	5	5	0	7	0	31	38	0	0	0	0	0
Crooked Creek	176	1	3	0	21	25	2	31	1	115	149	0	0	0	2	2
Ellejoy Creek	176	0	11	0	24	35	2	39	11	89	141	0	0	0	0	0
Reed to Carr (R) and Short (L) Creek	30	0	0	0	2	2	0	0	0	26	26	0	0	0	2	2
Reed Creek	32	0	0	0	1	1	0	1	0	30	31	0	0	0	0	0
Hesse Creek	85	0	1	0	4	5	0	0	0	80	80	0	0	0	0	0
Carr Creek	41	0	0	0	6	6	0	0	0	35	35	0	0	0	0	0
Right side -- Carr Creek to GSMN Park	74	0	0	0	4	4	0	1	0	68	69	0	0	0	1	1
Short Creek	115	0	0	0	2	2	0	0	0	112	112	0	0	0	1	1
Left side -- Short Creek to GSMN Park	96	0	0	0	17	17	0	3	0	73	76	0	0	0	3	3
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,146	1	54	0	154	209	4	257	30	1,617	1,908	0	3	0	26	29
Little River within Blount County	1,956	1	49	0	145	195	4	199	26	1,505	1,734	0	3	0	24	27
Little Tennessee River Basin																
Happy Valley, Tallassee and GSMN Park	16	0	1	0	2	3	0	0	0	13	13	0	0	0	0	0
Fourmile Creek	30	0	0	0	7	7	0	3	0	19	22	0	0	0	1	1
Big Gully area	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0
Ninemile Creek	148	0	6	1	24	31	1	48	13	54	116	0	1	0	0	1
Sixmile Creek	85	0	2	0	9	11	0	14	1	59	74	0	0	0	0	0
Baker Creek	130	0	3	2	7	12	0	55	16	47	118	0	0	0	0	0
Total	411	0	12	3	49	64	1	122	30	192	345	0	1	0	1	2
Tennessee River Basin																
Floyd/Cloyd Creeks	8	0	0	0	1	1	0	1	0	6	7	0	0	0	0	0
West of Gallagher and Ish	85	0	0	0	1	1	0	7	0	77	84	0	0	0	0	0
Gallagher and Ish Creek	158	0	2	0	5	7	0	24	6	119	149	0	0	0	2	2
North of Gallagher and Ish & Lackey	188	0	8	0	7	15	0	10	2	160	172	0	0	0	1	1
Lackey Creek	117	0	0	2	10	12	0	22	6	74	102	0	1	0	2	3
North of Lackey Creek to Fox Hills	68	0	1	0	1	2	0	10	0	54	64	0	0	1	1	2
Total	624	0	11	2	25	38	0	74	14	490	578	0	1	1	6	8
Total																
Blount County	2,991	1	72	5	219	297	5	395	70	2,187	2,657	0	5	1	31	37
Study area	3,181	1	77	5	228	311	5	453	74	2,299	2,831	0	5	1	33	39

*Conditions of septic sites: Condition 1=distinctive moisture pattern, Condition 2 =suspicious moisture pattern, Condition 3 =distinctive drain field, Condition 4 =suspect system

water disposal or natural seepage/spring. Another 81% showed no visible plume or drain field, but were at locations that are questionable for on-site septic systems. Such locations include home sites on very steep slopes, small lots, visible rock outcrops, or close proximity to streams, especially those on heavily wooded lots. Five house sites exhibited an effluent plume from a visible drain field pattern or prominent ponding down slope from the drain field. A visible drain field pattern, but no plume was evident from 2.6% house sites. This may indicate slow leaching, with no apparent breakout from a seasonally- or hydraulically-stressed system. It could also indicate evapotranspiration characteristics of a functioning system or newly-installed system.

A larger percentage of mobile home sites (25%) than houses or commercial sites (13%) exhibited a visible plume pattern, but no drain field was apparent. Most of the commercial sites (85%) and mobile home sites (73%) with on-site suspect septic systems were classified as condition four. This rating refers to systems that showed no visible plume or drain field but were located in areas that are questionable for on-site septic systems. Such locations include home sites on very steep slopes, small lots, visible rock outcrops, or close proximity to streams, especially those on heavily wooded lots. One commercial site and five mobile home sites exhibited a visible drain field pattern, but no plume was evident. This may indicate slow leaching, with no apparent breakout from a seasonally- or hydraulically-stressed system. It could also indicate evapotranspiration characteristics of a functioning system or newly installed system. One mobile home site exhibited an effluent plume from a visible drain field pattern or prominent ponding downslope of the drain field.

Imperviousness

Imperviousness has been found to be an indicator of land development impacts on water resources (Schueler, 1994b). Impervious surfaces collect and accumulate pollutants deposited from the atmosphere, leaked from cars, or derived from other activities. Pollutants include nitrogen, phosphorous, bacteria, metals, and oils. Most of the pollution that accumulates on impervious surfaces will be washed into the storm sewer system, and from there into streams. As the amount of imperviousness within a watershed increases the amount of pollutants delivered to the stream increases.

Increased imperviousness also changes the flow characteristics of streams within a watershed. Changes include increased amounts of water the stream must carry during rain events (peak flows), increased flooding frequencies, and lower base flows. These changes occur because more stormwater runoff is created by the impervious surfaces. (These surfaces do not allow the water to soak into the ground.) As peak stream flow increases, the stream channel becomes unstable. The stream channel becomes deeper and wider in order to carry the increased flow. This results in increased sediment loads and loss of aquatic and riparian habitat as soil and vegetation are scoured from the bottom and banks cave into the stream.

Research shows that it is extremely difficult to maintain predevelopment stream quality when watershed development exceeds 10 to 20% impervious cover. As the imperviousness increases beyond 10 to 20%, the stream becomes impacted. Fish and aquatic insect species (food for many fish, amphibians, and birds) are lost as stream temperatures increase and stream channels become unstable. Above 25% imperviousness, aquatic communities are severely impacted, stream channels are very unstable, and pollutant loads have increased to levels that threaten downstream lakes. Establishing an exact impervious threshold for protecting a given stream is not possible. However, the following thresholds are proposed for three levels of stream conditions (Schueler, 1994b):

Stressed streams	(1 to 10% impervious cover)
Impacted streams	(>10 to 25% impervious cover)
Degraded streams	(>25 to 100% impervious cover)

For stressed streams, predevelopment stream quality can be maintained if strict zoning, site impervious restrictions, stream buffers, and best management practices are applied. Impacted streams can be expected to experience some degradation after development even with controls. For degraded streams, predevelopment stream quality cannot be fully obtained even when controls and retrofits are applied. Intensive stream restoration techniques, if applied, can only partially restore some aspects of stream quality.

Current and projected (in the year 2020) imperviousness for each Blount County watershed are shown in Table 22. The table also gives the percent change in imperviousness. Current conditions show imperviousness percentages for all watersheds are below the degraded streams threshold level (25%). Two watersheds located in the Little River

Table 22. Current and projected watershed percent imperviousness for each Blount County watershed.

Watershed Name	Imperviousness (%) Current	Projected for year 2020	Percent change
Little River Basin			
Left side -- mouth to Pistol Creek	22%	27%	4.6%
Right side -- mouth to Nails Creek	4%	6%	1.6%
Stock Creek	7%	9%	1.7%
Pistol Creek	23%	24%	1.9%
Left side -- Pistol to Crooked Creek	7%	13%	5.9%
Nails Creek	6%	9%	3.0%
Right side -- Nails to Ellejoy Creek	6%	10%	3.8%
Crooked (L) and Ellejoy (R) to Reed Creek	6%	8%	2.0%
Crooked Creek	5%	7%	1.6%
Ellejoy Creek	3%	4%	1.3%
Reed to Carr (R) and Short (L) Creek	2%	2%	0.5%
Reed Creek	1%	2%	0.3%
Hesse Creek	1%	2%	0.3%
Carr Creek	1%	2%	0.3%
Right side -- Carr Creek to GSMN Park	2%	3%	1.1%
Short Creek	2%	3%	0.8%
Left side -- Short Creek to GSMN Park	5%	9%	3.8%
Little River headwaters within GSMN Park	1%	1%	0.0%
Little Tennessee River Basin			
Happy Valley, Tallassee and GSMN Park	1%	1%	0.0%
Fourmile Creek	2%	3%	0.7%
Big Gully area	3%	4%	0.8%
Ninemile Creek	4%	6%	1.2%
Sixmile Creek	3%	3%	0.6%
Baker Creek	6%	8%	2.6%
Tennessee River Basin			
Floyd/Cloyd Creeks	2%	4%	1.1%
West of Gallagher and Ish	5%	8%	3.2%
Gallagher and Ish Creek	5%	8%	2.5%
North of Gallagher and Ish & Lackey	4%	5%	1.5%
Lackey Creek	9%	12%	3.4%
North of Lackey Creek to Fox Hills	5%	9%	3.6%

Basin have reached the impacted streams threshold level of imperviousness (10 to 25%) under current conditions.

All watersheds in the study area, except the Little River from the Great Smoky National Park boundary to the headwaters, show increased in imperviousness in the year 2020 projections. The greatest increase in percent imperviousness was in the area on left side of Little River from Pistol Creek to Crooked Creek (5.88%), and the left side of the Little River form the mouth to Pistol Creek (4.60%). Baker Creek Watershed in the Little Tennessee River Basin had a 2.6% increase in imperviousness. Three watersheds in the Tennessee River Basin show increases in imperviousness above 3%.

Projected conditions show the left side of the Little River from the mouth to Pistol Creek Watershed will have 26.9% imperviousness, which moves this watershed into the degraded streams threshold level. Pistol Creek Watershed will be very close to the degraded classification, with a projection of 24.48% imperviousness in the year 2020. Three watersheds, the left side of Little River from Pistol Creek to Crooked Creek, the right side of the Little River from Nails Creek to Ellejoy Creek, and Lackey Creek are projected to be classified as impacted by the year 2020.

Soil Loss

The estimated soil loss from selected land use categories are given in Table 23. The estimated soil loss for the three basins is 265,368 tons per year for the Little River Basin, 127,927 tons per year for the Little Tennessee River Basin, and 88,476 tons per year for the Tennessee River Basin. Within the study area, heavily overgrazed pasture (35%), fair pasture (19%), and medium residue row crops (14%) contributed the greatest soil loss. Orchards, strip cropped lands, and scrub and shrub areas contributed the least amounts of soil loss for the study area. Some land uses, such as forest clear-cuts and disturbed areas, are temporary changes to the landscape. Therefore, care should be exercised when comparing annual soil loss from these temporary land changes with long-term land uses such as pasture and crop land. Because photography is used to generate the database, the database is a snapshot in time. A forest clear-cut or construction site present at the time of

Table 23. Estimated soil loss for each Blount County watershed by land use class.

Watershed Name	Total	Low residue crops	High residue crops	Strip cropped	Medium residue crops	Good pasture	Fair pasture	Heavily overgrazed pasture	Feedlot loafing area	Orchard	Scrub/ shrub	Forest	Clearcut	Mine/ quarry	Disturbed areas	Unpaved roads
								(tons per year)								
Little River Basin																
Left side -- mouth to Pistol Creek	6,163	720	1,294	0	0	29	922	2,025	0	0	39	2	212	0	920	264
Right side -- mouth to Nails Creek	14,907	0	920	0	3,470	114	2,561	5,845	161	0	33	8	211	193	1,391	728
Stock Creek	13,228	0	769	0	447	2	3,216	7,585	0	0	61	16	482	38	612	917
Pistol Creek	32,156	1,435	801	825	8,278	63	6,020	12,179	0	0	212	5	0	1,671	667	1,223
Left side -- Pistol to Crooked Creek	24,479	5,425	4,767	0	5,147	36	2,669	6,355	0	0	11	2	0	0	67	333
Nails Creek	32,372	8,578	3,680	0	5,893	94	3,995	9,332	577	0	79	8	136	0	0	808
Right side -- Nails to Ellejoy Creek	6,145	348	1,032	0	254	47	1,506	2,842	112	0	2	2	0	0	0	131
Crooked (L) and Ellejoy (R) to Reed Creek	12,728	4,167	1,820	0	4,239	18	661	1,218	0	0	2	4	0	21	578	587
Crooked Creek	30,289	5,937	2,373	0	2,843	59	5,741	12,129	299	1	57	22	397	0	431	2,134
Ellejoy Creek	34,936	1,737	5,596	194	5,806	207	7,982	12,302	406	2	75	28	66	0	536	2,862
Reed to Carr (R) and Short (L) Creek	2,842	455	346	0	0	10	561	399	0	5	13	59	0	0	993	371
Reed Creek	3,299	0	0	0	0	7	1,165	2,077	0	0	1	48	0	0	0	1,358
Hesse Creek	11,939	837	295	0	0	0	3,232	7,374	0	1	7	133	0	61	0	1,011
Carr Creek	4,418	0	0	0	327	0	2,027	822	979	0	0	40	0	223	0	647
Right side -- Carr Creek to GSMN Park	12,725	1,917	44	0	0	18	4,368	4,745	1,208	0	0	41	0	0	384	1,383
Short Creek	12,371	1,384	0	0	646	0	3,387	3,300	1,215	0	0	34	0	0	2,406	947
Left side -- Short Creek to GSMN Park	9,550	0	0	0	367	11	2,818	1,319	805	0	0	24	0	497	3,709	448
Little River headwaters within GSMN Park	821	0	0	0	0	0	0	0	0	0	0	821	0	0	0	0
Total	265,368	32,939	23,738	1,019	37,717	714	52,830	91,849	5,762	9	591	1,299	1,505	2,704	12,695	16,153
Little River within Blount County	695,117	101,764	75,576	3,419	124,417	2,185	120,339	224,804	9,275	13	1,680	779	2,524	6,942	21,400	14,308
Little Tennessee River Basin																
Happy Valley, Tallassee and GSMN Park	10,773	0	0	0	0	0	1,840	4,694	0	6	66	828	2,675	210	453	2,299
Fourmile Creek	784	24	0	0	0	0	298	130	0	3	4	10	150	0	165	763
Big Gully area	1,545	0	0	0	0	1	189	538	0	0	5	2	200	0	609	248
Ninemile Creek	57,144	11,091	7,509	0	8,732	272	11,132	15,376	616	0	127	19	1,832	10	431	2,547
Sixmile Creek	5,497	72	63	0	35	10	1,308	3,017	0	0	44	20	492	0	436	2,115
Baker Creek	52,183	8,705	6,599	0	3,920	226	9,913	20,300	119	0	150	7	1,161	108	975	1,170
Total	127,927	19,892	14,171	0	12,687	509	24,679	44,055	735	9	396	886	6,510	328	3,070	9,141
Tennessee River Basin																
Floyd/Cloyd Creeks	10,922	179	391	0	1,228	18	1,822	6,396	0	0	21	6	511	255	96	765
West of Gallagher and Ish	4,192	0	1,132	0	0	2	863	2,192	0	0	3	1	0	0	0	113
Gallagher and Ish Creek	23,409	1,390	1,763	0	3,365	134	5,129	9,259	0	0	76	12	446	596	1,239	1,430
North of Gallagher and Ish & Lackey	16,837	0	2,241	0	4,644	41	2,483	7,239	0	1	34	7	127	21	0	468
Lackey Creek	28,532	5,673	4,278	562	5,735	108	4,119	7,734	0	0	83	7	190	0	44	805
North of Lackey Creek to Fox Hills	4,584	0	0	0	0	5	973	1,936	0	5	25	6	0	0	1,635	461
Total	88,476	7,242	9,804	562	14,971	307	15,388	34,755	0	7	241	39	1,274	871	3,014	4,042
Total																
Blount County	911,521	128,898	99,551	3,980	152,075	3,002	160,405	303,614	10,010	29	2,317	1,705	10,308	8,141	27,484	27,492
Study area	481,771	60,073	47,712	1,581	65,374	1,530	92,896	170,660	6,497	24	1,228	2,224	9,289	3,904	18,778	29,337

photography could have healed or been completed, while new ones in a different watershed could exist by the time the inventory is completed.

Soil loss estimated for the Little River Basin within Blount County was greater than soil loss estimated for the entire Little River Basin (Table 23). Little River Basin within Blount County soil loss appears to be over-estimated. Due to limitations in the number watersheds that the spreadsheet can handle, the entire Blount County portion of the Little River Basin was treated as a single watershed by the Blount Country spreadsheet (see methods section). Basin-wide USLE values were used to calculate soil loss for the Little River within Blount County. A second spreadsheet was developed for the Little River Basin. In the Little River spreadsheet, the basin was sub-divided into 18 watersheds and included portions of the Little River Basin outside of Blount County. This second spreadsheet calculated soil loss separately for each Little River watershed based on watershed-specific USLE values. Soil losses from each watershed were summed to obtain soil loss estimates for the entire Little River Basin. Soil loss estimated for the entire Little River Watershed appears to be more reliable than soil loss estimated for Little River Basin within Blount County because the former was calculated with greater precision. Since the total soil loss for Blount County includes the values calculated for the Little River within Blount County it is likely to be over-estimated also.

Soil loss estimates for streambanks, road banks, and roads are presented in Table 24. Unpaved roads had the greatest amount of soil loss (29,337 tons per year) for the study area. Estimated soil losses for the study area were greater for road banks (10,435 tons per year) than streambanks (6,408 tons per year). The Little River Basin lost 2,237 tons of soil per year from streambanks, 3,106 tons of soil per year from road banks, and 14,308 tons of soil per year from unpaved roads. Soil loss in the Little Tennessee Basin was 1,606 tons per year from streambanks, 3,733 tons per year from road banks, and 9,141 tons per year from unpaved roads. The Tennessee River Basin had 783 tons per year soil loss from streambanks, 2,259 tons per year soil loss from road banks, and 4,042 tons per year soil loss from unpaved roads.

Table 24. Soil loss for streambanks, roadbanks and unpaved roads by watershed.

Watershed Name	Soil loss Stream bank (tons/year)	Road bank (tons/year)	Unpaved road (tons/year)
	Little River Basin		
Left side -- mouth to Pistol Creek	77	212	264
Right side -- mouth to Nails Creek	509	128	728
Stock Creek	604	558	917
Pistol Creek	275	995	1,223
Left side -- Pistol to Crooked Creek	91	43	333
Nails Creek	533	251	808
Right side -- Nails to Ellejoy Creek	27	110	131
Crooked (L) and Ellejoy (R) to Reed Creek	95	252	587
Crooked Creek	669	755	2,134
Ellejoy Creek	1,005	726	2,862
Reed to Carr (R) and Short (L) Creek	5	54	371
Reed Creek	22	36	1,358
Hesse Creek	18	55	1,011
Carr Creek	8	65	647
Right side -- Carr Creek to GSMN Park	42	111	1,383
Short Creek	26	73	947
Left side -- Short Creek to GSMN Park	13	21	448
Little River headwaters within GSMN Park	0	0	0
Total	4,018	4,443	16,153
Little River within Blount County	2,237	3,106	14,308
	Little Tennessee River Basin		
Happy Valley, Tallassee and GSMN Park	5	616	2,299
Fourmile Creek	138	260	763
Big Gully area	86	73	248
Ninemile Creek	520	1,003	2,547
Sixmile Creek	653	928	2,115
Baker Creek	205	852	1,170
Total	1,606	3,733	9,141
	Tennessee River Basin		
Floyd/Cloyd Creeks	316	536	765
West of Gallagher and Ish	22	53	113
Gallagher and Ish Creek	216	724	1,430
North of Gallagher and Ish & Lackey	75	243	468
Lackey Creek	114	580	805
North of Lackey Creek to Fox Hills	41	124	461
Total	783	2,259	4,042
	Total		
Blount County	4,627	9,098	27,492
Study area	6,408	10,435	29,337

Results

Annual TP, TN, TSS, and zinc loads were estimated for each land use and watershed based on NPS inventory as described in the methods section. Pollution loads were estimated for the year 2000, when photography was acquired, and for the year 2020 based on projected population growth and changes in land use.

Nonpoint Pollution Sources

Annual per-acre TP, TN, TSS, and zinc loads were lowest for forested areas and highest for commercial and industrial areas for each of the three basins (Figure 4). Residential areas contributed slightly higher per-acre loads of TP and TN than agricultural areas in the Little River Basin. In the Little Tennessee and Tennessee River Basins, annual per-acre TP and TN loads from agricultural areas were higher than residential area loads. Per-acre TSS loads from agricultural areas were higher in the Little River and Tennessee River Basins and lower in the Little Tennessee River Basin compared with loads from residential areas. Residential areas contributed higher per-acre zinc load than agricultural areas in each basin.

Annual pollution loads for major land use categories within the study area are summarized in Figure 5. Agriculture contributed the highest annual TP, TN, TSS in each basin. For the entire study area, agriculture contributed 58% of TP loads, 53% of TN loads, and 61% of TSS loads. This is in part because a large portion of each basin is in agriculture. Residential areas contributed the second highest annual TP, TN, and TSS loads in each basin, with the exception of TN in the Little River Basin. Commercial/industrial areas contributed the second highest TN loads in the Little River Basin. Over 85% of the zinc load originated from residential, commercial and industrial areas in each basin.

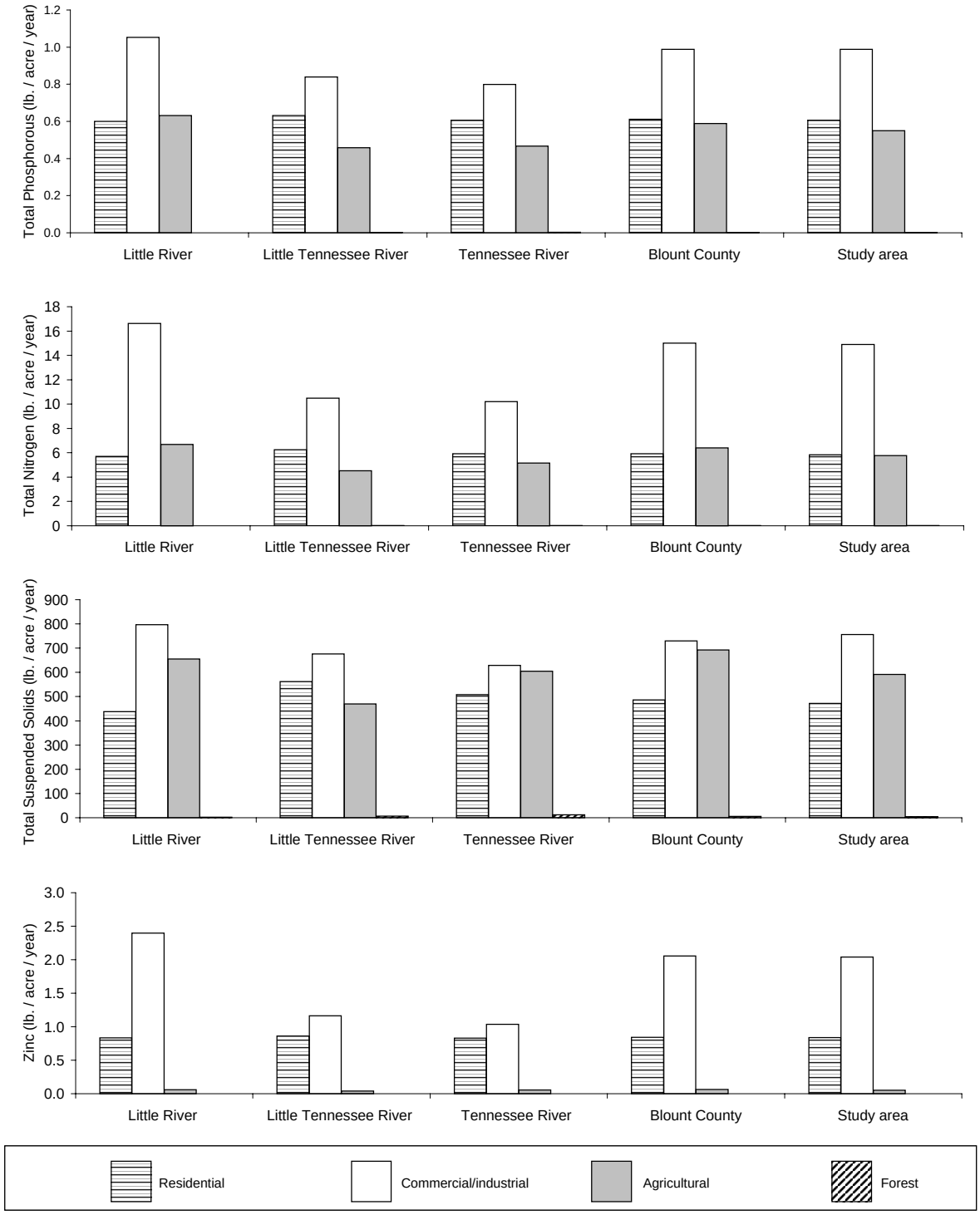


Figure 4. Estimated annual per-acre loads of total phosphorous, total nitrogen, total suspended solids and zinc for each major land use category.

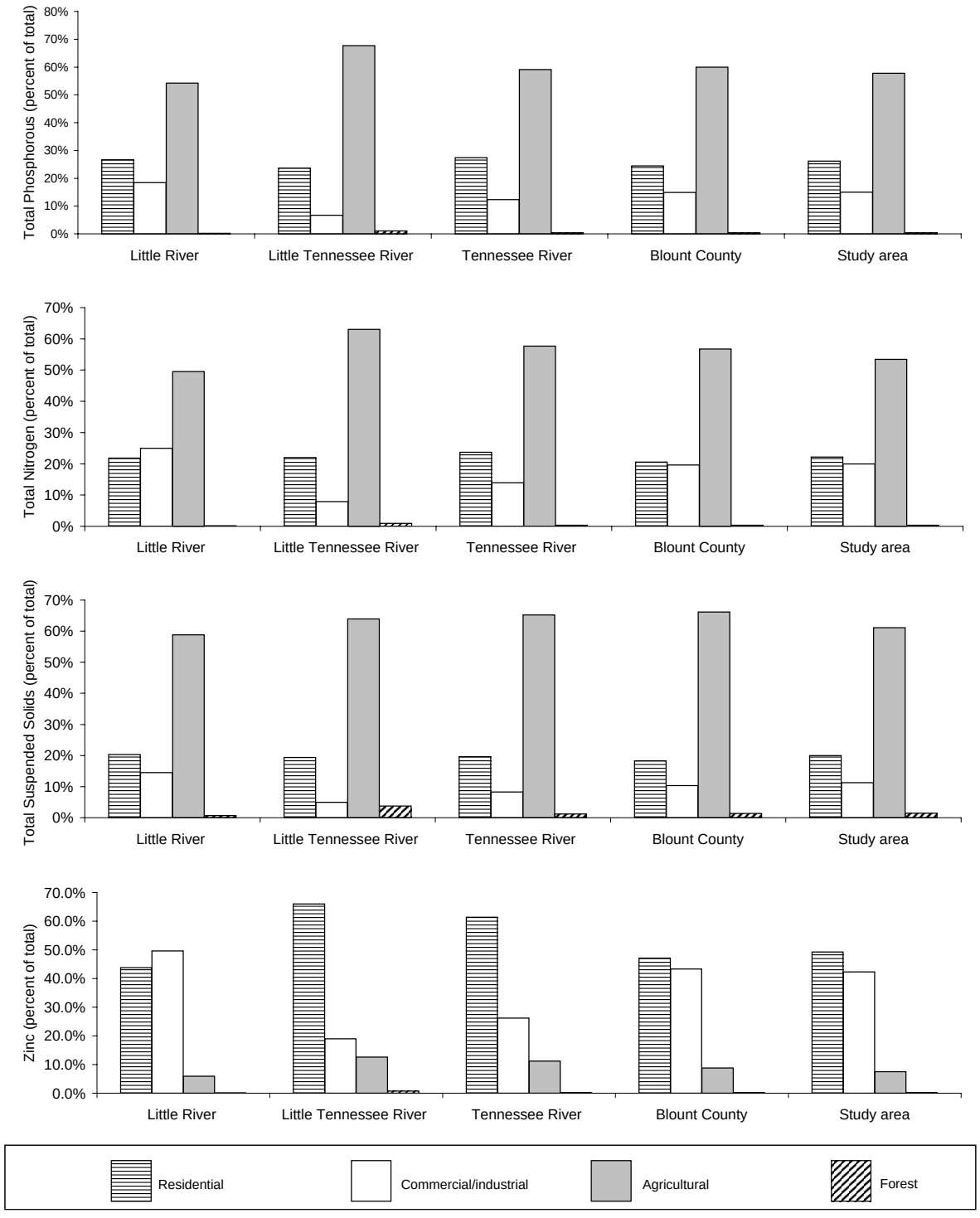


Figure 5. Percent of estimated annual loads of total phosphorous, total nitrogen, total suspended solids and zinc from each major land use category.

Average annual loads of TP, TN, TSS, and zinc for 28 NPS categories are listed in Table 25. Three to five land use categories accounted for over 60% of the load of each pollutant. Dominant sources of each pollutant are:

- Livestock with unrestricted stream access, residential and commercial areas, heavily overgrazed pastures, and medium residue crop lands accounted for 75% of the TP load.
- Heavily overgrazed pastures; residential, commercial, and industrial areas; and livestock with unrestricted stream access accounted for 61% of the TN load.
- Heavily overgrazed pastures, fair pastures, residential areas, and low and medium residue crop lands accounted for 65% of the TSS load.
- Residential, commercial and industrial areas contributed 90% of the zinc load.

Feedlot and loafing areas contributed the highest per-acre loads of TP (7.7 lb. /acre /year), TN (580 lb. /acre /year), and TSS (15,455 lb. /acre /year), and the fourth highest zinc load (1.4 lb. /acre /year) (Table 26). Although estimated pollution loads per-acre from feedlots and loafing areas were very high, this land use made up a very small percentage of the area (0.02%). Other land uses with high per-acre loads include:

- TP loads were highest from disturbed areas (4.0 lb. /acre /year), low residue crop lands (2.8 lb. /acre /year), medium residue crop lands (1.5 lb. /acre /year), and industrial areas (1.5 lb. /acre /year).
- TN loads were highest from low residue crop lands (43 lb. /acre /year), disturbed areas (40 lb. /acre /year), medium residue crop lands (22 lb. /acre /year), and industrial areas (30 lb. /acre /year).
- TSS loads were highest from disturbed areas (15,880 lb. /acre /year), low residue crop lands (5,679 lb. /acre /year), subdivisions under construction (3,475 lb. /acre /year) and medium residue crop lands (2,964 lb. /acre /year).
- Zinc loads were highest from industrial areas (4.0 lb. /acre /year), commercial areas (3.1 lb. /acre /year), disturbed areas (1.4 lb. /acre /year), and residential areas (0.9 lb. /acre /year).

Table 25. Annual total phosphorous, total nitrogen, total suspended solids, and zinc loads by land use category. Numbers in parentheses are ranks, in descending order, for the five land use categories with the highest load for each

Land use category	Total Phosphorous (lb)	%	Total Nitrogen (lb)	%	Total Suspended Solids (lb)	%	Zinc (lb)	%
				Residential				
Residential	22,149 (2)	25.1%	199,339 (1)	19.9%	11,074,366 (3)	12.3%	31,561.9 (1)	48.8%
Subdivision under construction	917	1.0%	22,935	2.3%	6,880,619	7.7%	247.7	0.4%
				Commercial / Industrial				
Commercial	6,977 (4)	7.9%	104,649 (3)	10.4%	3,488,309	3.9%	17,720.6 (2)	27.4%
Green	168	0.2%	840	0.1%	83,954	0.1%	99.1	0.2%
Industrial	3,323	3.8%	66,464 (5)	6.6%	2,492,398	2.8%	8,723.4 (3)	13.5%
Transportation, communication, utility	2,015	2.3%	20,152	2.0%	1,007,624	1.1%	513.9	0.8%
Mine/ quarry/ borrow	116	0.1%	1,161	0.1%	464,577	0.5%	41.8	0.1%
Disturbed areas	652	0.7%	6,517	0.7%	2,606,834	2.9%	234.6	0.4%
Road bank	308	0.3%	9,233	0.9%	1,231,021	1.4%	110.8	0.2%
Unpaved road	88	0.1%	26,486	2.6%	3,531,459	3.9%	317.8	0.5%
				Agriculture				
Crops								
High residue crops	2,919	3.3%	43,789	4.4%	5,838,482	6.5%	525.5	0.8%
Strip cropped	86	0.1%	1,295	0.1%	172,691	0.2%	15.5	0.0%
Medium residue crops	3,965 (5)	4.5%	59,471	5.9%	7,929,427 (4)	8.8%	713.6	1.1%
Low residue crops	3,646	4.1%	54,694	5.5%	7,292,472 (5)	8.1%	656.3	1.0%
Orchard	2	0.0%	23	0.0%	3,002	0.0%	0.3	0.0%
Pasture								
Good pasture	90	0.1%	1,356	0.1%	180,855	0.2%	16.3	0.0%
Fair pasture	5,646	6.4%	84,692	8.4%	11,292,234 (2)	12.6%	1,016.3 (5)	1.6%
Heavily overgrazed pasture	10,284 (3)	11.7%	154,265 (2)	15.4%	20,568,619 (1)	22.9%	1,851.2 (4)	2.9%
Feedlot loafing area	448	0.5%	33,596	3.4%	895,895	1.0%	80.6	0.1%
Beef	22,659 (1)	25.7%	90,588 (4)	9.0%	698,298	0.8%	0.0	0.0%
Dairy	1,064	1.2%	10,850	1.1%	75,993	0.1%	0.0	0.0%
Horses	165	0.2%	1,067	0.1%	6,404	0.0%	0.0	0.0%
				Forest and wetland				
Scrub/ shrub	35	0.0%	350	0.0%	140,188	0.2%	12.6	0.0%
Forest	49	0.1%	495	0.0%	197,975	0.2%	17.8	0.0%
Clearcut	247	0.3%	2,466	0.2%	986,219	1.1%	88.8	0.1%
Wetland	0	0.0%	0	0.0%	0	0.0%	0.0	0.0%
				Water				
Open water	0	0.0%	0	0.0%	0	0.0%	0.0	0.0%
Streambank	193	0.2%	5,795	0.6%	772,624	0.9%	69.5	0.1%
Total	88,212		1,002,567		89,912,541		64,636.0	

Table 26. Annual per-acre total phosphorous, total nitrogen, total suspended solids, and zinc loads for each land use category. Numbers in parentheses are ranks, in descending order, of five land use categories with the highest per-acre loads for each pollutant.

Land use category	Total Phosphorous (lb/ac)	Total Nitrogen (lb/ac)	Total Suspended Solids (lb/ac)	Zinc (lb/ac)
		Residential		
Residential	0.6	5.5	307.0	0.88 (5)
Subdivision under construction	0.5	11.6	3,474.6 (4)	0.13
		Commercial / Industrial		
Commercial	1.2	18.2	606.1	3.08 (2)
Green	0.1	0.5	52.7	0.06
Industrial	1.5 (5)	30.2 (4)	1,134.3	3.97 (1)
Transportation, communication, utility	0.6	6.1	304.5	0.16
Mine/ quarry/ borrow	0.3	3.0	1,187.4	0.11
Disturbed areas	4.0 (2)	39.7 (3)	15,879.8 (1)	1.43 (3)
		Agriculture		
Crops				
High residue crops	0.7	11.1	1,485.7	0.13
Strip cropped	0.6	8.3	1,111.0	0.10
Medium residue crops	1.5 (4)	22.2 (5)	2,963.4 (5)	0.27
Low residue crops	2.8 (3)	42.6 (2)	5,678.2 (3)	0.51
Orchard	0.0	0.3	46.5	0.00
Pasture				
Good pasture	0.0	0.2	29.2	0.00
Fair pasture	0.1	1.3	171.8	0.02
Heavily overgrazed pasture	0.8	12.1	1,617.0	0.15
Feedlot loafing area	7.7 (1)	579.6 (1)	15,454.8 (2)	1.39 (4)
		Forest and wetland		
Scrub/ shrub	0.0	0.1	29.1	0.00
Forest	0.0	0.0	0.7	0.00
Clearcut	0.4	4.1	1,625.6	0.15
Wetland	0.0	0.0	0.0	0.00

Pollution Loads by Watershed

Total Phosphorous

The total annual TP load from the study area is 88,212 lb. per year (Table 27). The Little River Basin contributed 55,709 lb. per year, the Little Tennessee River Basin contributed 18,135 lb. per year, and the Tennessee River Basin contributed 14,368 lb. per year.

Annual TP loads from each watershed are presented on Figure 6. TP loads ranged from 16 lb. per year in the Great Smoky Mountain part of the Little River Basin to 14,612 lb. per year in the Pistol Creek Watershed. Large watersheds dominated by urban and/or agricultural land uses had the highest TP loads. Pistol Creek (14,612 lb. per year), Crooked Creek (6,226 lb. per year), Ellejoy Creek (6,138 lb. per year), and Nails Creek (5,332 lb. per year) Watersheds accounted for 58% of the total Little River Basin TP. Ninemile Creek (6,895 lb. per year) and Baker Creek (7,820 lb. per year) Watersheds accounted for 81% of the Little Tennessee River Basin TP load. Lackey Creek (5,371 lb. per year) and Gallagher and Ish Creek (3,941 lb. per year) Watersheds accounted for 65% of the Tennessee River Basin TP load. All of these watersheds, except Lackey Creek, are classified by the TDEC as being impaired (2000 305 (b) report). Lackey Creek is classified as not assessed.

Annual per-acre TP loads from each watershed are summarized on Figure 7. Watersheds with the highest annual per-acre loads are: the left side of the Little River from Pistol to Crooked Creek (0.60 lb. per-acre per year), Pistol Creek (0.58 lb. per-acre per year), the left side of the Little River from the mouth to Pistol Creek (0.57 lb. per-acre per year), Nails Creek (0.46 lb. per-acre per year), Lackey Creek (0.43 lb. per-acre per year), the Little River from Crooked Creek (left) and Ellejoy Creek (right) to Reed Creek, (0.43 lb. per-acre per year). All of these watersheds, except Lackey Creek are located in the lower section of the Little River Basin. Each of these watersheds had at least 20% urban (residential, commercial and industrial) land use. Each of these watersheds except Pistol Creek and the left side of the Little River from the mouth to Pistol Creek had at least 30% agricultural land use.

Table 27. Estimated annual total phosphorous (TP) load for each Blount County watershed by major land uses. Percent TP load by major land use for each watershed is also shown.

Watershed Name	Residential TP (lb)	Residential Percent	Commercial / Industrial TP (lb)	Commercial / Industrial Percent	Agriculture TP (lb)	Agriculture Percent	Forest TP (lb)	Forest Percent	Streambanks TP (lb)	Streambanks Percent	Roads TP (lb)	Roads Percent	Total TP (lb)	Total TP (lb per acre)
Little River Basin														
Left side -- mouth to Pistol Creek	939	27.0%	1,884	54.3%	629	18.1%	9	0.3%	3	0.1%	9	0.2%	3,473	0.57
Right side -- mouth to Nails Creek	499	17.9%	173	6.2%	2,089	74.8%	8	0.3%	17	0.6%	7	0.2%	2,794	0.34
Stock Creek	1,579	38.5%	562	13.7%	1,910	46.5%	17	0.4%	18	0.4%	19	0.5%	4,106	0.30
Pistol Creek	5,559	38.0%	5,984	41.0%	3,028	20.7%	6	0.0%	7	0.0%	29	0.2%	14,612	0.58
Left side -- Pistol to Crooked Creek	707	20.8%	90	2.7%	2,596	76.4%	0	0.0%	3	0.1%	3	0.1%	3,401	0.60
Nails Creek	1,249	23.4%	276	5.2%	3,773	70.8%	7	0.1%	17	0.3%	10	0.2%	5,332	0.46
Right side -- Nails to Ellejoy Creek	385	30.2%	5	0.4%	878	68.9%	0	0.0%	1	0.1%	5	0.4%	1,275	0.40
Crooked (L) and Ellejoy (R) to Reed Creek	359	20.5%	166	9.5%	1,213	69.1%	0	0.0%	4	0.2%	12	0.7%	1,755	0.43
Crooked Creek	1,767	28.4%	360	5.8%	4,042	64.9%	13	0.2%	18	0.3%	26	0.4%	6,226	0.30
Ellejoy Creek	906	14.8%	108	1.8%	5,068	82.6%	4	0.1%	26	0.4%	26	0.4%	6,138	0.25
Reed to Carr (R) and Short (L) Creek	103	33.8%	63	20.8%	132	43.4%	3	0.9%	0	0.1%	3	1.1%	305	0.05
Reed Creek	62	15.0%	8	1.9%	332	81.0%	2	0.4%	1	0.2%	6	1.4%	409	0.05
Hesse Creek	204	15.4%	25	1.9%	1,088	82.1%	4	0.3%	0	0.0%	4	0.3%	1,326	0.08
Carr Creek	36	6.0%	10	1.7%	549	91.1%	2	0.3%	0	0.1%	5	0.9%	603	0.15
Right side -- Carr Creek to GSMN Park	125	7.7%	31	1.9%	1,457	89.7%	1	0.1%	2	0.1%	9	0.5%	1,625	0.25
Short Creek	148	13.4%	130	11.7%	820	74.1%	1	0.1%	1	0.1%	6	0.6%	1,106	0.19
Left side -- Short Creek to GSMN Park	217	18.0%	385	31.9%	601	49.8%	1	0.1%	1	0.0%	3	0.2%	1,208	0.29
Little River headwaters within GSMN Park	0	0.0%	0	0.0%	0	0.0%	16	100.0%	0	0.0%	0	0.0%	16	0.00
Total	14,846	26.6%	10,262	18.4%	30,207	54.2%	94	0.2%	118	0.2%	182	0.3%	55,709	0.23
Little River within Blount County	12,758	23.9%	9,760	18.3%	30,670	57.5%	69	0.1%	31	0.1%	63	0.1%	53,351	0.31
Little Tennessee River Basin														
Happy Valley, Tallassee, and GSMN Park	134	14.9%	307	34.0%	381	42.2%	65	7.2%	0	0.0%	15	1.7%	902	0.01
Fourmile Creek	179	46.9%	38	10.1%	141	36.9%	6	1.6%	5	1.3%	12	3.2%	382	0.07
Big Gully area	65	15.2%	55	12.9%	286	67.2%	11	2.5%	4	1.0%	5	1.2%	425	0.34
Ninemile Creek	1,657	21.2%	283	3.6%	5,784	74.0%	51	0.7%	13	0.2%	32	0.4%	7,820	0.32
Sixmile Creek	465	27.2%	154	9.0%	1,021	59.7%	17	1.0%	20	1.1%	34	2.0%	1,711	0.13
Baker Creek	1,785	25.9%	376	5.5%	4,665	67.7%	37	0.5%	6	0.1%	27	0.4%	6,895	0.38
Total	4,284	23.6%	1,213	6.7%	12,278	67.7%	186	1.0%	48	0.3%	126	0.7%	18,135	0.13
Tennessee River Basin														
Floyd/Cloyd Creeks	148	11.3%	56	4.3%	1,046	80.2%	20	1.5%	12	0.9%	23	1.7%	1,304	0.24
West of Gallagher and Ish	226	36.4%	1	0.2%	391	62.8%	0	0.0%	1	0.2%	3	0.5%	623	0.29
Gallagher and Ish Creek	1,194	30.3%	396	10.0%	2,303	58.4%	16	0.4%	6	0.2%	26	0.6%	3,941	0.27
North of Gallagher and Ish & Lackey	499	23.5%	25	1.2%	1,582	74.5%	6	0.3%	3	0.1%	10	0.5%	2,124	0.27
Lackey Creek	1,512	28.1%	1,097	20.4%	2,731	50.8%	9	0.2%	3	0.1%	20	0.4%	5,371	0.43
North of Lackey Creek to Fox Hills	357	35.5%	201	20.0%	438	43.6%	1	0.1%	2	0.2%	7	0.6%	1,005	0.21
Total	3,936	27.4%	1,776	12.4%	8,490	59.1%	51	0.4%	27	0.2%	88	0.6%	14,368	0.30
Total														
Blount County	20,978	24.4%	12,749	14.8%	51,438	59.9%	306	0.4%	106	0.1%	276	0.3%	85,853	0.24
Study area	23,066	26.1%	13,251	15.0%	50,975	57.8%	331	0.4%	193	0.2%	396	0.4%	88,212	0.20

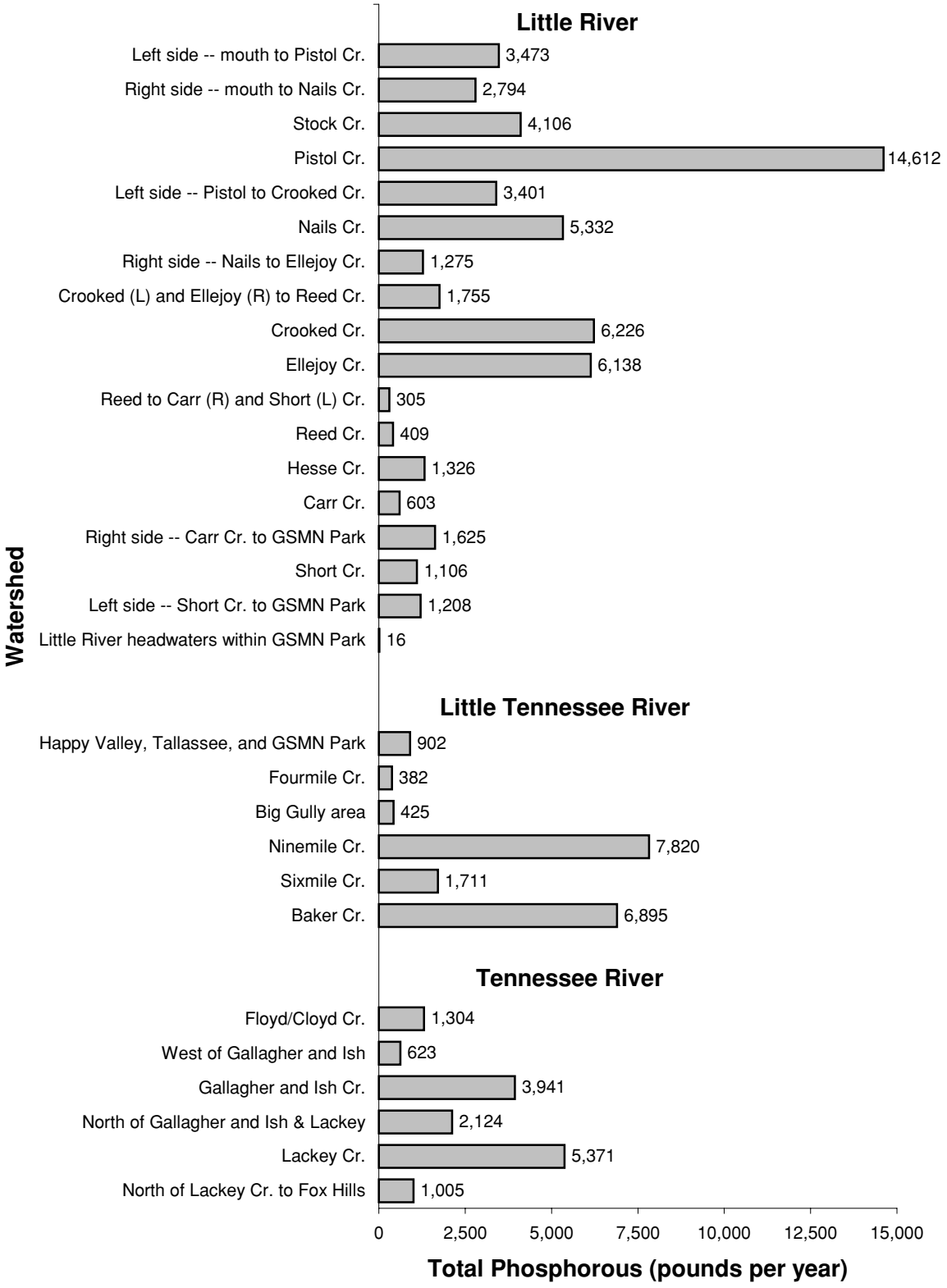


Figure 6. Plot of annual total phosphorous load for each watershed.

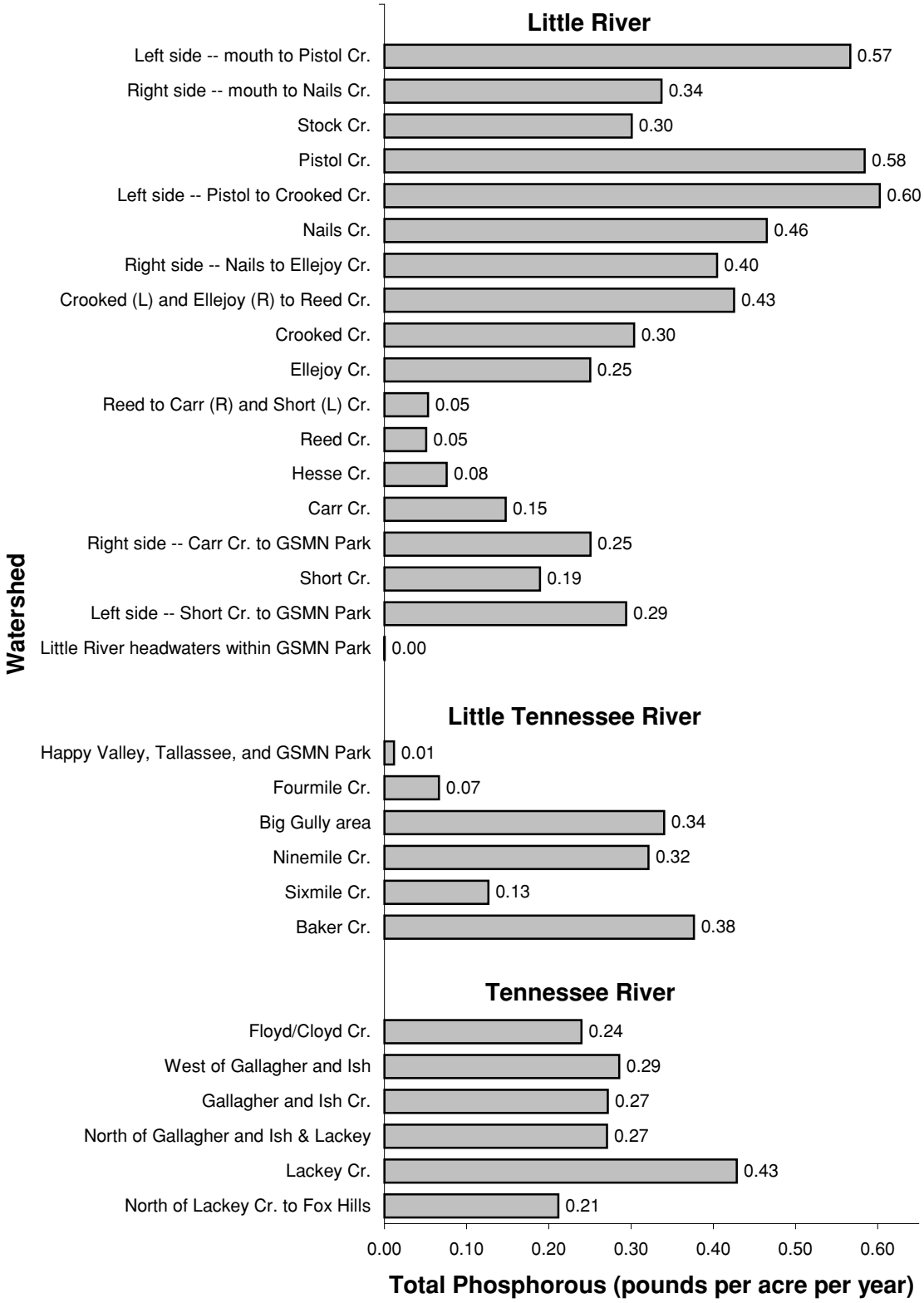


Figure 7. Plot of annual total phosphorous load per acre for each watershed.

Total Nitrogen

The annual TN load from the entire study area is 1,002,567 lb. per year (Table 28). The Little River Basin contributed 647,536 lb. per year, the Little Tennessee River Basin contributed 192,457 lb. per year, and the Tennessee River Basin contributed 162,457 lb. per year.

TN loads from each watershed are presented on Figure 8. TN loads ranged from 157 lb. per year in the Great Smoky Mountain part of the Little River Basin to 182,966 lb. per year in the Pistol Creek Watershed. As with TP, large watersheds dominated by urban and/or agricultural land uses had the highest loads. Pistol Creek (182,966 lb. per year), Crooked Creek (59,177 lb. per year), Ellejoy Creek (57,056 lb. per year), and Nails Creek (58,491 lb. per year) Watersheds accounted for 55% of the total Little River Basin TN. Ninemile Creek (81,009 lb. per year) and Baker Creek (75,676 lb. per year) Watersheds accounted for 81% of the Little Tennessee River Basin TN load. Lackey Creek (42,622 lb. per year) and Gallagher and Ish Creek (42,626 lb. per year) Watersheds accounted for 63% of the Tennessee River Basin TN load.

Watersheds with the highest annual TN per-acre loads are the same as those with the highest TP per-acre loads (Figure 9). These include: the left side of the Little River from the mouth to Pistol Creek (7.5 lb. per-acre per year), Pistol Creek (7.3 lb. per-acre per year), left side of the Little River from Pistol to Crooked Creek (6.9 lb. per-acre per year), land draining to the Little River from Crooked Creek (left) and Ellejoy Creek (right) to Reed Creek (5.3 lb. per-acre per year), Nails Creek (5.1 lb. per-acre per year), and Lackey Creek (4.8 lb. per-acre per year).

Total Suspended Solids

Annual TSS load from the study area is 91,460,733 lb. per year (Table 29). The Little River Basin contributed 53,394,137 lb. per year, the Little Tennessee River Basin contributed 19,682,348 lb. per year, and the Tennessee River Basin contributed 16,836,057 lb. per year.

TSS loads from each watershed are presented on Figure 10. TSS loads ranged from 62,776 lb. per year in the Great Smoky Mountain part of the Little River Basin to 11,261,884 lb. per year in the Pistol Creek Watershed. As with TP and TN, large watersheds dominated

Table 28. Estimated annual total nitrogen (TN) load for each Blount County watershed by major land uses. Percent TN load by major land use for each watershed is also shown.

	Residential		Commercial/Industrial		Agriculture		Forest		Streambanks		Roads		Total	
Watershed Name	TN (lb)	Percent	TN (lb)	Percent	TN (lb)	Percent	TN (lb)	Percent	TN (lb)	Percent	TN (lb)	Percent	TN (lb)	TN (lb per acre)
						Little River Basin								
Left side -- mouth to Pistol Creek	8,452	18.3%	29,388	63.6%	7,682	16.6%	92	0.2%	84	0.2%	516	1.1%	46,215	7.54
Right side -- mouth to Nails Creek	4,707	17.1%	2,668	9.7%	18,737	67.9%	85	0.3%	515	1.9%	865	3.1%	27,577	3.33
Stock Creek	14,625	35.7%	8,673	21.2%	15,605	38.1%	167	0.4%	541	1.3%	1,322	3.2%	40,933	3.00
Pistol Creek	53,189	29.1%	99,095	54.2%	28,717	15.7%	55	0.0%	211	0.1%	1,699	0.9%	182,966	7.31
Left side -- Pistol to Crooked Creek	7,171	18.3%	1,341	3.4%	30,165	77.0%	5	0.0%	100	0.3%	415	1.1%	39,197	6.95
Nails Creek	11,741	20.1%	4,042	6.9%	41,149	70.4%	70	0.1%	498	0.9%	990	1.7%	58,491	5.10
Right side -- Nails to Ellejoy Creek	4,402	30.2%	75	0.5%	9,763	67.0%	2	0.0%	34	0.2%	304	2.1%	14,580	4.63
Crooked (L) and Ellejoy (R) to Reed Creek	3,297	15.0%	2,125	9.7%	15,396	70.2%	2	0.0%	113	0.5%	996	4.5%	21,930	5.31
Crooked Creek	16,382	27.7%	5,094	8.6%	34,701	58.6%	128	0.2%	540	0.9%	2,332	3.9%	59,177	2.89
Ellejoy Creek	9,189	16.1%	1,557	2.7%	42,731	74.9%	43	0.1%	774	1.4%	2,762	4.8%	57,056	2.33
Reed to Carr (R) and Short (L) Creek	929	22.9%	666	16.4%	1,961	48.4%	26	0.7%	5	0.1%	468	11.5%	4,056	0.70
Reed Creek	597	10.1%	112	1.9%	3,748	63.4%	17	0.3%	23	0.4%	1,419	24.0%	5,916	0.73
Hesse Creek	1,855	12.6%	332	2.3%	11,591	78.7%	39	0.3%	15	0.1%	896	6.1%	14,728	0.84
Carr Creek	336	2.9%	104	0.9%	10,471	88.9%	16	0.1%	9	0.1%	846	7.2%	11,783	2.88
Right side -- Carr Creek to GSMN Park	1,247	5.2%	370	1.5%	20,702	86.3%	15	0.1%	45	0.2%	1,601	6.7%	23,981	3.70
Short Creek	1,332	6.5%	1,378	6.7%	16,578	81.1%	12	0.1%	29	0.1%	1,119	5.5%	20,447	3.50
Left side -- Short Creek to GSMN Park	1,965	10.7%	4,939	26.9%	10,861	59.2%	9	0.1%	16	0.1%	557	3.0%	18,347	4.47
Little River headwaters within GSMN Park	0	0.0%	0	0.0%	0	0.0%	157	100.0%	0	0.0%	0	0.0%	157	0.00
Total	141,417	21.8%	161,960	25.0%	320,559	49.5%	940	0.1%	3,551	0.5%	19,108	3.0%	647,536	2.67
Little River within Blount County	122,115	19.4%	155,766	24.7%	344,209	54.6%	688	0.1%	927	0.1%	7,214	1.1%	630,919	3.64
						Little Tennessee River Basin								
Happy Valley, Tallassee, and GSMN Park	1,232	11.4%	3,208	29.6%	4,147	38.3%	651	6.0%	3	0.0%	1,595	14.7%	10,835	0.14
Fourmile Creek	1,690	38.2%	469	10.6%	932	21.0%	60	1.4%	152	3.4%	1,127	25.4%	4,430	0.77
Big Gully area	625	16.1%	559	14.4%	1,964	50.7%	106	2.7%	131	3.4%	491	12.7%	3,876	3.10
Ninemile Creek	16,104	19.9%	4,074	5.0%	57,184	70.6%	508	0.6%	401	0.5%	2,738	3.4%	81,009	3.32
Sixmile Creek	4,393	26.4%	1,681	10.1%	7,071	42.5%	166	1.0%	586	3.5%	2,733	16.4%	16,631	1.23
Baker Creek	18,329	24.2%	5,142	6.8%	49,988	66.1%	365	0.5%	170	0.2%	1,681	2.2%	75,676	4.13
Total	42,372	22.0%	15,134	7.9%	121,286	63.0%	1,857	1.0%	1,443	0.7%	10,364	5.4%	192,457	1.36
						Tennessee River Basin								
Floyd/Cloyd Creeks	1,751	10.4%	669	4.0%	12,392	73.7%	200	1.2%	352	2.1%	1,451	8.6%	16,815	3.09
West of Gallagher and Ish	2,075	25.7%	14	0.2%	5,733	71.0%	2	0.0%	29	0.4%	226	2.8%	8,080	3.70
Gallagher and Ish Creek	12,071	28.3%	5,479	12.9%	22,822	53.5%	157	0.4%	191	0.4%	1,901	4.5%	42,622	2.94
North of Gallagher and Ish & Lackey	4,626	18.7%	368	1.5%	18,837	76.3%	58	0.2%	77	0.3%	728	2.9%	24,693	3.15
Lackey Creek	14,703	24.7%	13,602	22.8%	29,843	50.1%	85	0.1%	104	0.2%	1,268	2.1%	59,604	4.76
North of Lackey Creek to Fox Hills	3,259	30.3%	2,557	23.8%	4,213	39.2%	12	0.1%	47	0.4%	672	6.2%	10,760	2.27
Total	38,485	23.7%	22,690	14.0%	93,839	57.7%	514	0.3%	801	0.5%	6,246	3.8%	162,574	3.44
						Total								
Blount County	202,972	20.6%	193,590	19.6%	559,334	56.7%	3,059	0.3%	3,171	0.3%	23,825	2.4%	985,950	2.72
Study area	222,274	22.2%	199,784	19.9%	535,685	53.4%	3,311	0.3%	5,795	0.6%	35,719	3.6%	1,002,567	2.33

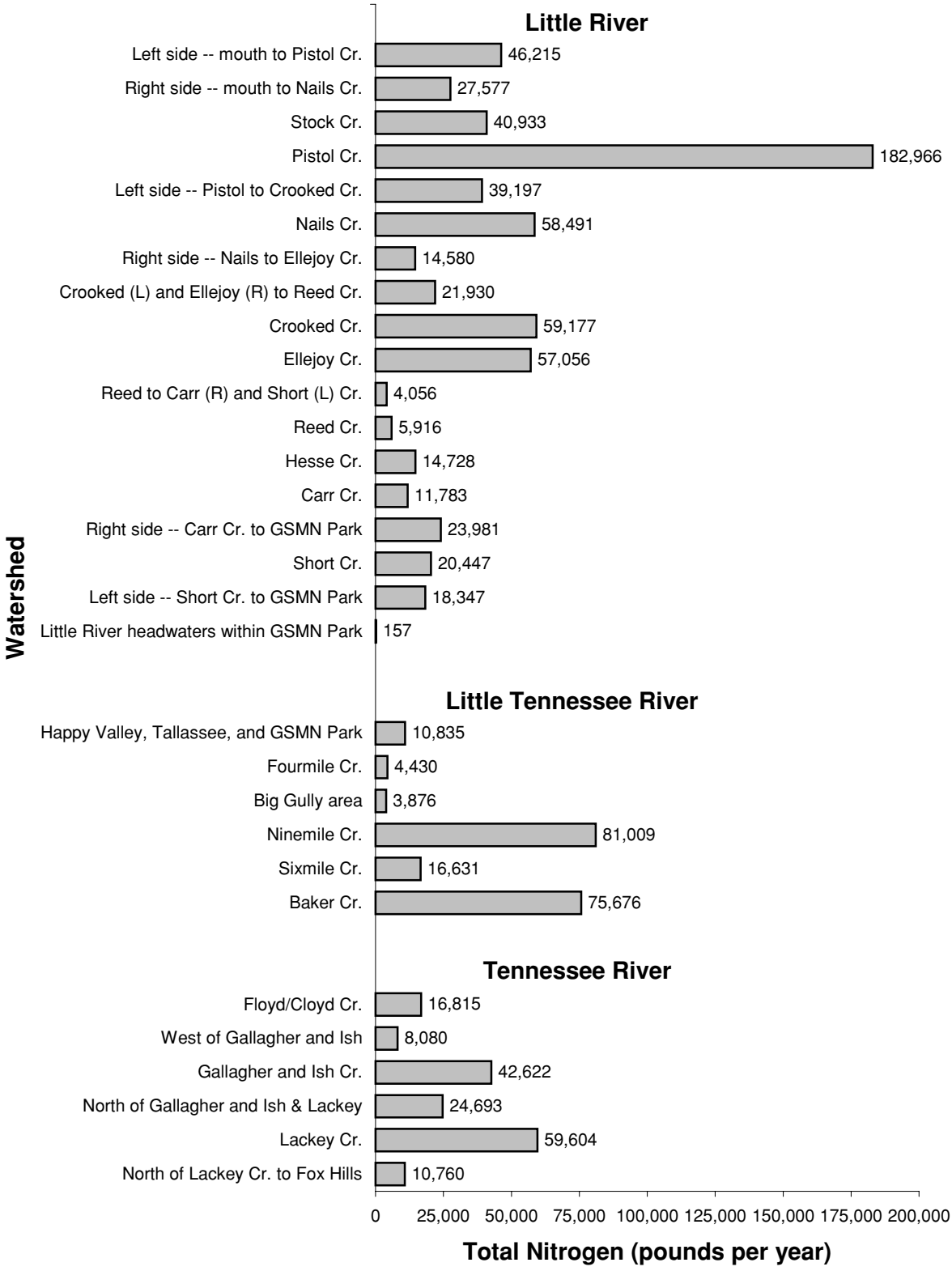


Figure 8. Plot of annual total nitrogen load for each watershed.

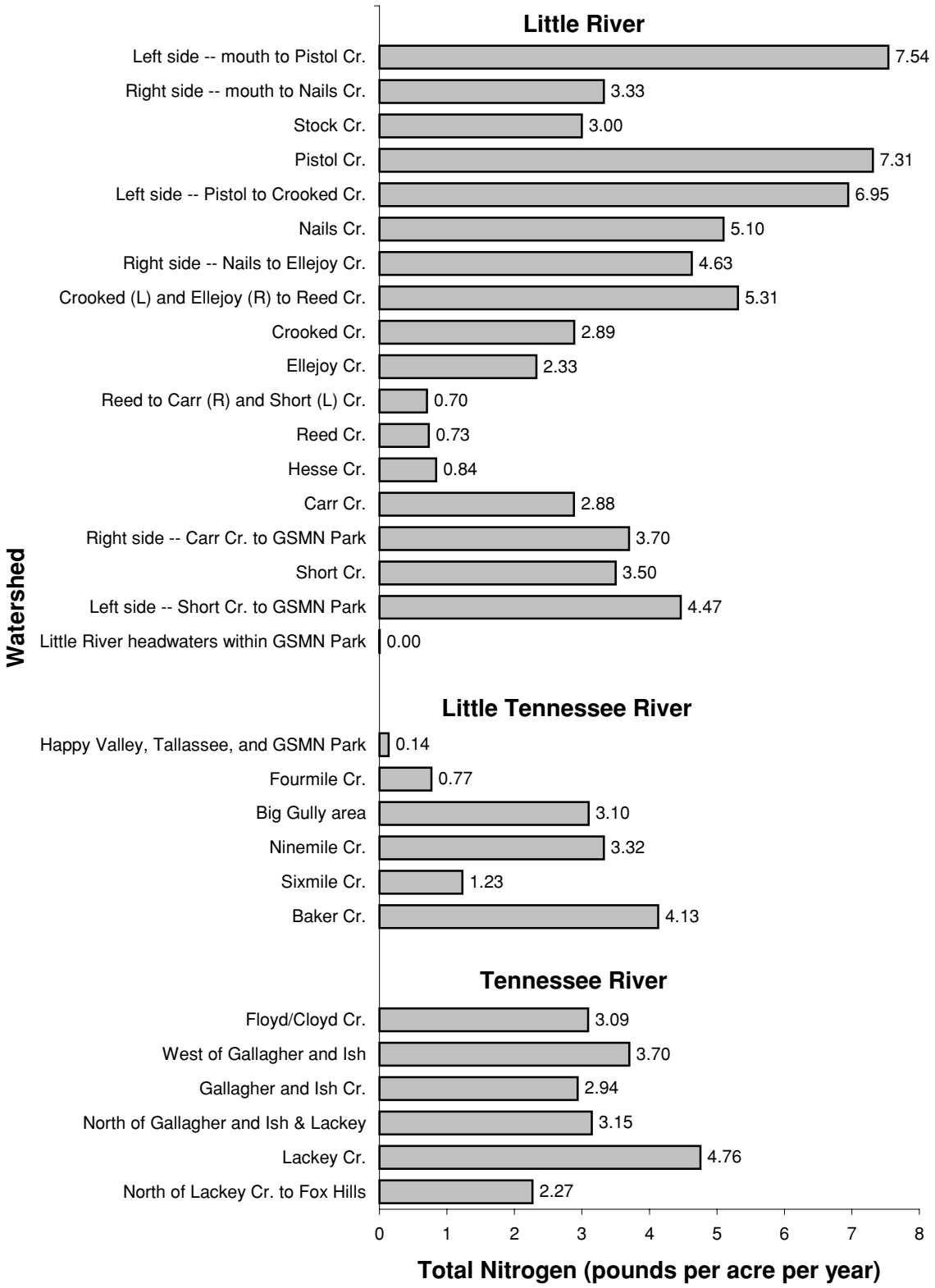


Figure 9. Plot of annual total nitrogen load per acre for each watershed.

Table 29. Estimated annual total suspended solids (TSS) load for each Blount County watershed by major land uses. Percent TSS load by major land use for each watershed is also shown.

	Residential		Commercial/Industrial		Agriculture		Forest		Streambanks		Roads		Total	
Watershed Name	TSS (lb)	Percent	TSS (lb)	Percent	TSS (lb)	Percent	TSS (lb)	Percent	TSS (lb)	Percent	TSS (lb)	Percent	TSS (lb)	TSS (lb per acre)
						Little River Basin								
Left side -- mouth to Pistol Creek	469,580	18.5%	1,219,047	47.9%	738,217	29.0%	36,605	1.4%	11,178	0.4%	68,863	2.7%	2,543,491	415.01
Right side -- mouth to Nails Creek	343,545	13.0%	290,806	11.0%	1,799,839	67.9%	33,964	1.3%	68,662	2.6%	115,369	4.3%	2,652,186	319.81
Stock Creek	969,508	30.9%	381,757	12.2%	1,472,486	46.9%	66,867	2.1%	72,101	2.3%	176,207	5.6%	3,138,926	229.83
Pistol Creek	4,161,517	37.0%	3,754,768	33.3%	3,068,875	27.3%	22,160	0.2%	28,073	0.2%	226,491	2.0%	11,261,884	450.07
Left side -- Pistol to Crooked Creek	706,148	15.9%	53,852	1.2%	3,622,460	81.3%	1,850	0.0%	13,367	0.3%	55,388	1.2%	4,453,065	789.07
Nails Creek	842,269	15.9%	141,029	2.7%	4,075,943	77.1%	27,831	0.5%	66,458	1.3%	132,060	2.5%	5,285,590	460.84
Right side -- Nails to Ellejoy Creek	601,853	35.6%	2,714	0.2%	1,042,132	61.6%	610	0.0%	4,508	0.3%	40,572	2.4%	1,692,388	537.09
Crooked (L) and Ellejoy (R) to Reed Creek	207,728	8.5%	166,318	6.8%	1,925,772	78.6%	927	0.0%	15,082	0.6%	132,842	5.4%	2,448,669	593.27
Crooked Creek	1,091,574	21.9%	225,797	4.5%	3,239,010	64.9%	51,299	1.0%	71,992	1.4%	310,981	6.2%	4,990,653	243.43
Ellejoy Creek	907,249	17.7%	103,974	2.0%	3,627,534	70.7%	17,331	0.3%	103,202	2.0%	368,226	7.2%	5,127,516	209.02
Reed to Carr (R) and Short (L) Creek	51,627	9.5%	159,177	29.2%	260,785	47.8%	10,591	1.9%	668	0.1%	62,338	11.4%	545,186	94.52
Reed Creek	49,537	7.1%	3,916	0.6%	444,469	63.8%	6,728	1.0%	3,022	0.4%	189,240	27.2%	696,913	86.35
Hesse Creek	111,643	7.0%	18,433	1.2%	1,329,264	83.3%	15,648	1.0%	1,976	0.1%	119,481	7.5%	1,596,444	91.01
Carr Creek	21,869	2.6%	36,000	4.3%	665,509	78.9%	6,294	0.7%	1,208	0.1%	112,844	13.4%	843,725	206.48
Right side -- Carr Creek to GSMN Park	114,872	5.3%	63,376	2.9%	1,774,549	81.5%	5,910	0.3%	6,042	0.3%	213,440	9.8%	2,178,189	335.78
Short Creek	73,976	3.6%	372,810	18.1%	1,455,848	70.7%	4,975	0.2%	3,813	0.2%	149,177	7.2%	2,060,600	352.70
Left side -- Short Creek to GSMN Park	112,377	6.2%	775,342	42.7%	848,104	46.7%	3,796	0.2%	2,084	0.1%	74,233	4.1%	1,815,936	442.01
Little River headwaters within GSMN Park	0	0.0%	0	0.0%	0	0.0%	62,776	100.0%	0	0.0%	0	0.0%	62,776	0.93
Total	10,836,874	20.3%	7,769,116	14.6%	31,390,798	58.8%	376,160	0.7%	473,435	0.9%	2,547,754	4.8%	53,394,137	220.45
Little River within Blount County	9,570,664	17.4%	7,040,326	12.8%	36,970,595	67.3%	275,254	0.5%	123,595	0.2%	961,894	1.8%	54,942,328	316.77
						Little Tennessee River Basin								
Happy Valley, Tallassee, and GSMN Park	77,767	6.3%	195,625	15.9%	481,527	39.2%	260,397	21.2%	366	0.0%	212,658	17.3%	1,228,339	15.65
Fourmile Creek	124,429	29.0%	40,456	9.4%	70,120	16.3%	24,102	5.6%	20,248	4.7%	150,275	35.0%	429,631	74.75
Big Gully area	51,178	11.0%	136,029	29.1%	154,854	33.1%	42,239	9.0%	17,499	3.7%	65,415	14.0%	467,214	373.80
Ninemile Creek	1,350,352	17.1%	186,780	2.4%	5,727,020	72.6%	203,333	2.6%	53,474	0.7%	365,011	4.6%	7,885,970	323.67
Sixmile Creek	323,377	21.3%	122,919	8.1%	562,609	37.1%	66,573	4.4%	78,156	5.1%	364,403	24.0%	1,518,037	112.23
Baker Creek	1,883,522	23.1%	295,169	3.6%	5,581,494	68.5%	146,127	1.8%	22,706	0.3%	224,137	2.7%	8,153,156	445.12
Total	3,810,626	19.4%	976,979	5.0%	12,577,624	63.9%	742,771	3.8%	192,448	1.0%	1,381,899	7.0%	19,682,348	138.89
						Tennessee River Basin								
Floyd/Cloyd Creeks	258,938	12.0%	75,780	3.5%	1,501,227	69.6%	79,945	3.7%	46,970	2.2%	193,468	9.0%	2,156,327	396.28
West of Gallagher and Ish	129,332	14.0%	471	0.1%	760,775	82.2%	765	0.1%	3,919	0.4%	30,156	3.3%	925,417	424.27
Gallagher and Ish Creek	1,176,662	26.5%	410,876	9.3%	2,508,407	56.5%	62,904	1.4%	25,451	0.6%	253,533	5.7%	4,437,833	305.93
North of Gallagher and Ish & Lackey	309,186	11.3%	15,236	0.6%	2,288,103	83.4%	23,017	0.8%	10,256	0.4%	97,043	3.5%	2,742,842	349.50
Lackey Creek	1,235,464	22.5%	570,842	10.4%	3,473,350	63.2%	34,115	0.6%	13,867	0.3%	169,009	3.1%	5,496,646	438.60
North of Lackey Creek to Fox Hills	197,903	18.4%	324,396	30.1%	454,091	42.2%	4,704	0.4%	6,280	0.6%	89,618	8.3%	1,076,992	226.76
Total	3,307,486	19.6%	1,397,601	8.3%	10,985,952	65.3%	205,451	1.2%	106,741	0.6%	832,827	4.9%	16,836,057	356.26
						Total								
Blount County	16,688,776	18.2%	9,414,906	10.3%	60,534,171	66.2%	1,223,476	1.3%	422,785	0.5%	3,176,620	3.5%	91,460,733	252.37
Study area	17,954,985	20.0%	10,143,696	11.3%	54,954,374	61.1%	1,324,382	1.5%	772,624	0.9%	4,762,480	5.3%	89,912,541	208.53

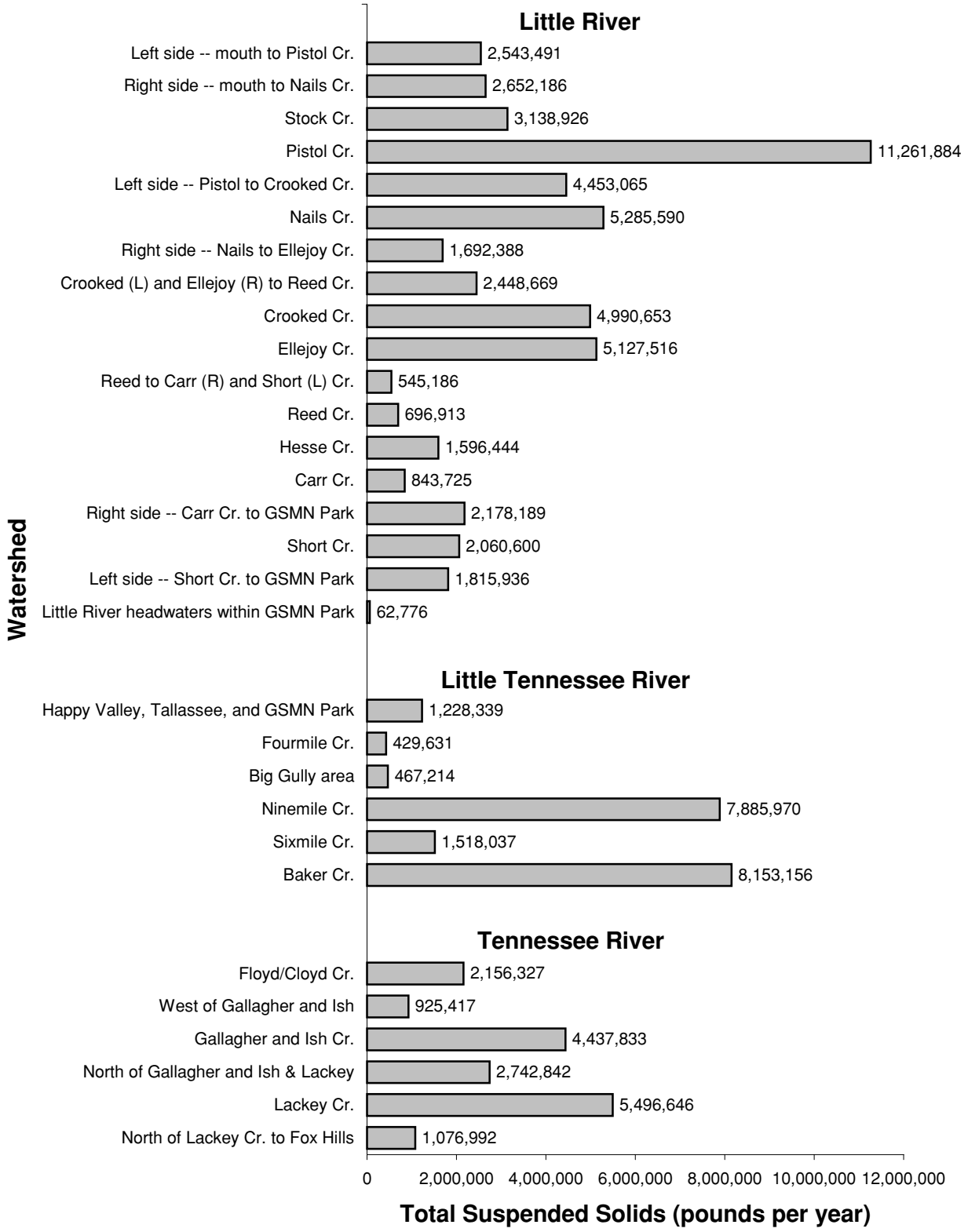


Figure 10. Plot of annual total suspended solids load for each watershed.

by urban and/or agricultural land uses had the highest loads. Pistol Creek (11,261,884 lb. per year), Crooked Creek (4,990,653 lb. per year), Ellejoy Creek (5,127,516 lb. per year), and Nails Creek (5,285,590 lb. per year) Watersheds accounted for 50% of the total Little River Basin TSS. Ninemile Creek (7,885,970 lb. per year) and Baker Creek (8,153,156 lb. per year) Watersheds accounted for 82% of the Little Tennessee River Basin TSS load. Lackey Creek (5,496,646 lb. per year) and Gallagher and Ish Creek (4,496,838 lb. per year) Watersheds accounted for 59% of the Tennessee River Basin TSS load.

Watersheds with the highest annual TSS loads per-acre (Figure 11) include: left side of the Little River from Pistol Creek to Crooked Creek (789.1 lb. per-acre per year), land draining to the Little River from Crooked Creek (left) and Ellejoy Creek (right) to Reed Creek (593.3 lb. per-acre per year), right side of the Little River from Nails Creek to Ellejoy Creek (537.1 lb. per-acre per year), Nails Creek (460.8 lb. per-acre per year), Pistol Creek (450.1 lb. per-acre per year), and Baker Creek (445.1 lb. per-acre per year). The Pistol Creek Watershed is predominantly urban (37% residential and 33% commercial/industrial); land use in the other watersheds with high per-acre annual TSS load is at least 65% agricultural.

Zinc

The total annual zinc from the study area was 61,201 lb. per year (Table 30). The Little River Basin contributed 47,033 lb. per year, the Little Tennessee River Basin contributed 8,832 lb. per year, and the Tennessee River Basin contributed 8,771 lb. per year.

Zinc loads from each watershed are presented on Figure 12. Zinc loading was highest in urban watersheds. Pistol Creek Watershed (22,720 lb. per-acre per year) and the left side of the Little River from the mouth to Pistol Creek Watershed (5,397 lb. per-acre per year) contributed 60% of the zinc loading to the Little River Basin. Nine Mile Creek (3,463 lb. per-acre per year) and Baker Creek Watersheds (3,629 lb. per-acre per year) contributed 80% of the zinc load to the Little Tennessee River Basin. Lackey Creek (3,735 lb. per year) and Gallagher and Ish Creek (2,450 lb. per year) Watersheds accounted for 70% of the Tennessee River Basin zinc load.

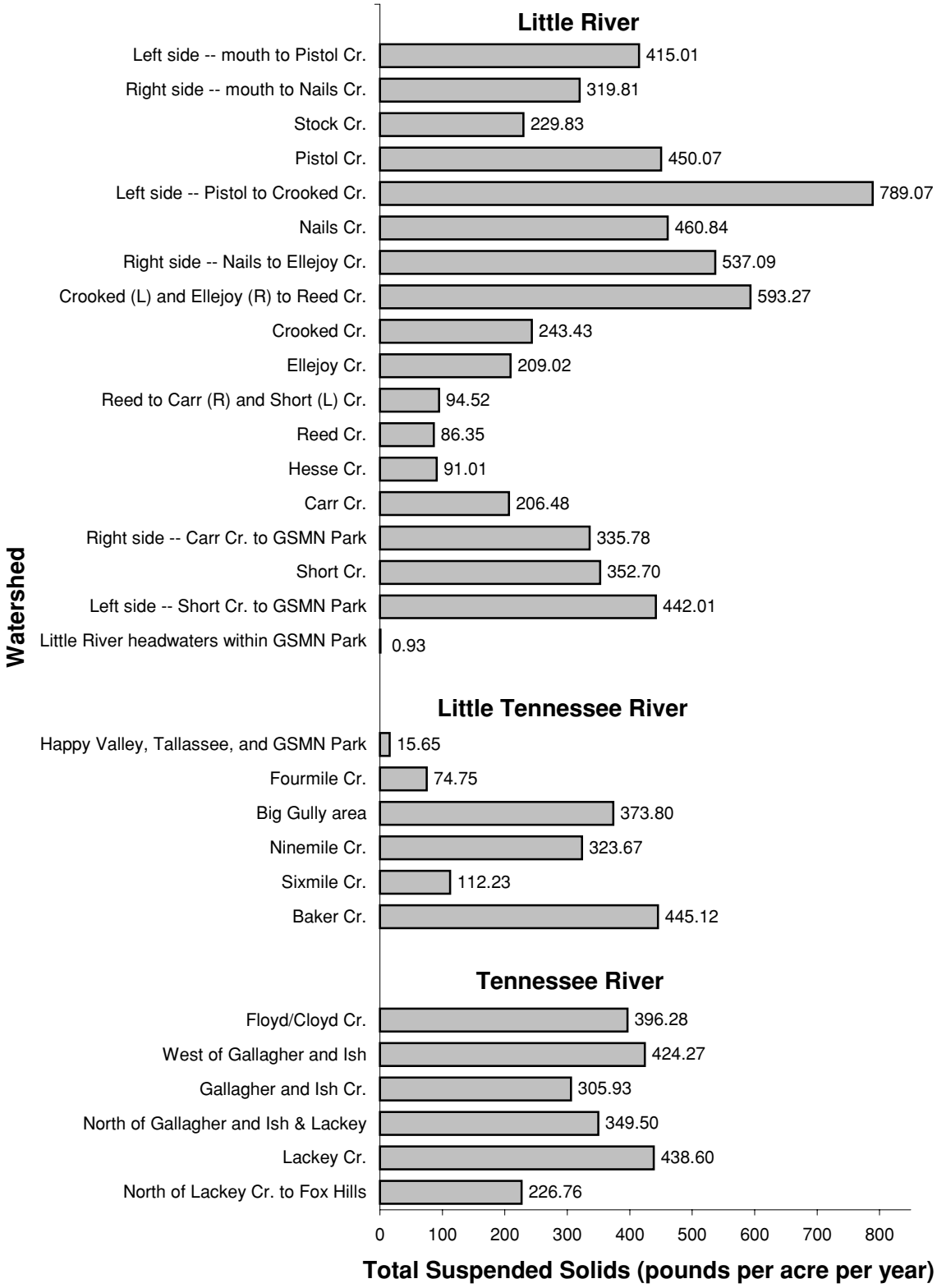


Figure 11. Plot of annual total suspended solids loading per acre for each watershed.

Table 30. Estimated annual zinc load for each Blount County watershed by major land uses. Percent zinc load by major land use for each watershed is also shown.

Watershed Name	Residential Zinc (lb)	Residential Percent	Commercial / Industrial Zinc (lb)	Commercial / Industrial Percent	Agriculture Zinc (lb)	Agriculture Percent	Forest Zinc (lb)	Forest Percent	Streambanks Zinc (lb)	Streambanks Percent	Roads Zinc (lb)	Roads Percent	Total Zinc (lb)	Total Zinc (lb per acre)
Little River Basin														
Left side -- mouth to Pistol Creek	1,338.3	24.8%	3,983.6	73.8%	65.0	1.2%	3.3	0.1%	1.0	0.0%	6.2	0.1%	5,397	0.88
Right side -- mouth to Nails Creek	695.7	58.0%	326.0	27.2%	158.6	13.2%	3.1	0.3%	6.2	0.5%	10.4	0.9%	1,200	0.14
Stock Creek	2,220.9	61.2%	1,252.3	34.5%	129.2	3.6%	6.0	0.2%	6.5	0.2%	15.9	0.4%	3,631	0.27
Pistol Creek	7,693.4	33.9%	14,729.5	64.8%	272.0	1.2%	2.0	0.0%	2.5	0.0%	20.4	0.1%	22,720	0.91
Left side -- Pistol to Crooked Creek	949.7	63.2%	223.7	14.9%	323.8	21.5%	0.2	0.0%	1.2	0.1%	5.0	0.3%	1,504	0.27
Nails Creek	1,744.3	62.6%	659.2	23.7%	360.9	13.0%	2.5	0.1%	6.0	0.2%	11.9	0.4%	2,785	0.24
Right side -- Nails to Ellejoy Creek	481.3	81.7%	10.8	1.8%	92.8	15.8%	0.1	0.0%	0.4	0.1%	3.7	0.6%	589	0.19
Crooked (L) and Ellejoy (R) to Reed Creek	507.3	53.0%	263.3	27.5%	172.6	18.0%	0.1	0.0%	1.4	0.1%	12.0	1.2%	957	0.23
Crooked Creek	2,484.3	69.0%	791.7	22.0%	284.7	7.9%	4.6	0.1%	6.5	0.2%	28.0	0.8%	3,600	0.18
Ellejoy Creek	1,215.4	67.2%	232.2	12.8%	316.2	17.5%	1.6	0.1%	9.3	0.5%	33.1	1.8%	1,808	0.07
Reed to Carr (R) and Short (L) Creek	147.1	69.5%	34.6	16.3%	23.5	11.1%	1.0	0.5%	0.1	0.0%	5.6	2.6%	212	0.04
Reed Creek	84.6	52.5%	18.9	11.7%	39.7	24.6%	0.6	0.4%	0.3	0.2%	17.0	10.6%	161	0.02
Hesse Creek	288.6	61.4%	50.9	10.8%	118.4	25.2%	1.4	0.3%	0.2	0.0%	10.8	2.3%	470	0.03
Carr Creek	51.3	40.3%	5.8	4.6%	59.3	46.6%	0.6	0.4%	0.1	0.1%	10.2	8.0%	127	0.03
Right side -- Carr Creek to GSMN Park	170.0	43.3%	43.8	11.2%	158.1	40.3%	0.5	0.1%	0.5	0.1%	19.2	4.9%	392	0.06
Short Creek	210.8	45.0%	112.8	24.1%	130.8	27.9%	0.4	0.1%	0.3	0.1%	13.4	2.9%	469	0.08
Left side -- Short Creek to GSMN Park	309.2	30.7%	614.2	61.0%	75.8	7.5%	0.3	0.0%	0.2	0.0%	6.7	0.7%	1,006	0.24
Little River headwaters within GSMN Park	0.0	0.0%	0.0	0.0%	0.0	0.0%	5.6	100.0%	0.0	0.0%	0.0	0.0%	6	0.00
Total	20,592.3	43.8%	23,353.4	49.7%	2,781.3	5.9%	33.9	0.1%	42.6	0.1%	229.3	0.5%	47,033	0.19
Little River within Blount County	17,653.1	40.5%	22,532.0	51.7%	3,290.1	7.5%	24.8	0.1%	11.1	0.0%	86.6	0.2%	43,598	0.25
Little Tennessee River Basin														
Happy Valley, Tallassee, and GSMN Park	189.3	44.3%	152.6	35.7%	42.9	10.0%	23.4	5.5%	0.0	0.0%	19.1	4.5%	428	0.01
Fourmile Creek	249.2	77.1%	50.7	15.7%	6.0	1.9%	2.2	0.7%	1.8	0.6%	13.5	4.2%	323	0.06
Big Gully area	89.0	65.5%	22.4	16.4%	13.3	9.8%	3.8	2.8%	1.6	1.2%	5.9	4.3%	136	0.11
Ninemile Creek	2,274.8	65.7%	626.0	18.1%	506.5	14.6%	18.3	0.5%	4.8	0.1%	32.9	0.9%	3,463	0.14
Sixmile Creek	647.7	75.9%	111.4	13.1%	48.5	5.7%	6.0	0.7%	7.0	0.8%	32.8	3.8%	853	0.06
Baker Creek	2,379.8	65.6%	716.9	19.8%	496.7	13.7%	13.2	0.4%	2.0	0.1%	20.2	0.6%	3,629	0.20
Total	5,829.8	66.0%	1,680.0	19.0%	1,114.0	12.6%	66.8	0.8%	17.3	0.2%	124.4	1.4%	8,832.4	0.06
Tennessee River Basin														
Floyd/Cloyd Creeks	179.7	46.1%	47.2	12.1%	134.3	34.4%	7.2	1.8%	4.2	1.1%	17.4	4.5%	390	0.07
West of Gallagher and Ish	320.0	81.2%	2.4	0.6%	68.4	17.4%	0.1	0.0%	0.4	0.1%	2.7	0.7%	394	0.18
Gallagher and Ish Creek	1,605.9	65.5%	590.9	24.1%	222.8	9.1%	5.7	0.2%	2.3	0.1%	22.8	0.9%	2,450	0.17
North of Gallagher and Ish & Lackey	701.0	71.6%	61.1	6.2%	204.7	20.9%	2.1	0.2%	0.9	0.1%	8.7	0.9%	978	0.12
Lackey Creek	2,075.3	55.6%	1,330.2	35.6%	309.8	8.3%	3.1	0.1%	1.2	0.0%	15.2	0.4%	3,735	0.30
North of Lackey Creek to Fox Hills	505.8	61.4%	268.2	32.6%	40.3	4.9%	0.4	0.1%	0.6	0.1%	8.1	1.0%	823	0.17
Total	5,387.6	61.4%	2,300.0	26.2%	980.3	11.2%	18.5	0.2%	9.6	0.1%	75.0	0.9%	8,770.9	0.19
Total														
Blount County	28,870.5	47.2%	26,512.0	43.3%	5,384.4	8.8%	110.1	0.2%	38.1	0.1%	285.9	0.5%	61,201	0.17
Study area	31,810	49.2%	27,333	42.3%	4,876	7.5%	119	0.2%	70	0.1%	429	0.7%	64,636	0.15

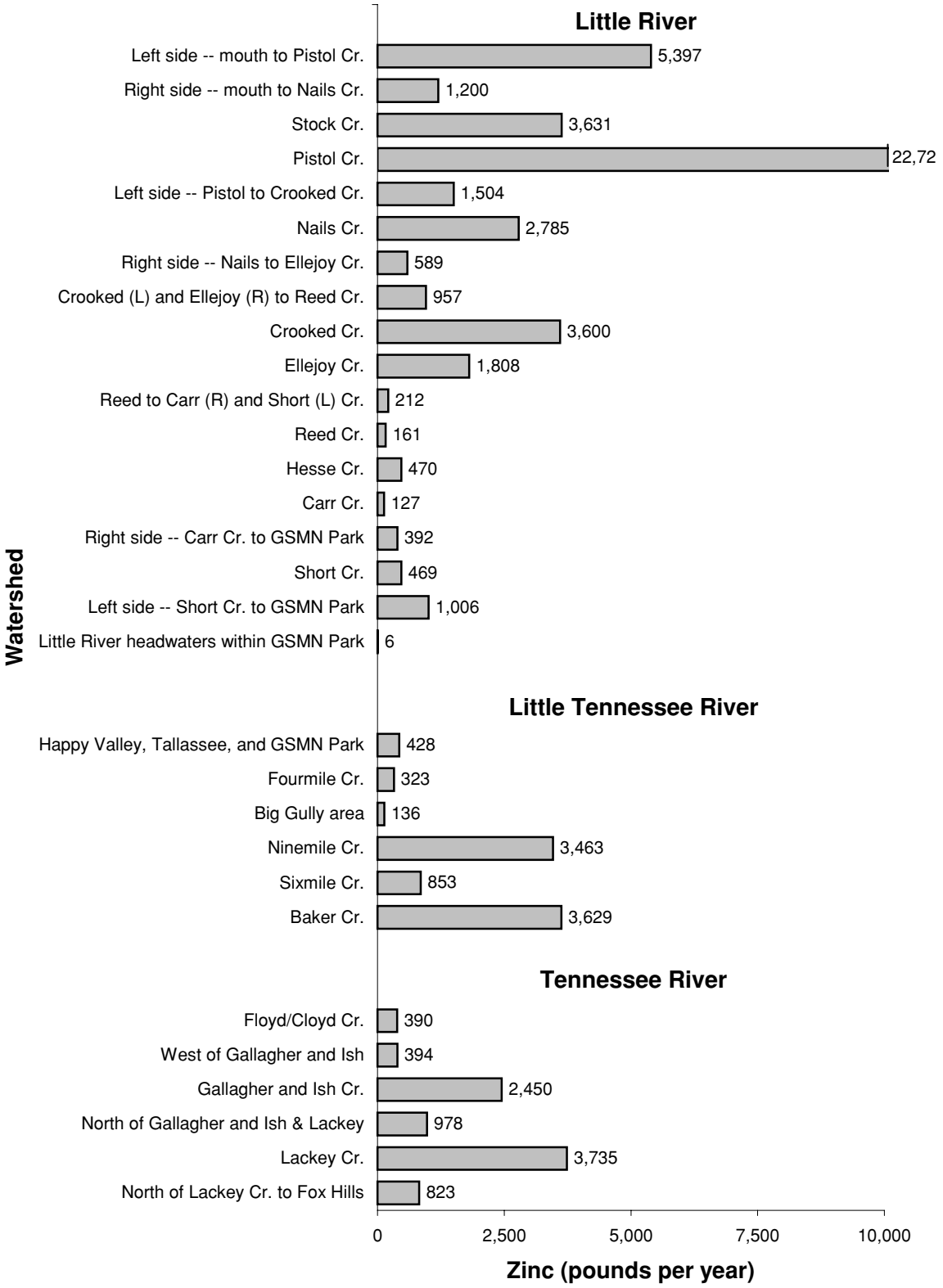


Figure 12. Plot of annual zinc load for each watershed.

Zinc load per-acre was determined by the amount of impervious surface in each watershed. Pistol Creek Watershed (0.91 lb. per-acre per year) and the left side of the Little River from the mouth to Pistol Creek Watershed (0.88 lb. per-acre per year) had much higher annual zinc loads that any other watersheds (Figure 13).

Projected 2020 Pollution Loads

Projected land use changes from the year 2000 to 2020 are summarized on Table 31 and Figure 14. Residential acreage is expected to increase by 32% in the Little River Basin, 47% in the Little Tennessee River Basin and by 54% in the Tennessee River Basin. Commercial acreage is expected to increase by 18% in the Little River Basin, 20% in the Little Tennessee River Basin and by 29% in the Tennessee River Basin. Agricultural acreage is projected to decrease by 16% in the Little River Basin, 10% in the Little Tennessee River Basin and by 19% in the Tennessee River Basin. Forested area is expected to decrease by less than 5% in each basin.

TP loads are projected to increase between 2000 and 2020 in each basin (Figure 15). TP loads increase by 5% in the Little River Basin, 5.5% in the Little Tennessee River Basin, and 9% in the Tennessee River Basin. TP load from residential and commercial/industrial land uses increased significantly in each basin. These increases were partially offset by decreased loads from agricultural areas.

Annual TP loads for each watershed are compared on Table 32. Watersheds with the largest relative TP load increase were the area North of Lackey Creek to Fox Hills (24%), Fourmile Creek (22.6%) and the left side of the Little River from Short Creek to the Great Smoky Mountain National Park (12%). TP loads in several watersheds in the upper section of the Little River Basin (between Reed Creek and the Great Smoky Mountain National Park) were predicted to decrease by 5% to 20%. Decreases in TP load are due to reductions of agricultural acreage in steep areas.

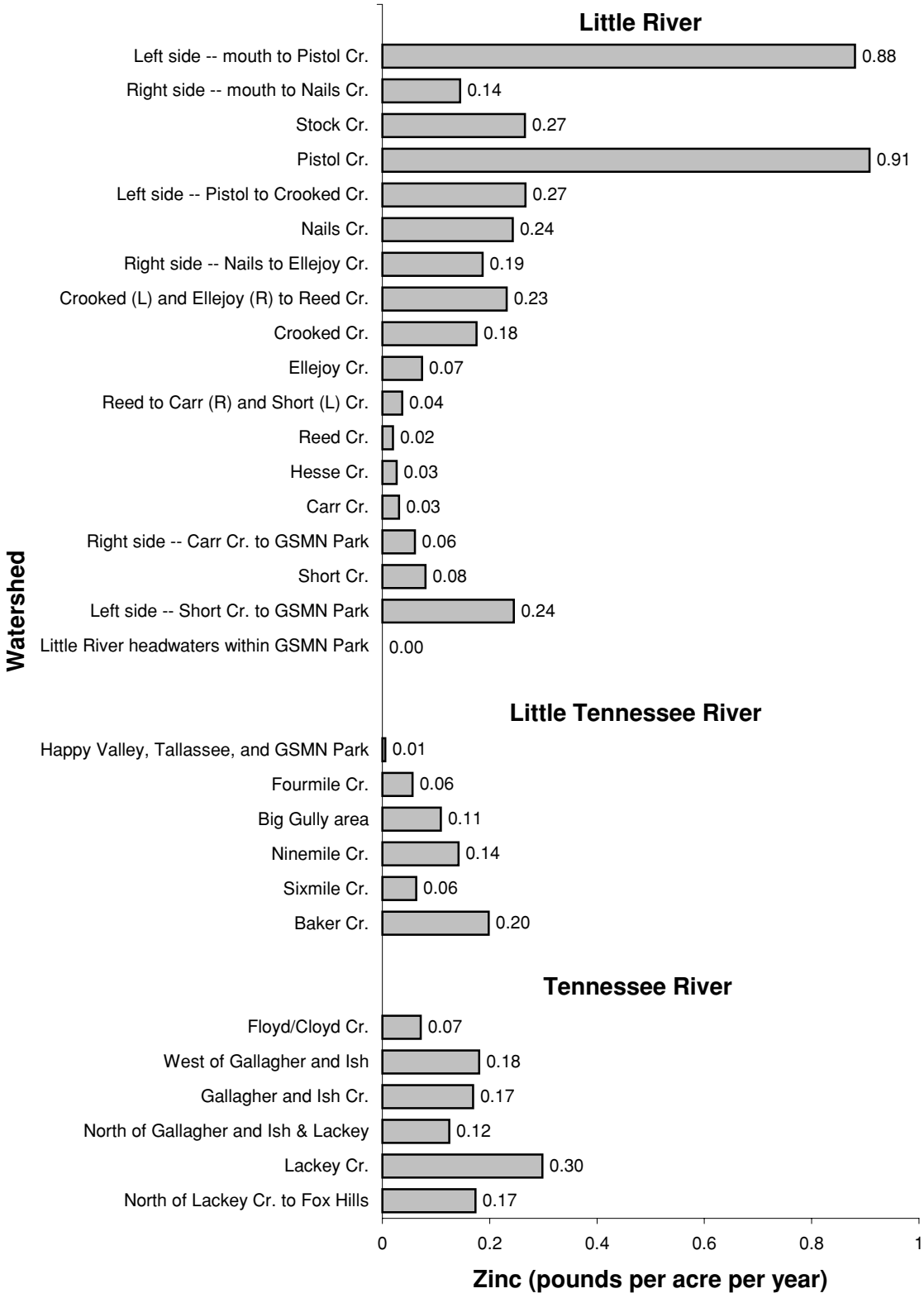


Figure 13. Plot of annual zinc load per acre for each watershed.

Table 31. Comparison of residential, commercial/industrial, agricultural and forested acreage 2000 with projected acreage in 2020.

	Residential				Commercial / Industrial				Agriculture				Forest			
Watershed Name	2000 (acres)	2020 (acres)	change	% change	2000 (acres)	2020 (acres)	change	% change	2000 (acres)	2020 (acres)	change	% change	2000 (acres)	2020 (acres)	change	% change
Little River Basin																
Left side -- mouth to Pistol Creek	1,562	1,648	86	5.5%	2,030	2,454	425	20.9%	1,131	722	-409	-36.1%	1,082	980	-102	-9.4%
Right side -- mouth to Nails Creek	837	1,270	433	51.7%	130	181	50	38.4%	3,310	2,923	-386	-11.7%	3,613	3,516	-97	-2.7%
Stock Creek	2,641	3,266	625	23.7%	500	600	100	20.0%	3,359	2,779	-580	-17.3%	7,008	6,863	-145	-2.1%
Pistol Creek	9,354	9,906	552	5.9%	5,385	5,885	500	9.3%	6,703	5,862	-842	-12.6%	3,465	3,254	-210	-6.1%
Left side -- Pistol to Crooked Creek	1,204	2,111	907	75.3%	75	305	230	305.5%	3,520	2,610	-910	-25.8%	747	519	-227	-30.5%
Nails Creek	2,095	3,219	1,124	53.6%	337	362	25	7.3%	5,227	4,308	-919	-17.6%	3,777	3,547	-230	-6.1%
Right side -- Nails to Ellejoy Creek	673	1,171	499	74.2%	6	6	0	0.0%	1,718	1,318	-399	-23.2%	695	595	-100	-14.4%
Crooked (L) and Ellejoy (R) to Reed Ck	600	891	292	48.6%	201	226	25	12.4%	1,279	1,026	-253	-19.8%	1,979	1,915	-63	-3.2%
Crooked Creek	2,896	3,944	1,048	36.2%	513	673	160	31.2%	6,854	5,887	-967	-14.1%	10,177	9,935	-242	-2.4%
Ellejoy Creek	1,542	2,806	1,264	82.0%	94	103	10	10.7%	9,918	8,898	-1,019	-10.3%	12,827	12,572	-255	-2.0%
Reed to Carr (R) and Short (L) Creek	162	265	103	64.0%	41	41	0	0.0%	131	44	-87	-66.6%	5,362	5,346	-16	-0.3%
Reed Creek	98	212	114	116.9%	10	10	0	0.0%	439	348	-91	-20.8%	7,516	7,493	-23	-0.3%
Hesse Creek	302	501	199	65.9%	42	42	0	0.0%	980	821	-159	-16.2%	6,730	6,690	-40	-0.6%
Carr Creek	56	98	42	74.2%	8	8	0	0.0%	392	359	-33	-8.5%	3,627	3,619	-8	-0.2%
Right side -- Carr Creek to GSMN	193	345	152	79.2%	33	103	70	211.3%	1,213	1,035	-178	-14.7%	4,582	4,537	-45	-1.0%
Short Creek	215	399	184	85.6%	138	138	0	0.0%	995	848	-147	-14.8%	4,487	4,451	-37	-0.8%
Left side -- Short Creek to GSMN	334	625	291	87.2%	203	362	158	78.0%	716	357	-360	-50.2%	2,187	2,097	-90	-4.1%
Little River headwaters within GSMN	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%	0	0	0	0.0%
Little River total	24,761	32,676	7,915	32.0%	9,746	11,499	1,753	18.0%	47,885	40,146	-7,739	-16.2%	79,858	77,929	-1,929	-2.4%
Little River -- subtotal (Blount only)	21,031	27,961	6,931	33.0%	9,233	10,754	1,521	16.5%	42,405	35,878	-6,527	-15.4%	66,667	64,738	-1,929	-2.9%
Little Tennessee River Basin																
Happy Valley, Tallassee, and GSMN	185	264	78	42.3%	419	419	0	0.0%	430	394	-36	-8.5%	15,119	15,080	-38	-0.3%
Fourmile Creek	277	435	158	56.9%	43	43	0	0.0%	338	259	-80	-23.5%	5,078	5,000	-78	-1.5%
Minor Little Tennessee River tributaries	101	142	42	41.5%	43	43	0	0.0%	211	194	-17	-8.1%	894	869	-25	-2.8%
Ninemile Creek	2,632	3,822	1,190	45.2%	340	365	25	7.4%	12,618	11,675	-944	-7.5%	8,633	8,362	-271	-3.1%
Sixmile Creek	721	1,046	325	45.2%	228	238	10	4.4%	1,722	1,592	-130	-7.6%	10,804	10,600	-205	-1.9%
Baker Creek	2,867	4,287	1,420	49.5%	371	621	250	67.3%	11,439	10,103	-1,336	-11.7%	3,557	3,223	-334	-9.4%
Little Tennessee River total	6,783	9,995	3,213	47.4%	1,445	1,729	285	19.7%	26,758	24,215	-2,543	-9.5%	44,085	43,134	-951	-2.2%
Tennessee River Basin																
Floyd/Cloyd Creeks	240	420	180	75.0%	93	121	28	30.3%	2,292	2,128	-164	-7.2%	2,808	2,767	-41	-1.5%
West of Gallagher and Ish	349	638	289	82.8%	1	1	0	0.0%	959	728	-231	-24.1%	571	513	-58	-10.2%
Gallagher and Ish Creek	1,950	3,023	1,073	55.0%	461	658	197	42.7%	5,792	4,774	-1,018	-17.6%	5,429	5,176	-253	-4.7%
North of Gallagher and Ish & Lackey	817	1,301	484	59.2%	32	32	0	0.0%	3,088	2,696	-392	-12.7%	2,833	2,741	-92	-3.3%
Lackey Creek	2,552	3,625	1,073	42.0%	1,463	1,763	300	20.5%	5,077	3,979	-1,098	-21.6%	3,066	2,791	-275	-9.0%
North of Lackey Creek to Fox Hills	596	1,019	423	71.0%	172	297	125	72.6%	970	511	-459	-47.3%	2,427	2,338	-89	-3.7%
Tennessee River total	6,504	10,025	3,522	54.1%	2,222	2,872	650	29.3%	18,178	14,816	-3,362	-18.5%	17,133	16,325	-808	-4.7%
Total																
Blount County	34,317	47,982	13,665	39.8%	12,899	15,355	2,456	19.0%	87,342	74,910	-12,432	-14.2%	127,885	124,196	-3,688	-2.9%
Study area	38,048	52,697	14,649	38.5%	13,412	16,101	2,688	20.0%	92,822	79,178	-13,645	-14.7%	141,076	137,388	-3,688	-2.6%

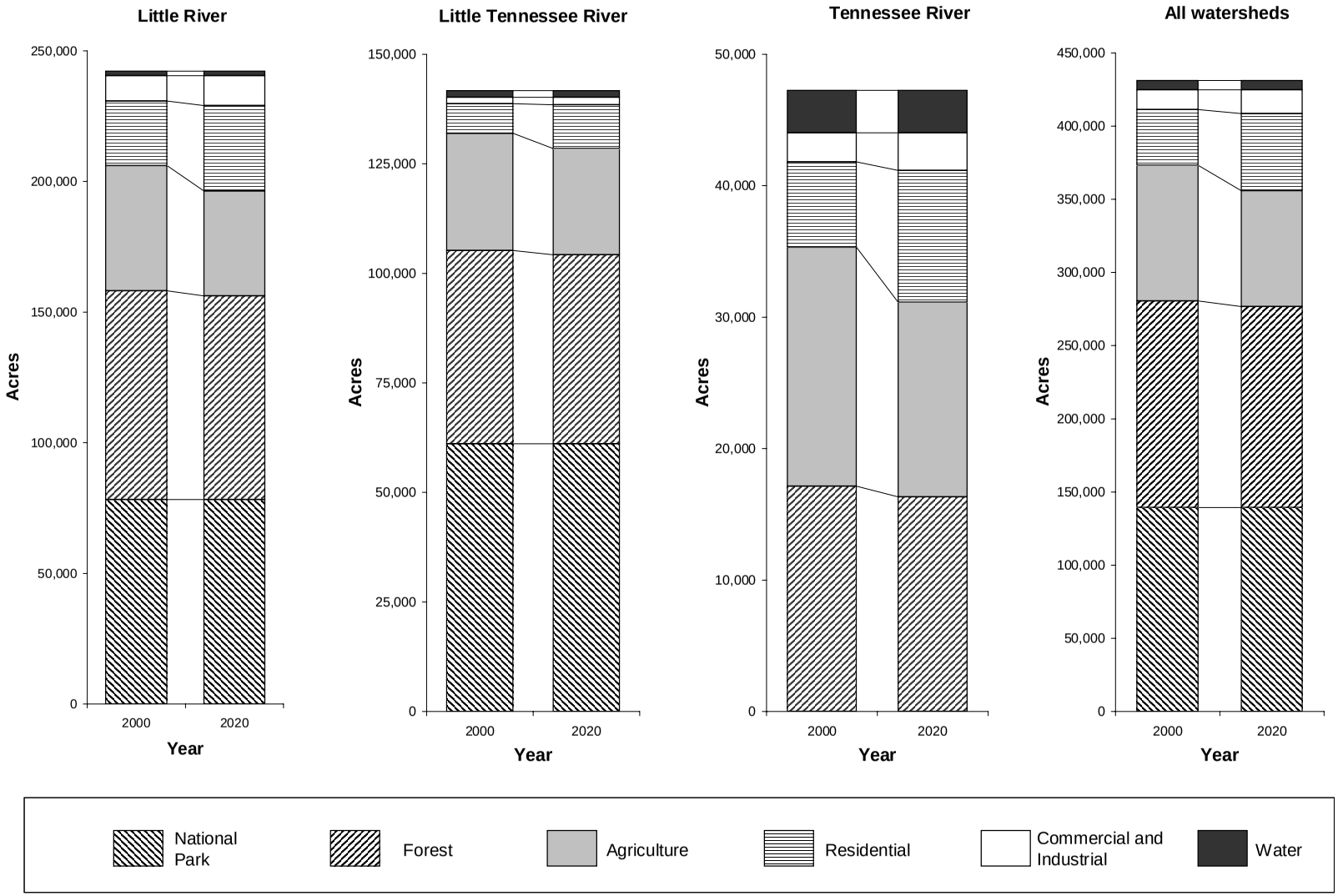


Figure 14. Comparison of major land use/land cover categories in 2000 with 2020 projections.

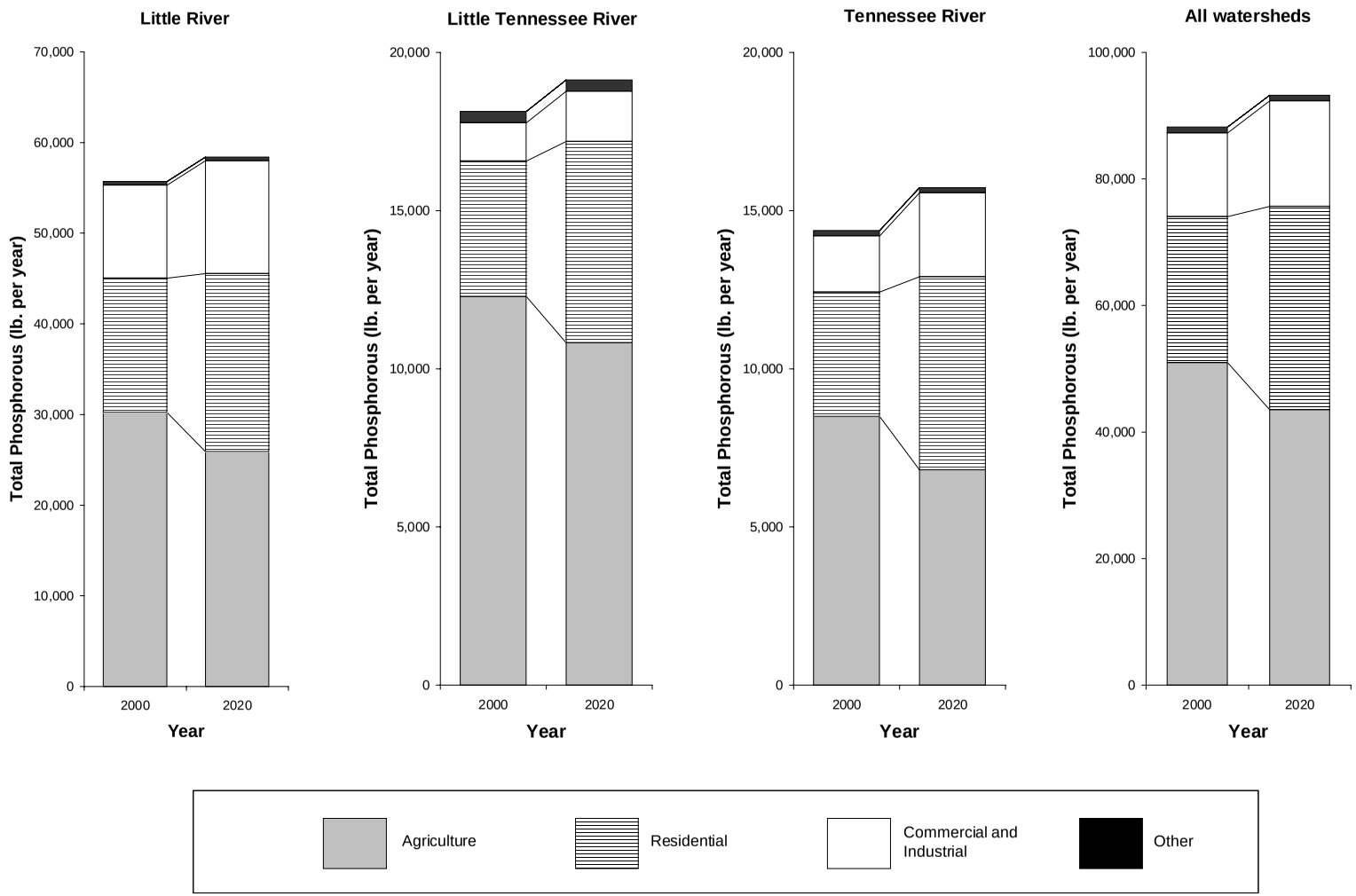


Figure 15. Comparison annual of total phosphorous loads in 2000 with projected 2020 loads.

Table 32. Annual total phosphorous load in 2000 compared with 2020 load projections for each watershed.

Watershed Name	Residential			Commercial / Industrial			Agriculture			Forest			Total		
	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)
Little River Basin															
Left side -- mouth to Pistol Creek	939	980	41	1,884	2,394	510	629	409	-221	9.15	9.14	-0.01	3,473	3,803	330
Right side -- mouth to Nails Creek	499	755	256	173	241	68	2,089	1,946	-143	8.49	8.48	-0.01	2,794	2,975	181
Stock Creek	1,579	1,943	363	562	698	136	1,910	1,674	-236	16.72	16.71	-0.01	4,106	4,369	263
Pistol Creek	5,559	5,893	334	5,984	6,630	646	3,028	2,739	-289	5.54	5.53	-0.01	14,612	15,302	690
Left side -- Pistol to Crooked Creek	707	1,256	548	90	379	289	2,596	1,934	-663	0.46	0.44	-0.02	3,401	3,575	174
Nails Creek	1,249	1,915	665	276	306	30	3,773	3,378	-394	6.96	6.94	-0.02	5,332	5,632	301
Right side -- Nails to Ellejoy Creek	385	697	312	5	5	0	878	647	-231	0.15	0.14	-0.01	1,275	1,355	80
Crooked (L) and Ellejoy (R) to Reed Creek	359	530	171	166	196	30	1,213	1,055	-157	0.23	0.23	-0.01	1,755	1,798	44
Crooked Creek	1,767	2,395	627	360	550	190	4,042	3,650	-392	12.82	12.81	-0.01	6,226	6,651	425
Ellejoy Creek	906	1,669	763	108	120	12	5,068	5,001	-67	4.33	4.32	-0.01	6,138	6,846	708
Reed to Carr (R) and Short (L) Creek	103	167	64	63	63	0	132	18	-114	2.65	2.64	-0.01	305	255	-50
Reed Creek	62	134	72	8	8	0	332	238	-94	1.68	1.68	0.00	409	388	-21
Hesse Creek	204	335	131	25	25	0	1,088	841	-247	3.91	3.90	-0.01	1,326	1,210	-116
Carr Creek	36	63	27	10	10	0	549	453	-97	1.57	1.57	0.00	603	533	-70
Right side -- Carr Creek to GSMN Park	125	227	101	31	110	79	1,457	1,092	-365	1.48	1.46	-0.01	1,625	1,441	-184
Short Creek	148	272	124	130	130	0	820	477	-343	1.24	1.23	-0.01	1,106	886	-220
Left side -- Short Creek to GSMN Park	217	403	186	385	584	199	601	362	-239	0.95	0.92	-0.03	1,208	1,353	146
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0	15.69	15.69	0.00	16	16	0
Total	14,846	19,633	4,787	10,262	12,450	2,188	30,207	25,913	-4,293	94.04	93.84	-0.20	55,709	58,390	2,681
Little River within Blount County	12,758	16,979	4,221	9,760	11,654	1,893	30,670	25,665	-5,005	68.81	68.60	-0.21	53,351	54,460	1,109
Little Tennessee River Basin															
Happy Valley, Tallassee, and GSMN Park	134	189	55	307	307	0	381	352	-29	65.10	65.09	-0.01	902	929	27
Fourmile Creek	179	280	101	38	38	0	141	126	-15	6.03	6.02	-0.01	382	468	86
Big Gully area	65	92	27	55	55	0	286	279	-7	10.56	10.56	0.00	425	446	21
Ninemile Creek	1,657	2,415	759	283	315	32	5,784	5,102	-682	50.83	50.82	-0.02	7,820	7,928	108
Sixmile Creek	465	674	209	154	167	13	1,021	985	-36	16.64	16.63	-0.01	1,711	1,896	186
Baker Creek	1,785	2,709	924	376	711	335	4,665	3,978	-687	36.53	36.51	-0.02	6,895	7,467	572
Total	4,284	6,360	2,076	1,213	1,592	379	12,278	10,822	-1,456	185.69	185.62	-0.07	18,135	19,134	999
Tennessee River Basin															
Floyd/Cloyd Creeks	148	271	123	56	93	37	1,046	953	-92	19.99	19.98	-0.01	1,304	1,371	67
West of Gallagher and Ish	226	411	184	1	1	0	391	227	-164	0.19	0.18	-0.01	623	643	20
Gallagher and Ish Creek	1,194	1,873	679	396	642	246	2,303	1,815	-488	15.73	15.71	-0.02	3,941	4,378	437
North of Gallagher and Ish & Lackey	499	790	291	25	25	0	1,582	1,383	-198	5.75	5.75	-0.01	2,124	2,217	93
Lackey Creek	1,512	2,156	644	1,097	1,518	422	2,731	2,164	-567	8.53	8.51	-0.02	5,371	5,871	500
North of Lackey Creek to Fox Hills	357	606	249	201	366	165	438	263	-175	1.18	1.17	-0.01	1,005	1,245	240
Total	3,936	6,107	2,171	1,776	2,646	870	8,490	6,806	-1,684	51.36	51.29	-0.07	14,368	15,725	1,357
Total															
Blount County	20,978	29,446	8,468	12,749	15,892	3,143	51,438	43,293	-8,145	305.87	305.52	-0.35	85,853	89,319	3,466
Study area	23,066	32,099	9,033	13,251	16,688	3,437	50,975	43,542	-7,433	331.10	330.76	-0.34	88,212	93,249	5,037

TN loads increased in each basin, but by a smaller percentage than TP (Figure 16). TN increased by 1% in the Little River Basin, 0.1 % in the Little River Basin, and 6% in the Tennessee River Basin.

Annual TN loads for each watershed are compared on Table 33. Watersheds with the largest projected TN load increase were the area North of Lackey Creek to Fox Hills (26%), Fourmile Creek (17%), the left side of the Little River from the mouth to Pistol Creek (12%), and Sixmile Creek (10%). TN loads in several watersheds in the upper section of the Little River Basin were predicted to decrease by 10% to 26%.

Projected TSS loads decreased by approximately 10% in each basin (Figure 17). TSS loads from urban areas increased in nearly all watersheds (Table 34). Reductions in TSS loadings from agriculture more than compensated for increases from urban areas.

The watershed with the highest TSS reduction was the right side of the Little River from Nails Creek to Ellejoy Creek (34%). Decreases in TSS loads in watersheds in the upper section of the Little River Basin (between Reed Creek and the Great Smoky Mountain National Park) ranged from 10% to 30%.

Zinc loads were projected to increase in each basin (Figure 18). Little River Basin loads increased by 24%, Little Tennessee River Basin loads increased by 42% and Tennessee River Basin loads increased by 57%. Zinc loads from urban areas increased while loads from agricultural areas decreased in each watershed except the Great Smoky Mountain National Park part of the Little River Basin (Table 35).

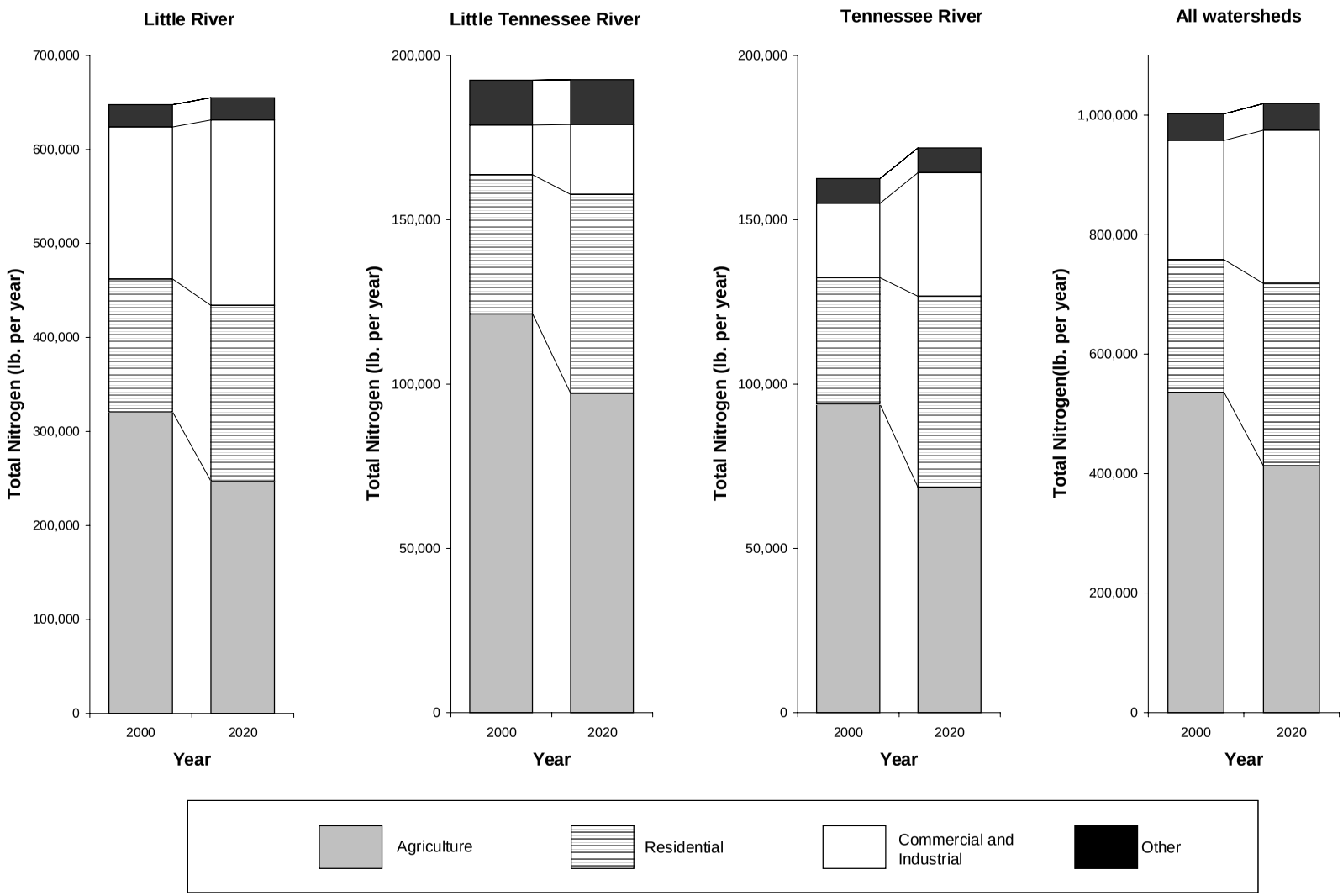


Figure 16. Comparison of annual total nitrogen loads in 2000 with projected 2020 loads.

Table 33. Annual total nitrogen load in 2000 compared with 2020 load projections for each watershed.

Watershed	Residential			Commercial / Industrial			Agriculture			Forest			Total		
	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)
Little River Basin															
Left side -- mouth to Pistol Creek	8,452	9,335	883	29,388	37,339	7,951	7,682	4,348	-3,334	92	91	0	46,215	51,714	5,499
Right side -- mouth to Nails Creek	4,707	7,194	2,487	2,668	3,875	1,207	18,737	16,382	-2,356	85	85	0	27,577	28,915	1,338
Stock Creek	14,625	18,500	3,875	8,673	11,084	2,411	15,605	11,574	-4,032	167	167	0	40,933	43,187	2,254
Pistol Creek	53,189	56,115	2,925	99,095	109,920	10,825	28,717	24,123	-4,594	55	55	0	182,966	192,122	9,156
Left side -- Pistol to Crooked Creek	7,171	11,958	4,787	1,341	6,335	4,994	30,165	20,196	-9,969	5	4	0	39,197	39,009	-188
Nails Creek	11,741	18,232	6,491	4,042	4,488	445	41,149	33,395	-7,754	70	69	0	58,491	57,672	-818
Right side -- Nails to Ellejoy Creek	4,402	6,635	2,234	75	75	0	9,763	6,148	-3,615	2	1	0	14,580	13,198	-1,382
Crooked (L) and Ellejoy (R) to Reed Creek	3,297	5,049	1,752	2,125	2,574	449	15,396	12,997	-2,399	2	2	0	21,930	21,732	-198
Crooked Creek	16,382	22,806	6,424	5,094	7,909	2,815	34,701	28,101	-6,599	128	128	0	59,177	61,817	2,640
Ellejoy Creek	9,189	15,894	6,706	1,557	1,737	179	42,731	36,764	-5,967	43	43	0	57,056	57,974	918
Reed to Carr (R) and Short (L) Creek	929	1,595	666	666	666	0	1,961	250	-1,711	26	26	0	4,056	3,010	-1,045
Reed Creek	597	1,275	679	112	112	0	3,748	2,301	-1,447	17	17	0	5,916	5,147	-769
Hesse Creek	1,855	3,190	1,334	332	332	0	11,591	7,859	-3,732	39	39	0	14,728	12,330	-2,397
Carr Creek	336	601	265	104	104	0	10,471	9,004	-1,467	16	16	0	11,783	10,581	-1,202
Right side -- Carr Creek to GSMN Park	1,247	2,158	910	370	1,494	1,124	20,702	15,104	-5,599	15	15	0	23,981	20,416	-3,565
Short Creek	1,332	2,587	1,255	1,378	1,378	0	16,578	11,378	-5,200	12	12	0	20,447	16,502	-3,945
Left side -- Short Creek to GSMN Park	1,965	3,837	1,872	4,939	7,896	2,957	10,861	7,276	-3,585	9	9	0	18,347	19,591	1,244
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0	157	157	0	157	157	0
Total	141,417	186,961	45,544	161,960	197,318	35,358	320,559	247,200	-73,360	940	938	-2	647,536	655,076	7,541
Little River within Blount County	122,115	161,690	39,575	155,766	185,792	30,026	344,209	269,144	-75,065	688	686	-2	630,919	625,454	-5,465
Little Tennessee River Basin															
Happy Valley, Tallassee, and GSMN Park	1,232	1,804	573	3,208	3,208	0	4,147	3,719	-428	651	651	0	10,835	10,980	145
Fourmile Creek	1,690	2,668	978	469	469	0	932	707	-225	60	60	0	4,430	5,183	753
Big Gully area	625	873	248	559	560	0	1,964	1,866	-98	106	106	0	3,876	4,026	150
Ninemile Creek	16,104	23,003	6,898	4,074	4,553	479	57,184	45,050	-12,134	508	508	0	81,009	76,252	-4,757
Sixmile Creek	4,393	6,418	2,025	1,681	1,875	194	7,071	6,528	-543	166	166	0	16,631	18,308	1,676
Baker Creek	18,329	25,799	7,471	5,142	10,560	5,418	49,988	39,284	-10,703	365	365	0	75,676	77,861	2,185
Total	42,372	60,566	18,194	15,134	21,225	6,091	121,286	97,155	-24,131	1,857	1,856	-1	192,457	192,610	153
Tennessee River Basin															
Floyd/Cloyd Creeks	1,751	2,577	826	669	1,218	549	12,392	11,005	-1,386	200	200	0	16,815	16,803	-12
West of Gallagher and Ish	2,075	3,912	1,837	14	14	0	5,733	3,272	-2,461	2	2	0	8,080	7,426	-653
Gallagher and Ish Creek	12,071	17,838	5,766	5,479	9,173	3,694	22,822	15,503	-7,319	157	157	0	42,622	44,763	2,141
North of Gallagher and Ish & Lackey	4,626	7,525	2,899	368	368	0	18,837	15,860	-2,977	58	57	0	24,693	24,616	-77
Lackey Creek	14,703	20,534	5,831	13,602	21,439	7,837	29,843	21,345	-8,498	85	85	0	59,604	64,774	5,170
North of Lackey Creek to Fox Hills	3,259	5,769	2,511	2,557	5,417	2,860	4,213	1,594	-2,619	12	12	0	10,760	13,511	2,751
Total	38,485	58,155	19,671	22,690	37,629	14,939	93,839	68,579	-25,261	514	513	-1	162,574	171,893	9,319
Total															
Blount County	202,972	280,412	77,440	193,590	244,647	51,057	559,334	434,878	-124,456	3,059	3,055	-4	985,950	989,957	4,007
Study area	222,274	305,683	83,409	199,784	256,172	56,388	535,685	412,933	-122,751	3,311	3,308	-3	1,002,567	1,019,579	17,013

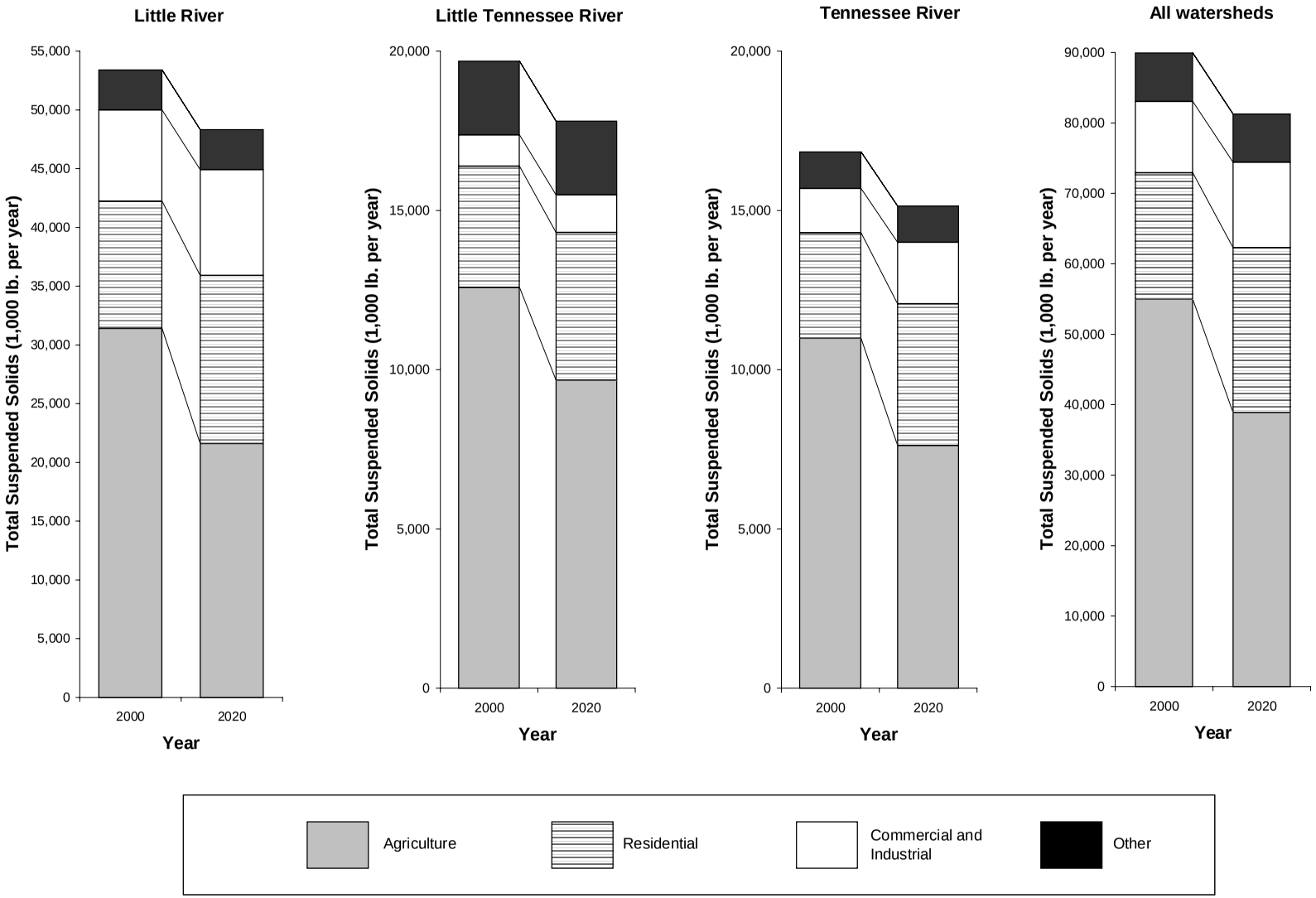


Figure 17. Comparison of annual total suspended solids loads in 2000 with projected 2020 loads.

Table 34. Annual total suspended solids load in 2000 compared with 2020 load projections for each watershed.

	Residential			Commercial / Industrial			Agriculture			Forest			Total		
Watershed Name	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)
Little River Basin															
Left side -- mouth to Pistol Creek	469,580	714,446	244,866	1,219,047	1,492,806	273,759	738,217	293,655	-444,562	36,605	36,568	-37	2,543,491	2,617,517	74,026
Right side -- mouth to Nails Creek	343,545	550,575	207,030	290,806	334,173	43,367	1,799,839	1,485,758	-314,082	33,964	33,933	-31	2,652,186	2,588,470	-63,716
Stock Creek	969,508	1,415,844	446,335	381,757	468,417	86,660	1,472,486	934,938	-537,549	66,867	66,825	-42	3,138,926	3,134,330	-4,596
Pistol Creek	4,161,517	4,294,568	133,051	3,754,768	4,134,482	379,714	3,068,875	2,456,291	-612,584	22,160	22,107	-52	11,261,884	11,162,013	-99,871
Left side -- Pistol to Crooked Creek	706,148	915,168	209,020	53,852	235,841	181,989	3,622,460	2,293,327	-1,329,133	1,850	1,767	-83	4,453,065	3,514,857	-938,208
Nails Creek	842,269	1,395,338	553,069	141,029	155,871	14,842	4,075,943	3,042,017	-1,033,926	27,831	27,762	-69	5,285,590	4,819,505	-466,085
Right side -- Nails to Ellejoy Creek	601,853	507,829	-94024	2,714	2,714	-	1,042,132	560,103	-482,029	610	568	-42	1,692,388	1,116,293	-576,094
Crooked (L) and Ellejoy (R) to Reed Ck	207,728	386,443	178,715	166,318	181,298	14,980	1,925,772	1,605,919	-319,854	927	906	-22	2,448,669	2,322,489	-126,181
Crooked Creek	1,091,574	1,745,393	653,819	225,797	320,636	94,839	3,239,010	2,359,096	-879,914	51,299	51,240	-59	4,990,653	4,859,338	-131,315
Ellejoy Creek	907,249	1,216,423	309,174	103,974	109,957	5,983	3,627,534	2,831,927	-795,608	17,331	17,272	-59	5,127,516	4,647,006	-480,510
Reed to Carr (R) and Short (L) Creek	51,627	122,064	70,437	159,177	159,177	-	260,785	32,661	-228,124	10,591	10,565	-26	545,186	387,473	-157,713
Reed Creek	49,537	97,605	48,068	3,916	3,916	-	444,469	251,520	-192,949	6,728	6,708	-20	696,913	552,012	-144,901
Hesse Creek	111,643	244,101	132,458	18,433	18,433	-	1,329,264	831,716	-497,548	15,648	15,611	-37	1,596,444	1,231,318	-365,127
Carr Creek	21,869	45,979	24,109	36,000	36,000	-	665,509	469,957	-195,553	6,294	6,280	-14	843,725	672,267	-171,458
Right side -- Carr Creek to GSMN Park	114,872	165,145	50,273	63,376	103,003	39,627	1,774,549	1,028,033	-746,516	5,910	5,857	-53	2,178,189	1,521,520	-656,669
Short Creek	73,976	197,953	123,977	372,810	372,810	-	1,455,848	762,505	-693,344	4,975	4,934	-41	2,060,600	1,491,192	-569,407
Left side -- Short Creek to GSMN Park	112,377	293,672	181,295	775,342	874,976	99,634	848,104	370,101	-478,002	3,796	3,675	-121	1,815,936	1,618,742	-197,194
Little River headwaters within GSMN Park	-	-	-	-	-	-	-	-	-	62,776	62,776	-	62,776	62,776	-
Total	10,836,874	14,308,546	3,471,672	7,769,116	9,004,509	1,235,393	31,390,798	21,609,523	-9,781,274	376,160	375,352	-809	53,394,137	48,319,118	-5,075,018
Little River within Blount County	9,570,664	12,374,498	2,803,834	7,040,326	8,078,928	1,038,602	36,970,595	26,960,019	-10,010,576	275,254	274,398	-857	54,942,328	48,773,343	-6,168,985
Little Tennessee River Basin															
Happy Valley, Tallassee, and GSMN Park	77,767	138,084	60,317	195,625	195,625	-1	481,527	424,510	-57,017	260,397	260,363	-34	1,228,339	1,231,602	3,262
Fourmile Creek	124,429	204,204	79,775	40,456	40,457	0	70,120	40,120	-30,000	24,102	24,080	-22	429,631	479,387	49,756
Big Gully area	51,178	66,831	15,653	136,029	136,035	6	154,854	141,763	-13,091	42,239	42,229	-10	467,214	469,776	2,562
Ninemile Creek	1,350,352	1,760,438	410,086	186,780	202,739	15,959	5,727,020	4,362,329	-1,364,691	203,333	203,264	-69	7,885,970	6,947,255	-938,715
Sixmile Creek	323,377	491,207	167,830	122,919	129,384	6,465	562,609	490,222	-72,388	66,573	66,525	-48	1,518,037	1,619,894	101,857
Baker Creek	1,883,522	1,974,487	90,966	295,169	482,417	187,248	5,581,494	4,207,267	-1,374,227	146,127	146,037	-90	8,153,156	7,057,054	-1,096,102
Total	3,810,626	4,635,252	824,626	976,979	1,186,657	209,678	12,577,624	9,666,211	-2,911,413	742,771	742,498	-273	19,682,348	17,804,968	-1,877,380
Tennessee River Basin															
Floyd/Cloyd Creeks	258,938	197,206	-61,732	75,780	94,067	18,287	1,501,227	1,316,377	-184,850	79,945	79,920	-25	2,156,327	1,927,976	-228,352
West of Gallagher and Ish	129,332	299,402	170,070	471	471	-	760,775	432,595	-328,180	765	738	-26	925,417	767,282	-158,135
Gallagher and Ish Creek	1,176,662	1,365,147	188,484	410,876	534,010	123,134	2,508,407	1,532,532	-975,875	62,904	62,832	-72	4,437,833	3,773,508	-664,324
North of Gallagher and Ish & Lackey	309,186	575,941	266,755	15,236	15,236	-	2,288,103	1,891,185	-396,918	23,017	22,986	-32	2,742,842	2,612,647	-130,195
Lackey Creek	1,235,464	1,571,522	336,058	570,842	857,226	286,384	3,473,350	2,340,307	-1,133,042	34,115	34,031	-84	5,496,646	4,985,962	-510,684
North of Lackey Creek to Fox Hills	197,903	441,543	243,640	324,396	426,010	101,614	454,091	104,870	-349,221	4,704	4,670	-34	1,076,992	1,072,991	-4,001
Total	3,307,486	4,450,761	1,143,276	1,397,601	1,927,020	529,419	10,985,952	7,617,866	-3,368,085	205,451	205,177	-273	16,836,057	15,140,366	-1,695,691
Total															
Blount County	16,688,776	21,460,511	4,771,736	9,414,906	11,192,605	1,777,699	60,534,171	44,244,097	-16,290,074	1,223,476	1,222,073	-1,403	91,460,733	81,718,678	-9,742,056
Study area	17,954,985	23,394,559	5,439,574	10,143,696	12,118,186	1,974,490	54,954,374	38,893,601	-16,060,773	1,324,382	1,323,027	-1,355	89,912,541	81,264,453	-8,648,089

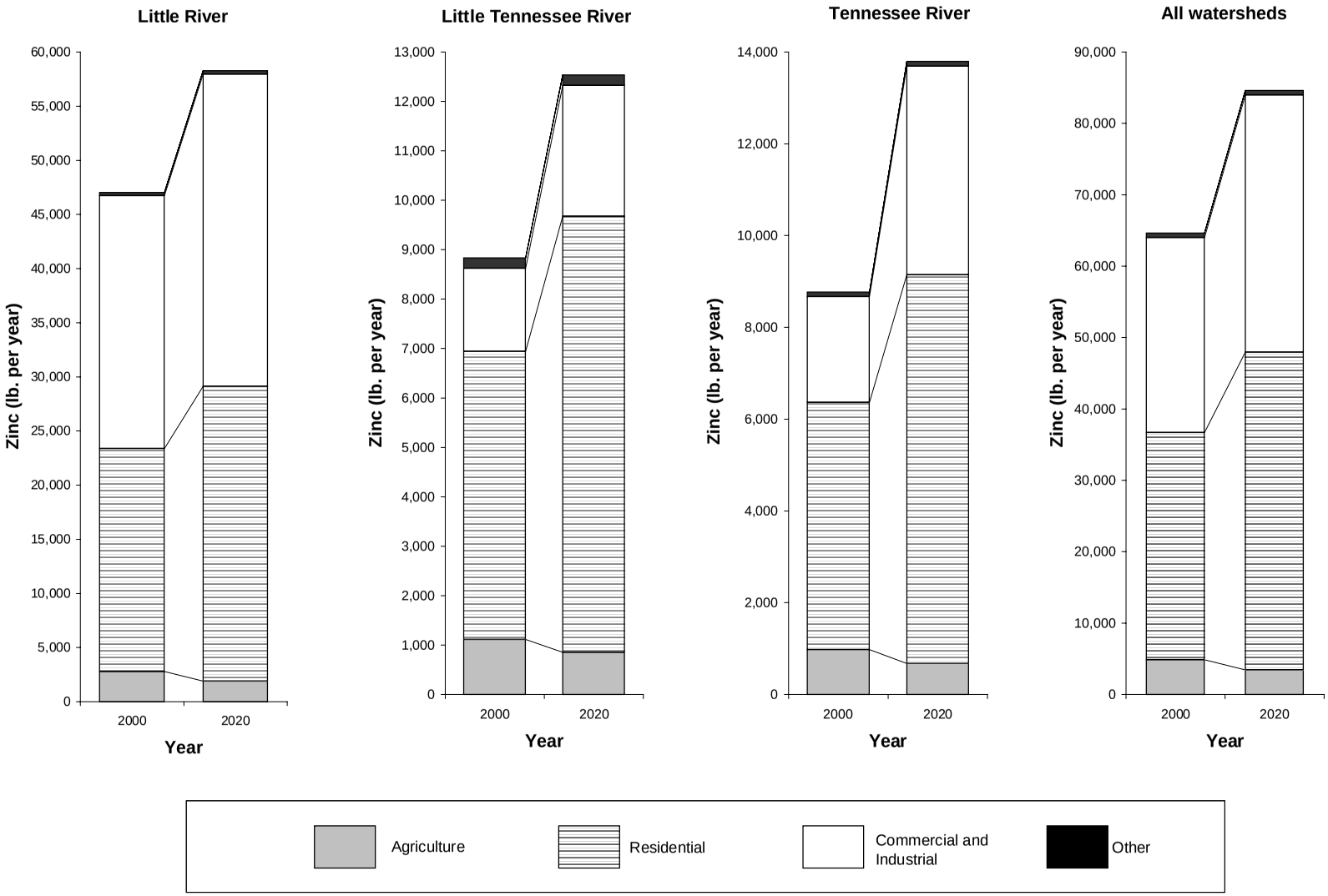


Figure 18. Comparison of zinc loads in 2000 with projected 2020 loads.

Table 35. Annual total zinc load in 2000 compared with 2020 load projections for each watershed.

Watershed	Residential			Commercial / Industrial			Agriculture			Forest			Total		
	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)	2000 (lb)	2020 (lb)	Change (lb)
Little River Basin															
Left side -- mouth to Pistol Creek	1,338	1,360	22	3,984	5,251	1,268	65	25	-40	3.3	3.3	0.0	5,397	6,647	1,249
Right side -- mouth to Nails Creek	696	1,048	352	326	502	176	159	130	-28	3.1	3.1	0.0	1,200	1,699	500
Stock Creek	2,221	2,695	474	1,252	1,603	351	129	81	-48	6.0	6.0	0.0	3,631	4,407	776
Pistol Creek	7,693	8,174	481	14,729	16,390	1,661	272	217	-55	2.0	2.0	0.0	22,720	24,806	2,086
Left side -- Pistol to Crooked Creek	950	1,742	792	224	929	705	324	204	-120	0.2	0.2	0.0	1,504	2,882	1,378
Nails Creek	1,744	2,656	912	659	735	75	361	268	-93	2.5	2.5	0.0	2,785	3,679	894
Right side -- Nails to Ellejoy Creek	481	967	485	11	11	0	93	49	-43	0.1	0.1	0.0	589	1,031	442
Crooked (L) and Ellejoy (R) to Reed Creek	507	736	228	263	339	76	173	144	-29	0.1	0.1	0.0	957	1,232	276
Crooked Creek	2,484	3,322	838	792	1,260	468	285	205	-79	4.6	4.6	0.0	3,600	4,827	1,227
Ellejoy Creek	1,215	2,315	1,100	232	263	30	316	245	-72	1.6	1.6	0.0	1,808	2,867	1,059
Reed to Carr (R) and Short (L) Creek	147	232	85	35	35	0	23	3	-21	1.0	1.0	0.0	212	276	65
Reed Creek	85	186	101	19	19	0	40	22	-17	0.6	0.6	0.0	161	245	84
Hesse Creek	289	465	176	51	51	0	118	74	-45	1.4	1.4	0.0	470	602	131
Carr Creek	51	88	36	6	6	0	59	42	-18	0.6	0.6	0.0	127	146	19
Right side -- Carr Creek to GSMN Park	170	314	144	44	215	172	158	91	-67	0.5	0.5	0.0	392	641	249
Short Creek	211	377	166	113	113	0	131	68	-62	0.4	0.4	0.0	469	572	104
Left side -- Short Creek to GSMN Park	309	559	250	614	1,106	492	76	33	-43	0.3	0.3	0.0	1,006	1,705	698
Little River headwaters within GSMN Park	0	0	0	0	0	0	0	0	0	5.6	5.6	0.0	6	6	0
Total	20,592	27,235	6,643	23,353	28,827	5,473	2,781	1,901	-880	33.9	33.8	-0.1	47,033	58,269	11,236
Little River within Blount County	17,653	23,554	5,901	22,532	27,275	4,743	3,290	2,389	-901	24.8	24.7	-0.1	43,598	53,341	9,743
Little Tennessee River Basin															
Happy Valley, Tallassee, and GSMN Park	189	263	73	153	153	0	43	38	-5	23.4	23.4	0.0	428	496	68
Fourmile Creek	249	389	140	51	51	0	6	3	-3	2.2	2.2	0.0	323	460	137
Big Gully area	89	127	38	22	22	0	13	12	-1	3.8	3.8	0.0	136	173	37
Ninemile Creek	2,275	3,351	1,076	626	707	81	506	384	-123	18.3	18.3	0.0	3,463	4,498	1,034
Sixmile Creek	648	935	287	111	144	33	49	42	-7	6.0	6.0	0.0	853	1,167	314
Baker Creek	2,380	3,758	1,378	717	1,574	857	497	373	-124	13.2	13.1	0.0	3,629	5,740	2,112
Total	5,830	8,823	2,993	1,680	2,651	971	1,114	852	-262	66.8	66.8	0.0	8,832	12,534	3,702
Tennessee River Basin															
Floyd/Cloyd Creeks	180	375	196	47	140	93	134	118	-17	7.2	7.2	0.0	390	662	272
West of Gallagher and Ish	320	570	250	2	2	0	68	39	-30	0.1	0.1	0.0	394	614	220
Gallagher and Ish Creek	1,606	2,598	993	591	1,216	626	223	135	-88	5.7	5.7	0.0	2,450	3,981	1,530
North of Gallagher and Ish & Lackey	701	1,096	395	61	61	0	205	169	-36	2.1	2.1	0.0	978	1,338	360
Lackey Creek	2,075	2,991	916	1,330	2,427	1,097	310	208	-102	3.1	3.1	0.0	3,735	5,646	1,911
North of Lackey Creek to Fox Hills	506	840	335	268	695	427	40	9	-31	0.4	0.4	0.0	823	1,553	730
Total	5,388	8,472	3,084	2,300	4,542	2,242	980	677	-303	18.5	18.5	0.0	8,771	13,794	5,023
Total															
Blount County	28,870	40,848	11,978	26,512	34,468	7,956	5,384	3,918	-1,466	110.1	110.0	-0.1	61,201	79,669	18,468
Study area	31,810	44,530	12,720	27,333	36,020	8,686	4,876	3,430	-1,445	119.2	119.1	-0.1	64,636	84,597	19,961

Discussion

TVA has developed an IPSI system for Blount County and its associated watersheds to promote cooperative efforts that protect and improve water quality. IPSI products, including a NPS inventory and atlas, a GIS database, and computer models for estimating NPS pollution loads, can be valuable tools for planning, targeting, and managing water quality improvement efforts. Copies of the GIS database and NPS atlas have been provided to Blount County, City of Maryville, City of Alcoa, Knox County, the Little River Watershed Association and TDEC.

This report describes potential NPS pollution sources and summarizes pollution load model findings on a county, basin and watershed scale. NPS pollution loads were calculated for the year 2000, based on the NPS inventory, and for year 2020, based on projected population growth and changes in land use. Key findings from a comparison of pollution loads from the four major land use categories include:

- Forested areas are the dominant land use in 2 of the 3 basins. Forested areas contribute relatively low NPS pollution loads.
- Agricultural areas were the dominant land use in the Tennessee River Basin, and the secondary land use in the Little River and Little Tennessee River Basins. Per-acre pollution loads from agricultural lands were consistently lower than those from commercial/industrial areas. Per-acre TP, TN, and TSS loads were generally comparable between agricultural and residential lands. Agriculture contributed over 50% of the total TP, TN, and TSS from each basin. As development occurs, agricultural acreage will decrease along with agriculturally-related pollution loads.
- Commercial/industrial areas contribute the highest per-acre NPS pollution loads. Since commercial/industrial areas make up less than 5% of each basin, the total pollution load from this major land use category is less than residential or agricultural areas. As the area develops, total pollution loads from commercial/industrial areas will increase.
- Residential land accounted for approximately 9% of the study area, the second lowest acreage among the major land use categories. Per-acre NPS pollution loads from residential areas were consistently lower than commercial/industrial areas. Per-acre TP, TN, and TSS loads were generally comparable between agricultural and

residential lands. As the area develops, total NPS pollution loads from residential land will increase.

Agriculture currently contributes over 50% of TP, TN, and TSS loads from each basin. Cost-share funds from several sources are available to assist property owners with installations of best management practices (BMPs). If the Farm Security and Rural Investment Act of 2002 is authorized, cost-share funds available through NRCS programs will greatly increase. In the short term, the most cost-effective strategy to reduce TP, TN, and TSS would probably be to focus on agricultural NPS pollution using funds provided through existing NRCS and other cost-share programs.

Blount County is a rapidly developing area. Agricultural and forested lands are being converted to urban uses. Between 2000 and 2020, residential land use acreage is projected to increase by 40%. Commercial and industrial acreage is projected to increase by 20% during this period. As the area develops, the amount of NPS pollution originating from urban sources will increase. By 2020 the majority of TP and TN will originate from urban sources. Urban areas currently account for 92% of zinc. By 2020 over 95% of zinc will originate from urban sources. As this area develops, the need to manage growth to minimize its impact on water quality will increase. It is far more effective and economically efficient to prevent water resource degradation through good planning and growth management strategies than it is to restore degraded rivers and streams after development impacts have occurred.

Three to five out of 28 NPS categories accounted for over 60% of each pollutant. Dominant pollution sources varied among pollutants. Residential, commercial, and industrial land, low and medium residue crop land, heavily overgrazed and fair pastures, and livestock with unrestricted stream access contribute significant amounts of at least one pollutant. Per-acre pollution loads from feedlots, loafing areas and, disturbed areas were also very high. Since these pollution sources made up a very small percentage of the total area, the total pollution loads from these NPS categories were not as high as other categories. A follow-up analysis of costs and water quality benefits of several BMP implementation scenarios to address NPS pollution sources is underway. This analysis will enable partner agencies to make efficient use of future cost-share funds by strategically targeting watershed improvement efforts.

Within each basin, a few watersheds accounted for 50 to 82% of each pollutant. Pistol Creek, Crooked Creek, Ellejoy Creek, and Nails Creek Watersheds accounted for 58% of TP, 55% of TN, and 50% of TSS loads in Little River Basin. Pistol Creek and left (west) side of the Little River from the mouth to Pistol Creek Watersheds contributed 60% of the zinc loading to the Little River Basin. Ninemile Creek and Baker Creek Watersheds accounted for 81% of TP, 81% of TN, 82% of TSS, and 80% of zinc loads in the Little Tennessee River Basin. Lackey Creek and Gallagher and Ish Creek Watersheds accounted for 65% of TP, 63% of TN, 59% of TSS, and 70% of zinc loads in the Tennessee River Basin. All of these watersheds, except Lackey Creek, are classified by TDEC as being impaired (2000 305 (b) report). Lackey Creek is classified as not assessed. Since these watersheds account for the majority of each pollutant, it is recommended that water quality improvement strategies include restoration efforts targeted to these impaired streams. More detailed analysis of the IPSI database could assist partners in developing restoration plans for these impaired streams.

This project was undertaken to assist Blount County and LRWQF with efforts to influence practices that adversely impact water resources, to restore impaired streams, and to keep additional streams from becoming degraded. While IPSI development represents a significant financial investment, it is only a first step of a long-term effort to improve and protect water quality and water supplies in Blount County and the Little River. IPSI inventory, database, atlas, and NPS pollution model results will be used to assist partners in accomplishing the following ongoing or planned activities:

- **General water quality plan** – Blount County Planning Department has conducted 22 community meetings where citizen input on water resource protection strategies was obtained. IPSI information along with public input is being used to formulate county-wide water quality policies.
- **Phase II stormwater plans** – Municipal and county governments have been provided with the IPSI database and NPS pollution model results to assist with planning and implementing stormwater management programs and to identify and target restoration of critical sites. NPS pollution loads described in this report were estimated using fairly low complexity models that calculated annual total pollutant loads from watershed-wide land use characteristics. The IPSI database could also be used to develop more complex models that could calculate both water quality and quantity at hourly or daily intervals.

- **Code and ordinance reviews** – IPSI information will assist municipal and county governments with ongoing review of current planning and zoning ordinances. Each community's ordinances are being compared with the 22 Model Development Ordinances recommended by the Center for Watershed Protection.
- **Pollution source identification** – NPS pollution loading models revealed that three to five out of 28 NPS categories accounted for over 60% of each pollutant. A follow-up analysis has been initiated that will compare costs and water quality benefits of various strategies to address these pollution sources.
- **Watershed restoration** – Watershed improvement initiatives are underway or planned in the Ellejoy Creek, Stock Creek, and Short Creek Watersheds. An NPS atlas has been developed to assist with each of these initiatives. More detailed NPS load models can be developed to identify sub-watersheds or sites contributing high pollution loads within each of these watersheds. IPSI information will assist with planning, targeting, and managing these watershed improvement initiatives.
- **Education of citizens and officials** – The Tennessee Growth Readiness Initiative (TGRI) is an educational program developed to teach local officials, and other adults about the sources and impacts of nonpoint source pollution, how different land uses affect water quality, and what communities can do to protect water quality. TGRI was partially funded through a 319(h) grant. The Little River Watershed served as the TGRI pilot area. IPSI information was used to demonstrate current and future impacts from land use and development and how planning and zoning decisions affect nonpoint pollution. The Little River Watershed Association and TVA have begun development of a non-technical IPSI publication and PowerPoint presentation that will present IPSI information in an easy to understand manner.
- **TDEC's watershed planning approach** – The IPSI database has been provided to TDEC for use in development and implementation of their watershed approach to water quality protection.

There are many ongoing and planned activities to improve or protect water quality in Blount County and/or the Little River Watershed. These activities address many of the factors impacting the areas water resources. However, they are being planned separately without clear, resource-based pollution reduction goals and without a comprehensive strategy for attaining these goals. The IPSI database and pollution loading models can provide

information to aid citizens and decision makers in determining the right combination of practices to form the most effective plan to achieve water quality goals.

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Appendix A

Calibration of Pollution Loading Model

Calibration of Pollution Loading Model

Water quality data collected by TDEC in 1997 and 1998 from nine stations in the Little River Watershed were used to evaluate the ability of the IPSI model to account for the processes that generate pollution and to calibrate the pollution load models. Stations used in calibration were located near the mouth of Stock Creek, Pistol Creek, Nails Creek, Crooked Creek, Ellejoy Creek, Reed Creek, Hesse Creek, and Short Creek, and in the headwaters of the Little River. Data from all nine stations were used for calibration of TSS and TN. One site, the Little River Headwaters, had no samples with TP concentrations above the measurement threshold, so this station was not used for TP calibration.

Pollution loads were estimated by multiplying median concentrations from each site by estimated average watershed discharge, then making necessary unit conversions. Discharge was estimated as 1.5 cubic feet per second per square mile, based on unpublished TVA data for the Little River region. The number of samples at these stations was limited (five samples at each station, typically) and may not represent the full range of conditions. Due to the small sample size, these estimates have substantial uncertainty, but can still serve to test the overall ability of the model to predict local conditions and the relative contributions of pollution from different land uses.

Parameter values with the most uncertainty were adjusted first to find the best model fit. Initial values of pollutant runoff concentrations (Mills et al., 1985) and soil pollutant coefficients (Schueler, 1994a) were base on literature values and on previous TVA IPSI work. Initial values were adjusted during calibration. Values used to calculate the soil loss from unpaved roads and road ditches were varied somewhat, as were the delivery ratios for livestock sites. For the most part, USLE parameter estimates were held constant. The only exception was the C value for forest land, which was lowered to reflect low pollutant loads from forested watersheds.

Because the model is driven by soil loss estimates for rural land uses, TSS is the easiest to predict. The model agreement with measured values was very good ($R^2 = 0.92$). The best-fit line (estimated using regression techniques) agreed well with the line of perfect

agreement (one to one line through origin) between measured and modeled data, indicating very little bias in the model (Figure A-1).

The TN fit was not as good as the TSS fit, with $R^2 = 0.54$. A comparison between the best-fit line and the line of perfect agreement shows that model predictions are, on the average, a little lower than measured values (Figure A-2). This is to be expected, because the model does not take into account the groundwater contribution of nitrogen.

The TP fit was almost as good as the TSS fit (Figure A-3), with R^2 of 0.76. Model predictions show a small high bias, especially for watersheds with low pollution loadings.

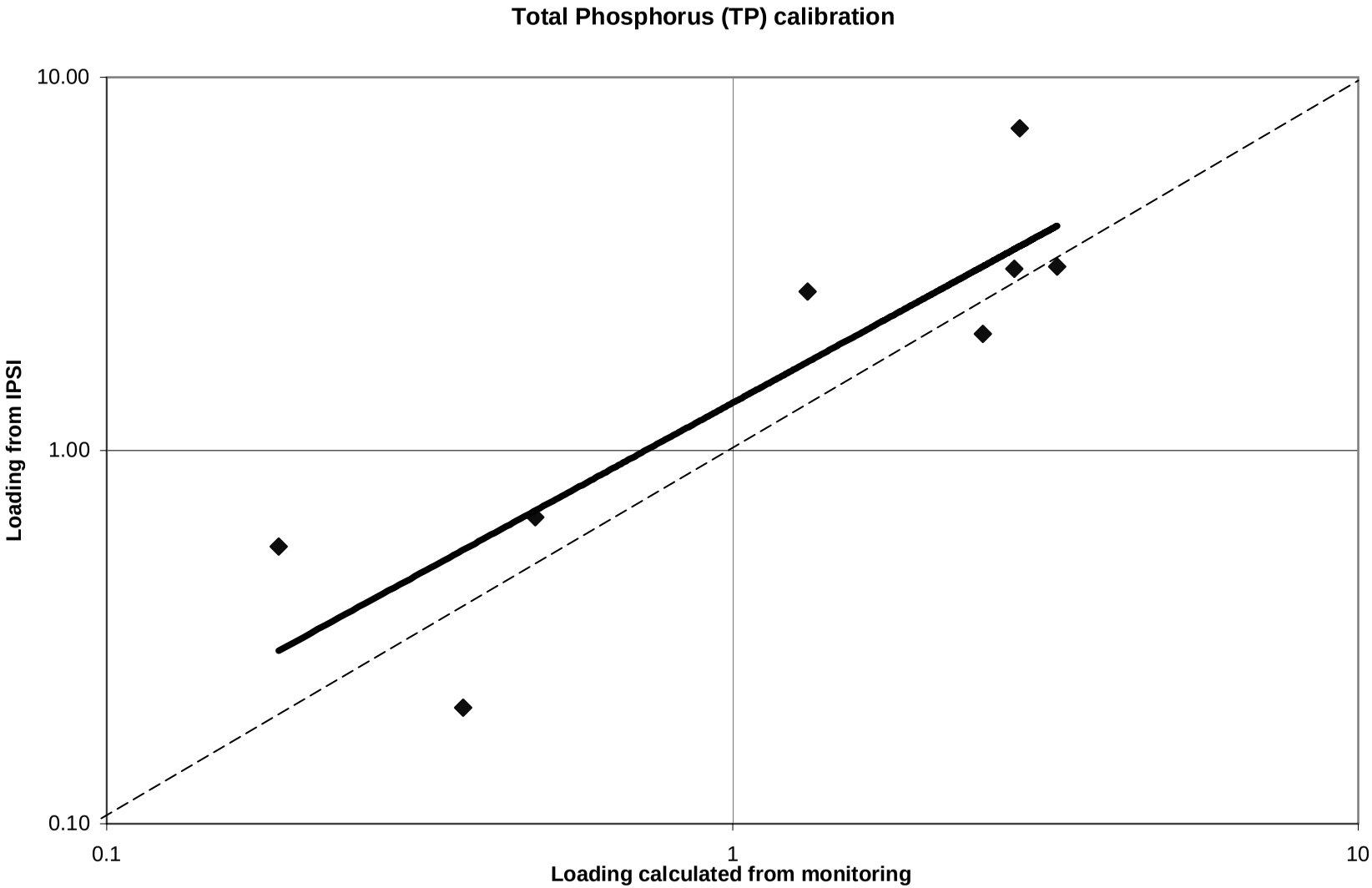

Figure A-1. Comparison of predicted total phosphorus loadings with water quality monitoring pollutant loadings. Dashed line represents line of perfect agreement and solid line represents best fit line.

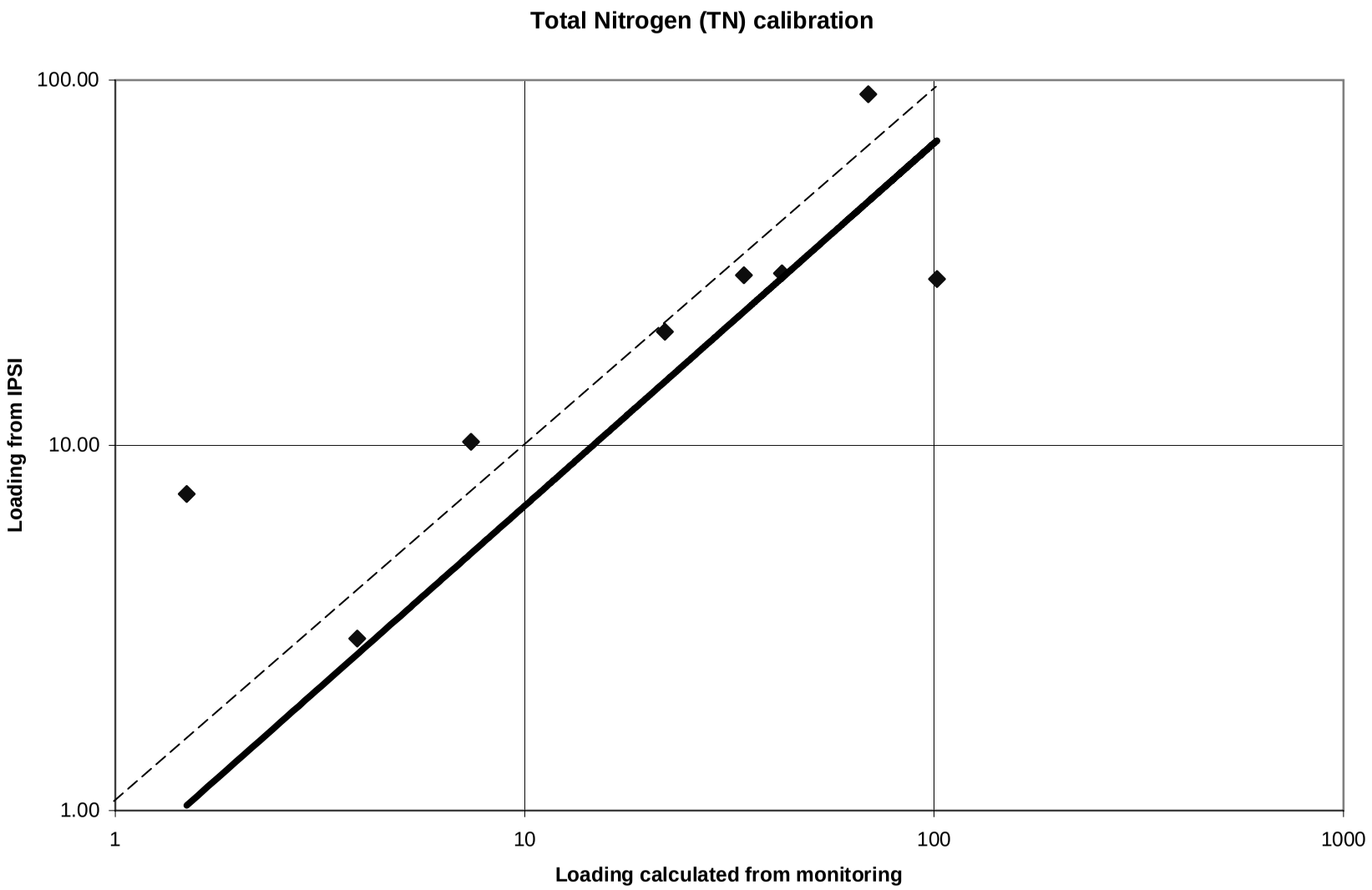

Figure A-2. Comparison of predicted total nitrogen loadings with water quality monitoring pollutant loadings. Dashed line represents line of perfect agreement and solid line represents best fit line.

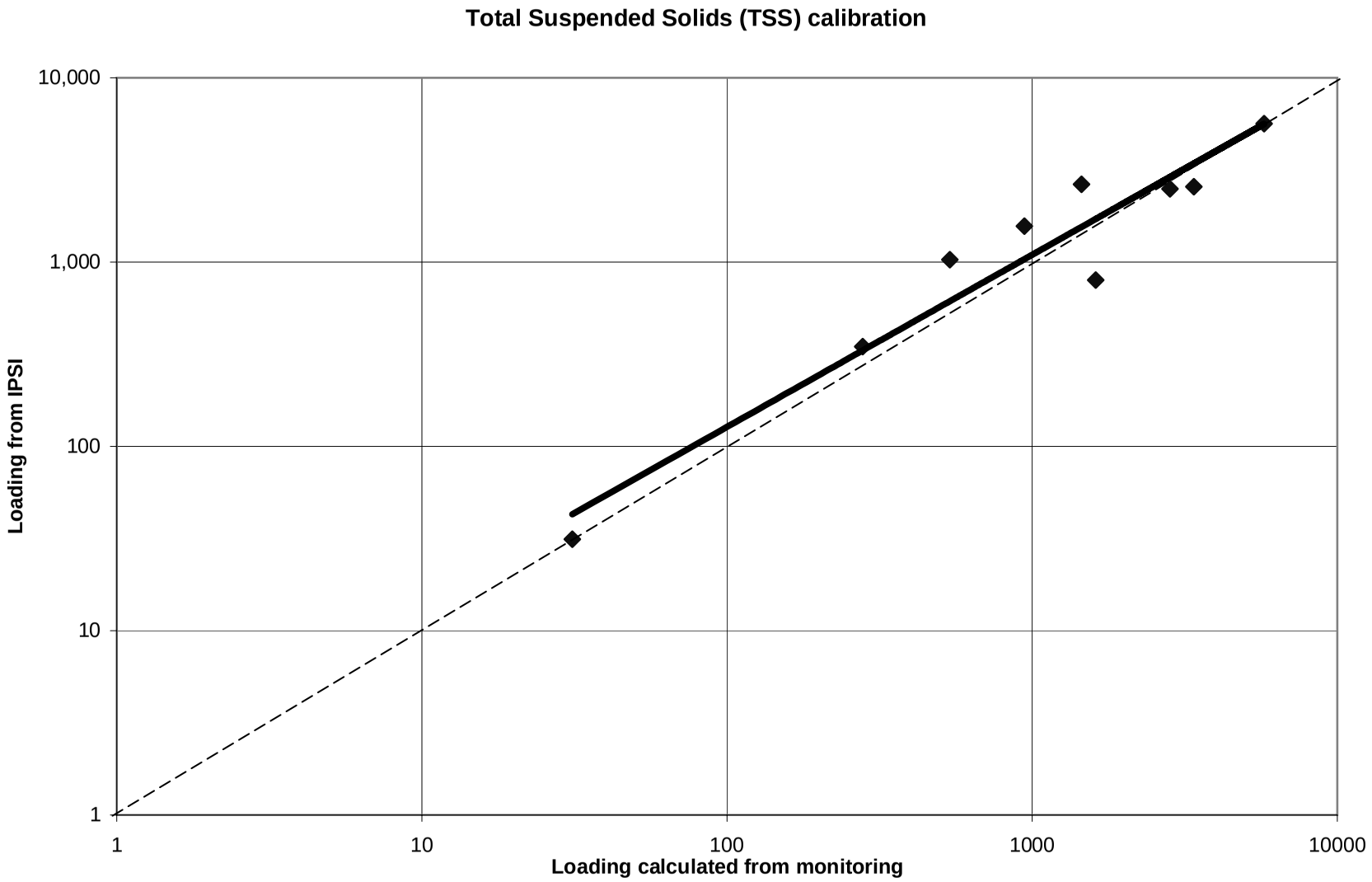

Figure A-1. Comparison of predicted total suspended solids loadings with water quality monitoring pollutant loadings. Dashed line represents line of perfect agreement and solid line represents best fit line.

Appendix B

Universal Soil Loss Factors for Blount County Area

Table B-1. Factors of computing USLE equivalent soil movement potential for ecoregion 67f Southern Limestone / Dolomite Valleys & Low Rolling Hills.

Ecoregion: 67f

R factor 190
K factor 0.37
LS factor 1.19

Cover / Practice Class	
C Factor	
2101. Row crop: no residue (0 to 10 %)	.551
2104. Row crop: medium residue (10 to 30 %)	.300
2102. Row crop: heavy residue (>30 %)	.149
2103. Strip crop:	.125
215. Heavily overgrazed pasture:	.200
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	.450
217. Feedlot or loafing areas:	.750
213. Fair pasture:	.013
212. Good pasture:	.003
2181. Tobacco:	.069
22. Nursey, Christmas trees, orchards	.003
4. Forest:	.002
45. Forest clear-cut:	.150
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers	
P Factor	
T. Terraced field:	0.5
Ct. Contour plowed and terraced:	0.4
Cn. Contour plowed:	0.5
Cg. Conservation cultivated:	1.0
G. Gullied:	1.0

Critical Erosion Features	
Average Erosion Rate	
Channelized streams:	70
Eroding streambank:	210
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	140

Table B-2. Factors of computing USLE equivalent soil movement potential for ecoregion 67g Southern Shale Valley.

Ecoregion: 67g

R factor 190
K factor 0.24
LS factor 1.62

Cover / Practice Class C Factor	
2101. Row crop: no residue (0 to 10 %)	.551
2104. Row crop: medium residue (10 to 30 %)	.300
2102. Row crop: heavy residue (>30 %)	.149
2103. Strip crop:	.125
215. Heavily overgrazed pasture:	.200
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	.450
217. Feedlot or loafing areas:	.750
213. Fair pasture:	.013
212. Good pasture:	.003
2181. Tobacco:	.069
22. Nursey, Christmas trees, orchards	.003
4. Forest:	.002
45. Forest clear-cut:	.150
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers P Factor	
T. Terraced field:	0.5
Ct. Contour plowed and terraced:	0.4
Cn. Contour plowed:	0.5
Cg. Conservation cultivated:	1.0
G. Gullied:	1.0

Critical Erosion Features Average Erosion Rate	
Channelized streams:	N/A
Eroding streambank:	140
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	140

Table B-3. Factors of computing USLE equivalent soil movement potential for ecoregion 67i Southern Dissected Ridges & Knobs.

Ecoregion: 67i

R factor 190
K factor 0.27
LS factor 1.37

Cover / Practice Class C Factor	
2101. Row crop: no residue (0 to 10 %)	.551
2104. Row crop: medium residue (10 to 30 %)	.300
2102. Row crop: heavy residue (>30 %)	.149
2103. Strip crop:	.125
215. Heavily overgrazed pasture:	.200
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	.450
217. Feedlot or loafing areas:	.750
213. Fair pasture:	.013
212. Good pasture:	.003
2181. Tobacco:	.069
22. Nursey, Christmas trees, orchards	.003
4. Forest:	.002
45. Forest clear-cut:	.150
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers P Factor	
T. Terraced field:	0.5
Ct. Contour plowed and terraced:	0.4
Cn. Contour plowed:	0.5
Cg. Conservation cultivated:	1.0
G. Gullied:	1.0

Critical Erosion Features Average Erosion Rate	
Channelized streams:	70
Eroding streambank:	210
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	140

Table B-4. Factors of computing USLE equivalent soil movement potential for ecoregion 66e Southern Sedimentary Ridges.

Ecoregion: 66e

R factor 190
K factor 0.18
LS factor 1.65

Cover / Practice Class C Factor	
2101. Row crop: no residue (0 to 10 %)	.551
2104. Row crop: medium residue (10 to 30 %)	.300
2102. Row crop: heavy residue (>30 %)	.149
2103. Strip crop:	.125
215. Heavily overgrazed pasture:	.200
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	.450
217. Feedlot or loafing areas:	.750
213. Fair pasture:	.013
212. Good pasture:	.003
2181. Tobacco:	.069
22. Nursey, Christmas trees, orchards	.003
4. Forest:	.002
45. Forest clear-cut:	.150
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers P Factor	
T. Terraced field:	0.5
Ct. Contour plowed and terraced:	0.4
Cn. Contour plowed:	0.5
Cg. Conservation cultivated:	1.0
G. Gullied:	1.0

Critical Erosion Features Average Erosion Rate	
Channelized streams:	N/A
Eroding streambank:	210
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	140

Table B-5. Factors of computing USLE equivalent soil movement potential for ecoregion 66f Limestone Valleys & Coves.

Ecoregion: 66f

R factor 190
K factor 0.24
LS factor 0.65

Cover / Practice Class	
C Factor	
2101. Row crop: no residue (0 to 10 %)	.551
2104. Row crop: medium residue (10 to 30 %)	.300
2102. Row crop: heavy residue (>30 %)	.149
2103. Strip crop:	.125
215. Heavily overgrazed pasture:	.200
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	.450
217. Feedlot or loafing areas:	.750
213. Fair pasture:	.013
212. Good pasture:	.003
2181. Tobacco:	.069
22. Nursey, Christmas trees, orchards	.003
4. Forest:	.002
45. Forest clear-cut:	.150
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers	
P Factor	
T. Terraced field:	0.5
Ct. Contour plowed and terraced:	0.4
Cn. Contour plowed:	0.5
Cg. Conservation cultivated:	1.0
G. Gullied:	1.0

Critical Erosion Features	
Average Erosion Rate	
Channelized streams:	N/A
Eroding streambank:	70
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	70

Table B-6. Factors of computing USLE equivalent soil movement potential for ecoregion 66g Southern Metasedimentary Mountains.

Ecoregion: 66g

R factor 190
K factor 0.17
LS factor 12.5

Cover / Practice Class C Factor	
2101. Row crop: no residue (0 to 10 %)	N/A
2104. Row crop: medium residue (10 to 30 %)	N/A
2102. Row crop: heavy residue (>30 %)	N/A
2103. Strip crop:	N/A
215. Heavily overgrazed pasture:	N/A
216. Poor pasture: sparse cover, shallow soils steep slopes, often gullied:	N/A
217. Feedlot or loafing areas:	N/A
213. Fair pasture:	N/A
212. Good pasture:	N/A
2181. Tobacco:	N/A
22. Nursey, Christmas trees, orchards	N/A
4. Forest:	.002
45. Forest clear-cut:	N/A
76. Disturbed area:	1.00

Land/Cover and Land Use Modifiers P Factor	
T. Terraced field:	N/A
Ct. Contour plowed and terraced:	N/A
Cn. Contour plowed:	N/A
Cg. Conservation cultivated:	N/A
G. Gullied:	N/A

Critical Erosion Features Average Erosion Rate	
Channelized streams:	N/A
Eroding streambank:	0**
Unpaved roads: farms, logging, driveways, or back roads	105
Eroding road banks and ditches:	70

** Not enough to measure