Management Report

ENVIRONMENTAL ANALYSIS OF THE PROPOSED
FOOTHILLS PARKWAY

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ENVIRONMENTAL ANALYSIS OF THE PROPOSED FOOTHILLS PARKWAY

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INTRODUCTION

The Foothills Parkway is proposed as a scenic drive for motorists visiting the Great Smoky Mountains National Park (Figure 1). It is one segment of a Circle-the-Smokies highway proposal which would provide an auto route offering views of, without intrusion into, the park, and could relieve pressures on Little River Road and Newfound Gap Road. The aim of this environmental impact assessment is to describe the route in terms of its resources:

Scenic and cultural values

Vegetation

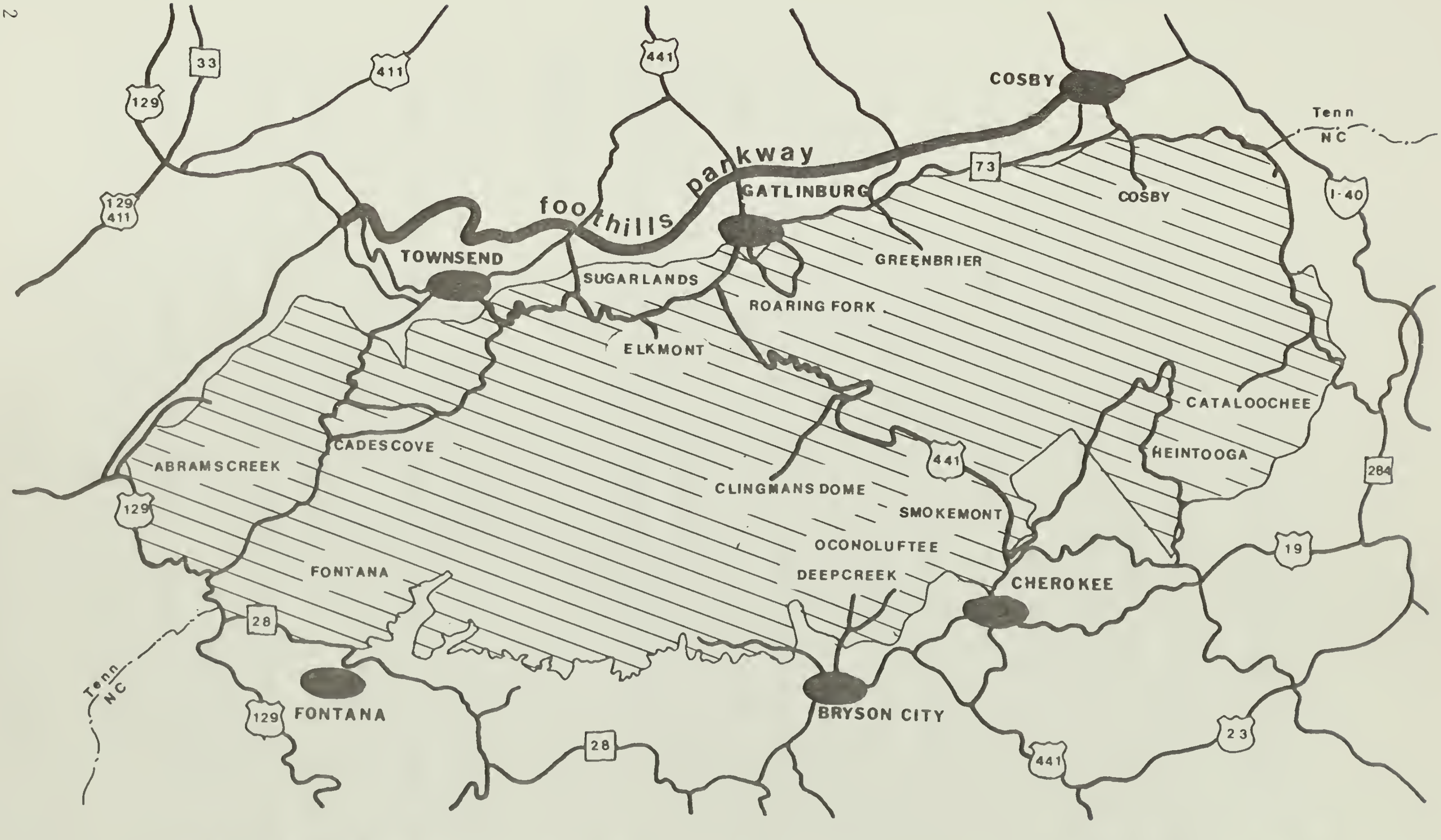
Animal abundance

Water quality

Geology

Archeology

Predictions are made as to where any gross environmental disturbances or potential construction hazards may occur.



GREAT SMOKY MOUNTAINS NATIONAL PARK

FOOTHILLS PARKWAY

SCALE IN MILES
0 5 10

Figure 1

DESCRIPTION OF THE FOOTHILLS PARKWAY ROUTE

The rights-of-way for the Foothills Parkway were purchased piecemeal. The route was planned and marked by Alan Hollister, an engineer for the Denver Service Center assigned to Great Smoky Mountains National Park. For ease of reference, the route was divided into geographical sections (Table 1 and Figures 2 and 3). Section 8A, from U.S. I-40 to Cosby, Tennessee, has already been completed. Its present terminus is at Larges store on Tennessee Hwy. 32 in Cosby. Approximately 75 percent of Section 8F was constructed between July 1966 and September 1968. The road was graded; culverts and drainage ditches were put in. Since that time all fills on the route have settled some 10 to 20 inches. Completion of 8F will involve refilling with stable material, surfacing, and incidentals.

Section 8B.

The route of Section 8B (Figure 2) begins with a grade separation (bridge) across Tennessee Hwy. 32 and Cosby Creek. It climbs 360 feet in elevation southwest to the crest of Big Ridge (mile 1), and travels along 1800- to 2000-foot elevations for 2.9 miles (mile 3.9). Slopes to Big Ridge are relatively steep (20-30°), but the road runs the length of Big Ridge on gentle slopes. The route descends and crosses one mile of Schults Cove before climbing south and west along the foothills of Webb Mountain for 2.9 miles (mile 9.7).

Table 1. Foothills Parkway Right-of-Way Section Lengths and Areas

SECTION	DESCRIPTION	MILES	ACRES
8B	Cosby to Pittman Center	14.14	1774.1
8C	Pittman Center to US 441	9.58	1044.7
8D	US 441 to Wear Cove Road	8.80	1276.1
8E	Wear Cove Road to Carr Creek	7.90	1153.8
	TOTAL	40.42	5248.7

SECTIONS 8B AND 8C

FOOTHILLS PARKWAY

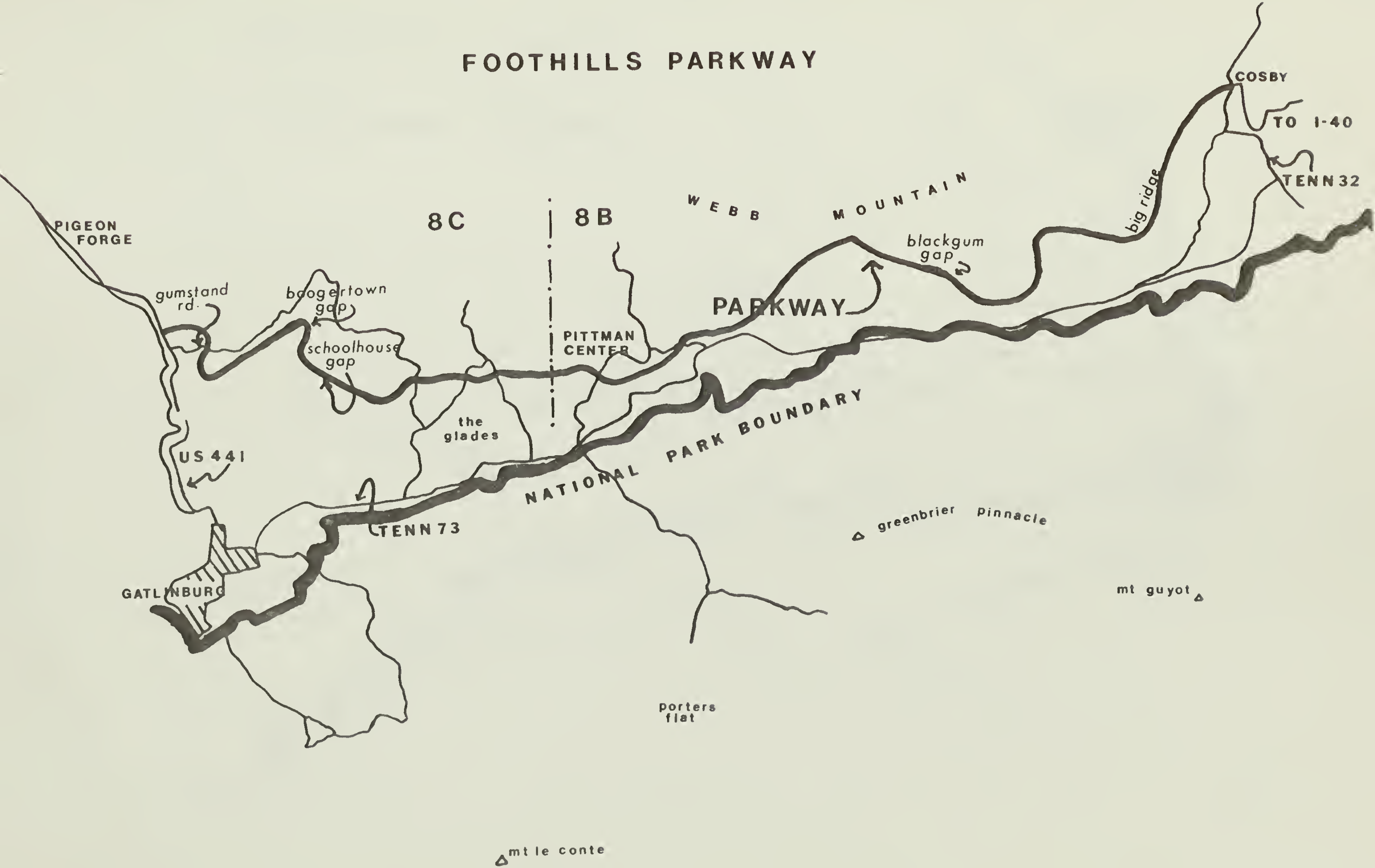


Figure 2

SECTIONS 8D AND 8E

FOOTHILLS PARKWAY

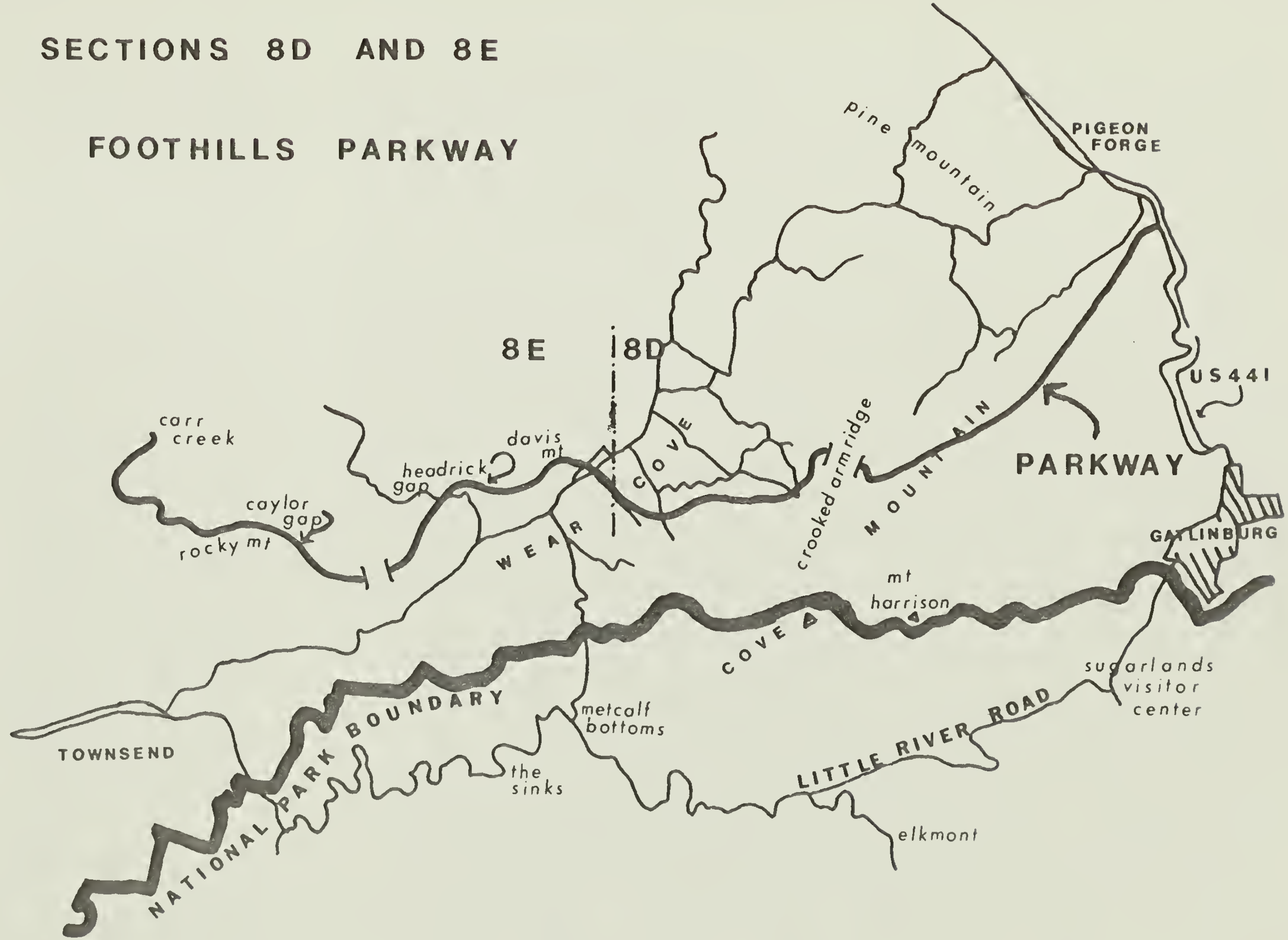


Figure 3

From Schults Cove to Blackgum Gap, the parkway route traverses the southern foothill slope. It climbs from an elevation of 2000 feet at Blackgum Gap to 2400-foot elevation on the slopes of Webb Mountain. Much of Webb Mountain has been purchased with the eventual purpose of constructing an overlook at the top. The center line descends to 1500-foot elevation (mile 13.4), to parallel both Tennessee Hwy. 73 and Webb Creek road. It crosses to the south side of Webb Creek road and travels 1.2 miles south of Pittman Center (mile 13.6). Section 8B crosses the road to Pittman Center (Tennessee Road 2421) (mile 13.8) and the Middle Prong of the Little Pigeon River about one-fourth mile south of Pittman Center and terminates on the flood-plain of the river in an abandoned field (mile 14.14). East of Blackgum Gap are steep slopes (20-40 degrees). The slopes west of Blackgum Gap are very steep, more than 40 degrees in some places. Large road cuts and fills will be necessary, as well as many small bridges across minor drainages. Section 8B is 14.14 miles long.

Section 8C.

Section 8C climbs from the river floodplain at 1300-foot elevation to south-facing slopes at elevations of 1500 to 1800 feet. It descends after one-and-one half miles to cross Buckhorn Road and the East Prong of Bird Creek about one-fourth mile south of the

Glades at 1600-foot elevation and descends to cross Glades Road and the West Prong of Bird Creek (mile 16.5). For three-fourths of a mile, it runs west along the top of a ridge between Glades Road and Powdermill Road (mile 17.3). West of Powdermill Road the parkway climbs to between 1800 and 1900 feet in elevation along south-facing slopes. It crosses to north-facing slopes of Big Ridge at 2000-foot elevation (mile 19.5) and travels north through Schoolhouse Gap. The road continues on steep north-facing slopes between 1600- and 1800-foot elevations to Boogertown Gap (mile 21.1) and beyond, to the site of the old Gatlinburg city dump (mile 22.6). A number of small bridges across minor drainages will be required all through this area. The route turns north on an east-facing slope and crosses Gnatty Branch and Gum Stand Road to terminate with a bridge across U. S. Hwy. 441 and the West Prong of the Little Pigeon River (mile 23.6). Section 8C is 9.58 miles long. Much of this section is on ridgetop, where slopes are gentle.

<u>Section 8D.</u>

Section 8D (Figure 3), to Crooked Army Ridge, travels entirely on north-facing slopes of Cove Mountain. From the terminus of 8C at 1100-foot elevation, the parkway climbs .6 mile above Caney Creek to slopes between 1600 and 1800 feet in elevation. This first

1.6 mile, if not placed directly on the ridgetop, will run on very steep slopes of 40-50 degrees (mile 25.2). Large road cuts and fills will be necessary. The route travels on gentler north-facing slopes for 3.9 miles to Mill Creek. Slopes range from 10-30 degrees. The route turns northwest across the upper end of Mill Creek (mile 28.3). A one-fourth-mile-long tunnel is proposed at 2000-foot elevation under Crooked Arm Ridge. West of the tunnel the road turns southwest and maintains its elevation at 2200 feet for nine-tenths mile (mile 29.5). As the route runs west on the slopes of Cove Mountain, it gradually loses elevation, to level out around the north side of Buckeye Knob at 1800-foot elevation (mile 30.4). Section 8D then crosses one and one-half mile of Wear Cove, travelling due west until one-fourth mile south of Mattox Cemetery (mile 31.9). The route turns north to run a straight line to its terminus at Wear Cove Road (mile 32.4). Section 8D is 8.8 miles long. Slopes in Wear Cove are negligible. However, drainage, or lack of it, will cause engineering problems.

Section 8E.

A bridge across Wear Cove Road separates 8D from 8E (Figure 3). Section 8E begins by traversing the remaining four-tenths of a mile of Wear Cove to the foot of Davis Mountain (mile 32.8). It rises to 1600-foot elevation north of the Wear Valley Church and circles around Davis Gap at 1600- to 1800-foot elevations. The eight-tenths of a

mile from Davis Gap to Headrick Gap is placed on the top of Davis Mountain. The route crosses Happy Hollow Road at Headrick Gap (mile 35.5), and ascends back to the ridgetop, travelling west-southwest to a proposed tunnel under the ridge that separates Patterson Hollow from Lemon Hollow (mile 36.5). West of the tunnel, the steep southern slopes of Rocky Mountain are traversed, climbing from 2000- to 2400-foot elevations at Caylor Gap (mile 38.2). It then gradually descends on the steep south face of Rocky Mountain, rounding a knob at 2000- to 1800-foot elevations at Dancing Gap (mile 39.8). The route continues around Grassy Mountain almost 180 degrees to connect with 8F at Carr Creek at 1300-foot elevation (mile 40.42). Road cuts and fills will, of necessity, be very wide all along here. Section 8E is 7.9 miles long.

GEOLOGIC SURVEY

In reviewing the geology of the area through which the Foothills Parkway right-of-way passes, three categories are analyzed. These include rock type and structure, topography, and soil types. Rock materials and structure directly affect road stability. Structural factors include cementation, strength, permeability, dips, degree of foliation, etc. Precipitation, topography, slope and aspect, and the location of springs and seeps are also important factors of stability to be considered in parkway placement.

Soil data are presented so that preliminary planning can be completed. It is assumed that a detailed survey of the road will determine soil characteristics beyond these generalities. Soil depth, ability to hold water, and potential for sliding or creeping are assessed in general; however, these data are not sufficient to support the design work.

To date, the geologic assessment below has not been tested in the field. Field verification of specific problem areas will occur in June 1977.

Description of Underlying Strata

Sections 8B and 8C are composed mainly of Pigeon Siltstone, a metamorphosed sedimentary rock of late pre-Cambrian Age. It is a member of the Snowbird Group of the Ocoee Series. Pigeon Siltstone is made up of thin layers of fine quartz and feldspar grains. It is underlaid conformably by Roaring Fork Sandstone, another member of the Snowbird Group.

Webb Mountain, in the middle of this area, is comprised of coarse, sandy rocks of the Ocoee Series. These rocks are not included either in the Snowbird Group or the younger Great Smokies Group. These sandstones seem to be intermediate between the two groups, possessing characteristics of both. They are now so fragmented by movement along the Greenbrier Fault that it is difficult to determine their original place in the sequence.

In section 8D to Wear Cove, Thunderhead Sandstone is exposed in strips that have been faulted and embedded between Metcalf Phyllite layers of the Snowbird Group. Metcalf Phyllite is structually similar to the Pigeon Siltstone and Roaring Fork Sandstone described earlier. King (1964) describes the Metcalf as a "homogenous body of thoroughly foliated argillaceous and silty rocks that are interbedded with layers of fine-grained sandstone." Shearing and folding have prevented its

larger structure from being determined. Thunderhead Sandstone is made up of thick grey to dark grey sandstone beds, separated by layers of slate. The beds are graded with the coarsest pebbles of quartz and feldspar found on the bottom. Grain size decreases gradually upward, and the uppermost part is relatively fine-grained.

Section 8E of the Foothills Parkway right-or-way crosses Wear Cove, a limestone window surrounded on all sides by Great Smokies Fault Line. These outcropping units are the Jonesboro Limestone of Ordovician Age and a relatively thin layer of Lenoir Limestone. The Jonesboro is mainly light to medium grey, fine-grained to aphanitic limestone. Lenoir Limestone is mainly cobbly and argillaceous. Another Ordovician unit, Blockhouse Shale, is exposed in some areas. The Blockhouse is dark grey and tends to break apart in thin plates. It contains graptolites and ranges from 150 to 400 feet thick. Most of the Wear Cove window, however, is overlain by alluvium related to the Walden Creek flood-plain. The present valley floor is probably early Wisconsin in age, but at least three older terraces can be seen along the edge of the cove, indicating higher valley floors.

The strata from Wear Cove to the end of the completed work section at Carr Creek (sections 8E-8F) are all part of the Walden Creek Group of the Ocoee Series. Walden Creek is the youngest of the three groups

within the Ocoee Series. Three formations are present within the Walden Creek: Licklog, Shield, and Wilhite. Licklog, the oldest, is found in beds 1200 to 1900 feet thickness, lying on the Great Smoky Fault. There are two sandstone units separated by argillaceous rocks. The sandstone is medium to fine grained and strongly foliated. The argillaceous rocks form thin plates of phyllite which are dull greenish to bluish grey in color.

The Shields Formation is made up of thick layers of sandstone and conglomerate which form strong layers and ridges. Thin layers of argillaceous slate are interbedded. The Shields in this area have been faulted up against the younger Wilhite Formation. The conglomerates and sandstones contain large amounts of rounded, milky or glassy quartz pebbles. These pebbles have been greatly deformed in this area, and in some places have been flattened and elongated. The argillaceous rocks are grey to greenish grey, weathering to tan where exposed.

The Wilhite Formation is made up of silty and argillaceous materials interbedded with layers of conglomerate, sandstone, quartzite, limestone, and dolomite.

The Foothills Parkway right-of-way crosses fault exposures 16 times. These fault lines are important, not because of possible lateral

movements -- the faults are inactive -- but because they are excellent planes of water movement. Where the faults bring permeable rock layers into contact with impermeable layers, the potential for water build-up exists. Surfaced roads along this line, if not carefully and correctly constructed, might cause slumping and landsliding.

At Big Ridge, in section 8-B, the right-of-way runs along the Webb Mountain Fault Line (part of the Gatlinburg fault system) for approximately one-half mile. It then crosses to the upthrown side and recrosses four more times. This low angle fault divides the sandstones of Webb Mountain from Pigeon Siltstones. The Webb Mountain rocks seem to be permeable, and the Pigeon Siltstones are probably also permeable, so hydrostatis pressure build-up is not expected.

In the vicinity of Big Ridge School the right-of-way crosses the Gatlinburg Fault once more. At McCookville it crosses the Dunn Creek Fault twice and the Pigeon Forge Fault once. As the right-of-way traverses the north slope of Cove Mountain, it encounters the Greenbrier Fault zone five times, running along one fault line for one-half mile. The Greenbrier Fault is a high-angle thrust fault which outcrops many times on the north slopes of Cove Mountain. It separates Metcalf Phyllite, a relatively impermeable layer, from Thunderhead Sandstone, another impermeable layer. Both the dip of the beds and foliation in this area point south into Cove Mountain.

No structural difficulties with sliding along the dip surfaces, therefore, are expected.

On the north side of Wear Cove, at the southern foot of Mount Davis, the Foothills Parkway crosses one exposure of the Great Smoky Fault, running along the fault line for one-fifth of a mile. The units that meet at this line are Blackhouse Shale, a relatively impermeable layer, and Shields Conglomerate, a relatively permeable layer. It is possible that hydrostatic pressure from rainfall could cause slope failure here.

Above Patterson Hollow, the Happy Hollow Fault is crossed twice (E on Figure 5). It separates Shields Slate from Licklog Slate and Shields Conglomerate. The conglomerate will probably be permeable, the slate layer will not. Again, the possibility of slope failure exists.

Topography

When not on the ridgetop or in the cove bottoms, the right-of-way is traversing steep slopes. Most of these slopes are greater than 20 degrees, and some are greater than 30 degrees. Areas with especially steep slopes are indicated on Figures 4 and 5 and are located on the slopes of Webb Mountain (A) and the north slopes of Cove Mountain (E). Regardless of the permeability of the underlying rocks, the danger of landslides and rockslides on these slopes will

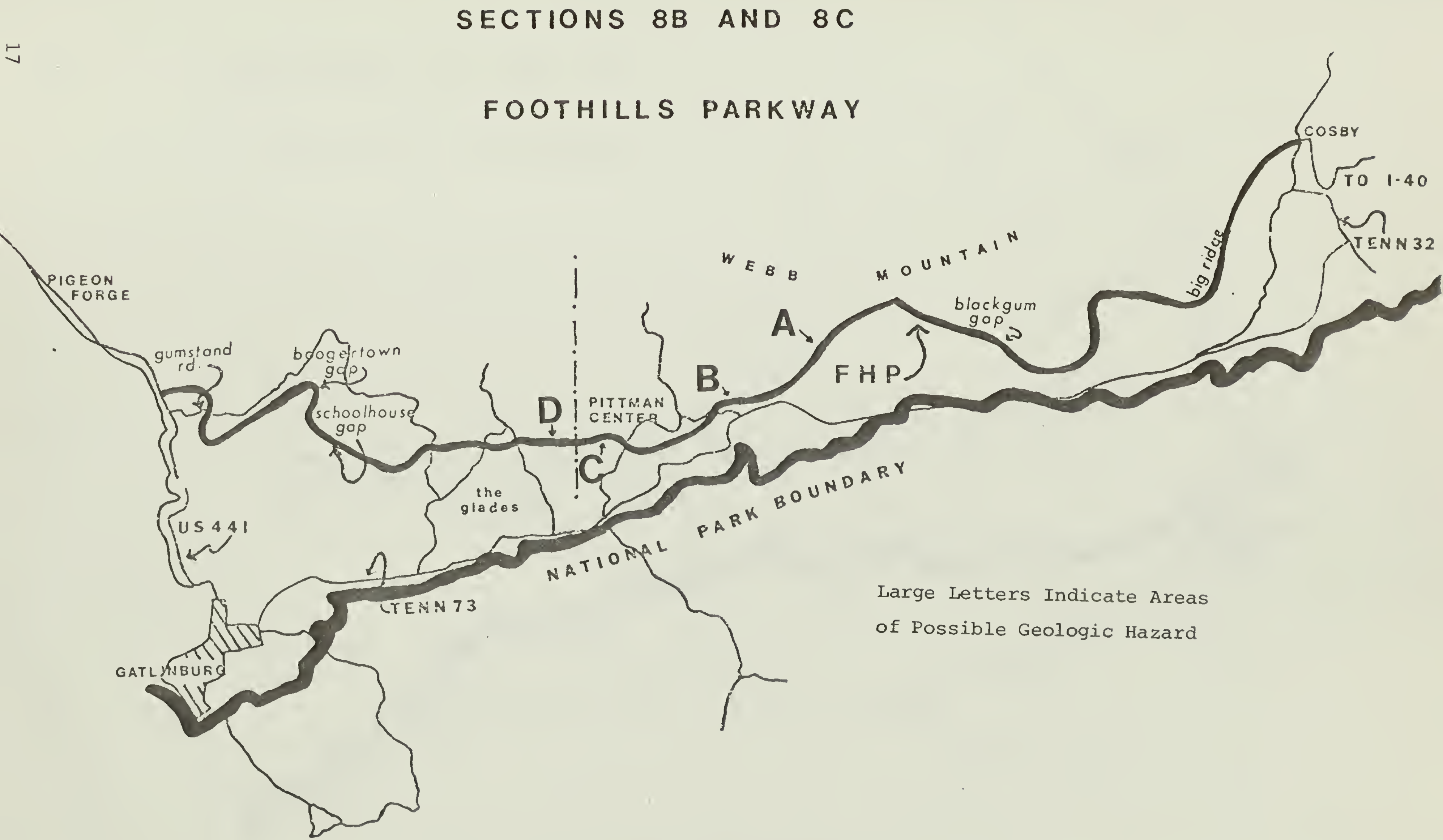

SECTIONS 8B AND 8C
FOOTHILLS PARKWAY
COSBY
TO I-40
TENN 32
big ridge
WEBB MOUNTAIN
blackgum gap
PIGEON FORGE
A
B
C
D
FHP
gumstand rd.
boogertown gap
schoolhouse gap
PITTMAN CENTER
the glades
NATIONAL PARK BOUNDARY
US 441
TENN 73
GATLINBURG
Large Letters Indicate Areas
of Possible Geologic Hazard

Figure 4

SECTIONS 8D AND 8E

FOOTHILLS PARKWAY

Large Letters Indicate Areas
of Possible Geologic Hazard

Figure 5

necessarily be great. On these slopes roadcuts and fills will be very wide, increasing the danger of slumping and mass-wasting due to erosion of the exposed soil.

Areas which have a potential for rock slippage are listed below (Figures 4 and 5). In these areas, both dip slopes and/or foliation of rocks are such that the potential for rock movements exists. Permeable fill material and underdrainages will minimize the threat of slides.

- B east of Pittman Center
- C west of old field across Little Pigeon River
- D midway between Emerts Cove and Buckhorn Road
- F slopes of Davis Mountain
- H west of Caylor Gap
- J Alie Mountain, south of Dancing Gap
- K just south of Carr Creek terminus

Soils

Most of the soils of the Foothills Parkway right-of-way are mapped within the Ramsey Series. This is a shallow, excessively drained soil derived mainly from the weathering of slate and fine-grained quartzite. The soil is acid throughout. Maximum depth may reach 1 meter, however, the soil is generally shallower. It is rated as class 5 agricultural soil, the lowest rating. Ramsey soils fall

into management groups 19 and 20. These are soils poorly suited for any kind of agricultural activity (Soil Survey-Sevier County, Tenn., Series 1945, #1 USDA SCS). The Tennessee State Planning Commission has classified the land as soil resource area 8. Slopes are mainly 25-50 percent, but range from 12-80 percent. The Commissions Transportational limitation rating was very severe. "The steep, rugged terrain is a very severe limitation. Extensive cuts and fills are necessary. This is made difficult because hard bedrock is within 18 inches of the surface" (Soil Resources of Sevier County, Tenn., Tennessee State Planning Commission, East Tenn. 1965).

The lowland areas on the right-of-way have much higher quality soils. In the Pittman Center area, Staser Fine Sandy Loam predominates. It is flatland derived from river deposits. It is rated as second class soil, within management group 1. The Tennessee State Planning Commission rates its transportational limitations as slight. Some of the area, however, is poorly drained or prone to flooding. Winter frost-wedging in these areas will be severe. The only other lowland of any size is Wear Cove, which supports a wide variety of soils. Sandy loams of the Jefferson Series predominate. They range from class 2 through class 5 and management groups 5 through 18. Its transportational rating is moderate. Slopes range from 5 to 15 percent, requiring some cutting and filling.

Near Cove Creek in Wears Valley, Hamblen silt loam and Tyler silt loam predominate. Both are soils that are poorly drained to very poorly drained. Tyler has a claypan which would cause severe frost-wedging throughout the winter months. Hamblen is a second class soil in management group 1. Tyler is a fourth class soil in management group 17. Both have a transportational rating of very severe due to their propensity for flooding.

Precipitation

Precipitation falling within the study area varies between 45 and 80 inches per year. In times of heavy rainfall flash floods occur on the steeper slopes and drainages. The parkway should be constructed well above projected flood levels to compensate for high water. Large amounts of precipitation and rapid discharge might cause debris slides to occur due to saturation of soil and unconsolidated materials. An increase in hydrostatic pressure within rock materials could also cause slope failure. Spring seeps will occur along major drainages. During periods of high rainfall these seeps might cause flooding of the road route if mitigating measures are not taken.

The potential for flooding exists in the Wears Valley lowlands. Drainage in these areas is poor, and standing water will linger for some time after a heavy rainfall. If the road bed were raised above the valley floor with permeable fill materials, this problem might be obviated.

SCENIC VALUES

The scenic values which were assessed include:

1. Vistas and views of the mountains
2. Views of pastoral landscapes
3. Proximity to craftsmen and artists' galleries
4. Waterfalls, cascades and streams
5. Cemeteries
6. Effects on scenic values as viewed from outside the parkway (especially from Great Smoky Mountains back-country)

As the Foothills Parkway is intended entirely for recreation, these items are of special importance.

The first section of the Foothills Parkway, 8-B, offers many extensive vistas of the Great Smoky Mountains. This 9.1 mile long section from Cosby to Pittman Center is situated along the south slopes of Big Ridge and Webb Mountain. From most vantages there are clear views of over 50 miles of ridgetops. The Smokies ridge can be seen from Mt. LeConte all the way to Mt. Cammerer. Mt. Winnesoka, Gabes Mountain, Greenbrier Pinnacle, and Snag Mountain are low ridges that can be seen in the foreground. Other forested ridges are visible to motorists on the parkway. If a lookout area were placed on top of Webb Mountain,

visitors would have a 360-degree view of the Great Smoky Mountains, the surrounding coves, the foothills and the Appalachian Valley. Specifically, peaks of Cherokee National Forest can be seen to the east. Green Mountain, Chestnut Mountain, Rich Mountain, and Stone Mountain can be seen to the northeast. The Great Smoky Mountains high ridge will, of course, be visible. The clearings in Emerts Cove and Cobbly Nob will provide pastoral views in the west. On the north is English Mountain and the Appalachian Valley with Douglas Lake in the distance.

Because of its position, section 8B will be highly visible to motorists in some stretches of Tennessee Hwy. 73. Many foot and horse trails in the national park will have unobstructed views of the entire roadcut. The Bullhead trail has at least three wide vista cuts from which the Foothills Parkway would be seen. Rainbow Falls trail, and Rocky Spur on it, offer the same. The slash would be easily visible from the top of Mt. LeConte. About 5 miles of the road along Webb Mountain will be seen from Brushy Mountain. Nearly 6 miles will be seen from the lookout tower on Greenbrier Pinnacle, and even if the tower is removed, another vista one-half mile down the trail gives the same views (Table 2).

It must be mentioned that the entire area crossed by the Foothills Parkway is riddled by other roads. Cobbly Nob, Highway 73, Pittman

Table 2. Maximum Visible Mileage of Sections from Present Great Smoky Mountain National Park Backcountry Sites

	8-B	8-E	8-D	8-E
Bullhead Trail	7	1	-	-
Rainbow Falls Trail Rocky Spur	7	1	-	-
Mt. LeConte	6	Not visible	-	-
Brushy Mountain	5	Not visible	-	-
Greenbrier Pinnacles	6	1	-	-
Boundary Trail	-	-	*	+3
Cove Mountain Tower	-	-	*	2
Rich Mountain Tower	-	-	-	+4
Rocky Top Appalachian Trail	-	-	-	3

* Within Hearing Distance

Center, the Glades, Gatlinburg, and the large roadcut ascending English Mountain are all highly apparent. The Foothills Parkway will not, therefore, be the only roadcut in an otherwise pristine area. Due to the steepness of the slopes on which it has been placed, however, it will be the largest roadcut visible to the park and other vantage points.

In addition to forested areas, the motorist will pass through several open agricultural settlements in Section 8B. Because of their rustic, Appalachian flavor, these areas are now visually pleasing. Old weathered barns, an occasional log cabin, and green, open cow pastures will provide a change from young oak, pine, and maple forests. The town of Cosby is the first open area encountered. From the parkway, the visitor will see Larges church and grocery store, as well as several active and abandoned farms. Five miles beyond Cosby, the parkway crosses 1 mile of Schults Cove, a small, isolated valley off of Hwy. 73. Most of the road will travel through lowland forests, as the right-of-way has lain fallow for more than 10 years. Motorists might have glimpses of what are now strictly rural areas, however.

At mile 13.6, the parkway descends to the agricultural area around Pittman Center. Emerts Cove is a wide and scenic cove that runs along a floodplain of the Middle Prong of the Little Pigeon River. The Middle Prong is under consideration for designation as a scenic waterway. Pittman Center is a prosperous small community.

Other historical sites include the old Sutton cemetery near Blackgum Gap. This is a family cemetery which is in use today. There is an unnamed plot near Pittman Center which is also in use. As these are active plots for families residing in the area, they should not be marked as possible visitor attractions.

The parkway crosses fifteen first-order creeks in Section 8-B. These are either small or intermittent, but will offer pleasant creek views periodically. Three larger creeks are crossed: Cosby Creek, Webb Creek and the Middle Prong of the Little Pigeon River. Any one of them could be developed as a picnic area, but the Little Pigeon is the most scenic. The other two are in developed areas, and might not be desirable. The City of Gatlinburg has proposed a water intake plant on the Middle Prong, which may change the character of the river at this point.

There are no cascades or waterfalls along Section 8-B.

Section 8-C

Section 8-C rises above Pittman Center, offering extensive views of the Smokies Ridge, the Middle Prong of the Little Pigeon and Emerts Cove. More than 40 miles of ridges can be seen. A pull-off and vista clearing within the first half mile would allow visitors to

photograph this area. The road continues to offer views of the Great Smoky Mountains for another 2 miles, until the parkway changes aspects at Big Ridge. Beyond Big Ridge vistas are mainly of local unnamed foothills. The ridge above the old Gatlinburg City Dump offers about 15 miles of mountain views to the southwest. Sugarlands Mountain and Mt. LeConte can be seen. Pine Mountain can be seen to the west, as well as some other local ridges.

Vistas on the Bullhead trail, Rainbow Falls trail and Greenbrier Pinnacle will give views of pieces of Section 8C (Table 2).

Excellent views of Emerts Cove and Pittman Center are offered at the beginning of Section 8C. Most of the area through which the parkway passes is settled to some extent. Farms, trailers and houses are never far from the roadway. Some neighborhoods, such as those around Glades Road and near Boogertown Gap, are heavily settled.

One of the main attractions in the area is the Glades Road craft tour. An exit from the parkway will permit access to Glades Road, the main artists′ colony in the vicinity of Gatlinburg.

Section 8C crosses nine small creeks (there are no waterfalls or cascades). None of the creeks are suitable for pulloffs or picnic areas.

Section 8-D

Panoramic views of local ridges, the largest of which is Grindstone Ridge are seen from McCookville to beyond the proposed tunnel under Crooked Arm Ridge. West of Crooked Arm Ridge there will be unlimited views of Wears Valley and its northern ridges. These include Davis Mountain, Hatcher Mountain, Sloan Ridge, and Tilda Ridge. Looking southwest from the valley floor, the motorist will see Roundtop, Little Roundtop, Chestnut Top Lead, and Cove Mountain. These ridges comprise over 20 miles of mountain views.

The parkway cannot be seen from the boundary trail or Cove Mountain Tower. There are no trails in the park from which this section can be seen. Traffic noises will be heard, however, from the boundary trail (Table 2).

Houses will be visible up Caney Creek and an Appalachian mountain farmstead is located at the end of Mill Creek below Crooked Arm Ridge.

Section 8D will offer extensive views of pastoral landscapes under present land uses.

Wears Valley is one of the larger coves in east Tennessee. The wide gently rolling valley contains many well-maintained farms. Exits on

and off the parkway will permit access to the craftsmen and honey venders in the cove. In the spring the northern slopes are covered with flowering dogwood and redbud trees.

Two cemeteries are located close to the right-of-way. Mattox Cemetery and another cemetery nearby are both active. Care should be taken to preserve their integrity.

Eighteen streams are crossed by this section. Most of them are small. Some are scenic, such as Mill Creek and Caney Creek. No cascades or waterfalls were found.

Section 8E.

From Wear Cove to Carr Creek the parkway route stays on slopes not rising to the ridgetops. Vistas are mainly local. Chestnut Top Lead, Round Top and Cove Mountain can be seen. At some vistas the Great Smoky Mountains high ridge can be seen from Spence Field to Thunderhead. Both Mountain and Defeat Ridge are visible. Motorists on the Foothills Parkway east of Dancing Gap will see Rich Mountain, Little Mountain and Scott Mountain. From Caylor Gap (site of the proposed Rocky Mountain overlook area) visitors can see Tuckaleechee Cove, Davis Ridge, Defeat Ridge and Bote Mountain leading up to the Smoky Mountains backbone. Approximately 12 miles of the high ridge can be seen.

Local peaks visible are Chestnut Top Lead, Scott Mountain, Rich Mountain, Little Mountain and High Top above Tuckaleechee Cove.

About three miles of Section 8-E can be seen from Tuckaleechee Cove and Townsend. Motorists on Hwy. 73 through this area will also see this road cut. The same numbers of miles can also be seen from the Wear Cove Road. Approximately one mile can be seen from the road coming through Wear Cove Gap from Metcalf Bottoms.

Several trail vistas will look out on the Foothills Parkway. More than three miles will be visible to winter hikers at Chestnut Top Lead on the Boundary Trail. More than four miles of 8-E will be seen from the Rich Mountain Tower and Gap. Three miles of the parkway can be seen from Rocky Top on the Appalachian Trail. From Cove Mountain Tower, hikers will be able to see two miles of the roadcut. If the tower is removed, however, and no vista clearing is maintained, nothing will be seen of the parkway. As with previous sections, the parkway roadcuts will not be the first slashes in an otherwise pristine area. Wear Cove and its northern slopes are developed already (Table 2).

Both Wear Cove and Tuckaleechee Cove will provide many pastoral landscapes for motorists. Happy Hollow and other hollows may be seen.

Seven primary creeks are crossed. These will all be too small to provide for recreation. Carr Creek is larger and may be suitable for development of a picnic area.

There are no cemeteries in the proximity of 8-E. Several farmhouses and buildings may be of historical interest.

WATER QUALITY

Introduction

Each species of aquatic fauna has certain physical, chemical, and biological requirements of the environment before it can inhabit particular aquatic systems. Thus, the occurrence in a stream of a species or a group (community) of species having similar (related) requirements of the environment; e.g., high concentrations of dissolved oxygen, reflects the characteristics of the water quality of the stream at particular sampling sites. Following this reasoning, it has been possible to identify certain species as indicators of the water quality of streams (Figure 6, page 41). Although this approach is not without limitations for developing explanations of how aquatic systems function, it is of value for assessing (rather quickly) the capacity of streams to support certain indicator species.

Benthic macroinvertebrates and fishes have been frequently used as indicators of the water quality of streams. Benthic macroinvertebrate organisms are not particularly motile, in general, and thus the species composition of the benthic community will reflect the quality of the overpassing water at a particular site along a stream. Although fishes are motile and they may avoid (emigrate) portions of a stream not suitable for them, they can be indirectly affected by changes of water quality that alter the

food web. Such changes can reduce their growth and production, which could ultimately lead to a change in the species composition of the fish fauna.

Another approach to assessing water quality is to determine the amount of contamination of fecal coliform bacteria in the water. This bacterial test has been used to determine stream classification in terms of standards established by the Water Quality Control Act of 1971 (State of Tennessee 1971). Waters have many uses in the public interest which are reasonable and necessary. Such uses, as defined by the Tennessee Water Control Board, pertaining to this study include: sources of water for domestic and industrial purposes, propagation and maintenance of fish and other desirable aquatic life, recreational boating and fishing, discharge of municipal sewage and industrial waste following adequate treatment, stock watering and irrigation, and the enjoyment of scenic and esthetic qualities of water. The rigid application of uniform water quality is not desirable or reasonable because of the varying uses of such waters. Thus, the bacterial water criteria established by the Tennessee Water Quality Act of 1971 applies differently to allowable concentrations of fecal coliform depending upon the uses outlined in Table 3.

Table 3. Maximum fecal coliform levels allowed for various water uses

Water Use	Maximum mean fecal coliform numbers allowable
Domestic raw water supply	1000/100 ml.
Recreation	200/100 ml.
Fish and aquatic life	1000/100 ml.
Drinking water	<1/100 ml.

The objective of the present work was to assess the water quality of each stream that would be crossed by the Foothills Parkway Extension (proposed). Water quality was assessed by three procedures: kicknet samples, seine samples, and bacterial tests. The kicknet samples were used to determine the species composition of the macroinvertebrate communities as well as their diversity ($\bar{d}$) and evenness (e). The seine samples were used to determine the number of fish species and their relative abundances. The bacterial tests were used to determine fecal coliform numbers in the water.

METHODS

Kicknet Samples

Following standard procecures, a series of kicknet samples were taken in each of the streams and selected tributaries which would be crossed by the Foothills Parkway (Figures 7 and 8). The taxa (Appendix B, Tables 1-16) collected were analyzed for stability of the aquatic macroinvertebrate community, using the Shannon-Weaver diversity index ($\bar{d}$) based on $\log_e$ (Shannon and Weaver 1963) and the Lloyd and Ghelardi (1964) equitability index (e), conforming to the MacArthur model (1957). These indices provided an indication of stream water quality based on community structure.

In most cases, higher $\bar{d}$ values indicate greater biological stability than low values and, by inference, increased water quality. In unpolluted waters, $\bar{d}$ generally is between 3 and 4, whereas in polluted waters $\bar{d}$ is generally less than 1. However, collected data from southeastern United States waters by EPA biologists indicate that, with slight to moderate levels of degradation, $\bar{d}$ lacks the sensitivity to demonstrate differences in water quality (Weber 1973).

Evenness (e) is an index of the chance of encountering the same species on a number of random encounters (Pielou 1975). In most cases, e will range from 0 to 1 except in situations where the

SECTIONS 8B AND 8C

WATER QUALITY SAMPLE SITES

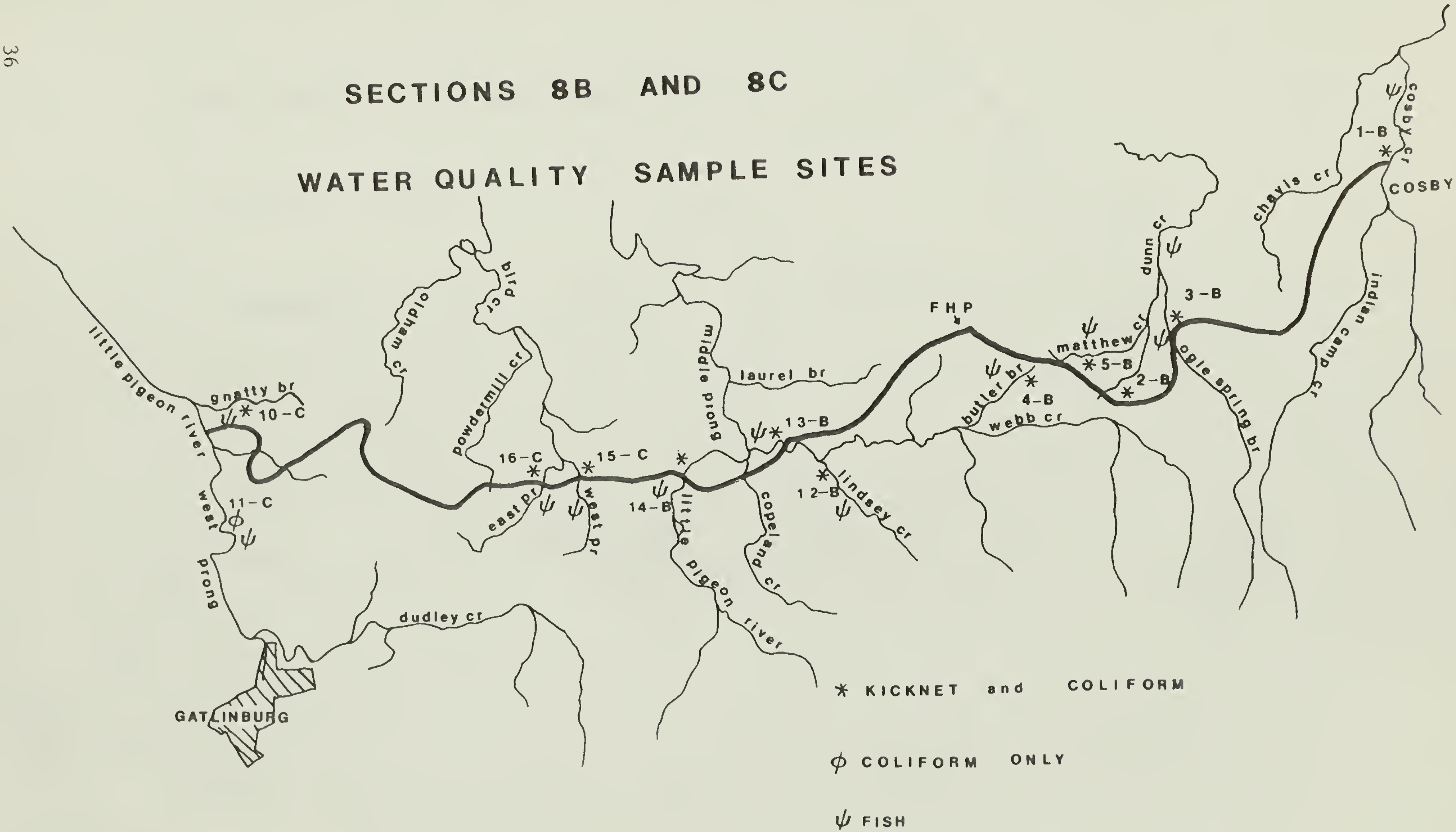


Figure 6

SECTIONS 8D AND 8E

WATER QUALITY

SAMPLE SITES

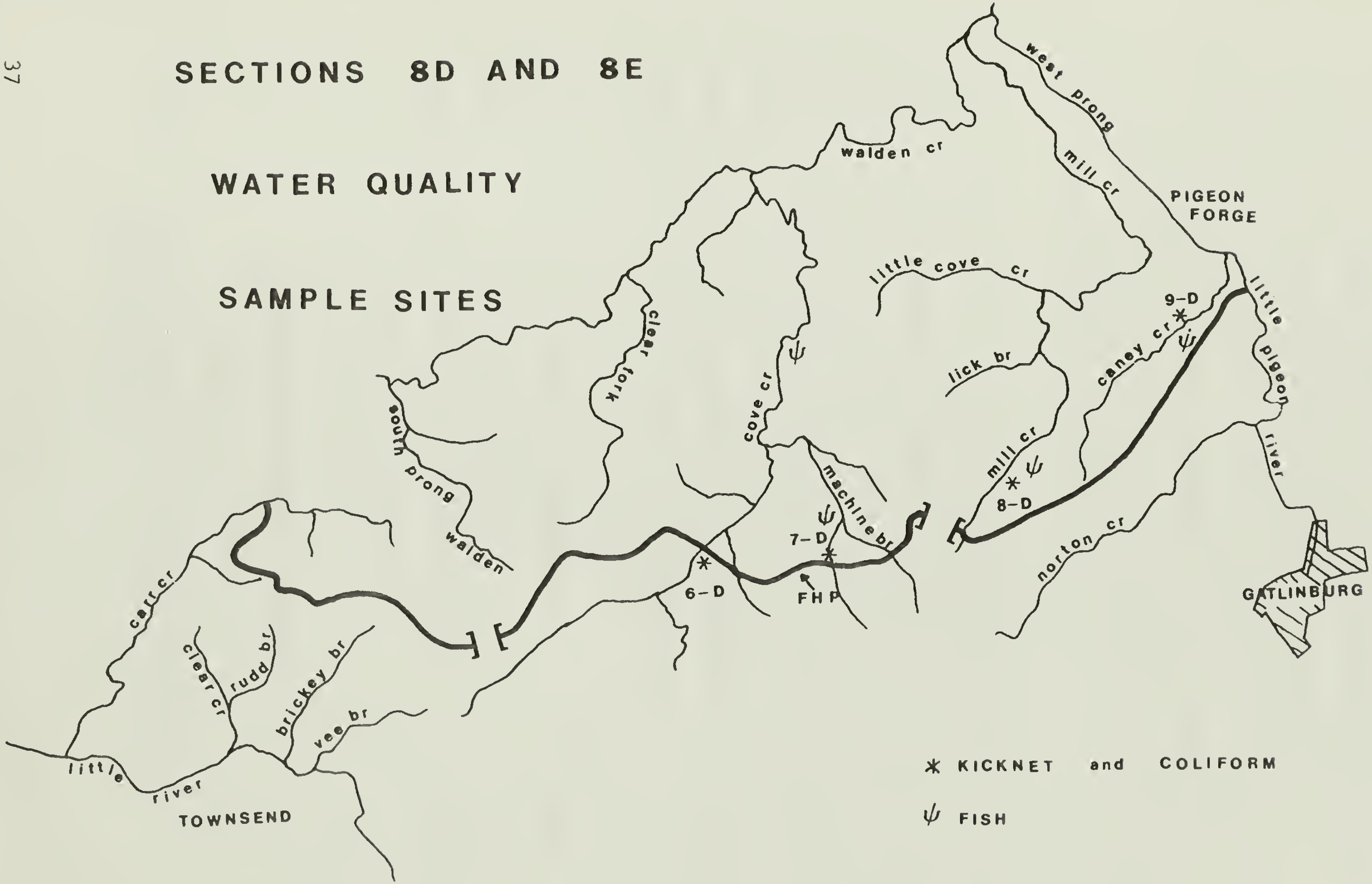


Figure 7

distribution in the sample is more equitable than the distribution resulting from the MacArthur model. Such an eventuality will result in values of e greater than 1, and this occasionally occurs in samples containing only a few specimens with several taxa represented (Weber 1973). Unlike $\bar{d}$, evenness (e) is very sensitive to slight levels of stream degradation. Even slight levels of degradation reportedly will reduce evenness below 0.5 and generally range between 0.0 and 0.3 (Weber 1973).

The reduction of $\bar{d}$ and e in a polluted system typically results in a simplified and unstable community (Cairns et al. 1971). As neutralization of a pollutant occurs below its entry into streams, benthic macroinvertebrate communities recover and, in general, the diversity of the community increases. The usual order of macroinvertebrate disappearance and reappearance on a sensitivity scale below pollution sources is shown in Figure 6.

Water Quality Deteriorating ↓		Water Quality Improving ↑
	Stoneflies (*Plecoptera*)	
	Mayflies (*Ephemeroptera*)	
	Caddisflies (*Trichoptera*)	
	Amphipoda (*Amphipoda*)	
	Isopoda (*Isopoda*)	
	Midges (*Diptera: Chironomidae*)	
	Oligochaetes (*Annelida*)	

Figure 8. Typical samples of the dominant groups of macroinvertebrates in streams of different water qualities

Seine Samples

Fish collections were made using a 10-foot seine, 1/8 inch-square mesh, modified for stream work by attachment of a sash chain (No. 35) to the lead line. Collection sites are indicated in Figures 7 and 8.

These data were collected primarily to establish species composition and a general inference of their relative abundances. Since stream inventories are generally accomplished using electroshocking gear or sodium cyanide application, which are more effective than seining, these data may not reveal the full diversity of the fish fauna. Some fish, such as darters and trout, can easily evade this type of sampling gear. A comparative assessment of the stream fishing is possible, however, since the same type of gear was used and unit of effort duplicated as much as possible. A list of fishes taxa collected is presented in Appendix C, Tables 1-16). The results of stream surveys by Dr. D. A. Etnier and L. B. Starnes, University of Tennessee, Department of Zoology, Knoxville, Tennessee, are provided, where available, on the same stream sections. In many cases these data fill gaps in the species list of fish in the present stream survey. The stream flow and composition of the stream bottom substrate as boulders, rock, and sand were estimated by eye.

Bacterial Samples

Analysis for fecal coliform bacteria was accomplished by the membrane filtration method, following standard procedures (Millipore Corp. 1973). One sample was collected from each stream system that would be crossed by the proposed Foothills Parkway Extension (Figures 7 and 8).

RESULTS

Station 1-B (Cosby Creek)

The benthic community is of relatively low diversity; however, the evenness is comparatively high (Table 4). Pollution intolerant mayflies (*Isonychia*, *Stenonema*) and stoneflies (*Acroneuria*, *Peltoperla*, *Nemoura*) have a relatively high abundance, indicating high water quality. No single species, however, dominates the habitat as indicated by the high evenness value. The stream supports a very diverse fishery with the highest number of individuals captured and species represented in the study (Appendix C). Moderate stream bank shade is provided by sycamore, buckeye, and ironwood. Moderate flow existed at the time of sampling. A boulder (35 percent), rock (35 percent), sand (30 percent) bottom substrate typified this stream section. The fecal coliform count was 48 (Table 5).

Station 2-B (Dunn Creek)

A relatively high benthic diversity, 3.52, characterizes this station (Table 4). The evenness index is slightly reduced, however, owing to the relatively high abundance of *Stenonema*. Predominant orders are mayflies and caddisflies. The fishery is not diverse, being represented by only three species. It is limited by low flow and moderate situation. Farm land in row crops lies adjacent to the station. The stream bank is characterized by moderate overstory and

Table 4. Benthic Macroinvertebrate Community Structure of the Study Streams

Stream	Station Number	Total Number of Taxa[+] per Station (s)	Total Number of Individuals per Station (n)	Diversity ($\bar{d}$)	Evenness (e)
Cosby Creek	1-B	9	17	2.88	1.12
Dunn Creek	2-B	17	49	3.52	0.95
Ogle Spring Branch	3-B	20	110	3.38	0.75
Butler Branch	4-B	11	44	3.20	1.18
Matthew Creek	5-B	13	34	3.48	1.23
Cove Creek	6-D	7	77	2.18	0.75
Machine Branch	7-D	14	48	3.26	0.95
Mill Creek	8-D	16	40	3.59	1.14
Carney Creek	9-D	15	55	3.58	1.14
Gnatty Branch	10-C	10	52	2.75	0.95
Little Pigeon River (West Prong) *	11-C	9	68	1.74	0.47
Lindsey Creek	12-B	23	74	3.95	0.96

+Taxa refers to lowest taxonomic level identified to (usu. genera).

* Benthic macroinvertebrate data taken from Starnes (1976)

(Cont'd)

Table 4. Benthic Macroinvertebrate Community Structure of the Study Streams - Cont.

Stream	Station Number	Total Number of Taxa per Station (s)	Total Number of Individuals per Station (n)	Diversity ($\bar{d}$)	Evenness (e)
Webb Creek	13-C	17	56	3.22	0.77
Little Pigeon River (Middle Prong) *	14-B	26	132	3.48	0.62
Bird Creek (East Prong)	15-C	14	34	3.54	1.16
Bird Creek (West Prong)	16-C	12	44	3.27	1.11

* Benthic macroinvertebrate data taken from Starnes (1976)

Table 5. Fecal coliform numbers per hundred milliliters of stream water for each study stream.

Stream	Number	Numbers of Fecal Coliform Bacteria
Cosby Creek	1-B	48
Dunn Creek	2-B	14
Ogle Spring Branch	3-B	152
Butler Branch	4-B	24
Matthew Creek	5-B	2
Cove Creek	6-D	158
Machine Branch	7-D	6
Mill Creek	8-D	22
Caney Creek	9-D	52
Gnatty Branch	10-C	20
Little Pigeon River (West Fork)	11-C	324
Lindsey Creek	12-B	5
Webb Creek	13-B	448
Little Pigeon River (Middle Fork)	14-B	59
Bird Creek (East Prong)	15-C	59
Bird Creek (West Prong)	16-C	3173

and dense understory vegetation (Table 6). The bacterial level is comparatively low at 14 (Table 5). Bedrock (30 percent), boulder (20 percent), rock (20 percent), sand (20 percent), silt (10 percent) characterized the bottom substrate. Estimated percent stream section in pools is 30 percent, with siltation causing as much as 30 percent of pool bottom substrate.

Station 3-B (Ogle Spring Branch)

This station had moderately high benthic diversity and average evenness index (Table 4). The mayfly, *Ephemerella*, had a high relative abundance at this station, which accounted in part for the lower evenness index. Stonefly (*Peltoperla*) and caddisfly (*Cheumatopsyche*) accounted for moderately high relative abundances at this site. The fishery was represented by a single species, the blacknose dace. (This species was the most widespread fish found in the study area, being present at 81.3 percent of the stations sampled.) The watershed is basically wooded, providing moderate overstory vegetation to the stream. A few houses are located nearby. The bottom substrate is boulder (30 percent), rock (30 percent), sand (30 percent), silt (10 percent), and the flow was moderate at the time of sampling. The bacterial count was 152 (Table 5).

Table 6. Stream Bank Vegetation.

Stream	Station Number	Species: Common Name	Species: Scientific Name
Cosby Creek	1-B	Sycamore	*Platanus occidentalis*
		Buckeye	*Aesculus octandra*
		Ironwood	*Carpinus caroliniana*
Dunn Creek	2-B	Mountain Laurel	*Kalmia latifolia*
		Hemlock	*Tsuga canadensis*
		Ironwood	*Carpinus caroliniana*
		Rhododendron	*Rhododendron maximum*
		Buckeye	*Aesculus octandra*
Ogle Spring Branch	3-B	Buckeye	*Aesculus octandra*
		Tulip Poplar	*Liriodendron tulipifera*
		Dogwood	*Cornus florida*
		Box Elder	*Acer negundo*
		Red Maple	*Acer rubrum*
		Ironwood	*Carpinus caroliniana*
		White Oak	*Quercus alba*
Butler Branch	4-B	Silverbell	*Halesia carolina*
		Dogwood	*Cornus florida*
		Virginia Pine	*Pinus virginiana*
		Tulip Poplar	*Liriodendron tulipifera*
		Red Maple	*Acer rubrum*
		Rhododendron	*Rhododendron maximum*
Matthew Creek	5-B	Tulip Poplar	*Liriodendron tulipifera*
		Rhododendron	*Rhododendron maximum*
Cove Creek	6-D	Willow	*Salix* sp.
		Ironwood	*Carpinus caroliniana*
		Sycamore	*Platanus occidentalis*
		Wild Rose	*Rosa multiflora*
Machine Branch	7-D	Buckeye	*Aesculus octandra*
		Serviceberry	*Amelanchier arborea*
		Sweetgum	*Liquidambar styraciflua*
		Tulip Poplar	*Liriodendron tulipifera*
		Red Oak	*Quercus rubra*

(Cont'd)

Table 6. Stream Bank Vegetation Cont.

Stream	Station Number	Species: Common Name	Species: Scientific Name
Mill Creek	8-D	Hemlock	*Tsuga canadensis*
		Sugar Maple	*Acer saccharum*
		White Oak	*Quercus alba*
		Tulip Poplar	*Liriodendron tulipifera*
		Dogwood	*Cornus florida*
		Rhododendron	*Rhododendron maximum*
Caney Creek	9-D	Tulip Poplar	*Liriodendron tulipifera*
		Beech	*Fagus grandifolia*
		Redbud	*Cercas canadensis*
		Oak	*Quercus* sp.
		Dogwood	*Cornus florida*
Gnatty Creek	10-C	Buckeye	*Aesculus octandra*
		Ironwood	*Carpinus caroliniana*
		Dogwood	*Cornus florida*
		Oak	*Quercus* sp.
Little Pigeon (West Fork)	11-C	Sycamore	*Platanus occidentalis*
Lindsey Creek	12-B	Sycamore	*Platanus occidentalis*
Webb Creek	13-C	Willow	*Salix* sp.
		Sycamore	*Platanus occidentalis*
		Red Maple	*acer rubrum*
Little Pigeon (middle Fork)	14-B	Ironwood	*Carpinus caroliniana*
		Sycamore	*Platanus occidentalis*
		Tulip Poplar	*Liriodendron tulipifera*
		Oak	*Quercus* sp.
Bird Creek (East Prong)	15-C	Willow	*Salix* sp.
		Blackberry	*Rubus* sp.
		Ironwood	*Carpinus caroliniana*
Bird Creek	16-C	Hickory	*Carya* sp.
		Willow	*Salix* sp.
		Hemlock	*Tsuga canadensis*

Station 4-B (Butler Branch)

The diversity of the benthic organisms at this station was about average (3.20), but a relatively high evenness index (1.18) was indicated (Table 4). Although (as indicated by the value of e) the species distribution in the sample was highly equitable, predominant familes represented were the mayflies, stoneflies, and caddisflies. These families generally indicate high water quality. The bacterial count at this station was also comparatively low, 24 (Table 5), adding to the high assessment of the water quality. The diversity of fishery did not reflect the high water quality, however, with only two species, stoneroller and blacknose dace, represented in the sample. The sparse overstory vegetation, which offered little cover to the stream, may account for this. Understory vegetation was moderate. Rock (50 percent), sand (45 percent), and silt (5 percent) characterized the bottom substrate.

Station 5-B (Matthew Creek)

This is a very high quality stream with a benthic diversity of 3.48 and evenness of 1.23 (Table 4). The entire watershed is wooded, providing dense overstory and moderate understory vegetation to the stream bank. Bottom substrate was composed of bedrock (70 percent) rock (20 percent), and sand (10 percent). This fishery is very limited, being represented by only one species, the blacknose dace. A solid bedrock substrate over 70 percent of the stream section allows very little cover or diverse habitat, which probably accounts for sparse fishery. This stream had the lowest bacterial

count in the survey, with only 2 fecal coliform. (Table 5)

Station 6-D (Cove Creek)

This station had relatively low d and e indexes (Table 4), mainly due to the high abundance of stonefly (*Isoperla*) and caddisfly (*Cheumatopsyche* . *Isoperla* is generally intolerant to pollution while *Cheumatopsyche* is known to be facultative in its tolerance to pollution (Weber 1973). A relatively high bacterial count (79 per 100 ml.) reflects the moderately degraded water quality (Table 5). Most of the local watershed was composed of farm land in row crops, but cattle grazing in adjacent streamside pastures also accounted for about 10 percent of the land use and probably contributed to the bacterial level in the stream. A rock (40 percent), gravel (30 percent), sand (30 percent) bottom substrate exists at this stream. The abundance of loose rocks offers good fishery habitat. Seine samples collected in the study accounted for five species of fish, reflecting a fairly diverse fishery. Dr. D. A. Etnier found six species of fish by cyanide sampling in 1940. Sparse overstory and moderate understory vegetation characterize the local watershed.

Station 7-D (Machine Branch)

With a diversity of 3.26 and evenness of 0.95, the relative water quality of this stream is high (Table 4). A low bacterial count

of 6 fecal coliform per 100 ml. also supports this interpretation (Table 5). The low bacterial count was, however, surprising since some of the adjacent land is used for cattle pasturage (15 percent) while the remainder of the local watershed is wooded (85 percent). A resulting dense overstory and understory vegetation characterizes the streambank. The discharge was relatively low at the time of sampling. A gravel (60 percent), rock (25 percent), mud (15 percent) substrate provides habitat for a fairly diverse fishery comprising six different species.

Station 8-D (Mill Creek)

This station and Station 9-D (Caney Creek) are almost identical in diversity and evenness (Table 4). A very high figure on both indices indicates high water quality. The bacterial count was also low at 22 fecal coliform (Table 5). Only a single species, the blacknose dace, was found at this station. Moderate siltation pollution apparently limits the fishery at this station; the bottom substrate is rock (30 percent), boulder (25 percent), sand (25 percent), silt (20 percent). Dense overstory and moderate understory vegetation provide shade and cover on the stream bank. The local watershed is about 60 percent timber, 20 percent pasture, 20 percent cultivation. It is subject to moderate flooding. Moderate flow existed at the time of sampling.

Station 9-D (Caney Creek)

This station was similar to Mill Creek in almost all characteristics except fish (Tables 4 and 5). Four species of fish were found at this station, reflecting an average diversity comparatively in the study area. A bacterial count of 52 fecal coliform was higher than that of Mill Creek, and the presence of pollution-tolerant chironomidae indicates some degradation probably exists. Moderate siltation pollution was evident. About 80 percent of the watershed is in timber, and 20 percent is pasture. Dense overstory and understory vegetation characterize the stream bank. The bottom substrate is sand (50 percent), silt (20 percent), rock (20 percent), boulder (10 percent),

Station 10-C (Gnatty Branch)

A moderately low relative diversity and high evenness characterized the benthos of this station (Table 4). Although a high bacterial count was thought likely with the Sevier County Animal Shelter upstream and low flow conditions in the stream, a fecal coliform count of only 20 (Table 5) was present. The stream bank was characterized by moderate overstory and understory vegetation. A rock (40 percent), sand (35 percent), silt (35 percent) substrate provided bottom habitat. Only two species comprised the fishery.

Station 11-C (Little Pigeon - West Prong)

The Little Pigeon system has two principle components, the West and Middle Prongs. The West Prong receives municipal sewage effluents from Gatlinburg and Pigeon Forge. This station reflected this municipal pollution with a low diversity and eveness (Table 4). The fishery composition is, however, high owing largely to the mere size and habitat diversity provided by a rock (60 percent) and boulder (40 percent) substrate. Moderate overstory and understory vegetation provides good stream side cover. The bacterial count was 324 fecal coliform (Table 5), resulting from the municipal pollution, and thus presents a health problem to water contact recreation.

Station 12-B (Lindsey Creek)

This stream has a high water quality, as evidenced by a diversity of 3.95 and evenness of 0.95 in the benthic community (Table 4). The presence of Lumbriculidae (aquatic worms), which are pollution tolerant, gives some indication of pollution degradation. The local water shed is agricultural (60 percent) and pasture (40 percent), with cattle-caused stream bank erosion. This habitat destruction is probably responsible for the low fish diversity and may eventually cause a significant decline in the benthos. There is only spare overstory and understory vegetation with low flow conditions. A rock (50 percent), sand (30 percent), silt (20 percent) substrate exists at this station, with siltation coming mainly from the stream bank erosion. The fecal coliform count was 5 (Table 5).

Station 13-B (Webb Creek)

This station has a relatively high diversity (3.22), but a significantly low evenness (0.77) to indicate water quality degradation (Table 4). The fishery is fairly diverse, ranging from a composition of three species by this survey and five species by D. A. Etnier in 1975. The local watershed is about 65 percent timber and 35 percent pasture. The relatively high number of cattle grazed in this area apparently accounts for the high bacterial count of 448 fecal coliform (Table 5). There is a rock (60 percent), boulder (30 percent), sand (10 percent) substrate with relatively rapid flow, providing good benthic and fishery habitat.

Station 14-C (Little Pigeon River - Middle Prong)

As previously stated, the Little Pigeon River has two principle components, with the Middle Prong forming that which is relatively pristine. It is not, however, pollution free. Although a relatively high diversity is present, the evenness index is only 0.62, indicating water quality degradation (Table 4). A highly diverse fishery exists at this station, as indicated both by samples of this study, with seven species represented, and those of Dr. D. A. Etnier, represented by 11 species. This is mainly a factor of the abundant habitat provided by this wide stream characterized by a rock (60 percent), boulder (30 percent), gravel (10 percent) substrate. Rainbow trout were observed but not captured. A

bacterial count of 59 fecal coliform indicates some fecal pollution (Table 5), but not high enough to present a hazard to body contact recreation. The flow is rapid in this stream. The stream has moderate overstory and understory vegetation.

Station 15-C (Bird Creek - East Prong)

Bird Creek has two prongs (East and West) which are nearly equal in their benthic composition, both in diversity and evenness (Table 4). The fishery of both is also represented by the same kind and number of species (two). The stream bank cover was poor with sparse overstory and understory vegetation created by the opening of several fields in the previously wooded area. Some stream bank erosion is apparent from moderate flooding of the watershed. A sand (60 percent), silt (30 percent), gravel (10 percent) substrate exists at this station. The local watershed is 60% timber, 40 percent pasture. The bacterial count was average at 59 fecal coliform (Table 5).

Station 16-C (Bird Creek - West Prong)

As previously stated, this station has a benthic composition similar to Station 15-C (Bird Creek - East Prong). Stream bank cover is poor but somewhat improved over Station 15-C, with sparse overstory and moderate understory vegetation. A sand (60 percent), silt (25 percent), rock (15 percent) substrate characterizes this stream portion. Open fields are also present in this portion of stream

shed, with additional openings created by a powerline right-of-way clearing which parallels the stream at this point. The local watershed is 40 percent timber, 10 percent cultivation, 50 percent pasture. Eroded stream banks are caused by moderate flooding conditions apparent over the shallow banks and by the access of cattle and sheep to the stream. An extremely high bacterial count was found at this station, 3173 fecal coliform (Table 5), which is well above body contact standard and may be a factor of cattle defecation to the streamshed.

DISCUSSION

The overall water quality of study streams which would be crossed by the proposed Foothills Parkway Extension is moderately high. A diverse benthic community was found at most stations, and many were composed of species known to be intolerant to pollution. A wide variation in the abundance of fishes and number of fish species was evident throughout the streams surveyed; thus, few generalized statements can be assessed in their regard. Nonetheless, some stations reflected degradation of stream quality by a relatively simple and unstable fish species composition. High levels of degradable organic waste, as indicated by high bacterial counts, resulted in high abundance of a few fish species at some stations and reflected an imbalanced fish community. Other streams, however, had a relatively diverse fishery, indicating the stability of the stream water quality. Many streams in the area are composed of a simple fish species composition, even in clean water. Bacterial counts ranged from very low (almost drinking water quality) to exceedingly high owing to municipal or agricultural (especially cattle) organic loading of stream systems. Whereas the average coliform count was 285 per 100 ml. for the streams sampled, only three stations actually exceeded 200 per 100 ml: Little Pigeon (West Fork), Webb Creek, and Bird Creek (West Prong). The exceedingly high count at Bird Creek (West Prong) may be due to a combination of agricultural runoff (especially cattle and sheep), low flow conditions, and rain previous to the sampling. Bacterial levels tend to build up.

The effect of road-building activities on the various communities of organisms will vary with the present stresses already acting on them. Those streams supporting highly diverse systems of aquatic life and which are relatively free from contamination and disturbance will probably suffer the greatest impact. Siltation from bank erosion is generally believed to be detrimental to some of the more sensitive species. Road cuts on steep slopes of the proposed parkway would be wide and could cause considerable soil erosion. The impact of such erosion on the aquatic life of the stream would depend in part on the amount and duration of erosion.

Although heavy sedimentation of riffles and pools will substantially affect the benthic macroinvertebrate communities in streams, the overall abundance of such organisms may not be markedly decreased by by sedimentation in relatively small portions of the streams. Insect species diversity usually decreases temporarily in natural streams after sedimentation of riffles, but Bjornn (1974) found no measurable effect on the density of benthic or drifting insects one or more days after sedimentation was completed in the streams he studied.

Reduction of pool area and volume from heavy sedimentation in the surveyed streams could result in a reduction of the capacity of streams to support and produce fish. Rainbow trout would probably be one of the most sensitive species to sedimentation resulting from construction of the road.

CONCLUSION

The macroinvertebrate $\bar{d}$ and e indices indicate that most of the streams crossed by the proposed Foothills Parkway Extension are of moderately high water quality. In some cases, degradation of water quality has occurred from sewage outfalls, agricultural runoff, and poor land use.

There is indication of fecal contamination in some streams, but most (81 percent) met with standards considered safe for body contact recreation set by the State of Tennessee (1971).

Studies of the possible sedimentation of streams resulting from the road construction would be appropriate.

VEGETATION SURVEY

The right-of-way was sampled for vegetation in March/April 1977. Twenty-six vegetation plots were taken, and, along with reconnaissance observations, were used to construct a rough vegetation map (see Figures 9 and 10). Trees were sampled within 10 x 20 meter plots. Shrubs and saplings were sampled within a tree plot in 10 x 10 meter quadrats. Herbs were sampled within tree plots using ten 1 x 1 meter plots.

Woody plants were arbitrarily divided into size classes. Stems greater than 4 centimeters (cm.) in diameter at breast height (dbh) were classed as trees. Those less than 4 cm. dbh, but greater than 1 cm. dbh, were classed as saplings. All woody stems less than 1 cm. dbh were classed as shrubs. Woody vines, including *Parthenocissus quinquefolia* (Virginia creeper), *Rhus toxicodendron* (poison ivy), *Lonicera japonica* (Japanese honeysuckle), *Smilax* spp. (catbrier), *Vitis* spp.(grape), and *Rubus* spp. (blackberry) were placed in these categories.

Numbers of individuals were recorded for woody species. Herbs were estimated by percent cover. A vegetation list is appended. Vegetation types were subjectively determined by frequency and size of trees and shrubs. Three broad types were found: a dry pine, oak, maple type; a mesic, multi-specied cove type; and an open-field-to-successional-

SECTIONS 8B AND 8C

VEGETATION MAP

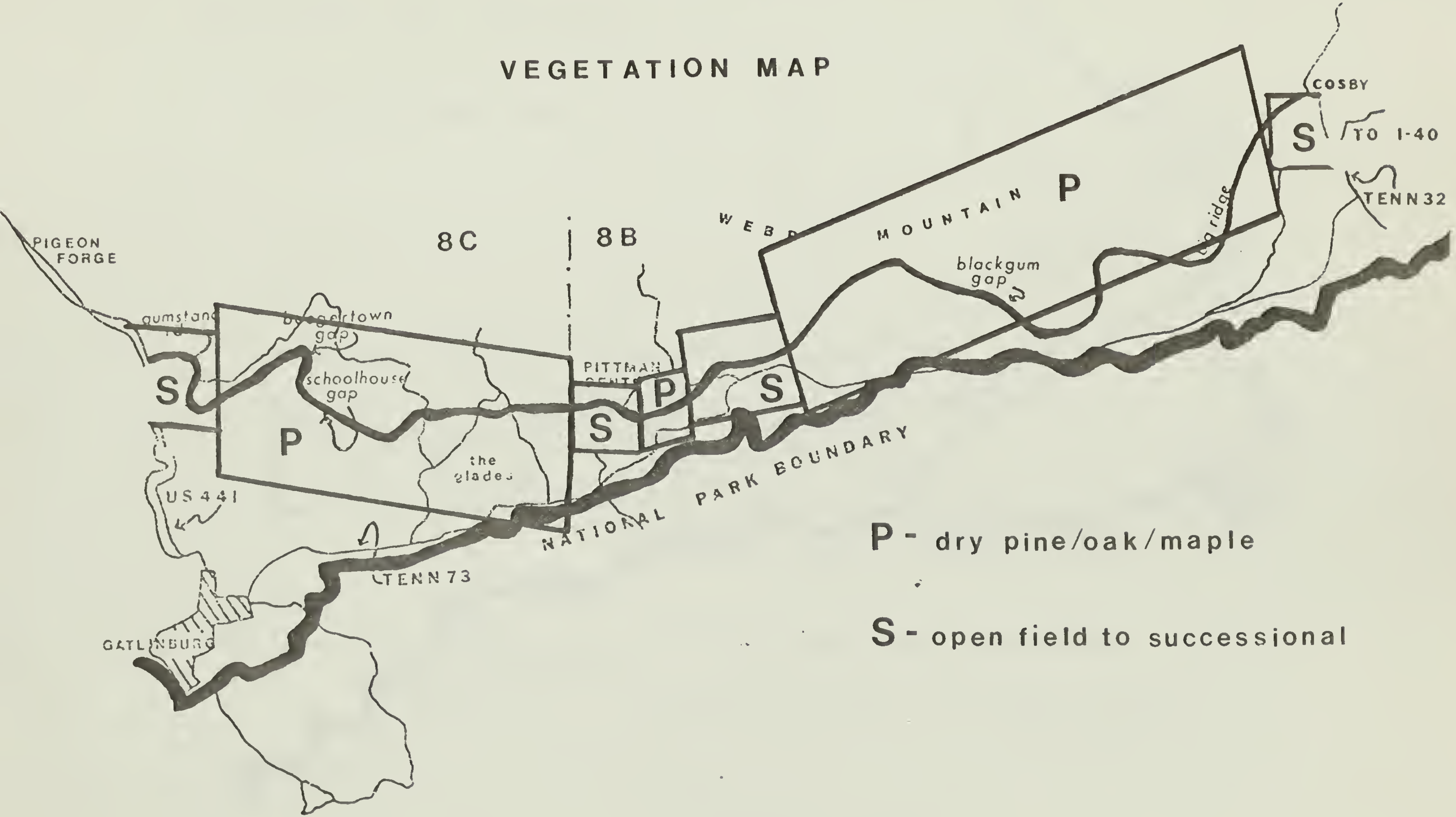


Figure 9

SECTIONS 8D AND 8E

VEGETATION MAP

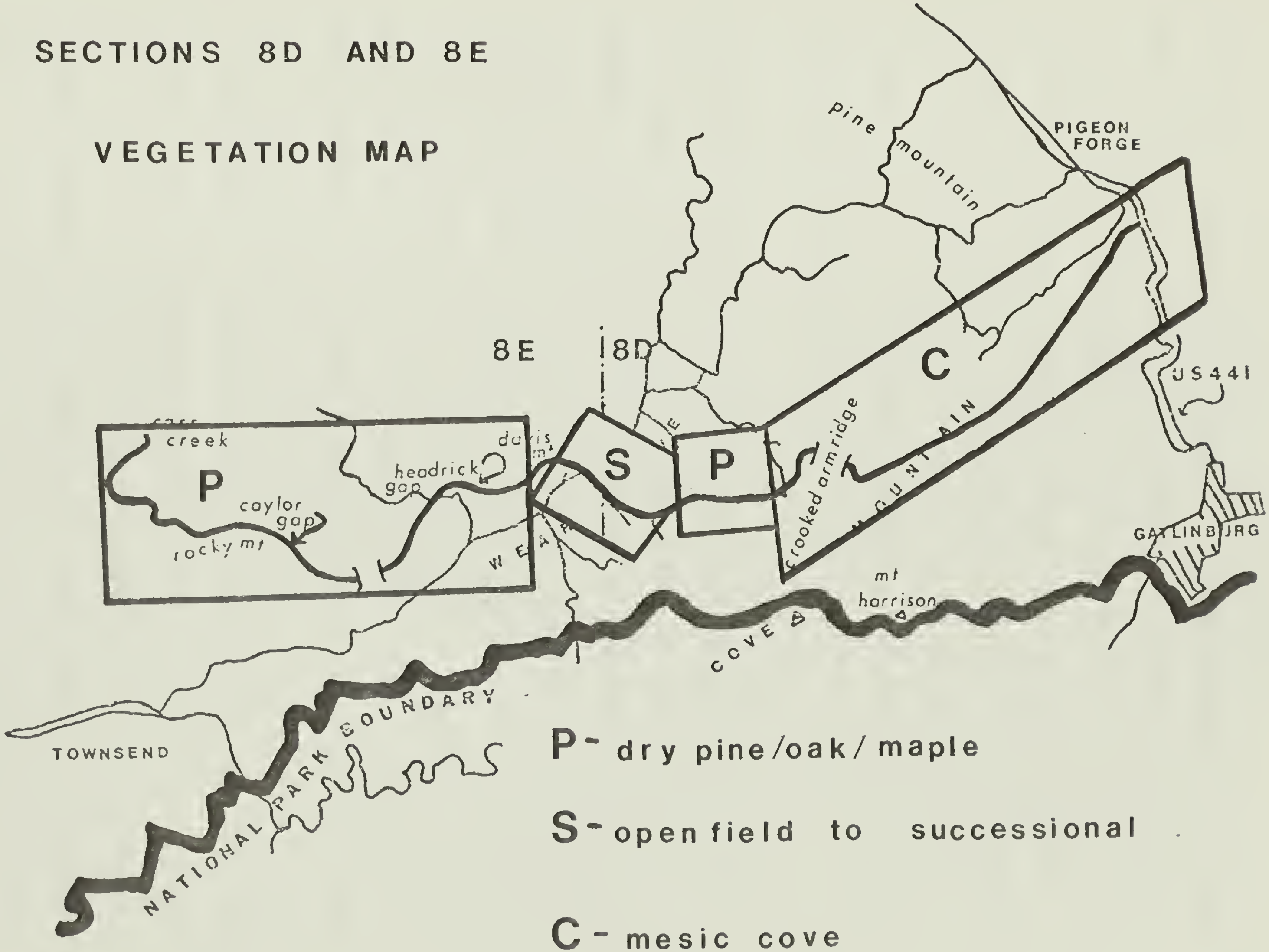


Figure 10

forest type. None of the right-of-way travels through virgin forest. Most of the area has been logged, burned, or diseased, as evidenced by sawed stumps, charred logs, and chestnut suckers. In some areas, the logging is recent. Forests ranged in age from young saplings not older than 15 years to mature forests of trees about 70-100 years old. There were several old homesites and fields on the right-of-way with large trees with spreading habits. These would be scattered among younger, second growth stems.

The Foothills Parkway travels primarily along ridgetops and south-facing slopes for most of its length. These are the most xeric habitats. The vegetation is represented by plants that can withstand prolonged periods of dry weather, shallow, rocky soil, high winds, and greater amounts of sunshine. Species that are most often found in these habitats are pines, oaks, red maple and blackgum. Dominance varied with each plot. *Pinus virginiana* (Virginia), *P. pungens* (Table Mountain), *P. strobus* (white), *P. rigida* (pitch), and *P. echinata* (short needle), were the pine species present. *Quercus rubra* (red), *Q. alba* (white), *Q. velutina* (black), *Q. prinus* (chestnut), *Q. coccinea* (scarlet), and *Q. marilandica* (blackjack) were the oak species found. *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood) were often present. *Cornus florida* (flowering dogwood), *Carya glabra* (pignut hickory), and *C. tomentosa* (mockernut hickory) were common in many of the samples.

Red maple was the most common young tree in the sapling category, and in the shrub category as well. Other common saplings were dogwood, oaks, hickories, blackgum, black cherry (*Prunus serotina*), serviceberry (*Amelanchier arborea*). The pine species were not well represented in the shrub category or the sapling category. Pines are generally thought to be successional. After logging, burning, or farming, pines reforest dry ridges and slopes. They are not as successful as other species, however, at surviving under an existing tree canopy.

The most common shrubs were ericaceous. *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (rhododendron), *R. calendulaceum* (flame azalea), *Gaylussacia ursina* (huckleberry), *Epigaea repens* (trailing arbutus), and *Vaccinium* spp. (blueberry) were well represented. *Pyrularia pubera* (buffalo-nut), *Euonymus americanus* (heart's-a-bustin'), and *Smilax* spp. (catbrier) were present in every plot sampled.

Ericads and pines create an acid soil which is unfavorable for the growth of many herbs. Very often, ericads constitute 100 per cent of the ground cover. Consequently, few herbs, both in number and diversity, were found in these areas. *Chimaphila maculata* (pipsissewa), *Galax aphylla* (galax), *Polystichum acrostichoides* (christmas fern), *Pteridium*

aquilinum (bracken), and *Gaultheria procumbens* (wintergreen) were the most common herbs. Other herbs present included *Lysimachia quadrifolia* (whorled loosestrife), *Aster* spp. (aster), *Solidago* spp. (goldenrod), *Prenanthes* spp. (coltsfoot), *Polygonatum biflorum* (Solomon's seal), and others, which are appended. *Polytrichum* sp., when present, covered up to 60 percent of the sample plot floor. Maximum ground cover of other herbs was 20 percent. More commonly, herbs covered 1 percent to 5 percent of the sample plot floor.

Approximately 25 miles of the Foothills Parkway right-of-way is covered in this pine-oak-maple forest.

About 7 miles of the right-of-way travels through lowland agricultural areas. These areas include Wear Cove, the old Gatlinburg city dump, Pittman Center area, and Shults Cove. These areas vary greatly in vegetation, ranging from cleared pastureland through all stages of succession, to early tulip-poplar forests.

Three of the five plots taken contained herbs only. *Festuca sciurea* (fescue) covered more than 100 percent of the ground in all plots. Many weedy herbs were also present in abundance: *Taraxacum officionale* (dandelion), *Bidens* sp. (beggar's ticks), *Lactuca* spp. (wild lettuce) *Aster* spp., *Solidago* spp., *Andropogon scoparius* (little blue stem), and many others. These open fields, when left to revegetate, will

succeed from grassland to briers to tulip-poplar second growth forest (see Management Report No. 9, page 77). The other two open-field plots were very similar to the above, but in a later successional stage. One, next to the Middle Prong of the Little Pigeon River, had greater than 100 per cent cover of *Lonicera japonica*, an exotic vine. *Rubus* sp. was also very common. *Rosa multiflora* was present in both of these plots, as well as many weedy herbs.

Five plots were taken in mesic forests. These varied tremendously, depending on their past history. Areas that were once open fields and homesites show mature trees with younger successional forests in unusual combinations. One plot contained old hemlock and beech trees, with young Virginia pine. Another had many mature holly trees, with tulip-poplar, sourwood, and red maple growing underneath. This area had an extremely diverse shrub and sapling layer. Twenty-eight species were represented. The most common was red maple. Silverbell (*Halesia carolina*), white oak, sassafras (*Sassafras albidum*), were also common. The most frequent shrubs were buffalo-nut, hearts-a-bustin', and Virginia creeper. Twenty-one herbs were represented.

A hemlock forest type was found in the Caney Creek watershed. The hemlocks ranged in size from 10-50 cm. dbh. Other trees found in the plot included an 80 cm. dbh white oak, several large beech trees,

a large tulip-poplar, and a red oak. The understory had many rhododendrons, calycanthus, euonymus, and dogwoods. The herb layer was rich. Twenty-three different herb species were found. Among the most common were *Smilacina racemosa* (false solomon's seal), *Polygonatum biflorum* (solomon's seal), *Trillium luteum* (yellow trillium), *Arisaema triphyllum* (jack-in-the-pulpit), and *Asarum arifolium* (little brown jug). Another mesic plot from the slopes of Cove Mountain had thirteen species of trees. The trees are young and crowded together. Among them are beech, buckeye, tulip-poplar, black cherry. The understory, with 17 different woody species, contained many mesic tree saplings. The herb layer also was diverse, with 28 species represented.

On the site of the Green Mountain developed area, a sphagnum moss mat occupies the creek bed for approximately 120 feet and averages 10 feet in width. Sphagnum mats are a limited habitat in the Smoky Mountains. and this particular site contains *Juncus* effusus, Sphagnum palustre, *Oxypolis rigidior, Osmunda cinnamomea, Carex baileyi, Eupatorium* spp. and others.

Other notable plants in the developed area site include flame azalea and scattered patches of lily-of-the-valley (*Convallaria montana*, a scarce species in the mountains) and pink lady slipper (*Cypripedium acaule*).

DISCUSSION

Botanically, the Foothills Parkway will not be visually exciting. Motorists driving along it will find little variation in forest type. Most of the road will pass through pines, oaks, hickories and red maples. The trees are young and crowded close together, so that the structure of the forest behind the front row of stems will not be evident to the motorist. There will be some displays of dogwood and mountain laurel when in bloom, but no concentrated accumulations of flowers.

On the north slopes of Cove Mountain, mesic forests will be encountered. The trees are young and close together, so again, the motorist will have difficulty seeing the structure of the forest. No large wild-flower concentrations were found, although the entire right-of-way was not surveyed. Rhododendron and dogwood would provide showy displays when in bloom, as well as some of the trees such as tulip-poplar, buckeye, silverbell and magnolia.

The successional and field areas will not offer much in the way of floral displays. There will be composites in the late summer and fall.

Unusual habitats were looked for on the right-of-way. Areas of virgin forest and rare and endangered plants were also looked for. None were found. It seems that the Foothills Parkway will not be harming any forest areas which should be preserved, although damage to the sphagnum area at Green Mountain should be avoided.

ANIMALS OF THE FOOTHILLS PARKWAY

The procedure employed for the animal census of the Foothills Parkway was as follows:

All vertebrates sighted were recorded.

Any rare and endangered species found were given special consideration.

Limestone caves in the area were checked for the Indiana bat (*Myotis sodalis*), an endangered species.

Most of the animal census was done while vegetation sampling within the road route and while walking the road route during the final phase of the project right-of-way.

An investigation of the limestone caves near the road revealed no evidence of the Indiana bat. An Eastern Box turtle (*Terrapene c. carolina*) was found on an unnamed ridge above Boogertown Gap. Woodchucks (*Marmota monax*) and their burrows were spotted in the Black Gum Gap above Butler Branch. Residents in the area of the right-of-way have reported sightings of raccoon (*Procyon lotor*) and opossum (*Didelphis virginiana*).

Although not sighted, the animals whose range extends into the Foothills Parkway right-of-way, according to Burt and Grossenheider (1964) and Linzey and Linzey (1971), are listed in Appendix A.

SUMMARY AND CONCLUSIONS

The completed Foothills Parkway would provide a scenic drive for many people. As with any construction activity, however, the benefits must be weighed against unavoidable detrimental effects. The Foothills Parkway is to be part of a "circle-the-Smokies" drive. At present about one-quarter of this drive is complete, with the remainder in the theory stage. The circle was proposed as one solution to ease traffic congestion within the national park. The Foothills Parkway will provide an alternate but will not be a faster way to traverse the Great Smoky Mountains. Maximum speed will be 45 m.p.h., and many areas will require reduced speeds. The parkway will be scenic, as are existing highways.

The negative aspects of road construction are as follows:

1) Many trails within the national park, including the Appalachian Trail and trails to Mount LeConte, will be within sight or hearing distance of the Foothills Parkway.

2. Siltation may cause a temporary lowering of aquatic faunal diversity.

3) Increased traffic may affect the quality of life in adjacent rural and developed areas.

4) Due to theoretical geological hazards and steepness of slopes, mitigating construction measures will have to be taken to ensure road stability. This will increase cost. Due to the steepness of some slopes, many roadcuts will have to be very wide.

5) Several archeological sites may be harmed (see archeological report).

6) The road may be expensive to maintain.

The positive aspects of road construction are as follows:

1) It will increase the mileage of scenic drives and the number of day use areas available to the vehicle-oriented visitor.

2) Unlike a number of other proposed road routes, the Foothills Parkway does not go through any known virgin forest areas or critical habitat for endangered or potentially endangered species.

3) No streams containing native trout populations will be affected.

4) Further construction of scenic roads will attract visitors to the area, which should prove economically advantageous for some residents of neighboring communities.

One alternative to the Foothills Parkway, which has been previously suggested, would be to upgrade existing roads. There are roads which parallel the right-of-way. Some of these are scenic. Tennessee State Highway 73 is not congested now. Part of the Wear Cove Road is being expanded to four lanes and the rest could be upgraded.

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APPENDIX

LIST OF APPENDICES

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APPENDIX A.

Animals and Birds.

Table A-1. Animals.

Insectivora	
Soricidae	
Masked Shrew	*Sorex cinereus*
Smoky Shrew	*S. fumeus*
Southeastern Shrew	*S. longirostris*
Longtail Shrew	*S. dispar*
Pygmy Shrew	*Microsorex hoyi*
Least Shrew	*Cryptosis parva*
Short-tail Shrew	*Blarina brevicauda*
Northern Water Shrew	*Sorex palustris*
Talpidae	
Star-nosed Mole	*Condylura cristata*
Eastern Mole	*Scalopus aquaticus*
Hairy-tailed Mole	*Parascalops breweri*
Lagomorpha	
Leporidae	
Snowshoe Hare	*Lepus americanus*
Eastern Cottontail	*Sylvilagus floridanus*
New England Cottontail	*S. transitionalis*
Rodentia	
Sciuridae	
Red Squirrel	*Tamiasciurus hudsonicus*
Fox Squirrel	*Sciurus niger*
Southern Flying Squirrel	*Glaucomys volans*
Northern Flying Squirrel	*G. sabrinus*
Eastern Chipmunk	*Tamias striatus*
Eastern Gray Squirrel	*Sciurus carolinensis*
Cricetidae	
Eastern Harvest Mouse	*Reithrodontomys humulis*
White-footed Mouse	*Peromyscus leucopus*
Golden Mouse	*Ochrotomys nuttalli*
Eastern Woodrat	*Neotoma floridana*
Rice Rat	*Oryzomys palustris*
Hispid Cotton Rat	*Sigmodon hispidus*
Southern Bog Lemming	*Synaptomys cooperi*
Gapperis Red-backed Mouse	*Clethrionomys gapperi*
Meadow Vole	*Microtus pennsylvanius*
Rock Vole	*M. chrotorrhinus*
Muskrat	*Ondatra zibethicus*

Table A-1. Animals - Cont.

Zapodiae	
Meadow Jumping Mouse	*Zapus hudsonicus*
Woodland Jumping Mouse	*Napaeozapus insignis*
Carnivora	
Mustelidae	
Least Weasel	*Mustela nivalis*
Longtail Weasel	*M. frenata*
Mink	*M. vison*
Spotted Skunk	*Spilogale putorius*
Striped Skunk	*Mephitis mephitis*
Canidae	
Red Fox	*Vulpes vulpes*
Grey Fox	*Urocyon cinereoargenteus*
Lervidae	
White-tailed Deer	*Odocoileus virginianus*

Table A-2. Birds.

The birds whose range is found in the Foothills Parkway Right-of-Way, as cited in Stupka (1963) and Robins, Bruan, and Zim (1966), are listed below:

Family Accipitridae	
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*A. cooperii*
Red-tailed Hawk	*Buteo jamaicensis*
Broad-winged Hawk	*B. platypterus*
Falconidae	
Sparrow Hawk	*Falco sparverius*
Tetraonidae	
Ruffed Grouse	*Bonasa umbellus*
Phasianidae	
Bobwhite	*Colinus virginianus*
Meleagrididae	
Turkey	*Meleagris gallopa*
Charadriidae	
Killdeer	*Charadrius vociferus*
Scolopacidae	
American Woodcock	*Philohela minor*
Common Snipe	*Capella gallinago*
Columbidae	
Mourning Dove	*Zenaidura macroura*
Cuculidae	
Yellow-billed cuckoo	*Coccyzus americanus*
Black-billed cuckoo	*C. erythropthalmus*
Tytonidae	
Barn Owl	*Tyto alba*
Strigidae	
Screech Owl	*Otus asio*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Saw-Whet Owl	*Aegolius acadicus*

Table A-2. Birds - Cont.

Caprimulgidae	
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*C. vociferus*
Common Night Hawk	*Chordeiles minor*
Apodidae	
Chimney Swift	*Chaetura pelagica*
Trochilidae	
Ruby-throated Hummingbird	*Archilochus colubris*
Acedinidae	
Belted Kingfisher	*Megaceryle alcyon*
Picidae	
Yellow-shafted Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Red-bellied Woodpecker	*Centurus carolinus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Hairy Woodpecker	*Dendrocepos villosus*
Downy Woodpecker	*D. pubescens*
Tyrannidae	
Eastern Kingbird	*Tyrannus tyrannus*
Great Crested Flycatcher	*Myiarchus arinitus*
Eastern Phoebe	*Sayornis phoebe*
Acadian Flycatcher	*Empidonax vires*
Traillis Flycatcher	*E. traillii*
Least Flycatcher	*E. minimus*
Eastern Wood Pewee	*Contopus virens*
Olive-sided Flycatcher	*Nuttallornis borealis*
Alaudidae	
Horned Lark	*Eremophila alpestris*
Hirundinidae	
Tree Swallow	*Iridoprocne bicolor*
Rough-winged Swallow	*Stelgidopteryx ruficollis*
Barn Swallow	*Hirundo rustica*
Purple Martin	*Progne subis*
Corvidae	
Blue Jay	*Cyanocitta cristata*
Common Crow	*Corvus brachyrhynchos*

Table A-2. Birds - Cont.

Paridae	
Black-capped Chickadee	*Parus atricapillus*
Carolina Chickadee	*P. carolinensis*
Sittidae	
White-breasted Nuthatch	*Sitta carolinensis*
Red-breasted Nuthatch	*S. canadensis*
Certhiidae	
Brown Creeper	*Certhia familiaris*
Troglodytidae	
House Wren	*Troglodytes aedon*
Winter Wren	*T. troglodytes*
Bewick's Wren	*Thryomanes bewickii*
Carolina Wren	*Thryothorus ludovicianus*
Mimidae	
Mockingbird	*Mimus polyglottos*
Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
Turdidaze	
Robin	*Turdus migratorius*
Wood Thrush	*Hylocichla mustelina*
Hermit Thrush	*H. guttata*
Swainson's Thrush	*H. ustulata*
Veery	*H. fuscescens*
Eastern Bluebird	*Sialia Sialis*
Sylviidae	
Blue-Gray Gnatcatcher	*Polioptila caerulea*
Golden-throated Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*R. calendula*
Bombycillidae	
Cedar Waxwing	*Bombycilla cedrorum*
Laniidae	
Loggerhead Shrike	*Lanius ludovicianus*
Sturnidae	
Starling	*Sturnus vulgaris*
Vireonidae	
White-eyed Vireo	*Vireo griseus*
Yellow-throated Vireo	*V. flavifrons*
Solitary Vireo	*V. solitarius*
Red-eyed Vireo	*V. olivaceus*

Table A-2. Birds - Cont.

Parulidae	
Black-to-White Warbler	*Mniotilta varia*
Worm-eating Warbler	*Helmitheros vermivorus*
Golden-winged Warbler	*Vermivora chrysoptera*
Tennessee Warbler	*V. peregrina*
Parula Warbler	*Parula americana*
Yellow Warbler	*Dendroica petechia*
Magnolia Warbler	*D. magnolia*
Cape May Warbler	*D. tigrina*
Black-throated Blue Warbler	*D. caerulescens*
Myrtle Warbler	*D. coronaia*
Black-throated Green Warbler	*D. virens*
Blackburnian Warbler	*D. fusca*
Yellow-throated Warbler	*D. dominica*
Chestnut-sided Warbler	*D. pensylvanica*
Blackpoll Warbler	*D. striata*
Pine Warbler	*D. pinus*
Prarie Warbler	*D. discolor*
Palm Warbler	*D. palmarum*
Ovenbird	*Seiurus aurocapillus*
Louisiana Waterthrush	*S. motacilla*
Kentucky Warbler	*Oporornis formosus*
Yellowthroat	*Geothlypis trichas*
Yellow-breasted Chat	*Icteria virens*
Hooded Warbler	*Wilsonia citrina*
Canada Warbler	*W. canadensis*
American Redstart	*Setophaga ruticilla*
Ploceidae	
House Sparrow	*Passer domesticus*
Icteridae	
Eastern Meadowlark	*Sturnella magna*
Redwinged Blackbird	*Agelaius phoeniceus*
Orchard Oriole	*Icterus spurius*
Common Grackle	*Quiscalus quiscula*
Thraupidae	
Scarlet Tanager	*Piranga olivacea*
Summer Tanager	*P. rubra*
Fringillidae	
Cardinal	*Richmondena cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Evening Grosbeak	*Hesperiphona vespertina*

Table A-2. Birds - Cont.

Fringillidae - Cont.	
Purple Finch	*Carpodacus purpureus*
American Goldfinch	*Spinus tristis*
Red Crossbill	*Loxia curvirostra*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Vesper Sparrow	*Pooecetes gramineus*
Slate-colored Junco	*Junco hyemalis*
Chipping Sparrow	*Spizella passerina*
Field Sparrow	*S. pusilla*
White-throated Sparrow	*Zonotrichia albicollis*
Fox Sparrow	*Passerella iliaca*
Swamp Sparrow	*Melospiza georgiana*
Song Sparrow	*M. melodia*

APPENDIX B.

Benthic Macroinvertebrates collected at each study stream

Table B-1. Cosby Creek Benthic Macroinvertebrates.
Station No. 1-B

Order / Family / Sub-family / Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Isonychia	5
Heptageniidae	
Stenonema	3
Plecoptera	
Perlidae	
Acroneuria	2
Peltoperlidae	
Peltoperla	1
Nemouridae	
Nemoura	1
Trichoptera	
Limnephilidae	
Pysnopsyche	1
Diptera	
Tipulidae	
Tipulinae	
Tipula	1
Coleoptera	
Psephenidae	
Psephenus	1
Decapoda	
Cambaridae	
Cambarus	2

n = 17
$\underline{s}$ = 9
$\bar{d}$ = 2.88
e = 1.12

Table B-2. Dunn Creek Benthic Macroinvertebrates. Station No. 2-B.

Order / Family / Subfamily / Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Heptageniidae	
Iron	1
Stenonema	13
Siphlonurinae	
Siphlonurus	1
Ephemeridae	
Ephemera	1
Baetidae	
Ephemerellinae	
Ephemerella	3
Plecoptera	
Pteronarcidae	
Pteronarcys	4
Trichoptera	
Rhyacophilidae	
Rhyacophila	3
Hydropsychidae	
Hydropsyche	1
Limnephilidae	
Limnephilus sp. 1	1
Limnephilus sp. 2	1
Odonata	
Gomphidae	
Hagenius	1
Diptera	
Rhagionidae	
Atherix variegata	1
Tipulidae	
Tipulinae	
Tipula	1

Table B-2. Dunn Creek Benthic Macroinvertebrates - Cont.
Station No. 2-B.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Megaloptera	
Corydalidae	
Chauliodes	1
Gastropoda	
Pleuroceridae	
Goniobasis	6
Decapoda	
Astacidae	
Cambarinae	
Cambarus	3
Orconectes	3

n = 49
s = 17
$\bar{d}$ = 3.52
e = 0.95

Table B-3. Ogle Spring Branch Benthic Macroinvertebrates.
Station No. 3-B.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Ephemerellidae	
Ephemerella	37
Baetis	2
Pseudocloeon	2
Siphlonuridae	
Ameletus	5
Leptophlebiidae	
Paraleptophlebia	1
Heptageniidae	
Stenonema	9
Epeorus	5
Ephemeridae	
Ephemera	2
Plecoptera	
Nemouridae	
Nemourinae	
Nemoura	2
Capniinae	
Allocapnia	1
Peltoperlidae	
Peltoperla	14
Perlodidae	
Isoperlinae	
Isoperla	1
Nemouridae	
Nemourinae	
Amphinemoura	7
Trichoptera	
Hydropsychidae	
Cheumatopsyche	10
Hydropsyche	1
Rhyacophilidae	
Rhyacophila	1

Table B-3. Ogle Spring Branch Benthic Macroinvertebrates - Cont.
Station No. 3-B.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Diptera	
Tipulidae	
Tipulinae	
Tipula	3
Oligochaeta	
Lubriculidae	2
Coleoptera	
Elmidae	
Optioservus	1
Gastropoda	
Pleuroceridae	
Goniobasis	4

n = 110
s = 20
$\bar{d}$ = 3.38
e = 0.75

Table B-4. Butler Branch Benthic Macroinvertebrates. Station No. 4-B.

Order / Family / Subfamily / Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Heptageniidae	
Stenonema	6
Leptophlebiidae	
Paraleptophlebia	8
Plecoptera	
Peltoperlidae	
Peltoperla	3
Perlodidae	
Isoperlinae	
Isoperla	2
Nemouridae	
Nemourinae	
Amphinemoura	1
Chloroperlidae	
Chloroperlinae	
Hastaperla	9
Trichoptera	
Hydropsychidae	
Hydropsyche	6
Cheumatopsyche	1
Diptera	
Tipulidae	
Tipulinae	
Tipula	3
Megaloptera	
Corydalidae	
Nigronia	2
Gastropoda	
Pleuroceridae	
Goniobasis	2

Table B-4. Butler Branch Benthic Macroinvertebrates - Cont.
Station No. 4-B.

n = 44
s = 11
$\bar{d}$ = 3.20
3 = 1.18

Table B-5. Matthew Creek Benthic Macroinvertebrates.

Station No. 5-B.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Ephemernptera	
Heptageniidae	
Stenonema	2
Ephemerellidae	
Ephemerella	4
Plecoptera	
Peltoperlidae	
Peltoperla	1
Nemouridae	
Nemourinae	
Amphinemoura	4
Capniinae	
Allocapnia	1
Perlodidae	
Isoperlimae	
Isoperla	3
Trichoptera	
Hydropsychidae	
Cheumatopsyche	3
Diptera	
Tipulidae	
Tipulinae	
Antocha	1
Tipula	3
Coleoptera	
Elmidae	
Elmini	
Promoresia	6
Psephenidae	
Psephenus	3

Table B-5. Matthew Creek Benthic Macroinvertebrates. Station no. 5-B.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Oligochaeta	
Lubriculidae	2
Decapoda	
Cambaridae	
- *Cambarus*	1

n = 34
s = 13
$\bar{d}$ = 3.48
e = 1.23

Table B-6. Cove Creek Benthic Macroinvertebrates.
Station No. 6-D.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Isonychia	1
Ephemerellidae	
Ephemerella	6
Plecoptera	
Perlodidae	
Isoperlinae	
Isoperla	28
Trichoptera	
Hydropsychidae	
Cheumatopsyche	29
Odonata	
Aeshnidae	
Boyeria	2
Diptera	
Tipulidae	
Tipulinae	
Tipula	4
Megaloptera	
Corydalidae	
Nigronia	5
Decapoda	
Cambaridae	
Cambarus	2

n = 77
$\underline{s}$ = 8
$\overline{d}$ = 2.18
e = 0.75

Table B-7. Machine Branch Benthic Macroinvertebrates. Station No. 7-D.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Ephemeridae	
Ephemera	1
Ephemerellidae	
Ephemerella	8
Heptageniidae	
Stenonema	8
Plecoptera	
Peltoperlidae	
Peltoperla	6
Nemouridae	
Nemourinae	
Nemoura	2
Trichoptera	
Rhyacophilidae	
Rhyacophila	1
Hydropshchidae	
Hydropsyche	11
Cheumatopsyche	1
Odonata	
Gomphidae	
Hagenius	2
Cordulegasteridae	
Cordulegaster	1
Diptera	
Tipulidae	
Eriocera	2
Coleoptera	
Elmidae	
Optioservus	1

Table B-7. Machine Branch Benthic Macroinvertebrates. Station No. 7-D.

Oligachoeta	
Lubriculidae	2
Decapoda	
Cambaridae	
Cambarus	2

n = 48
s = 14
$\bar{d}$ = 3.26
e = 0.95

Table B-8. Mill Creek Benthic Macroinvertebrates.
Station No. 8-D.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Isonychia	1
Ameletus	1
Ephemerellidae	
Ephemerella	3
Heptagennidae	
Epeorus	8
Plecoptera	
Perlidae	
Acroneuria	4
Perlodidae	
Isoperlinae	
Isoperla	6
Pteronarcidae	
Pteronarcys	6
Trichoptera	
Hydropsychidae	
Hydropsyche	1
Limnephilidae	
Pycnopsyche	1
Odonata	
Gomphidae	
Gomphus	1
Diptera	
Tipulidae	
Tipulinae	
Tipula	1
Hexatoma	1
Decapoda	
Cambaridae	
Cambarus	2
Gastropoda	
Pleuroceridae	
Pleurocera	3

n = 40
$\underline{s}$ = 15
d = 3.59
e = 1.14

Table B-9. Caney Creek Benthic Macroinvertebrates.
Station No. 9-D.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Baetis	10
Isonychia	2
Tipulidae	
Ameletus	3
Ephemerellidae	
Ephemerella	5
Heptageniidae	
Stenonema	7
Plecoptera	
Chloroperlidae	
Chloroperlinae	
Hastaperla	3
Odonata	
Aeshnidae	
Boyeria	1
Gomphidae	
Gomphus	1
Agrionidae	
Agrion	5
Coleoptera	
Psephemidae	
Psephenus	4
Diptera	
Chironmidae	3
Megaloptera	
Corydalidae	
Corydalis cornutus	3

Table B-9. Caney Creek Benthic Macroinvertebrates - Cont.
Station No. 9-D.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Decapoda	
Cambaridae	
Orconectes	1
Gastrapoda	
Pleuroceridae	
Goniobasis	1

n = 55
$\underline{s}$ = 15
$\bar{d}$ = 3.58
e = 1.14

Table B-10. Gnatty Branch Benthic Macroinvertebrates.
Station No. 10-C

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Heptageniidae	
Stenonema	12
Plecoptera	
Nemouridae	
Nemourinae	
Amphinemoura	13
Chloroperlidae	
Chloroperlinae	
Hastaperla	4
Trichoptera	
Rhyacophilidae	
Glossosoma	1
Limnephilidae	
Pycnopsyche	1
Diptera	
Tipulidae	
Tipulinae	1
Tipula	
Tabanidae	
Tabanus	5
Coleoptera	
Psephenidae	
Psephenus	1
Oligochaeta	
Lubriculidae	1
Decapoda	
Cambaridae	
Orconectes	3

n = 52
s = 10
$\bar{d}$ = 2.75
e = 0.92

Table B-10. Gnatty Branch Benthic Macroinvertebrates.
Station No. 10-C.

n = 52
$\underline{s}$ = 10
$\bar{d}$ = 2.75
e = 0.92

Table B-11. Little Pigeon River (West Fork) Benthic Macroinvertebrates*
Station No. 11-C.

Order / Family / Sub-family / Genus sp.	No. of Individuals per Taxa
Plecoptera	
Chloroperlidae	
Chloroperlinae	
Chloroperla cydippe	1
Hemiptera	
Gyrinidae	
Dineutus	1
Trichoptera	
Hydropsychidae	
Cheumatopsyche	2
Diptera	
Chironomidae	38
Gastropoda	
Ancylidae	
Ferrissia	2
Physidae	
Physa	1
Tubellaria	
Planariidae	
Planaria	1
Nematomorpha	
Gordius	1
Oligochaeta	21

n = 68
s = 9
$\bar{d}$ = 1.74
e = 0.47

* Samples taken during same period of 1976 (Starnes, 1976).

Table B-12. Lindsey Creek Benthic Macroinvertebrates.
Station No. 12-B.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Ephemeridae	
Pentagenia	
Ephemera	
Heptageniidae	
Epeorus	
Stenonema	
Baetiscidae	
Baetisca	
Ephemerellidae	
Ephemerella	
Tipulidae	
Ameletus	
Plecoptera	
Perlidae	
Acroneuria	
Peltoperlidae	
Peltoperla	
Nemouridae	
Nemourinae	
Nemoura	
Trichoptera	
Phyrganeidae	
Phyrganea	
Limnephilidae	
Pycnopsyche	
Molannidae	
Molanna	
Hydropsychiidae	
Cheumatopsyche	
Odonata	
Agrionidae	
Agrion	

Table B-12. Lindsey Creek Benthic Macroinvertebrates.- Cont.
Station No. 12-B.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Coleoptera	
Psephenidae	
Psephenus	3
Elmidae	
Elmini	
Promoresia	3
Chelonariidae	
Chelonarium	1
Oligochaeta	
Lubriculidae	2
Gastropoda	
Pleuroceridae	
Goniobasis	1
Decapoda	
Cambaridae	
Cambarus	2

n = 74
$\underline{s}$ = 23
$\bar{d}$ = 3.95
e = 0.96

Table B-13. Webb Creek Benthic Macroinvertebrates.
Station No. 13-C.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Ephemenoptera	
Siphlonuridae	
Isonychia	1
Ameletus	12
Ephemerellidae	
Ephemerella	1
Baetis	7
Heptageniidae	
Stenonema	16
Ephemeridae	
Ephemera	4
Plecoptera	
Nemouridae	
Capniinae	
Allocapnia	1
Trichoptera	
Limnephilidae	
Pycnopsyche	1
Hydropsychidae	
Macronema	1
Cheumatopsyche	2
Rhyacophilidae	
Glossosoma	1
Rhyacophila fuscula	1
Odonata	
Gomphidae	
Gomphus	1
Coleoptera	
Psephenidae	
Psephenus	4

Table B-13. Webb Creek Benthic Macroinvertebrates.
Station No. 13-C. Cont.

Diptera	
Tipulidae	
Tipulinae	
Tipula	1
Decapoda	
Cambaridae	
Cambarus	1

n = 56
s = 17
d = 3.22
e = 0.77

Table B-14. Little Pigeon River (Middle Fork) Benthic Macroinvertebrates.*
Station No. 14-B.

Order / Family / Sub-family / Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Isonychia	1
Baetis	1
Ephemerellidae	
Ephemerella	2
Heptageniidae	
Rhitrogena	4
Heptagenia	2
Stenonema	11
Plecoptera	
Nemouridae	
Leuctrinae	
Leuctra ferruginea	1
Perlidae	
Neophasganophora capitata	1
Acroneuria	1
Perlodidae	
Isoperlinae	
Isoperla	3
Chloroperlidae	
Chloroperlinae	
Chloroperla	1
Trichoptera	
Rhyacophilidae	
Glossosoma nigrior	1
Philopotamidae	
Sortosa distinctus	1
Psychomyiidae	
Polycentropus	2
Hydropsychidae	
Cheumatopsyche	25
Hydropsyche	8

Table B-14. Little Pigeon River (Middle Fork) Benthic Macroinvertebrates*. Station No. 14-B - Cont.

Order / Family / Subfamily / Genus sp.	No. of Individuals per Taxa
Nemertea	
Prostoma rubrum	1
Nematomorpha	
Gordius	1
Hydrocarina	1
Coleoptera	
Psephenidae	
Psephenus	5
Diptera	
Tipulidae	
Tipulinae	
Antocha	7
Heleidae	
Heleinae	
Palpomyia	1
Empididae	10
Gastropoda	
Ancylidae	
Ferrissia	3

n = 132.
$\underline{s}$ = 57.
$\bar{d}$ = 3.21
e = 0.23

*Samples taken during same period of 1976 (Starnes 1976)

Table B-15. Bird Creek (East Prong). Benthic Macroinvertebrates. Station No. 15-C.

Order / Family / Sub-family / Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Heptageniidae	
Stenonema	1
Plecoptera	
Nemouridae	
Nemourinae	
Amphinemoura	5
Trichoptera	
Limnephilidae	
Pycnopsyche	3
Odonata	
Gomphidae	
Gomphus	3
Coenaginidae	
Argia	1
Cordulegastridae	
Cordulagaster	2
Diptera	
Tipulidae	
Tipulinae	
Tipula	1
Hexatoma	1
Megaloptera	
Corydalidae	
Corydalis cornutus	1
Nigronia	4
Oligochaeta	
Lubriculidae	5

Table B-15. Bird Creek (East Prong). Benthic Macroinvertebrates. Station No. 15-C. - Cont.

Order Family Sub-family Genus sp.	No. of Individuals per Taxa
Gastrapoda	
Pleuroceridae	
Goniobasis	4
Pleurocera	1

n = 34.
s = 14.
$\bar{d}$ = 3.54
e = 1.16

Table B-16. Bird Creek (West Prong). Benthic Macroinvertebrates. Station No. 16-C.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Ephemeroptera	
Siphlonuridae	
Baetiscinae	
Baetisca	2
Ephemerellidae	
Ephemerella	8
Heptageniidae	
Stenonema	5
Ephemeridae	
Ephemera	9
Plecoptera	
Nemouridae	
Nemourinae	
Nemoura	2
Perlodidae	
Isoperlinae	
Isoperla	1
Trichoptera	
Hydropsychidae	
Cheumatopsyche	3
Odonota	
Aeshnidae	
Aeschna	1
Agrionidae	
Agrion	6
Gomphidae	
Hagenius	1
Diptera	
Chironomidae	1

Table B-16. Bird Creek (West Prong) Benthic Macroinvertebrates.
Station 16-C - Cont.

Order Family Subfamily Genus sp.	No. of Individuals per Taxa
Coleoptera	
Psephenidae	
Psephenus	4
Decapoda	
Cambaridae	
Orconectes	1

APPENDIX C.

Species List of Fish Collected From Each Study Stream

Table C-1. Cosby Creek. Species List of Fish Collected.
Station No. 1-B

Common Name*	Scientific Name	No.	Relative Abundance (%)
Mottled Sculpin	*Cottus bairdi*	7	8.5
Redline Darter	*Etheostoma rufilineatum*	5	6.1
Swannanoa Darter	*Etheostoma swannanoa*	4	4.9
Greenside Darter	*Etheostoma blennioides neumannii*	1	1.2
Tennessee Snubnose Darter	*Etheostoma simoterum*	6	7.3
Saffron Shiner	*Notropis rubricroceus*	7	8.5
Telescope Shiner	*Notropis telescopus*	4	4.9
Whitetail Shiner	*Notropis galacturus*	5	6.1
Blacknose Dace	*Rhinichthys cataractae*	12	14.6
Stoneroller	*Campostoma a. anomalum*	9	11.0
White Sucker	*Catostomus c. commersoni*	3	3.6
Northern Hogsucker	*Hypentelium nigricans*	10	12.2
Blacknose Dace	*Rhinichthys atratulus*	9	11.0

Number of Individuals (N) = 82
Number of Species (S) = 13

*Fish collected by Dr. D. A. Etnier

Table C-2. Dunn Creek. Species List of Fish Collected.
Station No. 2-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Stoneroller	*Campostoma anomalum*	1	16.7
Warpaint Shiner	*Notropis coccogenis*	1	16.7
Blacknose Dace	*Rhinichthys atratulus*	4	66.6

Number of Individuals (N) = 6
Number of Species (S) = 3

Common Name*	Scientific Name	No.	Relative Abundance (%)
Mottled Sculpin	*Cottus bairdi*	4	5.6
Blacknose Dace	*Rhinichthys atratulus*	67	94.4

Number of Individuals (N) = 6
Number of Species (S) = 3

*Fish collected by Dr. D. A. Etnier

Table C-3. Ogle Spring Branch. Species List of Fish Collected.
Station No. 3-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Blacknose Dace	*Rhinichthys atratulus*	1	100

Number of Individuals (N) = 1
Number of Species (S) = 1

Table C-4. Butler Branch. Species List of Fish Collected.
Station No. 4-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Stoneroller	*Campostoma anomalum*	2	14.3
Blacknose Dace	*Rhinichthys atratulus*	12	85.7

Number of Individuals (N) = 14
Number of Species (S) = 2

Table C-5. Matthew Creek. Species List of Fish Collected.
Station No. 5-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Blacknose Dace	*Rhinichthys atratulus*	9	100

Number of Individuals (N) = 9
Number of Species (s) = 1

Table C-6. Cove Creek. Species List of Fish Collected.
Station No. 6-D.

Common Name	Scientific Name	No.	Relative Abundance (%)
River Chub	*Nocomis micropogon*	1	3.2
Creek Chub	*Semotilus atromaculatus*	1	3.2
Stoneroller	*Campostoma anomalum*	11	35.5
Blacknose Dace	*Rhinichthys atratulus*	5	16.1
Saffron Shiner	*Notropis rubricroceus*	13	41.9

Number of Individuals (N) = 31
Number of Species (S) = 5

Common Name *	Scientific Name	No.	Relative Abundance (%)
Warpaint Shiner	*Notropis coccogenis*	20	48.8
Saffron Shiner	*Notropis rubricroceus*	2	4.9
Stoneroller	*Campostoma anomalum*	4	9.8
River Chub	*Nocomis micropogon*	11	26.8
Blacknose Dace	*Rhinichthys atratulus*	1	2.4
Creek Chub	*Semotilus atromaculatus*	3	7.3

Number of Individuals (N) = 41
Number of Species (S) = 6

* Fish collected by Dr. D. A. Etnier.

Table C-7. Machine Branch. Species List of Fish Collected. Station No. 7-D.

Common Name	Scientific Name	No.	Relative Abundance (%)
River Chub	*Nocomis micropogon*	1	3.1
Creek Chub	*Semotilus atromaculatus*	1	3.1
Stoneroller	*Campostoma anomalum*	10	31.2
Blacknose Dace	*Rhinichthys atratulus*	8	25.0
Saffron Shiner	*Notropis rubricroceus*	12	37.5

Number of Individuals (N) = 32
Number of Species (S) = 5

Table C-8. Mill Creek. Species List of Fish Collected.
Station No. 8-D

Common Name	Scientific Name	No.	Relative Abundance (%)
Blacknose Dace	*Rhinichthys atratulus*	10	100

Number of Individuals (N) = 10
Number of Species (S) = 1

Table C-9. Caney Creek. Species List of Fish Collected. Station No. 9-D.

Common Name	Scientific Name	No.	Relative Abundance (%)
Saffron Shiner	*Notropis rubricroceus*	3	37.5
Blacknose Dace	*Rhinichthys atratulus*	2	25.0
Creek Chub	*Semotilus atromaculatus*	2	12.5
Northern Hogsucker	*Hypentelium nigricans*	1	12.5

Number of Individuals (N) = 8
Number of Species (S) = 4

Table C-10. Gnatty Branch. Species List of Fish Collected.
Station No. 10-C.

Common Name	Scientific Name	No.	Relative Abundance (%)
Blacknose Dace	*Rhinichthys atratulus*	5	83.3
Creek Chub	*Semotilus atromaculatus*	1	16.7

Number of Individuals (N) = 6
Number of Species (S) = 2

Table C-11. Little Pigeon (West Prong). Species List of Fish Collected. Station No. 11-C.

Common Name *	Scientific Name	No.	Relative Abundance (%)
Telescope Shiner	*Notropis telescopus*	3	6.7
Saffron Shiner	*Notropis rubricroceus*	25	55.6
Sand Shiner	*Notropis stramineus*	7	15.6
Blacknose Dace	*Rhinichthys atratulus*	3	6.7
Longnose Dace	*Rhinichthys cataractae*	1	2.2
Creek Chub	*Semotilus atromaculatus*	1	2.2
Banded Sculpin	*Cottus carolinae*	1	2.2
Redline Darter	*Etheostoma rufilineatum*	1	2.2
Tennessee Darter	*Etheostoma simoterum*	1	2.2
Speckled Darter	*Etheostoma stigmaeum*	1	2.2
Swannanoa Darter	*Etheostoma swannanoa*	1	2.2

Number of Individuals (N) = 45
Number of Species (S) = 11

Common Name +	Scientific Name	No.	Relative Abundance (%)
Rainbow Trout	*Salmo gairdneri*	1	3.0
Stoneroller	*Campostoma anomalum*	8	24.2
Tennessee Shiner	*Notropis leuciodus*	1	3.0
Northern Hogsucker	*Hypentelium nigricans*	5	15.2
Fantail Darter	*Etheostoma flabellare*	10	30.3
Swannanoa Darter	*Etheostoma swannanoa*	2	6.1
Banded Sculpin	*Cottus carolinae*	6	18.2

Table C-11. Little Pigeon (West Prong). Species List of Fish Collected. Station No. 11-C.

Number of Individuals (N) = 33
Number of Species (S) = 7

* Fish collected by Dr. D. A. Etnier, 1967.

+ Fish collected by L. B. Starnes, 1976.

Table C-12. Lindsey Creek. Species List of Fish Collected. Station No. 12-B.

Common Name	Scientific Name	No.	Relative Abundance (%)
Creek Club	*Semotilus atromaculatus*	3	33.3
Blacknose Dace	*Rhinichthys atratulus*	6	66.7

Number of Individuals (N) = 9
Number of Species (S) = 2

Table C-13. Webb Creek. Species List of Fish Collected.
Station No. 13-B.

Common Name	Scientific Name	No.	Relative Abundance (%)
Warpaint Shiner	*Notropis coccogenis*	2	50.0
Telescope Shiner	*Notropis telescopus*	1	25.0
Northern Hogsucker	*Hypentelium nigricans*	1	25.0

Number of Individuals (N) = 4
Number of Species (S) = 3

Common Name	Scientific Name	No.	Relative Abundance (%)
Banded Sculpin	*Cottus carolinae*	2	13.3
Stoneroller	*Campostoma anomalum*	1	6.7
Warpaint Shiner	*Notropis coccogenis*	3	20.0
Telescope Shiner	*Notropis telescopus*	7	46.7
Saffron Shiner	*Notropis rubricroceus*	2	13.3

Number of Individuals (N) = 15
Number of Species (S) = 5

Table C-14. Little Pigeon (Middle Prong) Species List of Fish Collected. Station No. 14-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Stoneroller	*Campostoma anomalum*	3	12.0
Creek Chub	*Semotilus atromaculatus*	2	8.0
Warpaint Shiner	*Notropis coccogenis*	7	28.0
Telescope Shiner	*Notropis telescopus*	9	36.0
Longnose Dace	*Rhinichthys cataractae*	1	4.0
Tennessee Shiner	*Notropis leuciodus*	2	8.0
Spotfin Shiner	*Notropis spilopterus*	1	4.0

Number of Individuals (N) = 25
Number of Species (S) = 7

Common Name*	Scientific Name	No.	Relative Abundance (%)
Northern Hogsucker	*Hypentelium nigricans*	3	4.3
Saffron Shiner	*Notropis rubricroceus*	1	1.4
Warpaint Shiner	*Notropis coccogenis*	9	12.9
Whitetail Shiner	*Notropis galacturus*	10	14.3
Tennessee Shiner	*Notropis leuciodus*	10	14.3
Blacknose Dace	*Rhinichthys atratulus*	21	3.0
River Chub	*Nocomis micropogon*	2	2.9
Stoneroller	*Campostoma a. anomalum*	3	4.3
Redline Darter	*Etheostoma rufilineatum*	1	1.4

Table C-14. Little Pigeon (Middle Prong). Species List of Fish Collected - Cont.
Station No. 14-B

Common Name	Scientific Name	No.	Relative Abundance (%)
Rockbass	*Ambloplites rupestris*	5	7.1
Smallmouth Bass	*Micropterus d. dolomieui*	5	7.1

Number of Indivuduals (N) = 70
Number of Species (S) = 11

* Fish collected by Dr. D. A. Etnier.

Table C-15. Bird Creek (East Prong). Species List of Fish Collected. Station No. 15-C.

Common Name	Scientific Name	No.	Relative Abundance (%)
Blacknose Dace	*Rhinichthys atratulus*	6	66.7
Creek Chub	*Semotilus atromaculatus*	3	33.3
Fathead Minnow	*Pimephales promelas*	1	11.0

Number of Individuals (N) = 10
Number of Species (S) = 3

APPENDIX D.

Trees, Shrubs, and Herbs.

Table D-1. Trees.

Acer pensylvanicum	*Magnolia fraseri*
A. saccharum	*Malus pumila*
A. spicatum	*Nyssa sylvatica*
A. rubrum	*Oxydendrum arboreum*
Aesculus octandra	*Pinus echinata*
Amelanchier arborea	*P. pungens*
Aralia spinosa	*P. rigida*
Betula lenta	*P. strobus*
Carpinus caroliniana	*P. virginiana*
Carya glabra	*Platanus occidentalis*
C. tomentosa	*Prunus serotina*
Castanea dentata	*Quercus alba*
Cornus florida	*Q. coccinea*
Fagus grandifolia	*Q. marilandica*
Fraxinus americana	*Q. prinus*
Halesia carolina	*Q. rubra*
Ilex opaca	*Q. velutina*
Juniperus virginiana	*Rhododendron maximum*
Kalmia latifolia	*Robinia pseudo-acacia*
Liquidambar styraciflua	*Sassafras albidum*
Liriodendron tulipifera	*Tsuga canadensis*

Table D-1. Trees - Cont.

Ulmus sp.

Vitis aestivalis

Table D-2. Shrubs.

Acer pensylvanicum
A. saccharum
A. sricatum
A. rubrum
Aesculus octandra
Alnus rugosa
Amelanchier arborea
Aralia spinosa
Betula lenta
Calycanthus floridus
Carpinus caroliniana
Carya glabra
C. tomentosa
Castanea dentata
Cornus florida
Crataegus sp.
Euonymus americanus
Fagus grandifolia
Fraxinus americana
Gaylussacia ursina
Halesia carolina
Hydrangea arborescens
Hypericum sp.
Ilex opaca
Juniperus virginiana
Kalmia latifolia
Lindera benzoin
Liquidambar styraciflua
Liriodendron tulipifera
Lonicera japonica
Magnolia fraseri
Nyssa sylvatica
Oxydendrum arboreum
Parthenocissus quinquefolia
Picea Rubens
P. echinata
P. pungens
P. rigida
P. strobus
P. virginiana
Prunus serotina
Pyrularia pubera
Quercus alba
Q. coccinea

Table D-2. Shrubs - Cont.

Quercus marilandica

Q. prinus

Q. rubra

Q. velutina

Rhamnus caroliniana

Rhododendron calendulaceum

R. maximum

Rhus toxicodendron

Robinia pseudo-acacia

Rosa multiflora

Rubus spp.

Sassafras albidum

Smilax glauca

S. hispida

S. rotundifolia

Syringa vulgaris

Tsuga canadensis

Vaccinium spp.

V. vacillans

Viburnum alnifolium

Vitis aestivalis

Table D-3. Herbs.

Actaea pachypoda	*Conopholis americana*
Adiantum peoatum	*Daucus carota*
Agrimonia pariflora	*Dentaria diphylla*
Allium sp.	*Dicentra* sp.
Andropogon scoparius	*Dioscorea batatas*
Andropogon sp.	*Duchesnea indica*
Anemonella thalictroides	*Epigaea repens*
Antennaria plantaginifolia	*Eupatorium maculatum*
A. solitaria	*Festuca sciurea*
Arisaema trifphyllum	*Fragaria virginiana*
Asarum arifolium	*Galax aphylla*
Aster sp.	*Gallium* sp.
A. divaricatus	*Gaultheria procumbens*
Bidens spp.	*Geranium maculatum*
Botrichium virginianum	*Goodyera pubescens*
Chimaphila maculata	Grass
Chenopodium album	*Heuchera americana*
Chrysanthemum leucanthemum	*Houstania* sp.
Cirsium sp.	*Iris cristata*
Claytonia caroliniana	*Lactuca* sp.
Composite spp.	

Table D-3. Herbs - Cont.

Lepidium sp.
Lilium sp.
Lysimachia quadrifolia
Medeola virginica
Mitchella repens
Orchid sp.
Oxalis montana
Plantagio lanceolata
P. major
Poa sp.
Polygonatum biflorum
Polystichum acrostichoides
Polytrichum sp.
Potentilla canadensis
Prenanthes alba
P. sp.
Pteridium aquilinum
Ranunculus sp.
Rumex crispus
Smilacina racemosa
Solanum americanum
Solidagio sp.
Stellaria media
S. pubera
Streptopus amplexifolius
Taraxacum officionale
T. sp.
Thelypteris noveboracensis
Tiarella cordifolia
Trifolium pratense
T. repens
T. sp.
Trillium luteum
Uvularia perfoliata
Veronica sp.
Vicia sp.
Viola canadensis
V. hastata
V. pedata