PA FISH AND BOAT COMMISSION
COMMENTS AND RECOMMENDATIONS
June 8, 1992

WATER: Cooks Creek (602D) Bucks County

EXAMINED: July 1992

BY: Kaufmann, Soldo, Wnuk, Chikotas, and Moldenhauer

Bureau Director Action: Approved - Delano R. Graff Date: 11-7-94

Division Chief Action: Richard A. Snyder Date: 11-1-94

WW Unit Leader Action: _____ Date: _____

CW Unit Leader Action: K. Thomas Irvine Date: 10/25/94

AREA COMMENTS:

Cooks Creek is a 22.4 km long stream located in Springfield and Durham Townships, Bucks County. Cooks Creek boasts good to excellent water quality, a diverse benthic community, and, in Section 02, a Class A wild brown trout population. Additionally, tributaries to Cooks Creek support both Class A wild brown trout populations and Class A wild brook trout populations. The entire Cooks Creek drainage basin is classified as an exceptional value coldwater fishery in the Pennsylvania Department of Environmental Resources Chapter 93 water quality standards.

AREA RECOMMENDATIONS:

1. The Pennsylvania Department of Environmental Resources should continue to protect the entire Cooks Creek basin with the exceptional value coldwater fishery designation.

2. The Bucks County Conservation District should investigate the sources of the moderate siltation noted by the Pennsylvania Fish and Boat Commission in Section 01 of Cooks Creek and pursue corrective actions. Particularly noteworthy was bank erosion in a pasture immediately upstream from the village of Pleasant Valley. Additionally, best management practices on farmlands upstream from Springtown should be implemented to better control surface runoff into tributaries and the main stem.

3. The Bucks County Conservation District should investigate the Pennsylvania Department of Environmental Resources' report that livestock have free access to unnamed tributaries in the Cooks Creek basin and pursue corrective actions (see the Pennsylvania Department of Environmental Resources Cooks Creek Special Protection Status report for more detailed information).

4. The Pennsylvania Fish and Boat Commission should continue to manage the wild trout populations in Sections 02 and 03 of Cooks Creek with conventional, statewide angling regulations.

5. The Springtown Rod and Gun Club should restrict plantings of adult trout in Cooks Creek to the sections of stream upstream from Springtown and downstream from Durham (Sections 01 and 03), contingent on landowner permission.

6. If interested, the Bucks County Chapter of Trout Unlimited should pursue habitat improvement projects in Section 03 of Cooks Creek.

7. The Area 6 fisheries management staff should reconnoiter Section 03 of Cooks Creek to determine whether or not the sampling site's habitat was truly representative of the section. If not, a second, more representative, site for a trout population estimate should be chosen and an estimate conducted in 1994.

8. Township officials should consider enacting ordinances that will prevent future development from denuding stream banks of trees and natural vegetation. These provide the necessary shade to maintain cold water habitat for Cooks Creek's trout population and all natural vegetation, including trees, is important in preventing further bank erosion. Bank erosion contributes sediments to the stream, which negatively impacts fish and aquatic insects, and causes the stream to become wider and shallower.

9. The reported blockage of the spring river herring spawning migration up Cooks Creek by the paper mill dam near the mouth needs to be officially documented. This may only occur when east coast herring populations are high and when the overall spawning run in the Delaware River is exceptional.

CW UNIT COMMENTS:

Cooks Creek (602D), Sections 01-03, were examined during July 1992 as part of a routine reinventory of the Area 6 fisheries resource.

Section 01

This segment can be characterized as a small, fertile transitional stream. The 1992 evaluation documented a total of 14 fish species captured over four sample sites. Major limiting factors to the development of a coldwater fishery include siltation and seasonal elevation in water temperature.

Section 02

Section 02 can be characterized as a fertile limestone stream. The influence of a series of small limestone springs and tributaries improve the stream flow and temperature regime in terms of providing suitable salmonid habitat. The 1992 examination documented the presence of an excellent Class A wild brown trout population estimated in excess of 44 kg/ha.

Section 03

This segment can be characterized as a fertile limestone stream. The 1992 evaluation documented the presence of 10 individual fish species including a Biomass Class C wild brown trout population (17.10 kg/ha). The lack of

suitable physical habitat was cited as the primary factor limiting further development of the trout population.

CW UNIT RECOMMENDATIONS:

1. Cooks Creek (602D), Section 01, should be managed for its resident coldwater fishery under the Natural Yield option (Biomass Class D). The planting of cooperative nursery trout may continue providing that landowners allow access for the general angling public.

2. Cooks Creek (602D), Section 02, should be managed as a Class A wild trout fishery. Conventional statewide regulations should apply with no stocking.

3. Cooks Creek (602D), Section 03, should be managed for its resident trout fishery under the Natural Yield option (Biomass Class C. As with Section 01, the planting of cooperative nursery trout may continue providing that landowners permit angler access.

PENNSYLVANIA FISH AND BOAT COMMISSION
Bureau of Fisheries
Fisheries Management Division

Cooks Creek (602D)
Fisheries Management Report

Prepared by
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Date Sampled: July 1992 Date Prepared: December 1992

Introduction

Cooks Creek (Ck.) is a 22.4 km (13.9 mi.) long stream located in sub-subbasin 2D, Springfield and Durham townships, Bucks County (Co). The stream flows generally in a northeast direction from its origins south of Flint Hill to its confluence with the Delaware River at Durham Furnace. Cooks Ck. can be located on the Hellertown, Quakertown and Riegelsville, PA, USGS 7.5 minute Quadrangles (Fig. 1).

Cooks Ck. has a 76 km^2 (29 $mi.^2$) drainage basin. The entire basin is classified as an exceptional value coldwater fishery (EV-CWF) in the Pennsylvania Department of Environmental Resources (DER) Chapter 93 Water Quality Standards. The basin was originally classified as trout stocked fishery (TSF), but was upgraded to high quality coldwater fishery (HQ-CWF), and finally to EV-CWF, in response to petitions filed with the DER by the Cooks Ck. Watershed Association (CCWA). Under Chapter 93 guidelines, waters classified as EV-CWF are to be protected by the DER at their existing quality. While permitted discharges are allowed to EV-CWF streams, these discharges may not lower water quality.

The Cooks Ck. basin is rich in history, some of which is recounted in documents submitted by the CCWA to the DER in support of upgrading Cooks Ck. to EV-CWF and 1A Scenic River status (CCWA 1988a, 1988b). These documents state that the first white settlement in the basin is believed to have taken place around Durham Furnace as early as 1682. Other historical events of note mentioned in these documents include the initiation of the Walking Purchase of 1737 at Durham in 1734, the manufacture of cannon shot at Durham Furnace for the French and Indian War in 1755, the manufacture and shipment of cannons, shot and shells used in the Revolutionary War, and the construction of Durham Boats used by General Washington in crossing the Delaware River for the 1776 Battle of Trenton. Logically, the stream was known as Durham Ck. in the 1700s.

The Cooks Ck. basin, although settled as early as 1682, has retained its rural character in spite of heavy developmental pressures in surrounding areas. Homes and bridges built in the basin during the 1700s and 1800s are still in existence today, and some of the parcels in the basin have not been further subdivided since Thomas Penn times (CCWA 1988a, 1988b). The DER estimated that undeveloped woodlots and agriculture accounted for 40% of the land area in each basin (DER 1990). The remaining 20% is occupied by limited commercial development and single family residences, with a small portion of land downstream from SR 611 owned by the State of Pennsylvania. Some of this land is owned by DER and managed as part of the Delaware Canal State Park. The remainder, a strip of land bordering the Delaware River, was recently purchased from an estate by the Pennsylvania Fish and Boat Commission (PFBC). This strip will be managed to provide public fishing access to the river.

Development in the Cooks Ck. basin is limited by local zoning ordinances and the underlying geology of the area. There is no industrial zoning in the basin, and local zoning ordinances, including those of Springfield and Durham townships and Bucks Co., seek to preserve the rural and scenic characteristics of the region. The underlying geology presents hazards to development in the form of sinkholes, solution cavities and bedrock irregularities due to its limestone nature (DER 1990).

The underlying geology of Cooks Ck. upstream from Springtown is made up of rocks from the Triassic Age. The majority of these rocks are shale, siltstone and mudstone from the Brunswick Formation. Small amounts of Quartz Fanglomerate and Limestone Fanglomerate are also present. Quartz Fanglomerate consists of quartzite pebbles and Limestone Fanglomerate consists of angular limestone and dolomite pebbles, cobbles, and fragments.

The underlying geology of Cooks Ck. from Springtown downstream to the mouth is made up of rocks from the Cambrian Age. The majority of these rocks are from the Leithsville and Allentown Formations, both of which are predominately limestone in nature. The Leithsville Formation consists of crystalline dolomite with thin shale and dolomitic shale interbeds. The Allentown Formation consists of thick bedded dolomite and impure limestone with some calcareous siltstone at the base. A small amount of the Hardyston Formation is also present downstream from Springtown. The Hardyston Formation consists of quartzite and feldspathic sandstone.

The underlying geology of the Cooks Ck. basin results in the presence of numerous limestone springs, tributaries and wetlands. At least one of the wetlands in the basin has been documented as supporting three Pennsylvania species of concern (DER 1990). These species are the bog turtle (*Clemmys muhlenbergii*), the redbellied turtle (*Pseudemys rubriventris*) and the eastern mud salamander (*Pseudotriton m. montanus*). Two of the limestone tributaries in

the basin, Silver Ck. (Wnuk & Kaufmann 1991) and Coon Hollow Run (Wnuk & Kaufmann 1992), support Class A wild trout populations. The wetlands, limestone tributaries and limestone springs in the basin greatly affect water quality in Cooks Ck.

The DER investigated water quality characteristics of the Cooks Ck. drainage basin in 1989-1990 as part of its evaluation to determine if the basin merited EV-CWF designation (DER 1990). The DER found excellent water quality which was better than all criteria applicable to EV-CWF standards. The only source of water quality degradation found during the survey was increased erosion and sedimentation in tributary basins where livestock had direct access to the streams. The DER noted that Cooks Ck. appeared susceptible to non-point agricultural pollution such as runoff of fertilizers and manure, but water quality sampling did not indicate a serious problem. Ground water resources in the basin appeared to be acceptable for human consumption, but were considered highly susceptible to contamination due to the underlying limestone geology. Additionally, the CCWA (1988b) noted that on-site sewage systems were used throughout the basin, and some of these appeared to be malfunctioning.

While permitted discharges are allowed to EV-CWF streams, there are currently no permitted discharges to Cooks Ck. In the past, however, unpermitted discharges from the Durham Mills paper plant, located near the mouth of Cooks Ck., have affected the stream. The Durham Mills paper plant, formerly the Whippany Paper Mill, ceased operations in the middle 1980s. Prior to closing, the plant had a history of environmental problems dating back to at least 1959 (Daniels 1971). The plant was permitted to discharge to the Delaware River, but problems at the plant resulted in occasional discharges of waste to Cooks Ck. These discharges usually resulted from the company storing paper pulp on the stream bank, and on at least one occasion the pulp which washed into the stream was suspected of killing approximately 60 fish, including a number of trout. The Pennsylvania Fish and Boat Commission (PFBC) issued numerous warnings to Durham Mills, and twice cited the plant for illegal discharges to Cooks Ck. (Plevyak 1982 & 1983). The paper plant maintains a small dam near the mouth of Cooks Ck. Although not documented by the PFBC, this dam probably blocks upstream migration of blueback herring (*Alosa aestivalis*) during years when the herring run in the Delaware River is strong.

The PFBC performed its initial biological investigation of Cooks Ck. in 1970 to determine the effects of the paper company discharges on Cooks Ck. and the Delaware River (Daniels et al. 1970). Three sampling stations were surveyed: Stations 1 and 2 were located upstream from the Durham Mills plant and Station 3 was located downstream from the plant. Stations 1 and 2 supported healthy aquatic communities, with many aquatic macroinvertebrate taxa and fish species present. Station 3, however, was almost devoid of life. No aquatic macroinvertebrate taxa were collected at

the station, and only two fish species, common carp (*Cyprinus carpio*) and spottail shiners (*Notropis hudsonius*), were present. Water in Cooks Ck. downstream from the plant was heavily discolored, and paper wastes were knee deep in the channel. The Delaware River was also discolored for what was termed a great distance downstream from Cooks Ck.

In addition to pollution by the Durham Mills paper plant, water quality in Cooks Ck. has been threatened in the past by sedimentation and a proposed oil tank farm. The PFBC has two records on file in which the Bucks County Conservation District investigated sedimentation problems in the basin resulting from earthmoving activities. The first involved road ditching activities in Springfield Township (Thomas 1983), and the second involved earthmoving activities on a private farm (Thomas 1985).

The oil tank farm proposal was made in 1973 by the Interstate Energy Company of Houston, Texas. The company originally wished to locate an oil tank farm in the Cooks Ck. watershed, with pipeline crossings of both Cooks Ck. and Silver Ck. This proposal resulted in a PFBC biological survey to determine the possible environmental impacts of the project (Marshall et al. 1973). Four sampling stations were surveyed on Cooks Ck. proper, and two sampling stations were surveyed on tributaries to Cooks Ck. (Silver Ck. and Coon Hollow Run). All of the Cooks Ck. stations were located upstream from the Durham Mills plant. Aquatic macroinvertebrate populations were large and diverse at all six stations, and wild trout, in quantities termed from common to abundant, were captured at all stations. The investigators determined that the Cooks Ck. basin was a sensitive ecological area, and recommended that the Interstate Energy Company locate the tank farm outside of the watershed. The company eventually decided to build the tank farm next to the Bethlehem City Landfill in Northampton Co. (Philadelphia Bulletin 1973).

In spite of the pollution problems described above, overall water quality in Cooks Ck. has historically been excellent. The excellent water quality, in combination with the scenic and historic values of the basin, have made Cooks Ck. a popular fishing destination for both local and out of state anglers.

Cooks Ck. was once heavily stocked with adult trout by the PFBC. The stream sections stocked with trout varied over the years, and ranged from near the source to one mile upstream from the mouth. Numbers and species of trout stocked also varied, with brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*) all being stocked at one time or another.

Adult trout were first stocked in Cooks Ck. in 1939. The PFBC continued to stock adult trout in Cooks Ck. until 1975, when trout stocking was discontinued due to landowner posting resulting from

heavy angling pressure and poor angler behavior. Since 1975, the only adult trout stocked in Cooks Ck. have been stocked by the Springtown Rod and Gun Club, a PFBC Co-operative Nursery. The Springtown Rod and Gun Club stocks most of its production in Silver Ck., but has stocked an average of 142 adult trout in Cooks Ck. over the last three years. In addition to the Springtown Club adult trout stockings, the PFBC stocked 2,500 four inch fingerling rainbow trout in Cooks Ck. in the Durham area in 1992 and 5,000 more two inch fingerling rainbows in 1993. These were part of the unallocated fingerling trout which needed to be culled from the agency's hatchery production system. Rainbow trout fingerlings were stocked in Cooks Ck. to provide a fishery once they grew to adult size and to possibly establish a reproducing population in a section that was less heavily populated with wild brown trout. An evaluation of these stockings in October, 1993, indicated that survival was poor. Thus, future plans for small fingerling stockings in Cooks Ck. were terminated (Soldo 1993).

Cooks Ck. upstream from SR 212 was once under consideration as a fly fishing only area. The request for a fly fishing only area was initiated by a private landowner in 1972 due to his experiences with discourteous anglers on his property (Sweeny 1972). The request resulted in a PFBC stream survey to determine the section's suitability for fly fishing only management. One sampling station, located near SR 212, was surveyed on August 16, 1972 (Snyder 1972). A number of aquatic macroinvertebrate taxa were collected, including four mayfly families and two caddisfly families. Electrofishing documented the presence of 14 fish species, including brown trout and American eels (*Anguilla rostrata*). The fly fishing only request was denied, however, due to water temperature concerns during the warmer months and lack of suitable physical habitat.

Physical habitat for trout has been an issue on Cooks Ck. since at least 1970 (Kulikosky 1970), when the Bucks Co. Federation of Sportsmen's Clubs requested PFBC assistance in performing habitat improvement projects on the stream. Over the years, assistance in performing habitat improvement work has also been requested by the CCWA and the Bucks Co. Chapter of Trout Unlimited (BCTU). The most recent request for habitat improvement assistance was initiated in 1988 when BCTU "adopted" Cooks Ck. under the PFBC "Adopt-A-Stream" program.

Cooks Ck. was one of several streams used by Marshall (1976) in his arguments to change the guidelines of the PFBC's 1976 habitat improvement program, which would not allow the PFBC to assist with habitat improvement on streams not stocked with trout. Marshall et al. (1976) performed a complete stream inventory of Cooks Ck. after the 1975 termination of trout stocking. Three stations were sampled, all of which were resampled during the 1992 survey. Water quality and aquatic macroinvertebrate populations were excellent, and natural reproduction of brown trout was documented. The

investigators concluded that wild trout populations in Cooks Ck. would greatly benefit from habitat improvement projects directed toward decreasing erosion and increasing cover. The CCWA and BCTU were interested in doing these projects, but PFBC policy at the time would not allow the PFBC to provide assistance. This policy was changed, in part, as a result of the 1976 PFBC Cooks Ck. survey. The 1976 PFBC stream inventory of Cooks Ck. will be discussed in greater detail in the results section of this report.

This report documents the 1992 PFBC survey of Cooks Ck. The objective of the investigation was to provide current data on the physical, chemical and biological conditions of the stream in preparation for an anticipated legal challenge to its EV-CWF designation.

Methods

The fisheries investigation of Cooks Ck. was conducted from July 2 to 8, 1992. All procedures of the survey were carried out according to those outlined by Marcinko et al. (1986).

Cooks Ck. was divided into three sections for fisheries management purposes. Section 01 extended from the headwaters downstream to the confluence with Silver Ck., Section 02 extended from the confluence with Silver Ck. downstream to the SR 4075 (Durham Road) bridge, and Section 03 extended from the SR 4075 bridge downstream to the mouth. The sectioning strategy was based on water quality, physical habitat, wild trout density, and accessibility differences among the three sections. Physical and social data were collected for these sections, but parking counts were not made. The percentage of private land open to public fishing in Sections 02 and 03 was determined by contacting landowners in the sections. The section gradients were determined from USGS 7.5 minute topographic maps.

Four representative sampling stations were chosen in Section 01. Station 0101 was located 300 m downstream from the SR 4067 (State Road) bridge and was 150 m long. Station 0102 was located on the downstream side of a private farm road bridge (Gruversville vicinity) and was 150 m long. Station 0103 was located 150 m downstream from the T485 (Township Road) bridge and was 190 m long. Station 0104 was located 300 m downstream from the SR 4069 (Slifer Valley Road) bridge and was 300 m long. Station 0104 was a repeat of Station 1 in Marshall's 1976 survey.

Two representative sampling stations were chosen in Section 02. Station 0201 was located 1,240 m downstream from the SR 212/SR 412 bridge and was 308 m long. Station 0202 was located 930 m downstream from the T419 (Haupts Bridge Road) bridge and was 323 m long. Station 0202 was at the same site as Station 2 in Marshall's 1976 survey, except Marshall's station was 732 m long.

One representative sampling station was chosen in Section 03. Station 0301 was located 620 m upstream from the mouth (off Rattlesnake Road) and was 300 m long. Station 0301 was at the same site as Station 3 in Marshall's 1976 survey, except Marshall's station was 1,500 m long.

Physical-chemical parameters, aquatic macroinvertebrate communities, and fish communities were evaluated at all of the above stations. Aquatic macroinvertebrates were collected by kick screens and hand picking rocks. Aquatic macroinvertebrates were generally identified to the familial level, and were assigned pollution tolerance index values according to a combination of those developed by or through Illinois EPA (1989), Klemm et al. (1990), EA Mid-Atlantic Regional Operations Engineering, Science, and Technology Inc. (1990), RMC Environmental Services Inc. (1991), and PFBC field experience. At Stations 0101 to 0104, backpack electrofishing using from 75 to 125 volts of alternating current was conducted to describe the fish communities present. At Stations 0201 to 0301, towed boat electrofishing using 250 volts of direct current replaced backpack electrofishing. A Chapman modified Petersen population estimate (Ricker 1975) was used at Stations 0201 to 0301 to quantify the brown trout populations.

Results

Section 01

Physical and social characteristics for Section 01 are described below and presented in Table 1. Section 01 was 12.9 km long, averaged 4.8 m in width, encompassed 6.2 ha, and had a gradient of 11.1 m/km. Ownership was 100% private and considered open to public fishing. Road access was fair, as 35% of the section was within 100 m of a road, 80% of the section was within 300 m of a road, and 100% of the section was within 500 m of a road. The human population density for Section 01 was 64 persons/km^2 (suburban) based on the 1990 census.

Station 0101 - River Mile 13.27

Station 0101 was located in a partially shaded area of stream. Bank erosion was moderate with some areas of heavy erosion present, and the bottom substrate consisted of silt, gravel and boulders. There was a layer of silt covering the bottoms of the pools and slower moving areas. The station was primarily composed of long, shallow pools and long, shallow riffles. Water depth was generally shallow and water velocity was generally sluggish. Fish cover at the station was limited to some overhanging shrubs, a few fallen trees and one deeper pool.

Physical-chemical parameters and their associated values measured at Station 0101 on July 6, 1992, were as follows: air temperature

24.0°C, water temperature 19.2°C, pH 7.3, specific conductance 130 umhos, total alkalinity 50 mg/l, and total hardness 78 mg/l (Table 2).

Aquatic macroinvertebrate diversity at Station 0101 was fair, as 18 taxa were collected (Table 3). The collection included three mayfly families, one stonefly family and three caddisfly families. One of the taxa collected, Ephemerellidae (a mayfly family), was considered very intolerant of pollution. Chironomidae (chironomids) was the only taxon rated abundant; all other taxa were represented by only a few individuals each.

The fish community at Station 0101 consisted of 6 species (Table 4), and was dominated by fishes common in streams that are transitional between a coldwater and a warmwater environment. Blacknose dace (*Rhinichthys atratulus*) was the only species rated abundant at the station, while migratory American eels were rated present. No sportfish species were captured in 150 m of electrofishing.

Station 0102 - River Mile 11.82

Station 0102 was located in a partially shaded area of stream. Bank erosion was light and the bottom substrate consisted of gravel, rubble and bedrock. Some silt was also present, but siltation was not as heavy as at Station 0101. The station was primarily composed of short pools and short riffles. Fish cover was provided by overhanging shrubs, gaps in the bedrock and the deeper pools. A private citizen reported the past occurrence of fish kills at Station 0102 due to an upstream farmer occasionally washing pesticide drums.

Physical-chemical parameters and their associated values measured at Station 0102 on July 2, 1992, were as follows: air temperature 28.0°C, water temperature 20.5°C, pH 7.4, specific conductance 152 umhos, total alkalinity 55 mg/l, and total hardness 80 mg/l (Table 2).

Aquatic macroinvertebrate diversity at Station 0102 was fair, as 19 taxa were collected (Table 3). The collection included two mayfly families, one stonefly family, and two caddisfly families. No pollution intolerant taxa were collected. Heptageniidae (a mayfly family) was the only taxon rated abundant.

The fish community at Station 0102 consisted of 9 species (Table 4), and was dominated by fishes common in streams that are transitional between a coldwater and a warmwater environment. Blacknose dace and white suckers (*Catostomus commersoni*) were the only species rated abundant at the station, while migratory American eels were rated present. No gamefish species were captured in 150 m of electrofishing. The panfish species captured at Station

0102 were 7 bluegills (*Lepomis macrochirus*) and 7 redbreast sunfish (*L. auritus*). The bluegills ranged from 25 to 74 mm in total length, and the redbreast sunfish ranged from 50 to 149 mm in total length.

Station 0103 - River Mile 8.14

Station 0103 was located in a partially shaded area of stream. Bank erosion was light and the bottom substrate consisted of gravel, rubble, and bedrock. Some silt was present, but siltation was visibly less than at Stations 0101 and 0102. This was likely due to the steeper gradient at Station 0103. The station was primarily composed of medium length pools and both short and long riffles. Fish cover consisted of overhanging grasses, undercut banks, log jams, some deep runs, some deep pools, and some large instream boulders. Overall, both habitat and flow characteristics at Station 0103 were much improved over the two upstream stations.

Physical-chemical parameters and their associated values measured at Station 0103 on July 6, 1992, were as follows: air temperature 29.0°C, water temperature 23.0°C, pH 8.0, specific conductance 181 umhos, total alkalinity 62 mg/l, and total hardness 82 mg/l (Table 2).

Aquatic macroinvertebrate diversity at Station 0103 was good, as 23 taxa were collected (Table 3). The collection included four mayfly families, one stonefly family, and three caddisfly families. Two of the taxa collected, Ephemerellidae (a mayfly family) and Glossosomatidae (a caddisfly family), were considered very intolerant of pollution. Perlidae (a stonefly family), Hydropsychidae (a caddisfly family), and Psephenidae (water pennies) were the taxa rated abundant. Aquatic macroinvertebrates were generally more abundant at Station 0103 than at the two upstream stations in Section 01.

The fish community at Station 0103 consisted of 12 species (Table 4), and was dominated by fishes common in streams that are transitional between a coldwater and a warmwater environment. Common shiners (*Luxilus cornutus*), blacknose dace, and longnose dace (*Rhinichthys cataractae*) were the species rated abundant at the station, while migratory American eels were rated common. Brown trout were the only gamefish species captured at Station 0103. Three brown trout, ranging from 150 to 224 mm in total length, were captured in 190 m of electrofishing, and all appeared to be wild fish. Five bluegills, ranging from 50 to 74 mm in total length, and 23 redbreast sunfish, ranging from 50 to 174 mm in total length, represented the panfish community at Station 0103.

Station 0104 - River Mile 6.49

Station 0104 was located in a partially shaded area of stream. Bank

erosion was moderate overall, although one steeply eroded bank was noted at the downstream limit of the station. The bottom substrate consisted of silt, rubble and *Elodea spp.*, with a thick layer of silt covering the streambed. The station was primarily composed of short riffles, stagnant channels and some deep pools. Fish cover was limited to the few deep pools present. Overall, physical characteristics at Station 0104 were much poorer than those observed at Station 0103.

Physical-chemical parameters and their associated values measured at Station 0104 on July 7, 1992, were as follows: air temperature 26.0°C, water temperature 23.1°C, pH 8.4, specific conductance 219 umhos, total alkalinity 77 mg/l, and total hardness 106 mg/l (Table 2). The 1992 water chemistry data varied somewhat from those measured by Marshall in August, 1976, who recorded a specific conductance of 180 umhos, a pH of 9.0, a total alkalinity of 86 mg/l, and a total hardness of 66 mg/l. The reason for these differences was unclear, but may have been due to differences in the timing of the two surveys. The 1976 survey did not provide an explanation for total alkalinity exceeding total hardness.

Aquatic macroinvertebrate diversity at Station 0104 was fair, as 17 taxa were collected (Table 3). The collection included two mayfly families, one stonefly family, and one caddisfly family. No pollution intolerant taxa were collected. Psephenidae (water pennies) was the only taxon rated abundant at Station 0104.

The aquatic macroinvertebrate community at Station 0104 in 1992 was not as diverse as that found in 1976, when 29 taxa were collected. The 1976 collection included seven mayfly families and four caddisfly families. This dramatic decline in aquatic macroinvertebrate diversity may have been due to greater siltation at the station in 1992.

The fish community at Station 0104 consisted of 12 species (Table 4), and was dominated by fishes common in streams that are transitional between a coldwater and a warmwater environment. Common shiners, blacknose dace, longnose dace, and white suckers were the species rated abundant at the station, while migratory American eels were rated present. Brown trout were the only gamefish species captured at Station 0104. Three brown trout, ranging from 200 to 374 mm in total length, were captured in 300 m of electrofishing, and all appeared to be wild fish. Seven redbreast sunfish, ranging from 25 to 199 mm in total length, represented the panfish community at Station 0104.

The fish community at Station 0104 in 1992 was roughly similar to that found by Marshall in 1976, who recorded 17 species. The 1976 survey recorded a catch per unit effort (CPUE) for redbreast sunfish $\geq$150 mm of 23 fish/hr, while this value was only 4 fish/hr in 1992. The 1976 survey team did not capture any trout.

Section 01 Summary

Section 01 of Cooks Ck. was a low gradient, partially shaded stream section with good public access, fair road access, and moderate human population density. Physical habitat in the section was relatively limited, except at Station 0103, due mainly to siltation and sluggish flow.

Overall water quality in Section 01 was good, with moderate to heavy siltation at Stations 0101, 0102 and 0104 the only significant source of pollution noted. Water chemistry values indicated a moderately alkaline, well buffered system due to the presence of a small amount of limestone in the geology.

Aquatic macroinvertebrate diversity in Section 01 ranged from fair to good, with some pollution intolerant forms present. A dramatic decline in aquatic macroinvertebrate diversity at Station 0104 between 1976 and 1992 was possibly related to increased siltation at the station.

The fish community in Section 01 was dominated by species common in streams that are transitional between a coldwater and a warmwater environment. Low density wild brown trout and redbreast sunfish populations provided a limited fishery in the section. Blacknose dace were the only species rated abundant at all four stations in Section 01.

Section 02

Section 02 of Cooks Ck. extended from the confluence with Silver Ck. downstream to the SR 4075 (Durham Road) bridge. Section 02 was differentiated from Section 01 based on water quality, wild brown trout density, physical habitat, and access characteristics. Physical and social characteristics of Section 02 are described below and presented in Table 1.

Section 02 was 6.0 km long, averaged 11.2 m in width, encompassed 6.7 ha, and had a gradient of 6.0 m/km. Ownership was 100% private, of which 66% was considered open to public fishing with landowner permission and 34% was considered closed. Road access was relatively poor, as only 15% of the section was within 100 m of a road, 42% of the section was within 300 m of a road, and 100% of the section was within 500 m of a road. The human population density for Section 02 was 60 persons/km^2 (suburban) based on the 1990 census.

Station 0201 - River Mile 4.65

Station 0201 was located in a partially shaded area of stream. Bank erosion was light and the bottom substrate consisted of sand, gravel and rubble, with some silt present in the slower moving

areas. The station was primarily composed of long, shallow riffles in combination with a few deep pools. Fish cover was provided by undercut banks, overhanging brush, fallen trees, and the deep pools.

Physical-chemical parameters and their associated values measured at Station 0201 on July 7, 1992, were as follows: air temperature 26.0°C, water temperature 19.1°C, pH 8.3, specific conductance 233 umhos, total alkalinity 96 mg/l, and total hardness 140 mg/l (Table 2).

Aquatic macroinvertebrate diversity at Station 0201 was excellent, as 30 taxa were collected (Table 3). The collection included five mayfly families, one stonefly family and five caddisfly families. Three of the taxa collected, Ephemerellidae (a mayfly family), and Glossosomatidae and Rhyacophilidae (both caddisfly families), were considered very intolerant of pollution. Perlidae (a stonefly family), Hydropsychidae (a caddisfly family), Corixidae (water boatmen), and Rhyacophilidae were the taxa rated abundant. Aquatic macroinvertebrates in general were abundant at Station 0201.

The fish community at Station 0201 consisted of 13 species (Table 4), and was dominated by coldwater fishes and fish species common in streams that are transitional between a coldwater and a warmwater environment. Brown trout, blacknose dace, longnose dace, and migratory American eels were the species rated abundant at the station. The gamefish community was represented by brown trout, rainbow trout, brook trout, and largemouth bass (*Micropterus salmoides*). The panfish community was represented by redbreast sunfish, bluegills and black crappies (*Pomoxis nigromaculatus*).

Brown trout were the dominant gamefish species captured at Station 0201. Between the marking run and the recapture run, 189 individual brown trout, ranging from 50 to 374 mm in total length (Fig. 2), were captured by electrofishing at the 308 m long station. Of these 189 fish, 52.4% measured ≥150 mm in total length. Brown trout biomass and brown trout #/ha were 58.26 kg/ha and 1,024 fish/ha, respectively (Table 5). All of the brown trout captured at Station 0201 appeared to be wild fish.

The gamefish community at Station 0201 also included two rainbow trout, three brook trout and a single largemouth bass. The rainbow trout ranged from 275 to 299 mm in total length, the brook trout ranged from 200 to 324 mm in total length, and the single largemouth bass measured between 200 and 224 mm in total length. All of the rainbow and brook trout captured at Station 0201 appeared to be holdover fish stocked in either Cooks Ck. or Silver Ck. by the Springtown Rod and Gun Club. The largemouth bass probably originated from one of the small ponds in the drainage.

The panfish community at Station 0201 was represented by a single redbreast sunfish, three bluegills and a single black crappie. The redbreast sunfish measured between 150 and 174 mm in total length, the bluegills ranged from 50 to 199 mm in total length, and the black crappie measured between 200 and 224 mm in total length. Redbreast sunfish are native to Cooks Ck., while the bluegills and black crappie probably originated from one of the small ponds in the drainage.

Station 0202 - River Mile 3.10

Station 0202 was located in a partially shaded area of stream. Bank erosion was light and the bottom substrate consisted of sand, rubble and gravel. The station was adjacent to a farm pond, with a greenbelt of trees on one side of the stream and a wooded hillside on the other. The stream channel was generally wide and shallow, and was primarily composed of short riffles, long runs, and long pools. Fish habitat was provided by pocket pools, a few fallen trees, some undercut banks, and the few deeper pools.

Physical-chemical parameters and their associated values measured at Station 0202 on July 7, 1992, were as follows: air temperature 21.0°C, water temperature 17.2°C, pH 7.9, specific conductance 225 umhos, total alkalinity 100 mg/l, and total hardness 150 mg/l (Table 2). The 1992 water chemistry data varied somewhat from those measured by Marshall in August, 1976, who recorded a specific conductance of 265 umhos, a pH of 8.8, a total alkalinity of 106 mg/l, and a total hardness of 80 mg/l. The reason for these differences was unclear, but may have been due to differences in the timing of the two surveys. The 1976 survey did not provide an explanation for total alkalinity exceeding total hardness.

Aquatic macroinvertebrate diversity at Station 0202 was very good to excellent, as 29 taxa were collected (Table 3). The collection included 6 mayfly families, one stonefly family, and 7 caddisfly families. Three of the taxa collected, Ephemerellidae (a mayfly family), and Glossosomatidae and Rhyacophilidae (both caddisfly families), were considered very intolerant of pollution. Perlidae (a stonefly family), Elmidae (a beetle family), Corixidae (water boatmen), and Helicopsychidae (a caddisfly family) were the taxa rated abundant. Aquatic macroinvertebrates in general were abundant at Station 0202.

The aquatic macroinvertebrate community at Station 0202 in 1992 was similar to that found in 1976, when 29 taxa were collected. The 1976 collection included five mayfly families, one stonefly family and 7 caddisfly families. Aquatic macroinvertebrates in general were considered abundant at Station 0202 in 1976.

The fish community at Station 0202 consisted of 8 species (Table 4), and was dominated by coldwater fishes and fish species common

in streams that are transitional between a coldwater and a warmwater environment. Brown trout, blacknose dace and longnose dace were the species rated abundant at the station, while migratory American eels were rated common. The gamefish community was represented by brown and brook trout, and the panfish community was represented solely by green sunfish (*Lepomis cyanellus*). Green sunfish were not measured, and were rated rare at the station. They had probably originated from the nearby farm pond. Fish community composition at Station 0202 in 1992 was similar to that found in 1976, when 9 species were recorded.

Brown trout were the dominant gamefish species captured at Station 0202. Between the marking run and the recapture run, 152 individual brown trout, ranging from 50 to 349 mm in total length (Fig. 3), were captured by electrofishing at the 323 m long station. Of these 152 fish, 37.5% measured $\geq$150 mm in total length. Brown trout biomass and brown trout #/ha were 30.67 kg/ha and 879 fish/ha, respectively (Table 5). All of the brown trout captured at Station 0202 appeared to be wild fish.

The 1976 PFBC survey at Station 0202 captured 69 individual brown trout, ranging from 50 to 374 mm in total length, in 732 m of electrofishing. Brown trout biomass and brown trout #/ha were 14.07 kg/ha and 111 fish/ha, respectively. It was uncertain if the 1976 biomass estimate included stocked fish as well as wild fish, or solely represented wild trout biomass. Nevertheless, wild trout biomass has more than doubled at Station 0202 between 1976 and 1992. This biomass increase was most likely due to the 1975 cessation of trout stocking in Section 02.

In addition to brown trout, the gamefish community at Station 0202 in 1992 included 9 brook trout which ranged from 150 to 324 mm in total length. Eight of these fish were $\leq$224 mm in total length and appeared to be wild fish. These fish may have been spawned in Cooks Ck., but more likely were spawned in Coon Hollow Run and had migrated into Cooks Ck. Coon Hollow Run, a small limestone tributary to Cooks Ck., maintains the only documented Class A wild brook trout population in Bucks Co. (Wnuk & Kaufmann 1992). The single brook trout which appeared to be a stocked fish measured between 300 mm and 324 mm in total length, and was probably a holdover fish stocked in either Cooks Ck. or Silver Ck. by the Springtown Rod and Gun Club.

Section 02 Summary

Section 02 of Cooks Ck. was a low gradient, partially shaded stream section with reasonable public access dependent upon landowner permission. Road access was fairly poor, while human population density was moderate. Physical habitat in the section was fairly good, and siltation was visibly less than that observed in Section 01.

Overall water quality in Section 02 was excellent, with no significant sources of pollution noted. Water chemistry values indicated a moderately to strongly alkaline, well buffered system due to the presence of limestone in the geology as well as the addition of several small limestone springs and larger limestone tributaries that enter Cooks Ck. downstream from Springtown. Water temperatures in Section 02 were significantly lower than those in Section 01 due to the contribution of cold flow from these springs and tributaries.

Aquatic macroinvertebrate diversity in Section 02 ranged from very good to excellent, with many pollution intolerant forms present. Both the diversity and the density of aquatic macroinvertebrates in Section 02 were much greater than those observed in Section 01. This was probably due to a combination of lesser siltation and colder, higher quality water in Section 02.

The fish community in Section 02 was dominated by coldwater fishes and those species common in streams that are transitional between a coldwater and a warmwater environment. Brown trout, blacknose dace, and longnose dace were the three species rated abundant at both stations in the section. Wild brown trout were the dominant gamefish species captured, with a Class A mean section biomass of 44.46 kg/ha (Table 5). The Class A brown trout population developed between 1976 and 1992, probably as a response to the 1975 cessation of trout stocking in the section. The wild brown trout population in Section 02 was more dense than that in Section 01 because Section 02 had better physical habitat and colder, higher quality water.

Section 03

Section 03 of Cooks Ck. extended from the SR 4075 (Durham Road) bridge downstream to the mouth. Section 03 was differentiated from Section 02 based on differences in physical habitat, access and wild brown trout density. Physical and social characteristics of Section 03 are described below and presented in Table 1.

Section 03 was 3.5 km long, averaged 13.2 m in width, encompassed 4.6 ha, and had a gradient of 2.0 m/km. Ownership was 100% private (except for the very small strip of land at the mouth), of which 71% was considered open to public fishing with landowner permission and 29% was considered closed. Road access was excellent, as 92% of the section was within 100 m of a road and 100% of the section was within 300 m of a road. The human population density for Section 03 was 49 persons/km^2 (suburban) based on the 1990 census.

Station 0301 - River Mile 0.39

Station 0301 was located in a partially shaded area of stream. Bank erosion was light and the bottom substrate consisted of sand,

gravel and rubble, with some silt present in the slower moving pools and runs. The stream channel was excessively wide and shallow, and was primarily composed of long pools, long, shallow riffles, and gravel bars. Fish cover was provided by undercut banks, some pocket pools and a few deeper pools. Overall fish habitat was considered poor, especially for larger fish, due to the wide, shallow nature of the channel.

Physical-chemical parameters and their associated values measured at Station 0301 on July 7, 1992, were as follows: air temperature 20.0°C, water temperature 17.0°C, pH 7.6, specific conductance 220 umhos, total alkalinity 98 mg/l, and total hardness 144 mg/l (Table 2). The 1992 water chemistry data varied somewhat from those measured by Marshall in August, 1976, who recorded a specific conductance of 260 umhos, a pH of 8.3, a total alkalinity of 110 mg/l, and a total hardness of 108 mg/l. The reason for these differences was unclear, but may have been due to differences in the timing of the two surveys. The 1976 survey did not provide an explanation for total alkalinity exceeding total hardness.

Aquatic macroinvertebrate diversity at Station 0301 was excellent, as 31 taxa were collected (Table 3). The collection included 6 mayfly families, one stonefly family, and 6 caddisfly families. Two of the taxa collected, Ephemerellidae (a mayfly family) and Rhyacophilidae (a caddisfly family), were considered very intolerant of pollution. Heptageniidae and Tricorythidae (both mayfly families), Perlidae (a stonefly family), Planariidae (planaria), Limnephilidae (a caddisfly family), and Gammaridae (freshwater shrimp) were the taxa rated abundant. Aquatic macroinvertebrates in general were abundant at Station 0301.

The aquatic macroinvertebrate community at Station 0301 in 1992 was similar to that found in 1976, when 30 taxa were collected. The 1976 collection included four mayfly families, one stonefly family, and 8 caddisfly families. Aquatic macroinvertebrates in general were considered abundant at Station 0301 in 1976.

The fish community at Station 0301 consisted of 10 species (Table 4), and was dominated by coldwater fishes and fish species common in streams that are transitional between a coldwater and a warmwater environment. Brown trout, blacknose dace and longnose dace were the species rated abundant at the station, while migratory American eels were rated common. The gamefish community was represented by brown and brook trout, while the panfish community was represented solely by green sunfish. Green sunfish were not measured and were rated rare. Fish community composition at Station 0301 in 1992 was similar to that found in 1976, when 12 species were recorded.

Brown trout were the dominant gamefish species captured at Station 0301. Between the marking run and the recapture run, 105 individual

brown trout, ranging from 50 mm to 374 mm in total length (Fig. 4), were captured by electrofishing at the 300 m long station. Of these 105 fish, 34.3% measured ≥150 mm in total length. Brown trout biomass and brown trout #/ha were 17.10 kg/ha and 405 fish/ha, respectively (Table 6). All of the brown trout captured at Station 0301 appeared to be wild fish.

The 1976 PFBC survey at Station 0301 captured 31 individual brown trout, ranging from 50 to 324 mm in total length, in 1,500 m of electrofishing. Brown trout biomass was not estimated in 1976, but it is clear from CPUE rates that the wild brown trout population has greatly expanded since 1976. This increase was most likely due to the 1975 cessation of trout stocking in Section 03.

In addition to brown trout, the gamefish community at Station 0301 in 1992 included five brook trout. These fish ranged from 75 to 124 mm in total length, and all appeared to be wild fish. These fish may have been spawned in Cooks Ck., but more likely were spawned in Coon Hollow Run and had migrated into Cooks Ck.

Section 03 Summary

Section 03 of Cooks Ck. was a low gradient, partially shaded stream section, with reasonable public access dependent on landowner permission, excellent road access and moderate human population density. Physical habitat in the section was poorer than in Section 02, as habitat for adult trout was limited by the wide, shallow nature of the channel. The nature of the channel and the gravel bars present at Station 0301 indicated that Section 03 suffered from excessive stormwater runoff.

Overall water quality in Section 03 was excellent, with excessive stormwater runoff the only significant source of pollution noted. Water chemistry values indicated a moderately to strongly alkaline, well buffered system due to the presence of limestone in the geology as well as the addition of several small limestone springs and larger limestone tributaries that enter Cooks Ck. downstream from Springtown. Water temperatures in Section 03 were significantly lower than those in Section 01 due to these springs and tributaries.

Aquatic macroinvertebrate diversity in Section 03 was excellent, with many pollution intolerant forms present. Both the diversity and the density of aquatic macroinvertebrates in Section 03 were much greater than those observed in Section 01. This was probably due to a combination of lesser siltation and colder, higher quality water in Section 03.

The fish community in Section 03 was dominated by coldwater fishes and those species common in streams that are transitional between a coldwater and a warmwater environment. Brown trout, blacknose dace and longnose dace were the three species rated abundant in the

section. Wild brown trout were the dominant gamefish species captured, with a high Class C mean section biomass of 17.10 kg/ha (Table 6). This population was much denser than that documented in 1976, probably due to the cessation of trout stocking in Section 03 in 1975. The wild brown trout population in Section 03 was much less dense than that in Section 02 due to the limited physical habitat in Section 03.

Discussion

Cooks Ck. is a moderately alkaline, well buffered limestone stream that supports excellent aquatic macroinvertebrate populations and a Class A wild brown trout population. Class A wild trout populations are also present in Silver Ck. and Coon Hollow Run, small tributary streams to Cooks Ck. The wild brown trout populations in the Cooks Ck. basin are unique in Bucks Co., and the wild brook trout population in Coon Hollow Run is not only unique in Bucks Co., but is also very rare in the entire Area 6 fisheries management region. Both surface and ground water resources in the basin, on which the Class A wild trout populations depend, are very susceptible to contamination due to the limestone nature of the underlying geology. Because of its uniqueness, its proximity to heavily developed areas, the sensitivity of its environment, and its scenic and historical qualities, the DER should continue to protect the Cooks Ck. basin with EV-CWF designation.

The wild brown trout populations in Cooks Ck. are probably limited by a combination of seasonally warm water temperatures and restricted physical habitat. Section 01, upstream from the major limestone influences in the basin, warms too much during summer months to support many wild trout and also has poor physical habitat. Section 02, while it supports a Class A biomass, has somewhat restricted physical habitat for adult trout. Section 03 has much less physical habitat for adult trout than Section 02, and so supports a lesser biomass. Wild trout populations in Sections 02 and 03 are probably at their physical carrying capacities. Electrofishing in both sections, particularly in Section 03, produced adult trout from all suitable locations.

No trout longer than 350-374 mm (14.5 in.) were seen or captured during the survey, indicating that trophy size fish reported by anglers are truly rare fish in Cooks Ck. Habitat for large trout is limited by relatively low flows for a limestone spring creek and a very scanty distribution of deep channels and pools. Physical habitat improvement, especially in Section 03, would benefit wild trout populations in Cooks Ck. Physical habitat improvement should be directed toward narrowing and deepening the channel, which can best be accomplished through the use of various current deflector devices and rip-rap.

Public access is the major fisheries management issue on Cooks Ck. Sections 02 and 03, the wild trout sections, are heavily posted

against trespass. Anglers can gain access to these sections, however, through landowner permission. Many landowners, though not all, are willing to allow anglers to fish if the angler is polite, respects the property and does not litter. While not all landowners are willing to grant permission, and most landowners will not grant permission to everyone who asks, enough of the landowners contacted in the present survey are willing to grant permission to polite anglers that future fisheries management activities on Cooks Ck. and monitoring of the stream's wild trout populations can be justified.

Because of this restricted access, overall angling pressure on the wild trout populations in Cooks Ck. is relatively light. Additionally, some landowners who permit fishing require that all trout caught be released. Light angling pressure and the probability that wild trout populations in Cooks Ck. have reached the stream's physical carrying capacity suggest that the trout populations in Cooks Ck. would not respond to special angling restrictions such as catch and release or trophy trout management. Statewide angling regulations are adequate to sustain the Cooks Ck. fishery.

Cooks Ck. does not qualify for the statewide adult trout stocking program. Section 01 meets the minimum width requirements but most landowners prohibit trout stocking due to poor angler behavior in the past. The stretch of Section 01 in the general area of Station 0103 would qualify for delayed harvest management based on physical and chemical characteristics, but parking and access in this area are very limited. Section 02 does not qualify because it supports a Class A wild trout population. Section 03 does not qualify for adult stocking because landowners generally permit fishing, but prohibit stocking.

Trout stocking of Cooks Ck. by the Springtown Rod and Gun Club should be limited to those areas in Sections 01 and 03 where the club has obtained landowner permission. Stocking trout on top of the Class A wild trout population in Section 02 could have detrimental effects on the wild trout. These effects include reduced population fitness as a result of genetic dilution of the wild trout gene pool and lowered survival rates as a result of competition with stocked trout for limited physical habitat. The small number of trout stocked by the Club in Cooks Ck. in Section 01 or Section 03 would not be expected to impact the wild trout population in Section 02.

Management Recommendations

1. The Pennsylvania Department of Environmental Resources should continue to protect the entire Cooks Creek basin with the exceptional value coldwater fishery designation.

2. The Bucks County Conservation District should investigate the sources of the moderate siltation noted by the Pennsylvania Fish and Boat Commission in Section 01 of Cooks Creek and pursue corrective actions. Particularly noteworthy was bank erosion in a pasture immediately upstream from the village of Pleasant Valley. Additionally, best management practices on farmlands upstream from Springtown should be implemented to better control surface runoff into tributaries and the main stem.

3. The Bucks County Conservation District should investigate the Pennsylvania Department of Environmental Resources' report that livestock have free access to unnamed tributaries in the Cooks Creek basin and pursue corrective actions (see the Pennsylvania Department of Environmental Resources Cooks Creek Special Protection Status report for more detailed information).

4. The Pennsylvania Fish and Boat Commission should continue to manage the wild trout populations in Sections 02 and 03 of Cooks Creek with conventional, statewide angling regulations.

5. The Springtown Rod and Gun Club should restrict plantings of adult trout in Cooks Creek to the sections of stream upstream from Springtown and downstream from Durham (Sections 01 and 03), contingent on landowner permission.

6. If interested, the Bucks County Chapter of Trout Unlimited should pursue habitat improvement projects in Section 03 of Cooks Creek.

7. The Area 6 fisheries management staff should reconnoiter Section 03 of Cooks Creek to determine whether or not the sampling site's habitat was truly representative of the section. If not, a second, more representative site for a trout population estimate should be chosen and an estimate conducted in 1994.

8. Township officials should consider enacting ordinances that will prevent future development from denuding stream banks of trees and natural vegetation. These provide the necessary shade to maintain cold water habitat for Cooks Creek's trout population and all natural vegetation, including trees, is important in preventing further bank erosion. Bank erosion contributes sediments to the stream, which negatively impacts fish and aquatic insects, and causes the stream to become wider and shallower.

9. The reported blockage of the spring river herring migration up Cooks Creek by the paper mill dam near the mouth needs to be officially documented. This may only occur when east coast herring populations are high and when the overall spawning run in the Delaware River is exceptional.

Literature Cited

CCWA (Cooks Creek Watershed Association). 1988a. Letter to Roger Fickes and application for Scenic River status. PFBC files, Revere, PA.

CCWA (Cooks Creek Watershed Association). 1988b. Letter to Secretary, Department of Environmental Resources and application for EV-CWF status. PFBC files, Revere, PA.

Daniels, D., R. Marshall, and J. Weaver. 1970. Cooks Ck. stream survey report. PFBC files, Bellefonte, PA.

Daniels, D. 1971. Letter to R. Putt, Corps of Engineers. PFBC files, Bellefonte, PA.

DER (Department of Environmental Resources). 1990. Cooks Creek special protection evaluation report (2nd Draft). Pennsylvania Department of Environmental Resources, Harrisburg, PA.

EA Mid-Atlantic Regional Operations Engineering, Science, and Technology, Inc. 1990. Freshwater macroinvertebrate species list including tolerance values and functional feeding group designations for use in rapid bioassessment protocols. Prepared for US EPA, Washington, DC.

Illinois EPA. 1989. Biological stream characterization: A biological assessment of Illinois stream quality. Special Report #13, Illinois State Water Plan Task Force, Division of Water Pollution Control. Springfield, IL.

Klemm, D.J., P.A. Lewis, F. Fulk, and J.M. Lazorchak. 1990. Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters. US EPA, Cincinnati, OH.

Kulikosky, F. 1970. Memo to E. Miller. PFBC files, Bellefonte, PA.

Marcinko, M., R. Lorson, and R. Hoopes. 1986. Procedures for stream and river inventory information input. PFBC publication, Bellefonte, PA.

Marshall, R., P. Miller, J. Johnston, F. Rotchford, J. Weaver, and F. Mussel. 1973. Cooks Ck. stream survey report. PFBC files, Bellefonte, PA.

Marshall, R. 1976. Memo to R. Hesser. PFBC files, Bellefonte, PA.

Marshall, R., R. Hoopes, C. Emery, and Earle. 1976. Cooks Ck. stream examination report. PFBC files, Bellefonte, PA.

Philadelphia Bulletin. 1973. "Springfield Wins Tank Farm Relocation."October 15, 1973.

Plevyak, S. 1982. Cooks Creek pollution report. PFBC files, Revere, PA.

Plevyak, S. 1983. Cooks Creek pollution report. PFBC files, Revere, PA.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.

RMC Environmental Services, Inc. 1991. Post-diversion aquatic biology assessment for 1990. Prepared for the Philadelphia Electric Company, Philadelphia, PA.

Soldo, J. 1993. Rainbow trout fingerling stocking evaluations: Memo to R. Greene, Coldwater Unit Leader. PFBC files, Bellefonte, PA.

Snyder, R. 1972. Memo to R. Hesser. PFBC files, Bellefonte, PA.

Sweeny, T. 1972. Letter to the Pennsylvania Fish Commission. PFBC files, Bellefonte, PA.

Thomas, J. 1983. Earth disturbance inspection report. PFBC files, Revere, PA.

Thomas, J. 1985. Earth disturbance inspection report. PFBC files, Revere, PA.

Wnuk, R. and M. Kaufmann. 1991. Unnamed Tributary to Cooks Creek (Silver Creek) fisheries management report. PFBC files, Bellefonte, PA.

Wnuk, R. and M. Kaufmann. 1992. Unnamed tributary to Cooks Creek (Coon Hollow Run) fisheries management report. PFBC files, Bellefonte, PA.

Table 1. Physical and social characteristics of Cooks Ck. (602D), Bucks Co.

Characteristic	SECTION 01	02	03
USGS Quadrangle(s)	Hellertown, Quakertown	Hellertown, Riegelsville	Riegelsville
Physical			
Length (km)	12.9	6.0	3.5
Width (m)	4.8	11.2	13.2
Area (ha)	6.2	6.7	4.6
Gradient (m/km)	11.1	6.0	2.0
Social			
Ownership			
% Public	0	0	< 1
% Private (open)	100	66	71
% Private (closed)	0	34	29
Road Accessibility			
% Within 100 m	35	15	92
% Within 300 m	80	42	100
% Within 500 m	100	100	100
1990 Human Population Density (#/km^2)	64	60	49

Table 2. Physical-chemical parameters of Cooks Ck. (602D), Bucks Co., measured in July, 1992.

Characteristic	STATION						
	0101	0102	0103	0104	0201	0202	0301
Date	7/06	7/02	7/06	7/07	7/07	7/07	7/07
Air Temperature (°C)	24.0	28.0	29.0	26.0	26.0	21.0	20.0
Water Temperature (°C)	19.2	20.5	23.0	23.1	19.1	17.2	17.0
pH (Standard units)	7.3	7.4	8.0	8.4	8.3	7.9	7.6
Specific Conductance (umhos)	130	152	181	219	233	225	220
Total Alkalinity (mg/l)	50	55	62	77	96	100	98
Total Hardness (mg/l)	78	80	82	106	140	150	144

Table 3. Aquatic macroinvertebrate taxa collected in Cooks Ck. (602D), Bucks Co., in July, 1992.

Taxa	STATION 0101	0102	0103	0104	0201	0202	0301	PTI
Ephemeroptera								
Baetidae						X	X	7
Caenidae					X	X		7
Ephemeridae							X	4
Ephemerellidae	X		X		X	X	X	2
Heptageniidae	X	*	X	X	X	X	*	4
Siphlonuridae		X	X	X	X	X	X	7
Tricorythidae	X		X		X	X	*	5
Plecoptera								
Perlidae	X	X	*	X	*	*	*	3
Coleoptera								
Dryopidae						X		5
Dytiscidae					X		X	5
Elmidae		X	X	X	X	*	X	8
Gyrinidae			X	X	X	X	X	NA
Psephenidae	X	X	*	*	X	X	X	6
Trichoptera								
Glossosomatidae			X		X	X		0
Helicopsychidae						*	X	3
Hydropsychidae	X	X	*	X	*	X	X	4-8
Limnephilidae						X	*	4
Philopotamidae	X				X	X	X	6
Polycentropodidae	X	X	X		X	X	X	6
Rhyacophilidae					*	X	X	0

Table 3. Continued.

Taxa	STATION 0101	0102	0103	0104	0201	0202	0301	PTI
Odonata								
Aeshnidae		X			X	X	X	8
Gomphidae			X	X	X			4
Coenagrionidae			X	X				9
Diptera								
Chironomidae	*	X	X	X	X	X	X	0-10
Simuliidae	X	X					X	0-10
Tabanidae							X	4
Tipulidae	X	X		X	X		X	6
Megaloptera								
Corydalidae		X	X	X	X	X	X	6
Sialidae	X	X	X		X			8
Hemiptera								
Corixidae		X	X		*	*	X	NA
Gerridae	X	X	X	X	X	X	X	NA
Veliidae			X	X	X	X	X	NA
Decapoda								
Cambaridae	X	X				X		6
Amphipoda								
Gammaridae	X				X		*	2-8
Isopoda								
Asellidae					X	X	X	8

Table 3. Continued.

Taxa	STATION 0101	0102	0103	0104	0201	0202	0301	PTI
Tricladida								
Planariidae	X	X	X	X	X	X	*	10
Plesiopora	X	X	X	X	X	X	X	10
Opisthopora					X			10
Class Hirudinea			X					10
Class Gastropoda	X	X	X	X	X	X	X	1-9
Total Taxa	18	19	23	17	30	29	31	

X = Present at station
* = Abundant at station

PTI = Pollution Tolerance Index. PTI ranges from 0 (very intolerant of pollution) to 10 (very tolerant of pollution). NA = Not Available.

Table 4. Fish species captured by electrofishing in Cooks Ck. (602D), Bucks Co., in July 1992.

Scientific Name		STATION 0101	0102	0103	0104	0201	0202	0301
Oncorhynchus mykiss	Rainbow trout					R		
Salmo trutta	Brown trout			P	P	A	A	A
Salvelinus fontinalis	Brook trout					P	P	P
Exoglossum maxillingua	Cutlips minnow							P
Cyprinella analostana	Satinfin shiner			C	P			
Luxilus cornutus	Common shiner		R	A	A	P		P
Notropis hudsonius	Spottail shiner			R				
Rhinichthys atratulus	Blacknose dace	A	A	A	A	A	A	A
Rhinichthys cataractae	Longnose dace	R	P	A	A	A	A	A
Semotilus atromaculatus	Creek chub	C	P	P	R			
Catostomus commersoni	White sucker	C	A	C	A	C	C	C
Noturus insignis	Margined madtom				R			
Anguilla rostrata	American eel	P	P	C	P	A	C	C
Fundulus diaphanus	Banded killifish				R			
Lepomis auritus	Redbreast sunfish		P	C	P	R		
Lepomis cyanellus	Green sunfish						R	R
Lepomis macrochirus	Bluegill		P	P		P		
Micropterus salmoides	Largemouth bass					R		
Pomoxis nigromaculatus	Black crappie					R		
Etheostoma olmstedi	Tessellated darter	R	P	P	P	C	C	P
Total Species		6	9	12	12	13	8	10

Subjective abundance index (based on a 300 m long station):

A = Abundant (>100); C = Common (26-100); P = Present (3-25); R = Rare (1-2)

Table 5. Brown trout biomass estimates for Section 02 of Cooks Ck. (602D), Bucks Co., determined in July 1992.

Length group (mm)	Station 0201 (308 m) N	#/ha	#/km	kg/ha	Station 0202 (323 m) N	#/ha	#/km	kg/ha
50-74	18	49	58	0.05	15	43	46	0.13
75-99	240	655	779	2.62	227	657	703	3.94
100-124	0	0	0	0.00	1	3	3	0.04
125-149	1	3	3	0.07	0	0	0	0.00
150-174	3	8	10	0.40	0	0	0	0.00
175-199	24	66	78	5.24	15	43	46	3.43
200-224	26	71	84	6.88	23	66	71	7.32
225-249	11	30	36	4.35	11	32	34	4.68
250-274	18	49	58	10.17	5	14	16	3.47
275-299	20	55	65	13.59	2	6	6	1.63
300-324	10	27	32	9.82	3	9	9	3.14
325-349	0	0	0	0.00	2	6	6	2.89
350-374	4	11	13	5.07	0	0	0	0.00
Totals	375	1024	1216	58.26	304	879	940	30.67

MEAN BIOMASS FOR SECTION 02 IN 1992 = 44.46 kg/ha (Class A)

N = Chapman modified Petersen estimate
#/ha = Number of fish per hectare
#/km = Number of fish per kilometer
kg/ha = Kilograms of fish per hectare

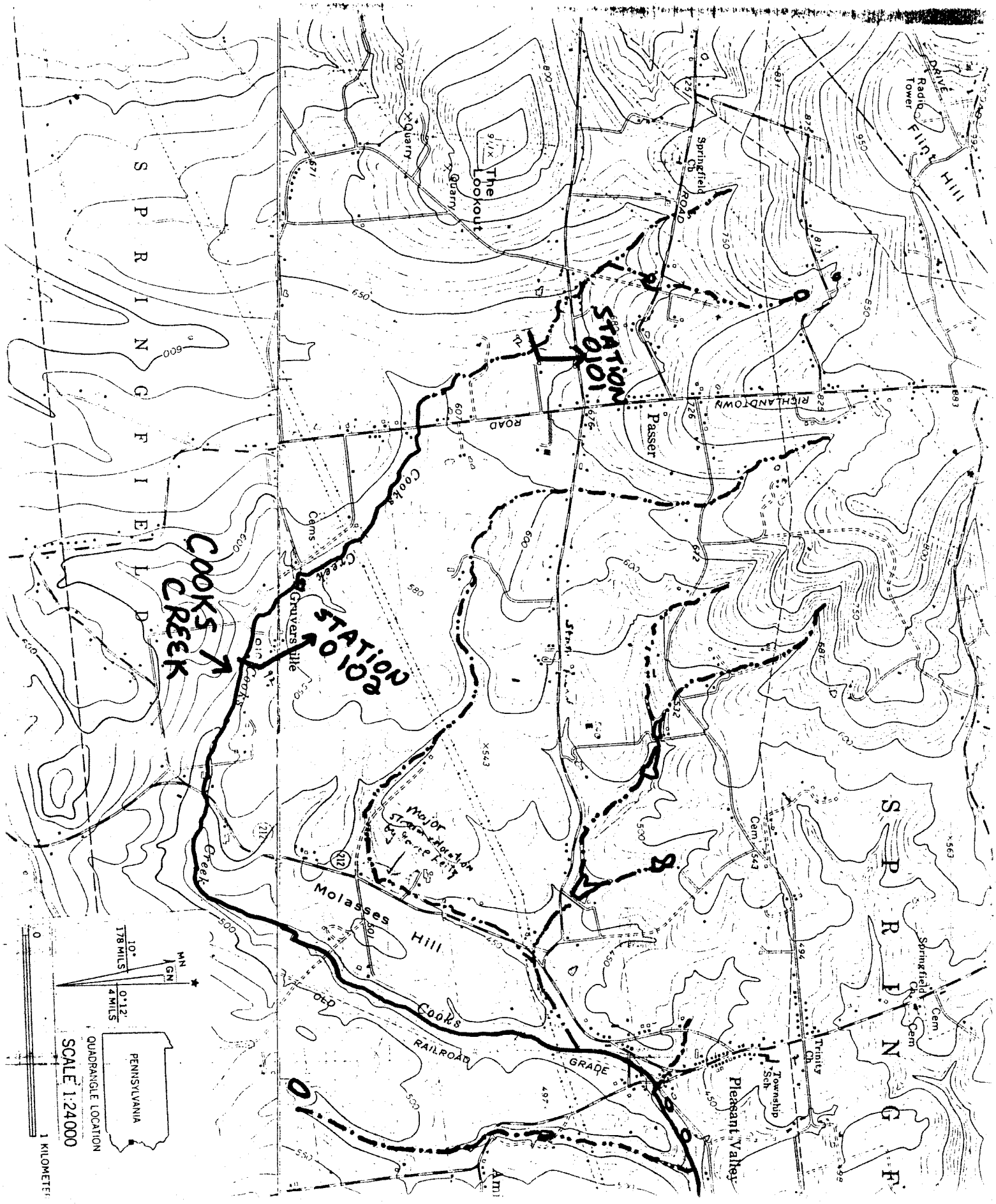
Table 6. Brown trout biomass estimate for Station 0301 of Cooks Ck. (602D), Bucks Co., determined in July, 1992.

Length group (mm)	N	#/ha	#/km	kg/ha
50-74	18	46	60	0.14
75-99	100	252	333	1.52
100-124	6	15	20	0.26
125-149	0	0	0	0.00
150-174	2	5	7	0.32
175-199	6	15	20	1.33
200-224	14	35	47	4.60
225-249	8	20	27	3.27
250-274	4	10	13	2.19
275-299	0	0	0	0.00
300-324	0	0	0	0.00
325-349	2	5	7	2.25
350-374	1	2	3	1.22
Totals	161	405	537	17.10 (Class C)

Station 0301 was 300 m long.

N = Chapman modified Petersen estimate
#/ha = Number of fish per hectare
#/km = Number of fish per kilometer
kg/ha = Kilograms of fish per hectare

Figure 1. Location map for Cooks Ck. (602D, Bucks Co.).



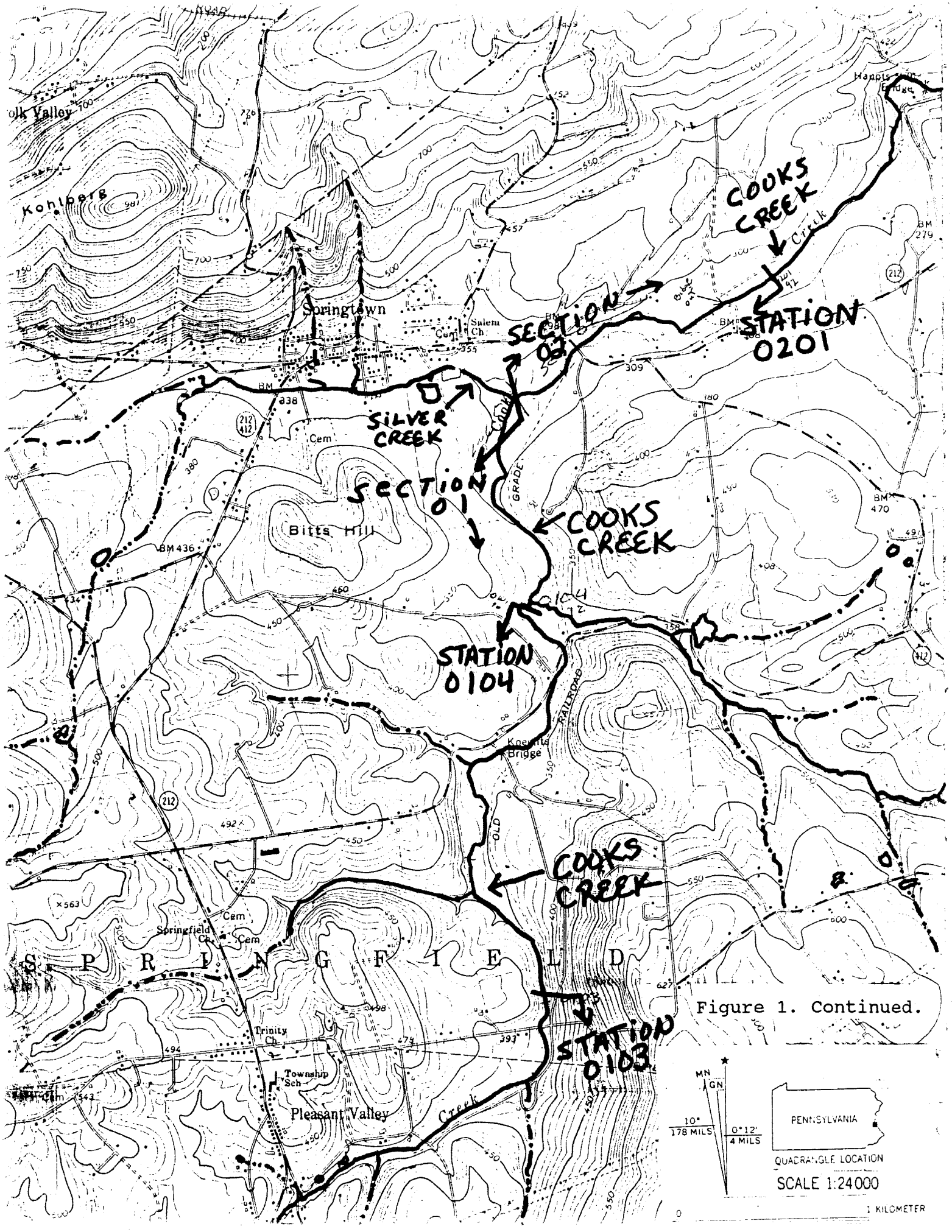


Figure 1. Continued.

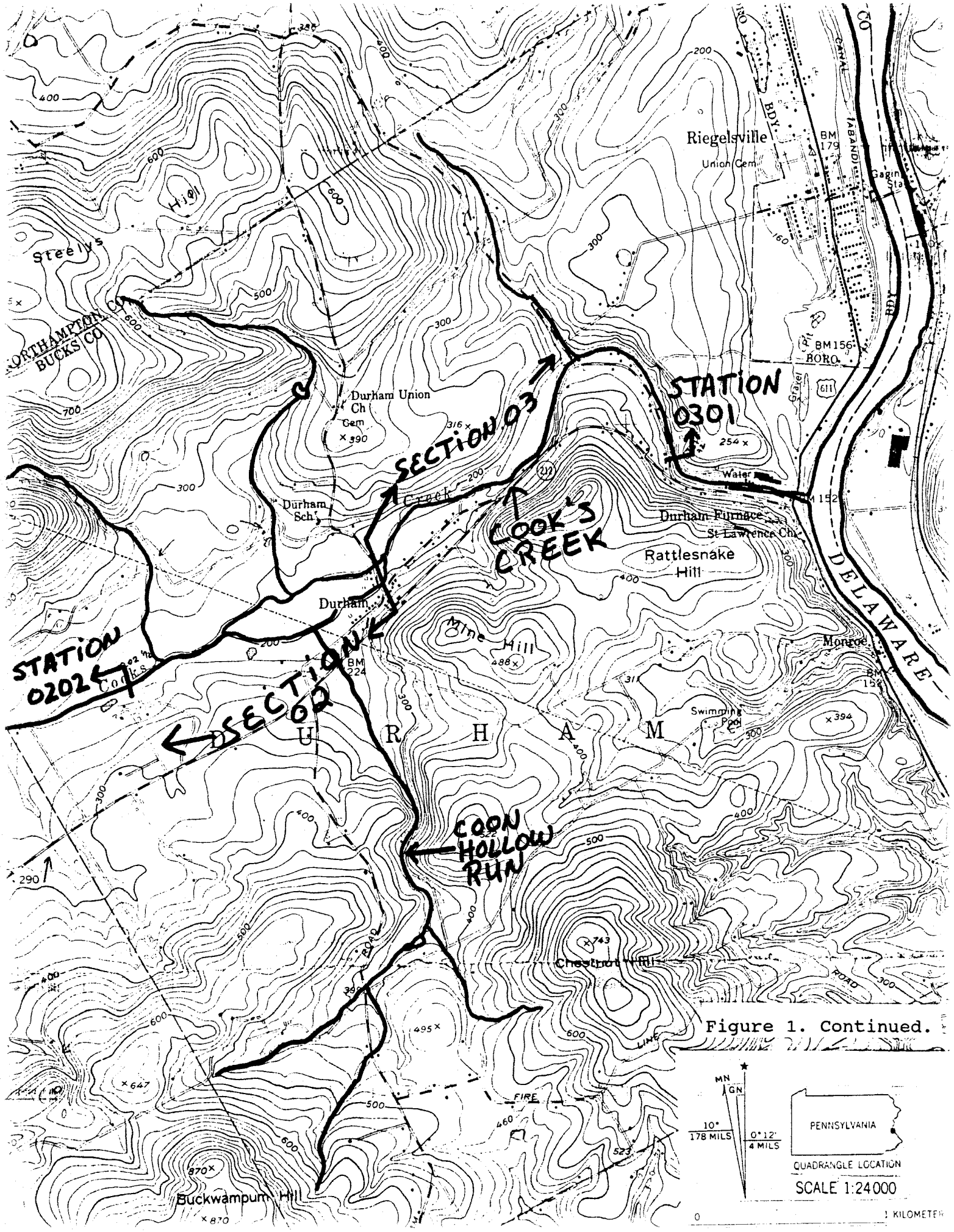


Figure 1. Continued.

Figure 2. Length–frequency distribution for brown trout captured at Station 0201 of Cooks Ck. (602D, Bucks Co.) in July, 1992.

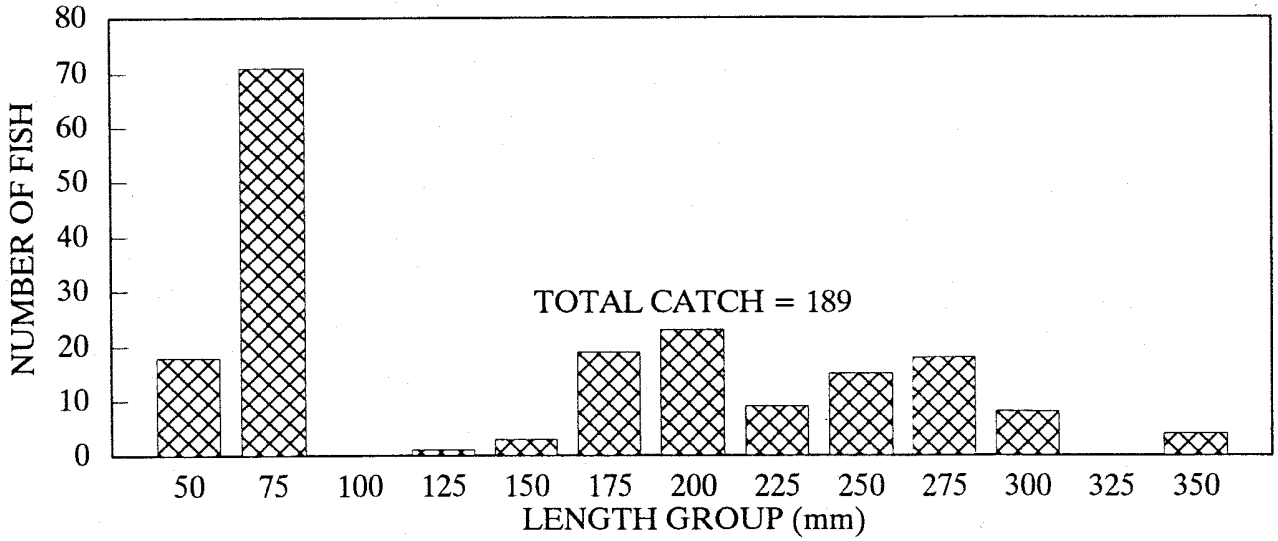


Figure 3. Length–frequency distribution for brown trout captured at Station 0202 of Cooks Ck. (602D, Bucks Co.) in July, 1992.

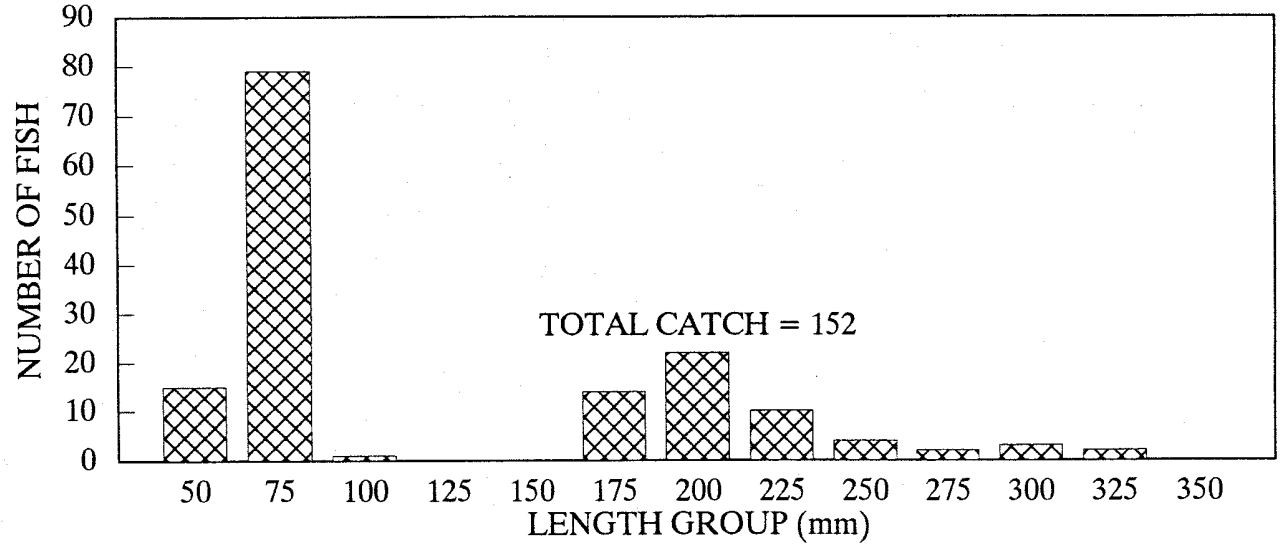


Figure 4. Length–frequency distribution for brown trout captured at Station 0301 of Cooks Ck. (602D, Bucks Co.) in July, 1992.