SAW KILL CREEK

PIKE COUNTY

SPECIAL PROTECTION EVALUATION REPORT

WATER QUALITY STANDARDS REVIEW

Segment: Entire Basin

Drainage List: C

QUALITY ASSESSMENT UNIT
DIVISION OF WATER QUALITY
BUREAU OF WATER QUALITY MANAGEMENT
DEPARTMENT OF ENVIRONMENTAL RESOURCES
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EXECUTIVE SUMMARY

General:

The Pennsylvania Department of Environmental Resources has developed water quality standards for all of the surface waters in the State. These standards, which are designed to safeguard Pennsylvania's streams, rivers, and lakes, consist of both use designations and the criteria necessary to protect those uses.

The Department's Special Protection program is a key element of a national and state program to prevent water pollution. Simply stated, the purpose of the program is to keep clean waters clean and provide Special Protection to exceptionally good quality waters and waters that represent outstanding environmental resources.

Special Protection is provided to streams designated as "High Quality Waters" or "Exceptional Value Waters." These classifications describe streams with excellent existing water quality and environmental features which are deserving of Special Protection. The water quality in a "High Quality Waters" stream can be lowered only if a discharge is the result of necessary social and economic development, the water quality criteria are met, and all existing uses of the stream are protected. "Exceptional Value Waters" are to be protected at existing quality. The water quality in "Exceptional Value Waters" shall not be degraded.

As part of its ongoing review of the water quality standards, the Department conducts evaluations of streams nominated for Special Protection designation. This report contains the results of such an evaluation.

Background:

Saw Kill Creek is a tributary to the Delaware River located in Pike County (Figure 1). The Saw Kill Creek basin is presently classified High Quality - Cold Water Fishes and is currently being considered for redesignation as Exceptional Value Waters at the request of a private citizen, Dr. Gifford B. Pinchot. The stream enters the Delaware River in the Delaware Water Gap National Recreational area near the Borough of Milford. The Saw Kill flows through the grounds of the Gov. Gifford Pinchot estate, Grey Towers, which is maintained by the U.S. Forest Service as a National Historic Landmark. Grey Towers has been described as the "birthplace of conservation in America" because of Gov. Pinchot's role in many forestry and other conservation related efforts. Pinchot Falls, listed in the Department's publication; Outstanding Scenic Geological Features of Pennsylvania, is located on Saw Kill Creek adjacent to Grey Towers.

The Saw Kill Creek basin lies entirely within the Glaciated Low-Plateaus section of the Appalachian Plateau's physiographic province and is underlain by siltstone, sandstone and conglomerate rock units. Most of the Saw Kill watershed is undeveloped and is predominantly wooded. Approximately 20% of the watershed consists of state forest, state game, and federal lands while the remainder is in private ownership.

Development in the watershed is primarily concentrated in the areas of Milford and the U.S. Route 6 corridor. There are two permitted point-source discharges in the watershed; a seasonal summer camp sewage treatment plant and an active sandstone quarry. Two more point-source treated sewage discharges are being proposed for the watershed; one from a shopping center/hotel complex known as Milford Commons and the other from an elementary school. Nonpoint-source discharges are represented by

many scattered single family dwellings and at least two housing developments in the southern portion of the watershed that are served by on-lot sewage disposal. Except for one illegal peat operation, there are no other known peat extraction activities in the watershed. The Department will continue to work to correct water quality problems caused by existing activities.

Findings:

Most of the Saw Kill has excellent water quality, but the absence of limestone or calcareous rock deposits in the underlying geologic units causes the stream to be a very sensitive, poorly buffered soft-water system. The Saw Kill basin supports marginally reproducing brook and brown trout populations upstream of Pinchot Falls. The Pennsylvania Fish Commission maintains a stocked trout fishery downstream from Pinchot Falls that is the only stocked stream segment in eastern Pike County. Sloat Brook, a tributary to the lower Saw Kill, has a well established reproducing brown trout population that supports the lower Saw Kill fishery as an important source of recruitment.

There are many small wetlands scattered throughout the watershed. The blend of upland mixed-oak forest with interspersed wetlands provides excellent habitat for black bear, deer, turkey, squirrel, grouse, mink, and beaver populations. The Saw Kill Creek watershed also serves as environs for at least two Species of Special Concern that are listed in the Pennsylvania Natural Diversity Inventory; the river otter and Bog-rosemary. The otter is considered 'vulnerable' by the Pennsylvania Game Commission and the Bog-rosemary is classified as Pennsylvania Rare. At least three other Pennsylvania Rare and three Pennsylvania Endangered plant species are located in nearby watersheds and may very likely be found in the Saw Kill basin.

Most of the soil types found in the Saw Kill basin are described as having severe or moderately severe limitations for housing and on-lot sewage development. These soils, which account for 90% of the watershed, are limited primarily by seasonal ground water levels or secondarily by steep slopes or rocky soil conditions.

Springs in the Saw Kill watershed (Vantine Brook subbasin) act as a source of unfiltered potable water for the Borough of Milford. The Milford Water Authority contends that Saw Kill Creek surface waters provide flow to the groundwater system that recharges these springs and that they would be threatened by any wastewater discharges upstream on the Saw Kill. These spring waters are chlorinated prior to entering holding ponds and degraded stream conditions that exist downstream from these ponds are possibly due to variable residual chlorine concentrations in the ponds' overflows.

Vantine Brook and the mainstem of Saw Kill Creek downstream from its confluence with Vantine Brook are not included in the EV recommendation because of observed degradation in the vicinity of the water authority reservoirs. Further, the lower sections of Vantine Brook and Saw Kill Creek flows through the most urbanized, developed portion of the watershed, which is incompatible with an EV designation.

Recommendations:

Based on the environmental attributes and existing land uses in the watershed, the Department recommends that Saw Kill Creek be redesignated as Exceptional Value Waters for that portion of the basin upstream from Vantine Brook. This recommendation would affect approximately 33.5 stream miles, an area of 22.9 square miles, and is based on the following:

1. The recommended portion of Saw Kill Creek exhibits excellent, but sensitive water quality conditions. Naturally reproducing brook and brown trout populations are present; particularly in Sloat Brook. The Department believes Sloat Brook is the main source of recruitment augmenting the stocked trout fishe y of the lower Saw Kill.

2. The Saw Kill Creek basin has many small wetland areas. The presence of at least one Pennsylvania Rare wetland plant (Bog-rosemary) within the Saw Kill basin has been documented. It is very likely that at least six other Rare or Endangered plants may also exist within the watershed. The wetland areas in the basin also provide habitat for the vulnerable but tenuously stable river otter population.

3. There are significant limitations for housing/on-lot sewage uses on approximately 90% of the soils in the Saw Kill basin. Consequently these soils could not properly renovate domestic sewage because of seasonal ground water levels, steep slopes, or rocky soil conditions.

4. Despite land use changes in the basin resulting from current levels of development, the stream itself has remained virtually unaffected, retaining its natural and wild character throughout most of the watershed.

5. The interaction of wetland and upland hardwood habitats provide excellent conditions which support abundant, valuable game populations of bear, deer, turkey, grouse, and squirrel and stable furbearer populations of beaver, mink, and otter.

6. The only public water authority within the watershed relies on springs in the Saw Kill basin as its source of potable water. While the exact groundwater source of these springs has not been fully documented, the Milford Water Authority contends that a hydrologic connection exists between the springs and Saw Kill Creek. An EV designation could benefit Milford's public water supply by preventing surface water degradation.

Location Map:

The attached figure shows the location of Saw Kill Creek and the segment evaluated for Special Protection.

INTRODUCTION

Saw Kill Creek is a tributary to the Delaware River located in Milford, Dingman, Shohola, and Westfall Townships, Pike County. The Saw Kill flows in a southeasterly direction for approximately 9.4 miles from its headwaters above Mud Pond to its confluence with the Delaware River in the Borough of Milford (Figure 1). The Saw Kill, with its 37 miles of streams, drains an area of approximately 24.3 square miles (15,500 acres).

The Saw Kill basin is presently classified for High Quality - Cold Water Fishes (HQ-CWF) in Chapter 93 of the Department's Rules and Regulations. A private citizen, Dr. Gifford Pinchot, has submitted a petition (with supportive documents and reports) requesting that the Saw Kill be reclassified as Exceptional Value (EV) Waters.

RESOURCES

Geology

The geology of the area (Figure 2) has been described by Fletcher and Woodrow (1970) and Sevon (in preparation). Sevon's more recent description revises the stratigraphic units discussed in Fletcher and Woodrow's publication. The following geologic discussion follows Sevon's stratigraphic correlations.

The Saw Kill Creek basin lies entirely within the Glaciated Low Plateaus section of the Appalachian Plateaus physiographic province. The topography for most of the watershed is characterized by flat-topped hills formed on nearly horizontal coarse-grained sandstone and conglomerate rock units. Maximum relief in the watershed is 1,140 feet where the elevation drops from a northwestern high point of approxiately 1,520 feet in the Savatine Creek sub-basin to 380 feet at the mouth of Saw Kill Creek. The hill tops, remnants of stream erosional processes, are separated by fairly steep-sided valleys. In the most southeastern portion of the watershed, the topography is dominated by an escarpement (known as The Cliff) that trends northeast-southwest with steep southeast slopes and gentle northwest slopes consisting of thick siltstones and sandstones. The Saw Kill Creek basin gained its final topographic features from erosion and depositional processes during Pennsylvania's last glacial period.

The underlying geology of the Saw Kill Creek basin is characterized by rock units of the Mahantango, Trimmers Rock, and Catskill Formations. Dark gray siltstones, silty shales, and shales comprise the Mahantango and Trimmers Rock Formations. The Catskill Formation is comprised of gray sandstones, gray and olive silty claystones, and red shales. These underlying geologic formations are covered by glacial till and outwash gravel deposits.

There is one geologic feature of Saw Kill Creek that is of special interest; Pinchot Falls. The Falls is located on the Pinchot estate, adjacent to Grey Towers (discussed later on Page 9). Pinchot Falls cascades more than 100 feet through a narrow gorge cut into the Mahantango Formation. It is listed in the Department's publication entitled Outstanding Geological Features of Pennsylvania (Geyer & Bolles, 1979).

Ground Water. Since private wells serve most of the domestic water demands in the watershed (excluding Milford), ground water yields are critical considerations in the Saw Kill Creek basin. The size sorting that occurred when materials were deposited in the watershed by glacial processes is generally unsuitable for long-term, dependable ground water yields. The yields of any shallow wells developed in these deposits are directly influenced by extended periods of dry weather. Sandstones, siltstones, and shales typically do not yield large volumes of water due to their low porosity and grain size. However, all the stratigraphic units of the geologic formations underlying the watershed comprised of these rock types act as viable aquifers (Fletcher and Woodrow 1970). The sandstones are extensively fractured by prominent joint sets with well-defined bedding partings. These features make the Long Run, Walckville, and particularly the Towamensing Members of the Catskill Formation excellent water- bearing rocks. For similar reasons, the fracture systems of silt and sandstone interbeds of the Trimmers Rock and Mahantango Formations allow good yields from these rock units.

Calculations were made to estimate monthly low flows (Q_{7-10}) based on geologic, precipitation, and areal factors. The lowest monthly (Q_{7-10}) at the mouth of Saw Kill Creek would typically occur during August and is estimated to be 2.9 cfs. The presence of wetlands scattered throughout the watershed (discussed later in this report) is further indicative of adequate ground water storage.

Even though there is very little well water chemistry data from the Saw Kill basin, the limited departmental file information indicates that ground water quality is good. Analysis of the Milford Water Authority's springs show parameter concentrations are well within public drinking water standards. Chemistry data available from wells in nearby watersheds also show low background concentrations of important drinking water parameters.

Mineral Resources. Sandstones were actively quarried from neighboring areas until the 1920's. Catskill sandstones are economically important because of their desirable weathering, ease-of-splitting, and hardness properties. Presently, there is one active quarrying operation in the watershed (Figure 2). This sandstone quarry was permitted for 151 acres, currently with 60 acres disturbed and discharges to the Saw Kill via a small unnamed tributary. Except for direct response from storm events and seasonal snow melt, the flow volume from this tributary is very low. Even though some siltation from this quarry is evident, preliminary observations indicate that the discharge has not caused any significant adverse impacts to Saw Kill Creek. Figure 2 also shows the locations of several small quarried areas that may have served as local sources of road bed materials (Sevon). Economic development of the few sand and gravel deposits found in the watershed is limited by the undesirable particle size distribution that characterizes the local glacial deposits.

A review of soils maps and wetland maps (discussed in further detail later in this report) indicates that there are very few peat deposits in the Saw Kill basin. Most of the peat deposits that do exist are too small to support intensive commercial exploitation. Departmental information does indicate, however, that illegal peat extraction has recently occurred in the vicinity of Mud Pond; the headwaters of Saw Kill Creek. The Department is presently considering legal action in this matter.

An exploratory well drilled to the north of the watershed indicates that subsurface structure and stratigraphy typifying the Saw Kill watershed and surrounding areas was not conducive for the accumulation of petroleum and natural gas reserves in exploitable quantities.

Soils

There are four soil associations that commonly occur in the watershed; the Chenango-Tunkhannock-Tioga (Chenango), Volusia-Tughill-Morris-Norwich (Volusia), Wurtsboro-Mardin-Swartswood (Wurtsboro), and Dekalb-Manlius-Oquaga Associations (DeKalb) (Taylor 1969).

Chenango soils are deep, well-drained and gravelly; developed from glacial outwash. These soils are normally found in lower terraces of larger stream and river valleys. With regard to residential development (septic fields, home sites), slopes of greater than 12% are major limitations. Soils from the Chenango Association are most commonly found in the southeastern $\frac{1}{3}$ of the watershed.

Volusia soils are poorly drained and occur in small valleys and upland depressions. These soils have seasonally high water tables and are either saturated most of the year or have well developed fragipans that impede root growth and penetration. The ground water conditions associated with these soils severely limit septic field and home site development.

Soils of the Wurtsboro Association are stony and are found in upland areas. With the exception of the Wurtsboro subgroup, other soils within this Association are generally well-drained. The Wurtsboro soils have seasonally high water tables caused by a compact fragipan. Although the Swartswood subgroup soils are well-drained, portions are found in areas of steeper slopes. The major factors limiting septic field and home site land uses of this Association are the poor drainage of the Wurtsboro soils, the steepness of some Swartswood soils, and general stoniness.

DeKalb soils are stony, shaly, well-drained, and found in upland areas. Unlike most of the soils from the other Associations, land use limitations of the DeKalb Assocation are not caused by ground water problems. Rather, the limitations of these soils are due to stoniness, depth-to-bedrock (2-4 feet), and steep slopes (>12%).

Figure 3 shows the extent of soils in the Saw Kill Creek basin where development potential is: 1) moderate-to-severe or severely limited by steep slopes, stony land, and poor drainage characteristics, or 2) has moderate or less-than-moderate limitations. Within the areas delineated as severely limited, particularly where limitations are based on slope, gently sloped lands that are suitable for home site construction and on-lot sewage disposal can be found, but in small isolated areas. However, as can be seen in this figure, 90% of the watershed area (13,980 acres) is generally unsuited for intensive development.

Vegetation and Habitat

The Saw Kill Creek basin is predominantly forested with limited clearings scattered throughout the watershed. The vegetation is characterized by a northern hardwood forest. The dominant forest type is mixed oak that includes white, red, chestnut, and scarlet varieties. Hemlock, white pine, beech, red maple, aspen, and ash can also be found in the basin. Most of the standing timber is not considered to be of high commercial quality.

Wetlands. The wooded upland areas that dominate the watershed are interspersed with many depressions and lowland areas that are classified as wetlands. These areas are depicted on Figure 4 and represent the wet extremes of the soil types with severe limitations from poor drainage characteristics. In recent years, the environmental benefits of wetlands have been gaining increased attention and recognition. Wetlands

are important in their role in stabilizing stream flow, improving water quality, aquifer recharge, and in providing desirable habitat for much of Pennsylvania's flora and fauna. Most of the wetlands delineated on Figure 4 are classified as Palustrine systems (<20 acres and <2m in depth of standing waters). They are also known by such generic names as marshes, swamps, bogs, fens, and ponds. Within the Saw Kill watershed, these Palustrine areas are sub-classified as Emergent (EM), Scrub-Shrub (SS), Forested (FO) or Open Water (OW) wetlands. Table 1 further explains these subclasses and other special wetland modifier definitions. The common feature of the Palustrine wetlands in the Saw Kill watershed is that they are normally seasonally flooded or saturated. Two other wetland areas, Saw Kill Pond and Lily Pond, are classified as Lacustrine systems (>20 acres, >2m deep). Figure 4 and Table 1 are based on the National Wetlands Inventory Maps and the classification system developed by Cowardin *et al* (1979).

Wildlife Habitat. The vegetative cover and undisturbed setting of the Saw Kill watershed provides excellent wildlife habitat for many game species. Most of the Saw Kill basin is prime black bear habitat that also supports very good populations of deer, turkey, squirrel and grouse. To a lesser extent, woodcock, snowshoe hare, and cottontail rabbit populations can also be found in the watershed. The diverse habitats associated with the wetlands also support well established and stable furbearer populations of mink, beaver, and river otter. Several factors are responsbile for the abundance of these popular game and furbearer populations. The basin's general undisturbed condition provides vast expanses of forested valleys and hollows that act as refuges; providing shelter and tree cover for roosting. The mix of wetlands and oak-dominant hardwoods offer a wide variety of food types. Most of the area is privately owned and posted, thus reducing hunting pressure on the resident game populations.

The highly productive habitat and indigenous wildlife populations found in the Sawkill basin would likely benefit from the further protection provided by an EV designation.

Water Quality Conditions

There have been several stream studies conducted on the Saw Kill during the last several years. The Pennsylvania Fish Commission (PFC) has conducted at least three surveys since the mid-1970's. More recently, during the winter and spring of 1988, Department biologists have conducted two localized surveys and one basin-wide survey. During the course of these surveys, water quality and biological conditions were evaluated. Results of the Saw Kill surveys are compiled in Tables 2-4. Existing land use conditions were also observed during these surveys.

Water Chemistry. Laboratory analysis of water samples collected from locations in the Saw Kill basin (Figure 5) reveal excellent water quality conditions. The concentrations for most of the parameters of concern (i.e., nutrients, metals, total dissolved solids, hardness, and fecal coliforms) were low or in trace amounts (Table 2). However, concentrations of parameters associated with the stream's natural buffering system are also very low (pH, alkalinity, calcium, magnesium). This indicates that the Saw Kill is a naturally infertile, softwater, poorly buffered stream, reflecting the influence of its underlying geologic rock units. As previously mentioned, these rocks are predominantly sandstones and siltstones that are virtually devoid of any limestone or other carbonaceous rock types. The Saw Kill's weak buffering system renders the stream incapable of assimilating any acidic or other pH-altering discharges that may result from commercial or industrial development.

Benthos. Benthic macroinvertebrates (fish-food organisms) were collected at 15 stations (Table 3) during the Department's surveys. The overall density of benthic macroinvertebrates was quite low. However, this is typical of benthic communities

found in infertile streams. The benthic samples collected from most sites revealed healthy, balanced communities that are remarkably diverse, despite the Saw Kill's naturally low fertility. Minor differences found between these communities may be attributed to subtle differences in substrate and habitat as well as minor water quality variations between stations.

The most significantly degraded conditions in the Saw Kill watershed were found at the lower station (14VB) in the Vantine Brook subbasin. This station is downstream from the Milford Water Authority's chlorinated reservoirs' overflows. Only a few benthic organisms (6 taxa) were collected at Station 14VB compared to 21 taxa collected upstream of the reservoirs at Station 13VB. While a detailed study was not conducted on the reservoirs' impact on the receiving stream, it is possible that residual chlorine concentrations in the overflows may be responsible for the observed degraded benthic conditions.

Fish. The lower 1.4 mile portion of the Saw Kill, downstream from its confluence with Sloat Brook, is managed for catchable trout by the PFC. This stream section (Section 03) is stocked with brown trout and is the only PFC stocked segment in eastern Pike County. The PFC has conducted three fishery management surveys (Billingsley *et al* 1976, 1985; Bourke *et al* 1984) on the Saw Kill's Section 03 since 1976. These studies found that the fishery was dominated by a naturally reproducing brown trout population with minor occurrences of brook trout. From 1976 to 1985, brown trout biomass had decreased (84.82 kg/ha to 30.63 kg/ha) but trout numbers had increased (551 trout/ha to 1232 trout/ha). This indicates that the fishery's population structure shifted from being dominated by older, larger trout with few sublegal sized fish (<175 mm, 7 inches) to one dominated by younger, smaller trout with many sublegal sized fish. Based on an analysis of age-class data, the PFC concluded that upstream sources in the Saw Kill basin serve as important areas of recruitment for the brown trout population.

Since the fishery of the lower Saw Kill was well documented, the Department's survey efforts concentrated on documenting fish communities from other, unstudied areas of the watershed. The survey results are compiled in Table 4. The Department found salmonid populations at five other locations within the Saw Kill basin; four supporting sublegal sized trout. Except for Sloat Brook, the population densities of all fish species were very low. Based on catch-per-unit effort (Table 4), Sloat Brook has the best fishery found outside PFC's Section 03. When considering the marginal trout populations found at upstream sites, the Sloat Brook fishery, and the natural barrier of Pinchot Falls, it appears that Sloat Brook acts as an important recruitment source for the lower Saw Kill fishery.

The low-density populations of all fish species found above Pinchot Falls further reflects the naturally low fertility of the watershed. Other factors may also have significant influence on fish production; particularly salmonids. The overall lack of gravel substrate that is important for trout spawning success contributes significantly to the low reproductive potential of the investigated tributary segments. In fact, the only young-of-year salmonids seen during the Department's surveys, were found in Dimmick Meadow Brook in one of the few benthic kick samples that happened to be collected from a gravel riffle. While almost all of the stream channels have excellent cover, the many ponds and wetlands (Figure 4) may discharge warmer waters during the hotter summer months. Also, it has been observed that many of the shallow ponds and impoundments in the Poconos often become anaerobic during extended periods in winter. It is probable that this event may occasionally affect Saw Kill Creek's ponds. Anything that may adversely affect temperatures and oxygen concentrations in Saw Kill Creek (i.e., warm pond waters or frozen snow-covered ponds) for even short periods of time can have deleterious effects on resident trout populations.

In summary, the general water quality conditions of the Saw Kill are quite pristine. The diversity of the benthic populations and presence of a reproducing trout fishery very clearly supports this conclusion. The surface water quality conditions and in-stream biota deserve the greater degree of protection provided by an EV designation.

Point Source and Nonpoint Source Discharges. Presently, there is one permitted discharge in the Saw Kill basin. The New Jersey Federation of YMHA/YWHAs operates a summer camp that has a seasonal non-public sewage discharge entering Saw Kill Pond that is permitted for a maximum of 100,000 GPD. The outfall from the camp's sewage treatment facility is submerged near the middle of Saw Kill Pond. Recent inspections (Summer 1987) by the Department revealed that the system was providing inefficient treatment that resulted in a gray, slightly septic effluent with suspended solids being discharged. An analysis of the treated effluent exhibited parameter values that exceeded permit maximums for suspended solids, BOD (5-day), and ammonia-nitrogen. The camp also uses Saw Kill Pond for water-based recreation and has permitted bathing beach facilities. There were no microbiological violations recorded for 1987. However, in 1986, there were fecal coliform violations (greater than 200 fecal coliforms/100 ml) in Saw Kill Pond and a downstream pond that is also maintained by the permittee. Since the camp's treatment facility was not in operation at the time of the Department's survey, no impacts to the downstream stations were noticed. It is possible that such impacts may occur downstream during the summer months when the camps are discharging.

Another point source discharge is from the Milford Water Authority's reservoir overflows. As previously mentioned, there is degradation evident in Vantine Brook downstream from these reservoirs. The reservoirs are chlorinated so it is possible that residual chlorine may be the cause of this degradation. The public water supply is discussed in further detail in a later section of this report.

There is an application under review by the Department that proposed to discharge up to 150,000 GPD to Saw Kill Creek near the U.S 6 road crossing. This non-public sewage treatment facility would discharge the treated effluent from a shopping center/hotel-restaurant complex (Milford Commons) that is proposed near the Exit 10 interchange of I-84. Two other discharge points, the headwaters of Sloat Brook and Vantine Brook, are also being considered as alternate discharge locations.

The Delaware Valley School District is planning to construct a new elementary school on the District's property holdings near Sagamore Estates. Their tentative plans may include a point source discharge of treated sewage to an unnamed tributary of Savantine Creek. On-lot disposal appears unlikely due to soil unsuitability; further attesting to the basin's poor soil conditions discussed earlier.

Another point source discharge located in the Saw Kill basin does not have an NPDES permit. Eureka Stone Quarry (MDP 5276SM5, Figure 2) has a very low-volume discharge entering Saw Kill Creek downstream from Savantine Creek. Eureka's original permit was issued before NPDES permits were required for non-coal operations. There is no significant adverse impact on the receiving stream from this quarry operation.

One point source discharge in the lower Saw Kill does not involve affected or treated water. A privately operated water powered grist mill in Milford receives water from an impoundment on Vantine Brook. This reservoir also receives some water diverted from the Saw Kill to supplement Vantine flow. In order to protect the Saw Kill's fishery, Departmental conditions for the encroachment permit allowing the Saw Kill diversion

require the mill operators to maintain at least 25% of the average daily flow at all times below the diversion structures.

Nonpoint source discharges consist of on-lot sewage systems serving the housing developments, isolated primary dwellings, and seasonal residences that are scattered through the lower half of the basin. The entire town of Milford is served by subsurface disposal systems. Septic system malfunctions are common in the watershed, particularly with the older systems such as in the Sagamore Estates area .

Public Water Supply

There is only one public water supply located in the Saw Kill basin. The Milford Water Authority (MWA) provides unfiltered water to Milford Borough and portions of Milford and Dingman Townships. The source of MWA's water is two primary and eleven secondary springs situated along Vantine Brook, south of U.S. 6. The spring water is stored in two concrete reservoirs and is then gravity fed through most of MWA's distribution system. Chlorination is the only treatment provided.

Presently, the source of MWA's springs has not been fully documented. When MWA became aware that the Milford Commons hotel/restaurant project proposed to discharge treated sewage effluent to the adjacent Saw Kill basin, the Authority became concerned about potential pollution of their springs via ground water contamination. The results of a private study commissioned by the Authority concludes that Saw Kill Creek is a "losing stream" in the vicinity of U.S. 6; i.e. surface water is 'lost' to the ground water system through permeable geologic substrates underlying the stream. The study further contends that this ground water system provides flow to the Authority's springs in the adjacent Vantine Brook basin via joints and fractures that characterize the underlying geologic formation. A review by the Department's technical staff found the study inconclusive and that further, more detailed studies are necessary to properly determine if the Saw Kill and MWA springs are hydrologically connected.

Species of Special Concern

The Pennsylvania Natural Diversity Inventory (PNDI) database was searched to identify Species of Special Concern known to occur within the Saw Kill Creek watershed. In addition, the Edgemere, Milford, Pond Eddy, and Shohola 7.5' quadrangle areas surrounding the Saw Kill were also searched. The PNDI revealed that 17 plant species, 7 animal species, and 2 communities of special concern occur or are known to have occurred within the 4 quadrangle search area (Table 5). Only 1 Pennsylvania Rare (PR) plant species, Bog-rosemary (*Andromeda polifolia*), and its associated glacial bog community has been documented to occur in the Saw Kill Creek watershed. Three Pennsylvania Endangered (PE) species; Spotted pond weed, Labrador marsh bedstraw, and Rock clubmoss, and 3 other PR species; Water lobelia, Slender water-milfoil, and Floating heart have been documented (some as recently as 1982-1986) from nearby watersheds. These plants are found in habitat types that also occur in the Saw Kill basin and, thus it is likely that they may also be present in the study area. Five other plants that are identified as rare, endangered, or threatened, have also been found in surrounding watersheds but the probability of their occurrence in the Saw Kill basin is uncertain because their habitat requirements are not clearly defined in the PNDI database.

The status of several other plants and animals has been defined as Tentatively Undetermined (TU). For a plant or animal to receive this designation, it is believed that the species is in danger of population decline but needs further study to determine a more accurate status. According to the PNDI, some of these species, such as the Soft-

leaved sedge, Crawford's sedge, Timber Rattlesnake, and Eastern hog-nosed snake have been found in the Saw Kill basin.

Another species of special significance, the river otter, is described as "vulnerable" by the Pennsylvania Game Commission (PGC). As a result of habitat losses due to land use disturbances, the river otter's range in Pennsylvania has been reduced to the Poconos region. Until recently, Pennsylvania's only surviving otters were represented by a tenuously stabilized population in the Poconos. In order to improve the river otter's population conditions, the PGC has been reintroducing otters to other locations in its original range .

Other animal Species of Special Concern, their status, and date of last sighting are also listed in Table 5.

The natural diversity and aesthetic/ecological attributes represented by the Species of Special Concern are compatible with and would benefit from the protection offered by an EV designation.

LAND USE

Existing Land Uses

Existing land use in the Saw Kill watershed is heavily dominated by woodlands and associated wetlands. Secondary uses consist of residential (permanent and seasonal) and recreational areas, and roadways. Residential use is primarily represented by the population center surrounding and including the Borough of Milford. Secondary population centers consist of the much less densely populated rural developments of Sagamore Estates and Saw Kill Creek. There are also many single family and second home structures scattered throughout the southern half of the watershed. Recreational uses are associated with the Delaware State Forest (14% of the watershed), Grey Towers National Historic Landmark, Delaware Water Gap National Recreation area, private summer camps, and a small portion of State Gamelands #209. Figure 6 depicts township boundaries and public land ownership in the Saw Kill basin. Other existing land uses related to agricultural, industrial, commercial, mineral activities affect very small areas of the Saw Kill Creek basin.

Land Use Plans

Comprehensive land use plans for the watershed have been developed at the township level. All four of the townships (Milford, Dingman, Shohola, and Westfall) have enacted zoning, sub-division, and building code ordinances. These township ordinances specify areas within each municipality for certain levels of development. All of the townships have similarly defined zoning classifications for areas allowing varying levels of development intensity: Conservation Districts (CD, C, CP), lower density residential (RU, R-1, R), and higher density residential and commercial (D, ND, MP). The townships control the land use pressure from housing development by requiring specific lot-size minimums. For areas designated as conservation or low-density residential districts (C, CD, CP, R, R-1, RU), minimum allowable lot sizes are required to be 1-2 acres, depending on the township and zoning classification. In areas where high-density housing is allowed, lot size minimums are smaller ($\leq$20,000 square feet). Figure 6 depicts the different zoning districts in the Saw Kill basin and summarizes the types of development allowed in each district.

Milford Township. There are three land development codes set forth by Milford Township's zoning ordinances: Conservation District (CD), Residential District (RD), and

Development District (DD). Most of the township north of U.S. 6 and the area of Grey Towers are zoned as CD, comprising about 73% of the township's area that lies within the Saw Kill basin. The remaining southeastern portions of Milford Township and parcels in the U.S. 6 corridor are zoned as Residential or Development comprising 15% and 11% of Milford Township, respectively.

Dingman Township. Dingman Township has five zoning categories: Conservation and Parks (CP), Rural (RU), low-density Residential (R-1), Neighborhood Development (ND) and Mobile Home Park (MP). The headwater areas of the Saw Kill, in the vicinity of Mud and Saw Kill Ponds and the Sloat Brook sub-basin, are zoned as R-1. Most of the areas of Dingman Township within the Saw Kill Basin that are zoned for high density housing and commercial development are situated along the U.S. 6 corridor.

Shohola and Westfall Township. All of Shohola Township that lies within the study area is zoned as a low-density Residential district (R-1). Except for a very small RU area, the Saw Kill portion of Westfall Township is zoned as CD. Most of this CD area is part of the Delaware State Forest.

If zoning restrictions currently in effect are enforced, local land use management plans are generally compatible with an EV Waters designation because of their emphasis on low-density development.

ARCHAEOLOGICAL AND HISTORICAL FEATURES

Personnel from the Bureau of Historic Preservation (PA Historical and Museum Commission) reviewed information and materials related to permit applications submitted for the Milford Commons project. Their findings indicate that there is a high probability that archaeological resources are located in the project's general vicinity. Further discussions with Museum personnel indicated that it is very likely that there would be similar archaeological findings on other parts of the watershed, as well. However, it is important to note that such findings would not necessarily preclude development. The archaeological analysis only raises a warning flag to developers; alerting them to exercise caution so that any encountered artifacts may be removed under guidelines and procedures provided by the Bureau of Historic Preservation.

The estate of Governor Gifford Pinchot, Grey Towers, is registered as a National Historic Landmark. The 102 acre property is maintained and operated by the U.S. Forest Service and is situated adjacent to Milford along U.S. Rt. 6. The historical significance of Grey Towers is that it has been described as the "birthplace of conservation in America" because of Governor Pinchot's early efforts to advance American forestry education and his tenure as the first Chief of the U.S. Forest Service (where he substantially increased the number of national forests and supported other conservation minded activities). In recent years, Grey Towers has attracted more than 15,000 visitors per year. The mainstem of the Saw Kill flows through the Grey Towers' grounds.

CONCLUSIONS AND RECOMMENDATIONS

The Saw Kill Creek watershed is underlain by geologic formations that are predominantly sandstones, siltstones, and shales. The quality of waters providing baseflow to the Saw Kill is excellent. The Saw Kill Creek watershed can be generally characterized as a pristine, naturally soft water system with very low buffering capacity. Presently, the Saw Kill watershed has experienced relatively little land use disturbance, thus retaining a naturally wooded or 'wild' character throughout most of the basin. The most intensive land use pressures and population densities are restricted to Milford and vicinity in the extreme southeastern corner of the watershed. The existing housing developments in other parts of the basin rely on individual on-lot sewage disposal and comprise a very small proportion of the watershed surface area.

Therefore, based on the environmental attributes as well as existing and proposed land use conditions in the watershed, the Department recommends that the protected use of Saw Kill Creek be changed from High Quality-Cold Water Fishes to Exceptional Value Waters for that portion of the basin upstream from Vantine Brook. This recommendation is based on the following:

1. Saw Kill Creek is a very infertile stream which exhibits excellent water quality. Although the benthic populations are present in low densities because of the infertile conditions, they are very diverse, well-balanced communities. The occurrence of naturally reproducing brook and brown trout populations is further indication of the excellent quality of the Saw Kill.

   The Pennsylvania Fish Commission has documented the presence of an excellent, reproducing brown trout fishery in the Saw Kill downstream from Pinchot Falls. This natural population is supplemented with stocked trout because of the rarity of recreational trout water in eastern Pike County that is still open to the public. The Department has also found a comparable brown trout fishery in Sloat Brook and believes that Sloat Brook is the primary source of recruitment supporting Saw Kill's brown trout fishery. For this reason, Sloat Brook is included in the EV recommendation.

   Vantine Brook and the mainstem of Saw Kill Creek downstream from its confluence with Vantine Brook are not included in the EV recommendation because of observed degradation in the vicinity of the water authority reservoirs. Further, the lower sections of Vantine Brook and Saw Kill Creek flows through the most urbanized, developed portion of the watershed, which is incompatible with an EV designation.

2. Many small wetland areas are scattered throughout the basin. The importance of wetland habitats and their hydrologic role are clearly illustrated in considering the Saw Kill watershed. The Saw Kill Creek basin has been documented to contain at least one Pennsylvania Rare wetland plant species and it is very likely that as many as six more Pennsylvania Rare or Endangered plants (five being either wetland or aquatic varieties) may also inhabit the same environ.

3. The interaction of wetland and surrounding upland hardwood habitats provide a well-balanced, abundant food supply and valuable refuge for game and fur-bearing species. These excellent conditions are responsible for abundant deer, turkey, bear, grouse, squirrel and mink populations. In addition, two fur-bearer populations, beaver and river otter, are stable. It is important to note that the otter is classified as "vulnerable" by the Pennsylvania Game Commission, with prohibitions against trapping. While the PGC has had some success in

reintroducing otter to other areas, the Poconos is the only region in the state that presently has stabilized otter populations. The stability and future of this vulnerable species is critically dependent on habitat availability. The river otter and other valuable Pennsylvanian wildlife will benefit from an EV designation.

4. There are severe limitations on most of the soil types found within the watershed. The soils associated with the wetlands and their surroundings and areas of steep slopes and rocky soils impose moderately-severe to severe restrictions for housing/on-lot sewage uses on about 90% of the watershed. Consequently, these soils will not protect the stream from development by properly renovating domestic sewage.

5. Despite land use changes resulting from the current level of development, the stream remains virtually unaffected. The problem discharge on Saw Kill Pond associated with the New Jersey YMHA/YWHA camps is seasonal. Any corrective action needed for these discharges can be effectively addressed through the Department's inspection and enforcement process. While the discharge from the permitted sandstone quarry has caused some siltation, it has not significantly degraded the receiving stream.

   Most of the watershed is zoned for low impact land uses; i.e. conservation or low-density residential areas. There are areas zoned to allow more intensive land uses, but they are almost exclusively restricted to highway corridors with little stream frontage. Further, while there are areas with soils acceptable for on-lot sewage disposal, they are discontinuous; occurring in many, small isolated pockets. The restricted extent of these areas provide a natural deterrent to widespread, intensive development.

6. The only public water supply system in the Saw Kill watershed relies upon an unfiltered source. Milford Water Authority's reservoir system is fed by two large springs and eleven smaller springs. While the exact ground water source of these springs has not been fully documented, the Milford Water Authority contends that surface waters from the Saw Kill recharge the Authority's springs through hydrologic ground water connections. An EV designation could benefit Milford's public water supply by preventing surface water degradation.

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TABLE 1

WETLAND CODES FOR SAW KILL CREEK
FIGURE 4

Symbol From Figure 4	Wetland Inventory Map Code	Ecological Modifiers			Special Modifiers
		System	Class	Sub-Class	
A	POW	P: Palustrine	OW: Open Water		
A'	POWZ	P: Palustrine	OW: Open Water		Z: Intermittently exposed, permanent
B	POWZh	P: Palustrine	OW: Open Water		Z: Intermittently exposed, permanent h: impounded
C	PFO1	P: Palustrine	FO: Forested	1: Broad-leaved deciduous	
D	PFO1E	P: Palustrine	FO: Forested	1: Broad-leaved deciduous	E: Seasonally saturated
E	PFO 1/4	P: Palustrine	FO: Forested	1/4: 1 + Needle-leaved evergreen	
F	PFO4E	P: Palustrine	FO: Forested	4: Needle-leaved evergreen	E: (see above)
G	PFO4/1E	P: Palustrine	FO: Forested	4/1: (See 4 and 1 above)	E: (see above)
H	P FO/SS 1	P: Palustrine	FO/SS: FO + Scrub/Shrub	1: (See 1 above)	
I	P FO/SS 1E	P: Palustrine	FO/SS: FO + Scrub/Shrub	1: (See 1 above)	E: (See above)
J	P FO/SS 4E	P: Palustrine	FO/SS: FO + Scrub/Shrub	4: (See 4 above)	E: (See above)
K	P F01/EM5 E	P: Palustrine	FO/EM: FO + Emergent	1: (See 1 above) 5: narrow-leaved persistent	E: (See above)
M	PSS1	P: Palustrine	SS: Scrub/Shrub	1: (See 1 above)	
N	PSS1C	P: Palustrine	SS: Scrub/Shrub	1: (See 1 above)	
O	PSS3Ba	P: Palustrine	SS: Scrub/Shrub	3: Broad-leaved evergreen	B: Saturated a: acidic
Q	P SS/FO 1A	P: Palustrine	SS/FO: SS + Forested	1: (See 1 above)	A: Temporary
R	P SS1/EM	P: Palustrine	SS/EM: SS + Emergent	1: (See 1 above)	
S	P SS1/EM5 C	P: Palustrine	SS/EM: SS + Emergent	1/5: (See 5 above)	C: Seasonal
T	P SS1/EM5 E	P: Palustrine	SS/EM: SS + Emergent	1/5: (See 5 above)	E: (See above)
U	P SS1/EM5 Ed	P: Palustrine	SS/EM: SS + Emergent	1/5: (See 5 above)	E: (See above) d: Partial drainage
V	PEM5E	P: Palustrine	EM: Emergent	5: (See 5 above)	E: (See above)
W	P EM5/OW Fh	P: Palustrine	EM/OW: Em + Open Water	5: (See 5 above)	F: Semi-permanent h: Impounded
X	L10W	L: Lacustrine	10W: Limnetic open water		
Y	L10WHh	L: Lacustrine	10W: Limnetic open water		H: Permanent h: Impounded
Ω	Ω	Uplands	No wetland		

TABLE 2.
WATER CHEMISTRY DATA[1]
SAW KILL CREEK, PIKE COUNTY
MARCH 15, 1988

Station/ Sample I.D. (0906---)	1SC 082	2SC 081	3SaC 080	5CB 085	6CB 084	7PB 083	9DMB 071	10SC 070	12SB 074	13VB 072	14VB 073	15SC 075
Field Parameters												
Temp (°C)	1	2.5	.5	2.5	3	1	.5	1	3	1	3.5	1.5
pH	-	-	-	-	6.4	6.3	5.8	6.1	6.8	6.7	7	6.8
Cond (umhos)	30	55	15	10	18	15	10	25	45	25	40	30
Diss. O_2	13.5	13	13.7	13.6	13	13.6	13.8	13.6	13.1	13.8	13	13.8
Laboratory Parameters												
pH	5.7	6.7	6.6	6.3	6.4	6.4	**	6.6	6.6	6.7	6.8	6.8
Alkalinity	2	8	6	4	4	4	**	6	6	8	10	6
Acidity	32	0	0	30	26	26	**	0	0	0	0	0
Hardness	12	21	12	<10	11	11	**	16	20	16	20	17
T Diss. Sol.	12	52	8	<2	14	<2	**	34	30	54	56	40
Susp. Sol.	2	<2	<2	<2	10	<2	**	6	<2	<2	<2	<2
NH_3-N	<.02	.02	<.02	<.02	<.02	<.02	**	.03	<.02	<.02	<.02	<.02
N_2-N	<.004	<.004	<.004	<.004	<.004	<.004	**	<.004	<.004	<.004	<.004	<.004
NO_3-N	<.04	.14	<.04	<.04	<.04	<.04	**	.12	.22	.20	.38	.16
Total P	<.02	.03	<.02	<.02	<.02	<.02	**	.02	<.02	.02	.02	<.02
Ca	2.42	5.67	3.08	2.7	2.79	3.09	2.13	4.69	5.59	4.05	5.66	4.48
Mg	1.01	1.58	<1	<1	<1	<1	<1	1.24	1.77	1.57	1.92	1.3
Cl	9	15	2	1	1	1	**	6	14	6	10	7
SO_4	<10	11	<10	<10	<10	11	**	<10	11	<10	<10	<10
As*	<4	<5	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Cd*	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20
Cr*	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cu*	27	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Fe*	90	171	48	36	46	28	45	73	77	99	62	476
Pb*	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Mn*	44	51	10	<10	17	<10	<10	<10	13	<10	<10	12
Ni*	38	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Zn*	<25	10	<10	<10	<10	<10	<10	12	<10	<10	13	<10
Al*	<135	<135	<135	<135	<135	<135	<135	<135	<135	<135	<135	<135
fecal colif. mpn/100ml	<10	<10	10	<10	<10	10	<10	<10	50	<10	<10	10

[1] Except for pH and conductance and indicated otherwise, all values are total concentrations in mg/l

* Total concentrations in ug/l

** Improperly fixed in field

TABLE 3

BENTHIC MACROINVERTEBRATE QUALITATIVE RESULTS[1]
SAW KILL CREEK, PIKE COUNTY 1987-88*

Taxa[2]	Station														
	1 SC	2 SC	3 SaC	UP B*	DN B*	5 CB	7 PB	8 SC	9 DMB	10 SC*	11 SB*	12 SB	13 VB	14 VB*	15 SB
Mayflies															
Baetidae; *Baetis*	-	-	-	-	-	-	-	-	R	X	-	-	P	-	P
Ephemeridae; *Ephemera guttulata*	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-
Litobrancha recurvata	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-
Ephemerellidae; *Ephemerella* spp	-	-	-	X	X	-	-	-	-	X	2spp	-	-	-	-
Ephemerella rotunda	-	-	P	-	-	R	-	-	P	-	-	A	P	-	A
E. subvaria	-	-	P	-	-	-	-	C	-	-	-	-	-	-	P
Eurylophella funeralis	P	R	-	-	-	R	P	C	P	-	-	-	-	-	-
Heptageniidae; *Epeorus*	-	-	-	X	X	-	P	-	P	X	X	P	C	-	C/A
Leucocruta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
Stenonema	-	P	P	X	-	-	-	P	-	X	-	-	-	-	-
Leptophlebiidae; *Leptophlebia*	P	-	-	X	-	-	-	-	-	-	X	-	-	-	-
Paraleptophlebia	-	-	P	X	-	-	P	P	P	X	X	-	R	-	P
Oligoneuridae; *Isonychia*	-	-	P	X	X	-	-	P	-	X	-	P	-	-	P
Siphlonuridae; *Ameletus*	-	-	-	-	-	P	C	-	P	-	X	-	P	-	-
Stoneflies															
Capniidae; *Paracapnia angulata*	-	-	-	-	-	P	-	-	P	X	X	-	P	-	P
Chloroperlidae; *Suwallia/Sweltsa*	-	-	-	-	-	-	-	-	P	-	X	-	P	-	-
Leuctridae; *Leuctra*	P	-	-	-	-	-	P	-	P	-	X	-	P	-	-
Nemouridae; *Amphinemura*	P	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Ostrocerca	-	-	P	-	-	-	R	-	-	-	-	P	-	-	P
Paranemoura	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Peltoperlidae; *Tallaperla*	-	-	-	X	X	-	-	P	P	X	X	-	-	-	-
Perlidae; *Acroneuria abnormis*	-	P	P	X	X	-	-	P	P	X	X	-	-	-	-
A. carolinensis	-	-	P	-	-	-	-	-	P	X	X	-	-	-	-
A. internata	P	P	-	-	-	-	-	P	-	-	-	-	P	-	-
Phasganophora capitata	-	-	-	-	-	-	-	-	-	X	-	-	-	-	P
Perlodidae; *Cultus decisus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
Diploperla	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Isogenoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
Isoperla dicala n.r.	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-
I. holochlora n.r.	-	-	-	-	-	-	-	-	P	-	-	-	-	-	P
I. similis	P	-	-	-	-	-	P	-	-	-	X	-	-	-	-
I. sp	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-
Pteronarcyidae; *Pteronarcys*	-	-	P	-	X	-	-	P	R	X	-	P	P	-	R
Taeniopterygidae genus	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Oemopteryx	P	P	C	-	X	P	-	C	-	X	-	C	-	-	C
Taeniopteryx	-	-	X	X	X	P	-	-	-	-	-	-	-	-	-

TABLE 3
(Continued)

Taxa[2]	Station														
	1 SC	2 SC	3 SaC	UP B*	DN B*	5 CB	7 PB	8 SC	9 DMB	10 SC*	11 SB*	12 SB	13 VB	14 VB*	15 SB
Caddisflies															
Brachycentridae; *Adicrophleps*	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-
Micrasema	P	-	P	-	-	-	-	-	P	-	-	-	-	-	-
Glossosomatidae; *Glossosoma*	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-
Hydropsychidae; *Aphropsyche*	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-
Cheumatopsyche	-	P	P	-	-	-	-	P	P	-	-	P	P	-	-
Diplectrona	P	-	P	-	-	P	P	P	-	-	X	R	P	-	-
Hydropsyche Ceratopsyche spp.	-	-	-	-	-	P	-	P	P	-	-	P	P	-	-
H. Hydropsyche spp	-	P	-	X	X	-	-	-	-	X	-	P	-	-	P
Hydroptilidae; *Hydroptila*	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-
Lepidostomatidae; *Lepidostoma*	P	-	P	-	X	-	P	-	P	-	-	-	P	-	P
Leptoceridae; *Oecetis*	-	-	-	-	-	P	-	-	-	X	-	-	-	-	-
Limnephilidae; *Limnephilus*	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neophylax	P	P	P	-	-	P	R	P	R	-	X	-	-	-	-
Pyncopsyche	P	P	P	X	X	P	P	P	-	X	X	-	-	X	P
Philopotamidae; *Chimarra*	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Dolophilodes	-	-	P	X	X	-	-	R	P	X	X	P	-	-	-
Phryganeidae; *Ptilostomis*	P	P	-	-	-	-	-	P	-	-	-	-	-	-	-
Odontoceridae; *Psilotreta*	-	-	-	-	-	-	-	-	-	-	X	P	-	-	C
Rhyacophilidae; *Rhyacophila* sp.	-	-	-	X	X	-	-	-	-	-	X	-	-	X	-
Rhyacophila fuscula	-	R	-	-	-	-	-	P	-	-	-	-	-	-	-
R. glabberima	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-
R. invaria subgroup	P	-	-	-	-	P	-	-	-	-	-	-	-	-	-
R. manistee n.r.	-	-	-	-	-	-	-	-	P	-	-	P	-	-	-
R. nigrita	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-

TABLE 3
(Continued)

Taxa[2]	Station														
	1 SC	2 SC	3 SaC	UP B*	DN B*	5 CB	7 PB	8 SC	9 DMB	10 SC*	11 SB*	12 SB	13 VB	14 VB*	15 SB
True Flies															
Athericidae; *Atherix*	-	-	P	X	X	P	-	-	-	X	-	P	-	-	-
Ceratopogonidae; *Bezzia* gr.	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-
Empididae; *Chelifera*	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-
Clinocera	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Simuliidae genus	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-
Prosimulium	C	A	P	-	-	P	-	P	P	-	-	P	P	-	
Simulium	-	P	-	-	-	-	A	-	-	-	-	P	-	-	-
Tipulidae; *Dicranota*	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-
Hexatoma	-	P	-	-	-	-	-	-	P	X	X	P	P	X	P
Tipula	R	P	P	X	X	-	P	P	P	-	X	P	-	X	P
Chironomidae genera	C	P	P	X	X	P	P	P	R	X	X	P	P	X	P
Miscellaneous Insects	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Aeshnidae, *Boyeria*															
Cordulegastridae; *Cordulegaster maculatus*	-	-	P	-	X	-	-	P	-	-	-	-	-	-	-
Gomphidae; *Lanthus*	-	-	P	X	-	P	-	-	R	-	-	P	-	-	-
Octogomphus	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Corydalidae; *Nigronia*	P	P	P	X	-	P	-	P	P	X	-	-	-	-	P
Sialis	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Elmidae; *Promoresia*	-	-	P	-	-	-	-	P	-	-	-	P	-	-	-
Psephenidae; *Ectopria*	-	-	P	-	-	P	-	P	-	-	-	-	P	-	-
Psephenus	-	-	-	-	-	-	-	-	R	-	-	-	-	-	P
Non-Insect Taxa															
Asellidae; *Asellus*	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Cambaridae; crayfish	-	R	P	-	-	-	-	P	-	-	-	-	-	-	-
Gammaridae; a hypogean sp.	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-
Spongillidae; fresh-water sponge	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca; *Ferrissia*	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-
Oligochaeta; lumbricid type	-	-	-	-	-	-	R	-	-	-	-	-	R	-	-
tubificid type	-	-	-	-	-	-	R	-	-	-	-	-	-	X	-
Turbellaria; flat-worm	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-
Total # of Taxa	19	24	31	18	18	19	20	29	29	22	25	25	21	6	24

*Date Sampled:
UPB - 1/27/88
DNB - 1/27/88
10SC - 2/17/87
11SB - 2/16/88
14VB - 3/14-16/88

1 - Relative Abundance:
A - Abundant
C - Common
P,X - Present
R - Rare

2 - Miscellaneous Taxonomic Abbreviations:
gr. - group
sp - 1 specie
spp - 2 + species
n.r. - nearest resemblance

TABLE 4
QUANTITATIVE ELECTROFISHING RESULTS
SAW KILL CREEK
MARCH 15-16, 1988

	Stations							
	1SC	3SaC	5CB	7PB	8SC	9DMB	12SB	13VB
Brook trout, *Salvelinus fontinalis*	0	5	0	1	6	4	0	0
Brown trout, *Salmo trutta*	0	0	0	0	3	5	23	0
salmonid total#	0	5	0	1	9	9*	23	0
Blacknose dace, *Rhinichthys atratulus*	0	7	1	0	11	3	0	0
White sucker, *Catastomis commersoni*	0	0	0	0	3	0	0	0
Golden shiner, *Notemigonus crysoleucas*	0	3	0	0	0	0	0	0
total species	0	3	1	1	4	3	1	0
electrofishing time (min)	5	15	--	8	16	13	15	5
@ vac	600	500	--	600	600	600	--	450
catch/unit effort (# trout/hr.)	0	20	0	7.5	33.75	41.5	92	0

*in addition, 4 sac fry were collected in benthic sampling net.

TABLE 5
SPECIES OF SPECIAL CONCERN
PENNSYLVANIA NATURAL DIVERSITY INVENTORY
EASTERN PIKE COUNTY

PNDI Common/Element Name	USGS Quad	Township	Watershed	Habitat[1]	State Status[2]	Last Seen
Bog-rosemary *Andromeda polifolia*	Edgemere	Dingman	Saw Kill Cr.	PCA	PR	1985
Glacial bog	Edgemere	Dingman	Saw Kill Cr.	PCA	N	1985
Water lobelia *Lobelia dortmanna*	Edgemere Shohola	Delaware Shohola	Dingmans Cr. Twin Lakes Cr.	LA- LAA	PR	1899 1961
Slender water-milfoil *Myriophyllum tennellum tabies*	Edgemere Shohola	Delaware Shohola	L. Bushkill Twin Lakes Cr.	L-- LAA	PR	1986 1961
Floating-heart *Nymphoides cordata*	Edgemere Shohola	Delaware Shohola	L. Bushkill Twin Lakes Cr.	L-- LAA	PR	1986 1982
Spotted pondweed *Potamogeton pulcher*	Edgemere	Delaware	Dingmans Cr.	LA-	PE	1917
Labrador marsh bedstraw *Galium labradoricum*	Milford	Dingman	Raymondskill Cr.	TBC	PE	1983
Rock clubmoss *Lycopodium porophilum*	Milford	Dingman	Raymondskill Cr.	RDA	PE	1983
Prickly-pear cactus *Opuntia humifusa*	Milford	Dingman	Delaware R.	THG	PR	1983
Bicknell's hoary rockrose *Helianthemum bicknellii*	Milford	Delaware	Delaware R.	T--	PT	1936
Roseroot stonecrop *Sedum rosea*	Shohola	Lackawaxen	Lackawaxen R.	TH-	PE	1959
Lupine *Lupinus perennis*	Shohola	Lackawaxen	Shohola Cr.	T--	PR	1974
Slender mtn-ricegrass *Oryzopsys pungens*	Shohola	Blooming Grove	Shohola Cr.	T-	PR	19??
Yellow cowlily *Nuphar luteum*	Edgemere	Delaware	L. Bushkill	LA-	TU	1899
Soft-leaved sedge *Carex disperma*	Edgemere	Dingman	Gum Brook	PC-	TU	1961
Crawford's sedge *Carex crawfordii*	Shohola	Shohola	Savantine Cr.	T-	TU	1944
White water-crowfoot *Ranunculus trichophyllus*	Milford/ Shohola	Dingman/ Lackawaxen	Delaware R. Lackawaxen R.	R--	TU	1939 1932
Northern hound's-tongue *Cynoglossum boreale*	Shohola	Shohola/ Dingman	Shohola Cr.	T-	TU	1939
Timber rattlesnake *Crotalis horridus*	Edgemere Pond Eddy Shohola	Dingman/ Delaware Shohola/ Westfall	Adams Cr. Savantine Cr. Delaware R.	-- -- --	TU	unk unk 1952

TABLE 5
(Continued)

PNDI Common/Element Name	USGS Quad	Township	Watershed	Habitat[1]	State Status[2]	Last Seen
Eastern hognose snake *Heterodon platyrhinos*	Shohola	Shohola	Savantine Cr.	---	TU	1952
Sea lamprey *Petromyzon marinus*	Shohola	Lackawaxen	Delaware R.	---	TU	1969
Bald eagle *Haliaeetus leucocephalus*	Milford	Dingman	Delaware R.	---	LE	1900
Vesper sparrow *Pooecetes gramineus*	Milford	Dingman/ Milford	Sloat Brook	---	LS	1905
River otter *Lutra canadensis*	Edgemere	Delaware	Dingmans Cr.	L--	LS	1980
Tiger beetle *Cicindela marginipennis*	Milford	Milford/ Dingman	Delaware R.	R--	N	1960
Shale cliff community	Milford	Dingman	Delaware R.	THG	N	1983

1 - PNDI Habitat codes:

PC-	Palustrine/bog
PCA	Palustrine/glacial bog
L–	Lacustrine
LA-	Lacustrine/lake
LAA	Lacustrine/glacial lake
R–	Riverine/river
RDA	Riverine/waterfall & plungepool
T--	Terrestrial
TBC	Terrestrial/Northern hardwood - conifers
TH -	Terrestrial/rock exposures
THG	Terrestrial/shale cliff community

2 - Status codes:

PR-	Pennsylvania Rare
PT-	Pennsylvania Threatened
PE-	Pennsylvania Endangered
TU-	Tentatively undetermined
LE-	Endangered
LS-	Species of special concern
N -	No status. However, it appears on PNDI because of concern from advisory committee recommending that the element merits special study to determine actual status

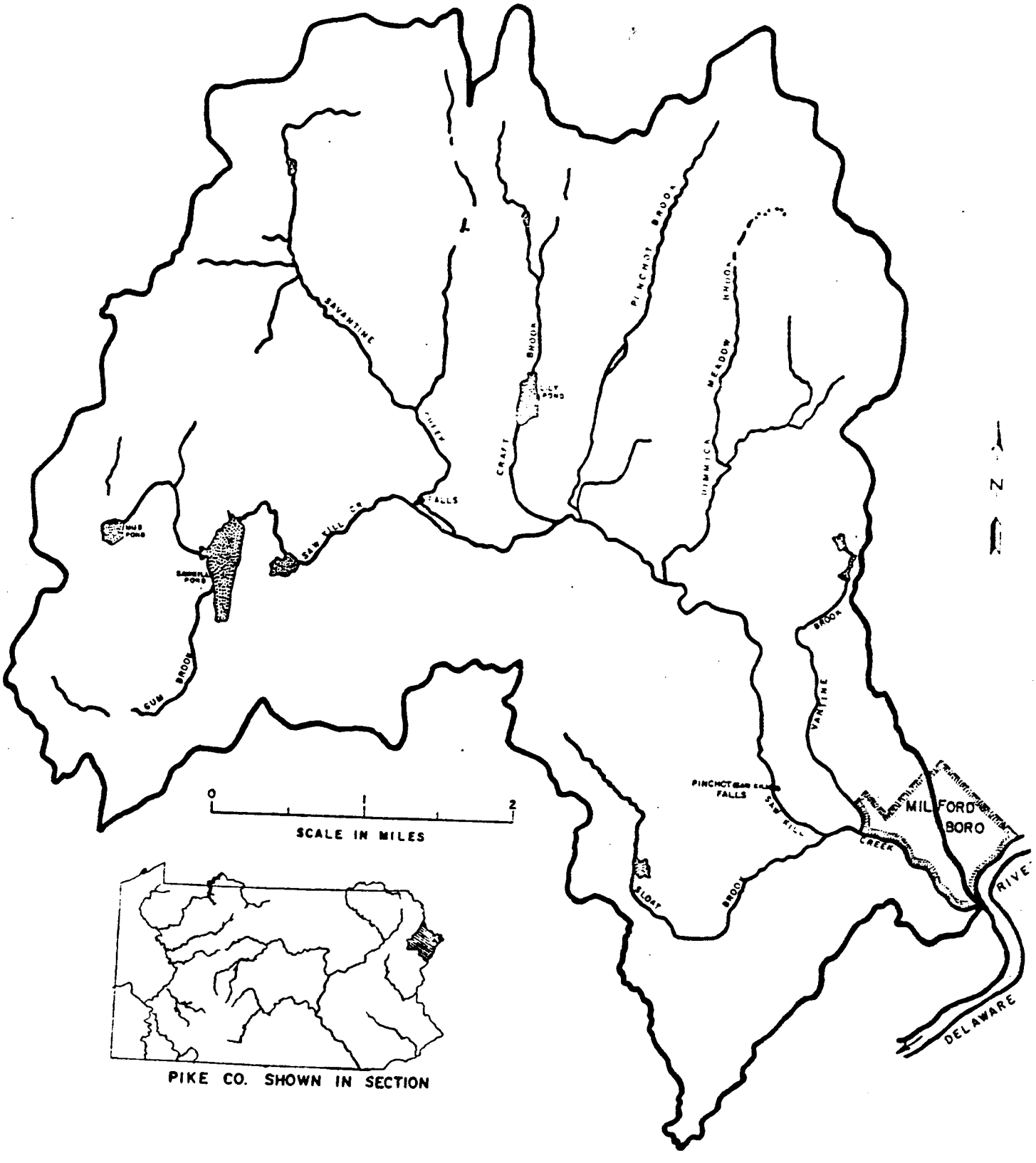

FIGURE 1 - SAW KILL CREEK BASIN, PIKE COUNTY

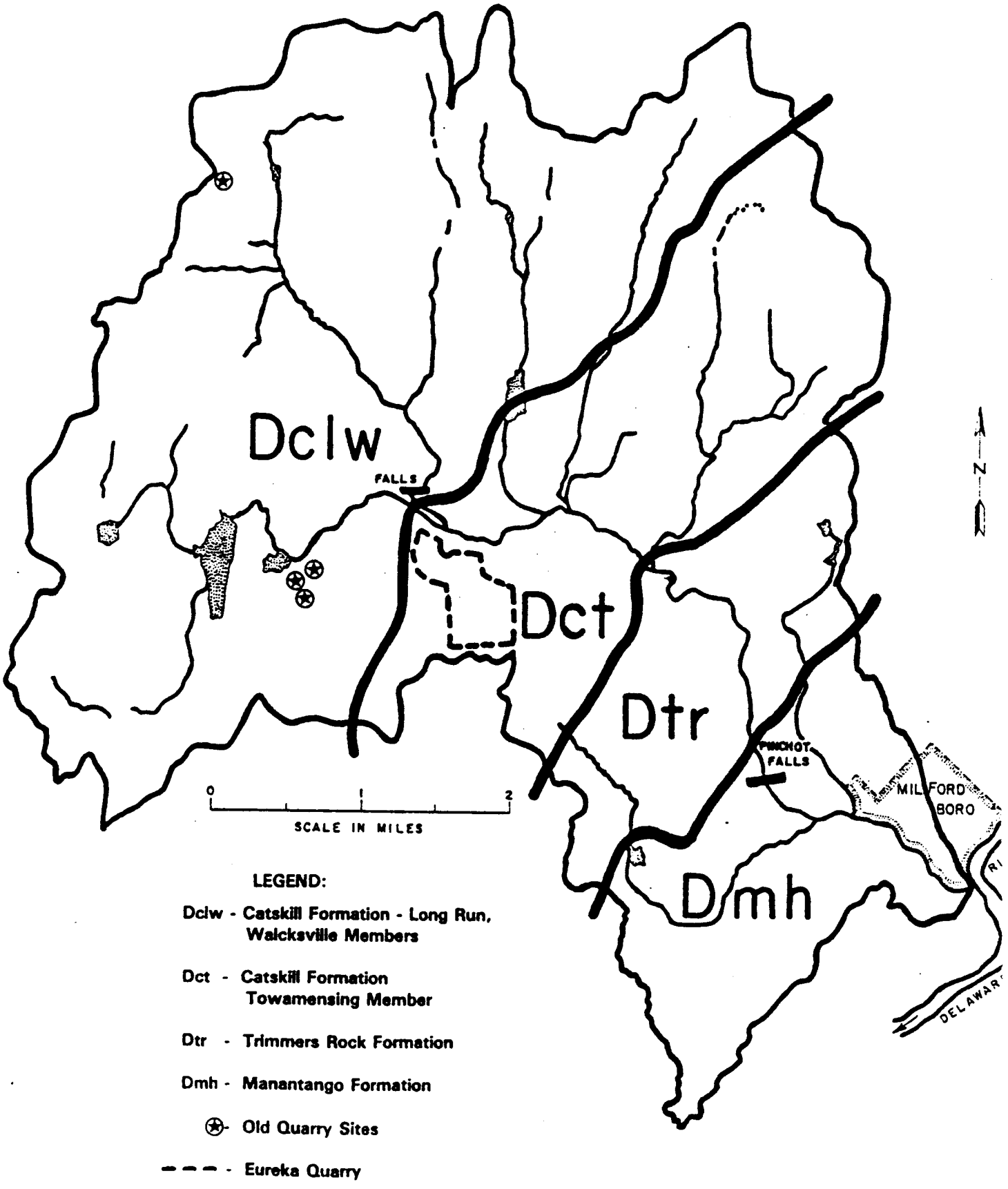

FIGURE 2 - GEOLOGIC FEATURES OF SAW KILL CREEK

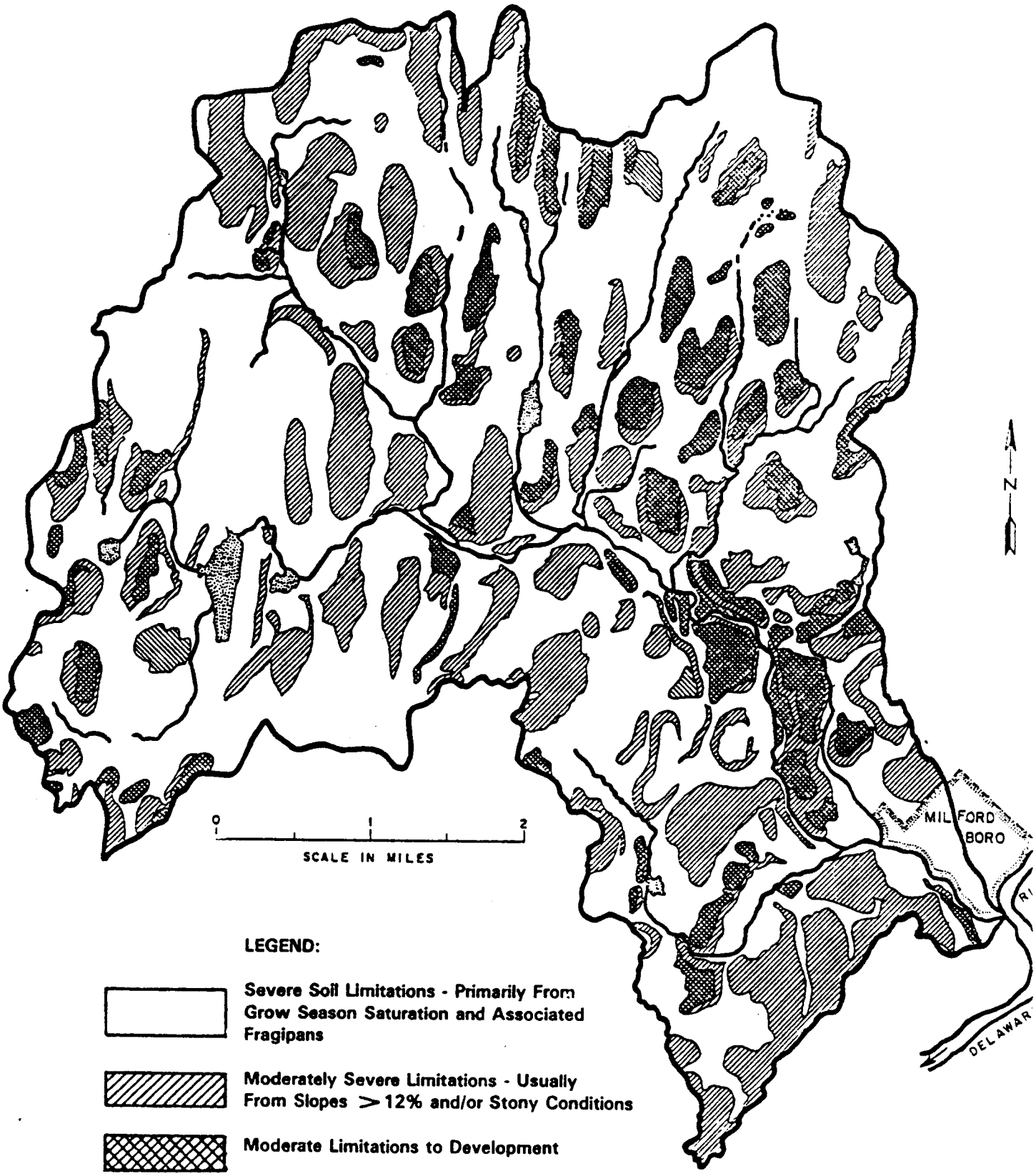

FIGURE 3 - SAW KILL CREEK BASIN DEVELOPMENT LIMITATIONS

(BASED ON SOILS CONDITIONS)

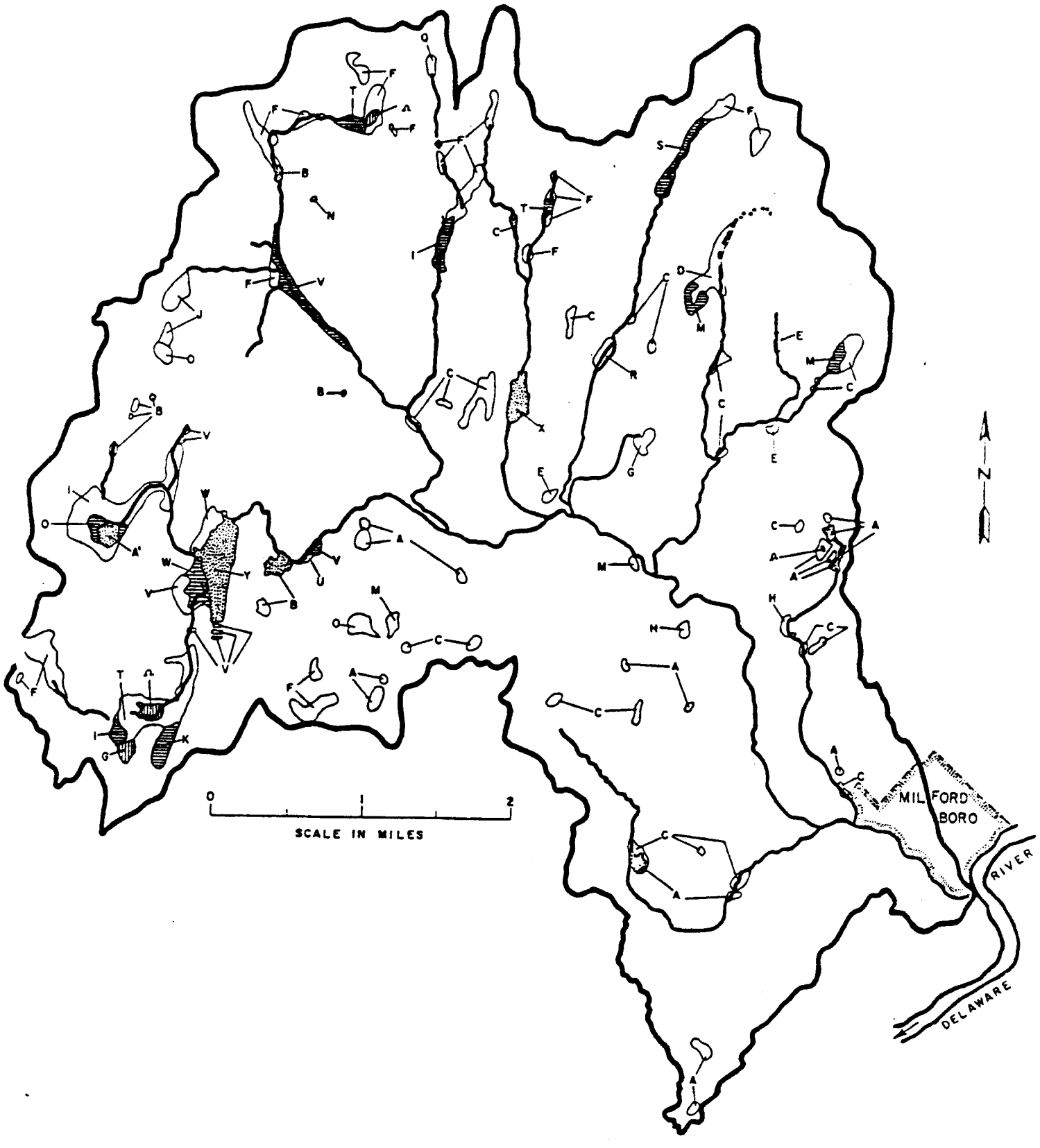

FIGURE 4 - WETLAND AREAS OF SAW KILL CREEK WATERSHED

(See Table 1 for explanation - Crosshatching has no significance except to distinguish between two or more adjoining areas that differ in wetland classification.)

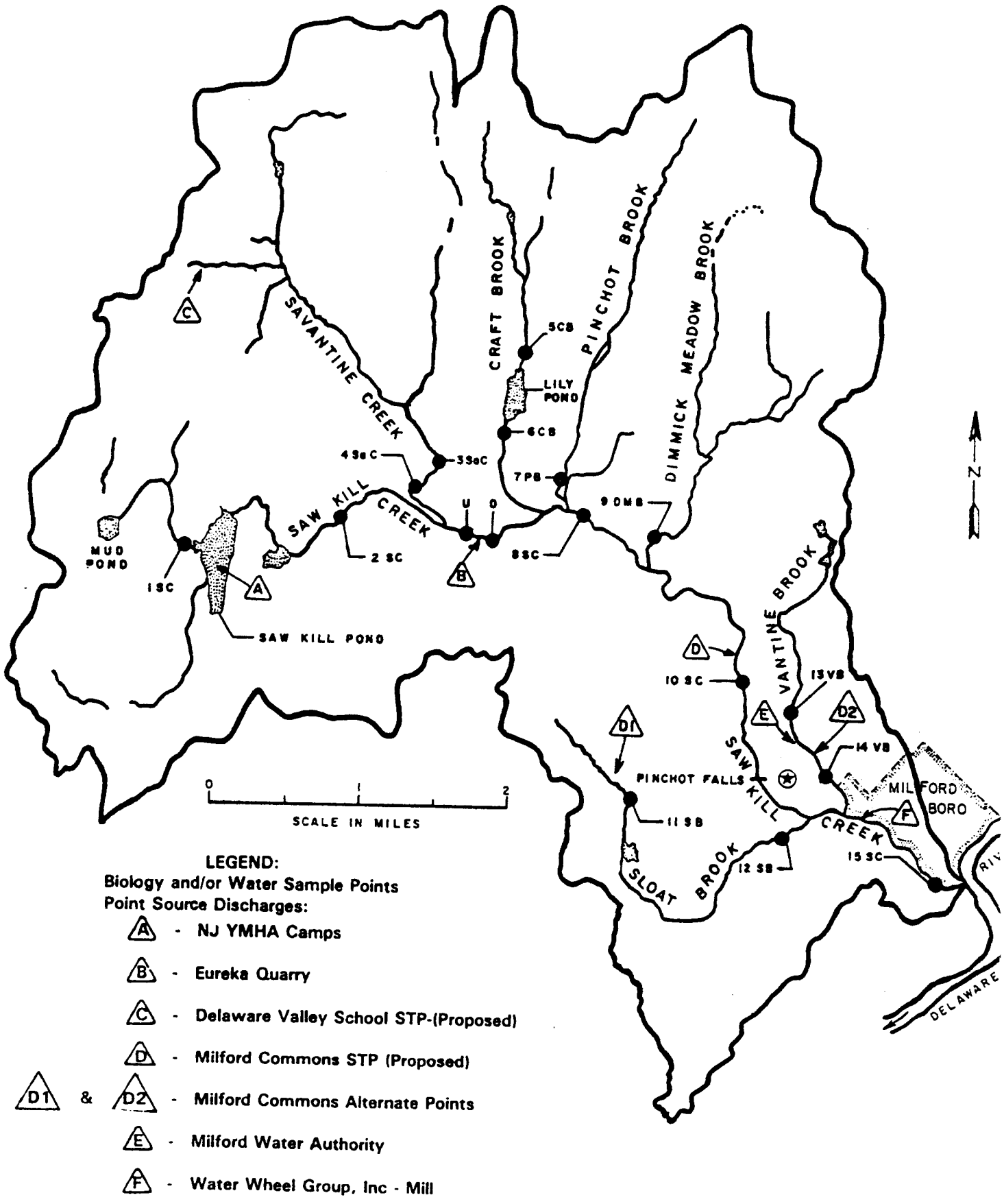

FIGURE 5 - SAW KILL CREEK SAMPLE STATION AND POINT SOURCE DISCHARGE LOCATIONS

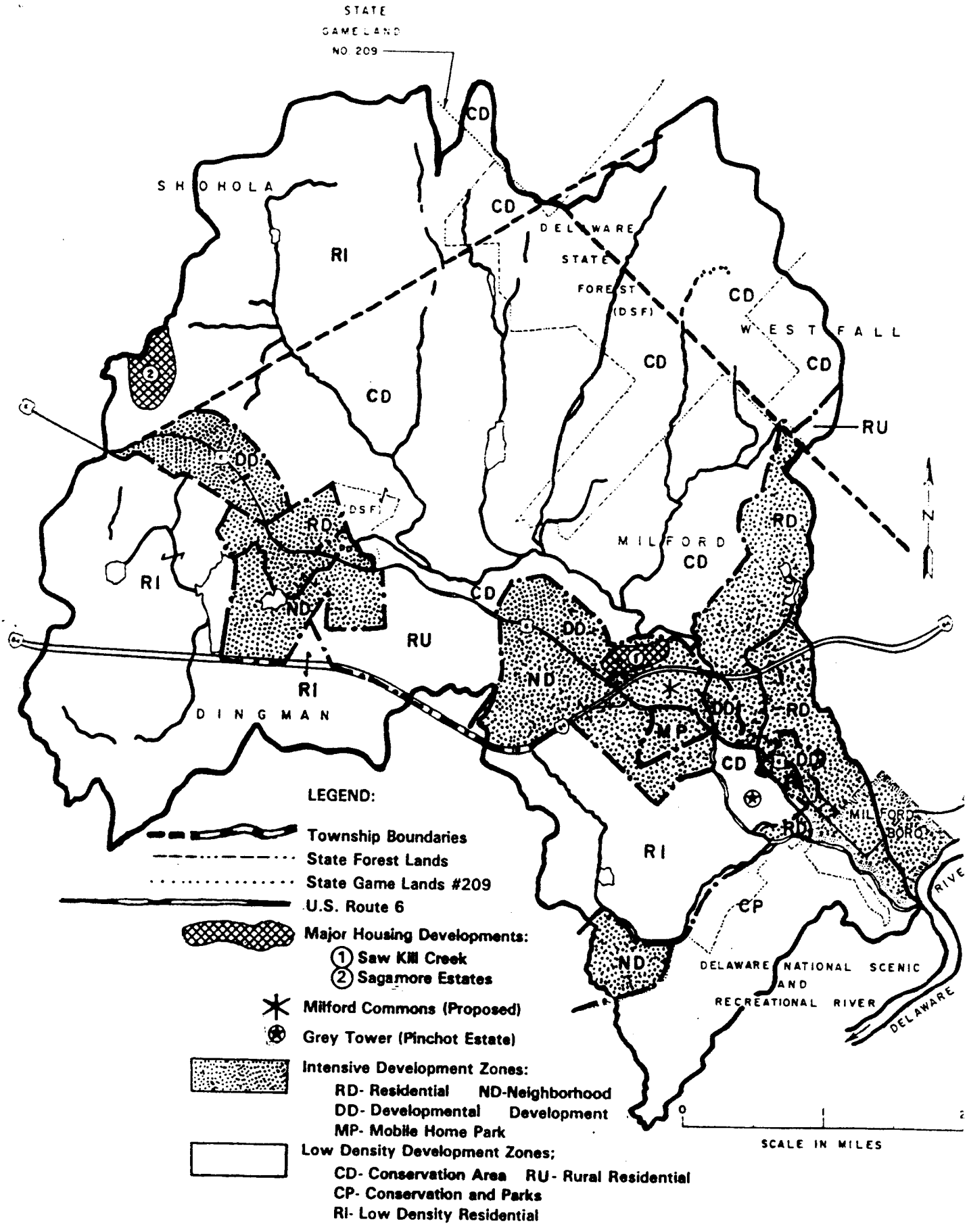

FIGURE 6 - SAW KILL CREEK TOWNSHIPS AND ZONING CLASSIFICATIONS

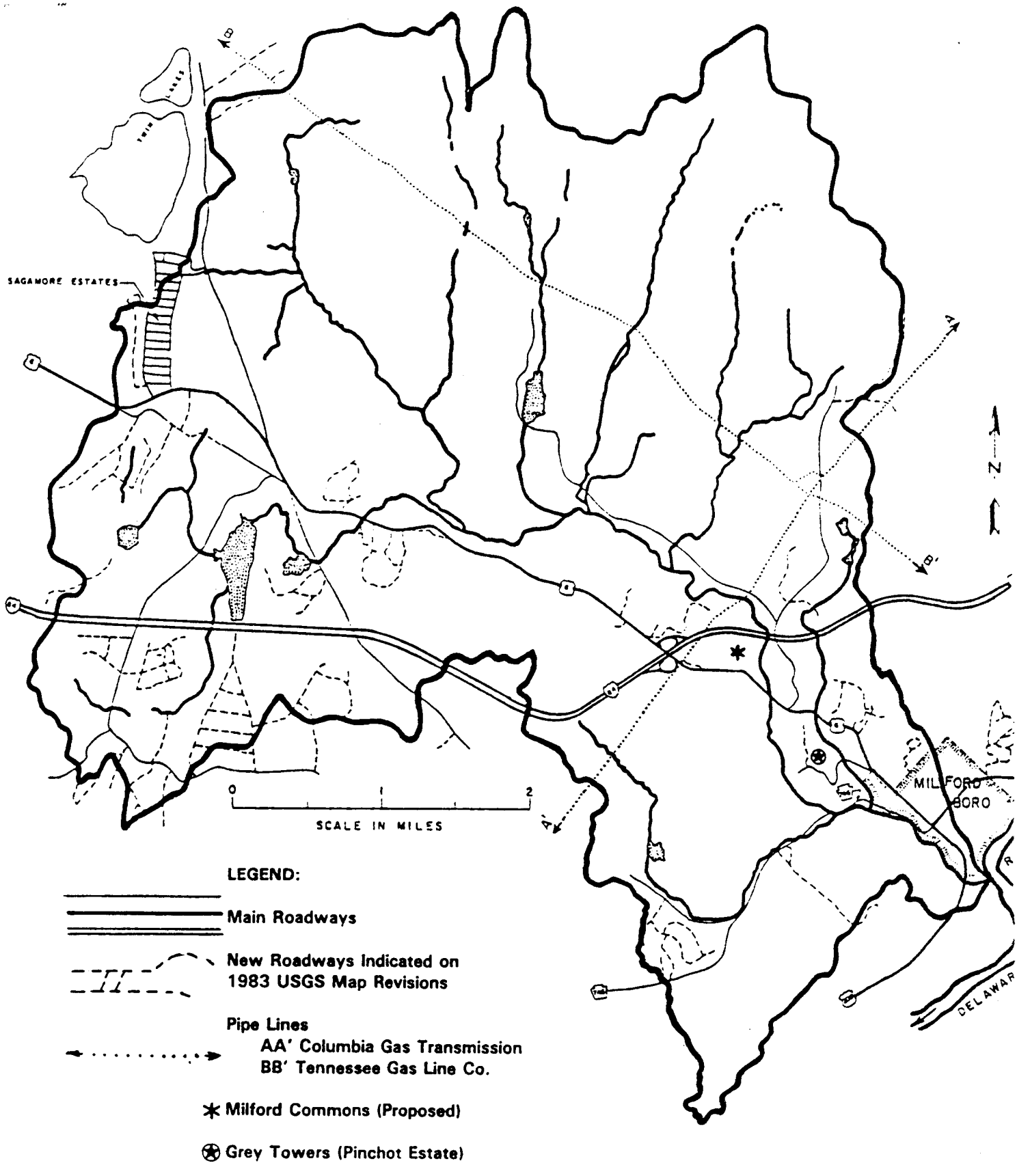

FIGURE 7 - SAW KILL CREEK — ROAD NETWORK AND OTHER LAND USES