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A MANAGEMENT PLAN FOR THE TROUT FISHERIES OF UPPER SCHOHARIE AND GOOSEBERRY CREEKS

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LIST OF TABLES, FIGURE AND APPENDIX

FIGURE

ABSTRACT

The upper Schoharie Creek watershed, a recent history of its fishery and water quality and quantity are described. Trout habitat protection is emphasized as a management strategy. The diversion of up to 20 cubic feet per second (cfs) of water from the creek for snowmaking by Hunter Mountain threatens the trout fishery.

Schoharie Creek yearling wild trout density averaged about 3.0 per acre in upper sections including brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*). Wild trout biomass was about 6.4 pounds per acre. Stocking recommendations for the 24 mile, 178 acre stocked section of Schoharie Creek vary from 44 to 184 brown trout yearlings per acre, depending on the section, and average about 108 per acre for a total of 19,250. Most of Schoharie Creek will be stocked in two increments, from 70 to 81 percent of the fish in late April, depending on management type, and the remainder in late May. Statewide fishing regulations, 10 trout of any size per day and an open season from 1 April through 30 September, will be continued.

Gooseberry Creek wild yearling trout average 189 per acre in a mix of 33, 18 and 49 percent brown, brook and rainbow trout, respectively and wild trout biomass averaging 22 pounds per acre. Gooseberry Creek will no longer be stocked.

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INTRODUCTION

Schoharie Creek is the most significant trout resource in Greene County, and one of the major trout resources of east-central New York. It served as an inspiration and laboratory for the late Art Flick who studied the aquatic insects and their emergence cycles and published his findings in 1947 in an angler's companion he called the Streamside Guide to Naturals and Their Imitations. Man's development of the watershed threatens this fragile stream system. The purpose of this plan is twofold. It is first intended to increase public awareness of watershed problems in relation to the management of the trout fishery in the 27 mile stream reach above Schoharie Reservoir and to focus on those guidelines, regulations and laws that are available to help protect the fishery resource. Second, the plan recommends trout stocking and fishing regulations to meet trout fishery objectives which are dependent on the maintenance of trout habitat.

WATERSHED DESCRIPTION

Setting

The upper Schoharie Creek watershed (Figure 1) has a drainage area of 236 square miles upstream of the United States Geological Service (USGS) gaging station at Prattsville which is located 0.4 miles upstream from 1,146 acre Schoharie Reservoir, a New York City water supply reservoir. The watershed is located entirely within the Greene County towns of Ashland, Cairo, Halcott, Hunter, Jewett, Lexington, Prattsville and Windham and mostly within the boundaries of the Catskill Park. Schoharie Creek originates at an elevation of nearly 2,700 feet on Twin Mountain and the trout inhabited reach flows 28 miles in a generally westerly direction to Schoharie Reservoir, just north of Prattsville. Its average width is about 44 feet. Downstream from Schoharie Reservoir, from which water is diverted via a 11.9 mile aqueduct to the Esopus Creek, the river flows north for another 58 miles before joining the Mohawk River. Primary sport fish species in the lower river include smallmouth bass (Micropterous dolomieu), and walleye (Stizostedion vitreum). Major tributaries of the upper Schoharie and their respective lengths include the Batavia Kill (22 miles), East Kill (13 miles), West Kill (11 miles) and Gooseberry Creek (4 miles) (Figure 1).

Stream Flow

Flows of record for Schoharie Creek measured at the Prattsville USGS gaging station are 51,600 and 4.8 cubic feet per second (cfs) on 16 October, 1955 and 22 September, 1964, respectively (Firda et al 1988). The average discharge for the 87 water years of record (October through September) from 1902 through 1990 is 462 cfs. Major water diversions are located at Windham on the Batavia Kill for snowmaking (up to 8 cfs), at Tannersville on Gooseberry Creek for an auxiliary public water supply (up to 100,000 gallons per day (gpd) or 0.15 cfs) and at Dolans Lake, just upstream from Tributary 141 (Shanty Hollow Brook) at Hunter for snowmaking at Hunter Mountain Ski Area. Hunter Mountain Ski Area pumps are capable of removing at least 9,000 gallons of water per minute (gpm) from Dolans Lake (20.0 cfs). A previous diversion of water from Gooseberry Creek, upstream from the Clum Hill Road bridge, for snowmaking for skiing at Cortina Valley Ski Area, has been discontinued. However, when the Cortina diversion was operational it shunted virtually all the creek water into a pond from which water was pumped for snowmaking, and any leftover was returned to the creek downstream from the diversion.

Geology

Surface features of the watershed have most recently been shaped by continental and local glaciation which occurred during the Wisconsin Epoc (Rich 1935). Underlain by red sandstone and shale; kames, eskers, drumlins, terraces and benches remain as watershed glacial deposits. Soils of the watershed, described by Flach et al. (1957), are predominantly of three types, strongly acidic (pH 5.1-5.5), and derived from the red sandstone and shale substrate. The Lackawanna Association and Lackawanna - Wellsboro Association soils differ by the stoniness and better drainage of the Lackawanna-Wellsboro Association. Those two medium textured soils overlay red till. Barbour-Tunkhannock Association soils are located in the floodplain and are medium textured, well to excessively drained on recent alluvium or gravelly outwash. The watershed south of the creek and east of the West Kill is generally steep, stony land underlain with red shale and sandstone as is a large part of the watershed south of the Batavia Kill and East Kill. Glaciation resulted in deposition of fines and development of clay lenses in the watershed, both of which may contribute heavily to watershed turbidity.

Topography

The watershed is mountainous and the upper 28 miles of Schoharie Creek has an average gradient of about one percent (56 ft per mile). Only 31 state regulated wetlands, those 12.4 acres or larger, are located in the drainage, and they represent less than 0.6 percent of the watershed area. There are no natural lakes and only five impoundments of more than 15 acres surface area in the basin. The smaller streams of the system, those with the highest gradient, are extensively forested (Reigner 1951). Sixty percent of the drainage has slopes steeper than 20 percent while five percent of the watershed is of less than five percent slope. The remaining 35 percent of the basin has slopes from five to 20 percent (Reigner 1951). In 1974, about 90 percent of the watershed was forested and only about six percent was in agriculture (Preston 1974).

Watershed Ownership and Management

Most stream side land is in private ownership. Public watershed lands are generally in the State Forest Preserve, set back away from water on the mountain tops and side hills on the southern and eastern edges of the watershed. Upper Schoharie Creek watershed is included in the publicly owned Halcott Mountain, Hunter Mountain, East Kill, Black Head Range and Windham High Peaks wild forest areas and the West Kill Mountain wilderness area. The Catskill Park State Land Master Plan (CPSLMP) (Anonymous 1985) defines wilderness as an area "where earth and its community of life are untrammeled by man... where man himself is a visitor who does not remain". It further describes wilderness as "an area of state land or water having a primeval character, without significant improvement or permanent human habitation". The CPSLMP defines a wild forest area as "a section of the Forest Preserve where the resource can sustain a somewhat higher degree of human use than a wilderness area" and which may "contain, within its bounds, smaller areas of land or water that are essentially wilderness in character, where the fragility of the resource or other factors requires wilderness management". Specific management of each unit of public land has or will be described in individual unit management plans, following the guidelines of the CPSLMP and subject to public review and update after five years. Watershed management is central to that planning process.

Watershed Access and Development

Major access to the watershed is via the New York Thruway and Routes 23 or 23A. Route 23A parallels most of upper Schoharie Creek. No area in the watershed is much more than one hour drive from the Thruway, and the Thruway exits are about 2.25 hours by car from New York City. Development of the eastern watershed portion has been fast paced in connection with growing use of the area for recreation, particularly skiing. Associated with this development has been an increased use of water for waste assimilation, domestic needs and snowmaking. In addition to limited agricultural activities, valley residents generally find employment in the tourist industry. Except for the villages of Tannersvillle, Hunter and Prattsville, the Schoharie Valley is generally sparsely populated.

RECENT HISTORY OF THE FISHERY

Schoharie Creek Fish

DEC fisheries surveys conducted since 1954 have collected 24 species of fish in eight families and 20 genera listed in phylogenetic order by common and scientific name following Robins et al. (1991) in Table 1. In the 1950's and 1960's, trout were the most abundant gamefish above the mouth of the East Kill in Schoharie Creek; but, downstream from the East Kill smallmouth bass were more common than trout. Smallmouth bass became established upstream of Devasago Falls, north of Prattsville, during the 1930's with the completion of Schoharie Reservoir and subsequent inundation of the falls. Public disdain for the small, slow growing smallmouth bass of upper Schoharie Creek prompted the then New York State Conservation Department to construct a fish barrier dam across Schoharie Creek in Prattsville during 1939 to prevent the movement of bass upstream. In 1981 bass were generally less abundant than previously and also less abundant than trout above the barrier dam. The dam may have exerted some control on upstream smallmouth bass populations over time.

Age and Growth of Schoharie Creek Game Fish

Schoharie Creek brown trout, *Salmo trutta*, and smallmouth bass length at capture for age groups is compared to regional means for those species in Table 2. Brown trout growth in Schoharie Creek is nearly equal to that for brown trout in other regional streams for ages 1+ through 3+. Upper Schoharie Creek smallmouth bass grow slowly and mean length for fish above age 2+ is well below that for other streams in the region. Smallmouth bass average well under 12 inches, the current statewide size limit.

Trout Biomass and Carrying Capacity Estimates

Trout biomass and carrying capacity estimated for the main stem of Schoharie Creek from survey data obtained from 1954 through 1981 and for Gooseberry Creek from survey data from 1974 through 1984 are shown in Table 3. Biomass was estimated following Engstrom-Heg (1990) which relates electro-fishing collection efficiencies to gear type, size of trout and stream width. Carrying capacity (CC) was estimated from the formula of Engstrom-Heg (1990): CC = 73.3 ((NHF)1/3-0.8) in which non-trout fishes (N), trout habitat (H) and stream fertility (F), values are rated as one, two or three, with three as best.

Biomass estimates for 1958 were generally lower than those for 1954 (Figure 1 and Table 3). This was probably the result of severe flooding which occurred in the valley in the fall of 1955 and undoubtedly caused widespread habitat damage. Although historical biomass comparisons are limited by the lack of standardized sampling locations, standing crops were generally lower downstream from the Hunter Mountain Ski Area water diversion (near Tributary 142) in 1975 and 1981. In 1954 and 1958 before the era of snowmaking, biomass differences above and below the diversion were less evident. Percentage of carrying capacity represented in biomass downstream of the water diversion ranged from zero to 65 and averaged 12 while above the diversion values ranged from three to 123 and averaged 31 percent.

Percentage of wild fish in electrofishing collections upstream and downstream of the Dolans Lake diversion were markedly different. Upstream, wild fish comprised between 50 and 100 percent of the catch and averaged 80 percent while downstream wild trout represented 24 to 58 percent of the trout catch, averaging 31 percent.

Gooseberry Creek biomass estimates were predominantly 31 to 68 percent of stream carrying capacity, but ranged from zero to 310 percent. Samples from stations upstream from the outfall of the Tannersville Sewage Treatment Plant (STP), which is located at a point about 0.4 miles downstream from the mouth of tributary one, generally included more trout than those downstream (Figure 1 and Table 3).

Creel Census

A creel census of Schoharie Creek was conducted during 1971 and 1972 to determine fishing pressure, angler success and catch composition (Fieldhouse 1973). The census area was bounded by the dam at Prattsville and the Route 214 bridge above Hunter, a distance of 18 miles. Anglers were contacted from April 1 through July 4 on pre-selected sample days including half the weekend days. Each year 16,250 marked yearling brown trout were stocked in the study section in two nearly equal increments. An additional 2,400 unmarked brown trout yearlings were stocked upstream of the study section at the same time. During the 1971 census period anglers harvested an estimated 7,367 or 45 percent of the stocked yearlings, 623 wild brown trout, 1448 hatchery holdovers and some unmarked hatchery yearlings. During the 1972 census, a year characterized by a cold wet spring and summer, anglers harvested 5,403 or 33 percent of the stocked yearlings, 685 hatchery holdovers from 1971, and 319 wild trout. Angling pressure on the approximately 161 acres of stream census section was estimated at 6,603 and 4,246 angler trips for 1971 and 1972, respectively, for the first three months of the season. This is thought to represent between 70 and 75 percent of the total fishing pressure for the six month fishing season, or up to 157 angler hours per acre per season, which would be considered light today. Mean catch composition for the two years consisted of 93.2 percent hatchery brown trout, 5.6 percent wild brown trout, about one percent brook trout (*Salvelinus fontinalis*), and very few rainbow trout (*Oncorhynchus mykiss*). Anglers creeled about one trout for every two hours fished and each trip averaged 2.7 hours in duration. Catch rates were likely higher but were not estimated. About 45 percent of the anglers caught trout.

Aerial Angler Counts

Schoharie Creek aerial angler counts were conducted in 11 years from 1960 through 1986. Estimated total annual angler trips on upper Schoharie Creek varied from 36 to 75 per acre with a mean of 54 (Table 4). For 1971, when the same areas of the creek were both censused and flown, the estimate from creel census was 70 percent higher than the aerial angler count estimate. The cause of the difference is not known. It has been found that stream side vegetation over-story prevents some anglers from being counted from aircraft but other similar overstoryed waters both censused and flown provided estimates generally within 11 percent (Keller 1988).

Trout Stocking

The existing trout stocking policies for upper Schoharie Creek and Gooseberry Creek evolved from an analysis of fisheries survey data following the methodologies and criteria developed by Embody (1927) and modified by Greene and Senning (1935).

The trout stocking of upper Schoharie Creek and Gooseberry Creek, from 1942-1991 is summarized by year in Table 5. Schoharie Creek was stocked with yearling or older brown, brook and rainbow trout at an average ratio of 8.5:1.0:3.9, respectively and an average rate of 564 per mile and 129 per acre from 1942 through 1958. Only brown trout were stocked from 1959 through 1961, at an average rate of 614 per mile and 140 per acre. From 1962 through 1967, brown and brook trout were stocked at an average ratio of 2:1 and an average rate of 658 per mile and 150 per acre. From 1968 through 1991 only brown trout were stocked, at an average rate of 617 per mile and 141 per acre.

Major stocking policy changes included the deletion of brook and rainbow trout. Brook trout were discontinued from stocking as a result of studies on other Region Four trout streams which showed superior brown trout performance in the fishery. Rainbow trout were removed from the policy since their performance was unproven in relation to brown trout in stream fisheries.

Changes in the number of fish stocked annually are largely the result of shortfalls in hatchery production, shortfalls that are prorated across the state by species.

Only brook trout were stocked in Gooseberry Creek from 1942 through the present, with the exception of 1987, when no spring yearling brook trout were stocked in any New York streams (Table 5). The stocking of Gooseberry Creek included an average of 139 trout per mile and 83 per acre or about 618 fish per year.

Stocking Older Age Trout

During 1947, a study was conducted to determine the relative contribution of brown trout, age two and two and one-half at stocking, and rainbow trout age one and one-half and two at stocking, to the fishery of upper Schoharie Creek (Petty 1948). Marked trout were stocked during the fall of 1946 and the spring of 1947 and capture by anglers was determined by spot check from April through July of 1947. Three hundred trout of each species were marked by finclip and stocked during the fall of 1946 and similar numbers during the spring of 1947. Ten percent of each group were further marked, each fish with two metal tags, one tag on the lower jaw and the other on the dorsal part of the tail posterior to the peduncle, to determine the suitability of the tail tag. Of the 108 marked fish handled during spot check interviews of fishermen in 1947, fall stocked fish comprised the majority, represented by 72 percent of the marked rainbow trout catch and 66 percent of the marked brown trout catch. Most trout, both marked and unmarked, were checked during the month of June. Whether or not that was a function of sampling intensity was not noted. The experiment was discontinued because of difficulties in obtaining an adequate sample and because the expense of stocking older age trout was not justified by the return of trout to anglers. The tail tags were apparently easily shed.

Special Trout Regulations

To increase trout survival and fishing quality an experimental fishing for fun (no-kill) section of about 10 acres was established legislatively on Schoharie Creek, extending downstream a distance of 1.44 miles from a point 600 feet downstream from the Mosquito Point bridge (Figure 1). Special regulations, in effect during the 1962 and 1963 fishing seasons, allowed the use of only one line, with or without a rod, attached to not more than one lure with not more than one hook point, the hook being not larger than one-half inch between shank and tip. The open season was consistent with the statewide season, April 1 through September 30, but no fishing was allowed out of season, except that suckers could be taken by snatching, from November through March. All trout caught during the sucker snatching season had to be returned immediately to the water without unnecessary injury. Electrofishing catches of trout in June 1962 and September 1963 included 13 brown trout in 600 feet of stream and 49 brown trout in 1200 feet, respectively. Brown trout standing crop estimates for those two years were 10.7 and 37.9 pounds per acre, respectively.

A 1971-1972 Schoharie Creek creel census showed that anglers harvested over one trout for every two hours fished but larger fish were scarce in the catch. To improve the size of trout in the catch, an experimental special fishing area (SFA) was established in 1975, from the mouth of John Chase Brook (T131a, Figure 1) upstream 1.4 miles, using the following criteria:

1) Good visibility from the road to aid law enforcement
2) Adequate angler access and parking facilities
3) Suitable summer water temperatures
4) Capability of the section to support a satisfactory standing crop of trout

Special trout regulations including a 10 inch limit, a three fish creel limit and the use of artificial lures only were initiated April 1, 1975 with the objective of at least doubling the trout biomass in the SFA, which was 13 and 18 pounds per acre in 1973 and 1974, respectively, and improving the average size of the catch. The success of the special regulation was assessed by making trout population estimates in the SFA and in a control area where statewide fishing regulations, i.e. no size limit and 10 trout creel limit, were in effect at that time. SFA brown trout biomass averaged 16.2 pounds per acre, ranging from 11.9 to 24.4 pounds per acre for the years 1975 through 1977 (Table 6). The trout population expanded in 1976 but in 1977 it was less than in 1975. Biomass in the control area diminished from 1975 through 1976 and 1977. The late summer SFA trout population composition averaged 65 percent yearling hatchery trout, 10 percent holdover hatchery trout and 25 percent wild trout. Control area trout population composition was 62 percent hatchery yearlings, seven percent hatchery holdovers and 30 percent wild trout.

The mid-August density of stocked yearling trout in the SFA was strongly correlated to mean daily summer (1 July through August 15) stream discharges. There was, however, no relationship between mid-August standing crops and flow for wild or holdover brown trout in the SFA or any cohorts of brown trout in the control area (personal communication with Phil Hulbert, DEC Bureau of Fisheries, Albany, NY 12233). The relationship of trout biomass and winter stream flow was not studied.

Statewide brown trout regulations were changed to include a nine-inch size limit and a five fish creel limit during the 1978 fishing season. However, the SFA regulations were continued as established until they and the nine inch, five fish creel limit were dropped for Schoharie Creek when no size limit, and the 10 trout creel limit were reinstated as the statewide regulations subsequent to the findings of Engstrom-Heg and Hulbert (1982). Although Schoharie Creek was not one of the waters specifically included in their study, Engstrom-Heg and Hulbert (1982) concluded a "9-inch size limit and five fish creel limit on brown and rainbow trout is not needed to protect the resource....., is not the best statewide regulation and should not be continued as such". They pointed out that specific exceptions were coldwater sections of larger rivers, moderately to heavily fished wild trout streams where age 2+ trout of the dominant species average at least 9 inches by late summer or moderately fished stocked streams with evident high inseason and overwinter survival and good growth of stocked fish.

Bass Regulations

Black bass in Schoharie Creek above the fish barrier dam at Prattsville were also subject to special regulation, although not protective, in an attempt to help control smallmouth bass populations. For a number of years the bass size and creel limits were dropped and the open season was extended from April 1 through November 30. This regulation was modified during 1977 to include a creel limit of five fish as an option in the new statewide regulation package but was dropped entirely in 1982 when new statewide bass regulations went into effect. These were a 12 inch size limit, five fish creel limit with a season from the third Saturday in June through November 30. The change to the statewide regulations for Schoharie Creek was not prompted by biological factors but rather to help simplify regulations and avoid the proliferation of exceptions. This change appears to have had no significant effect on the bass population or angling opportunity.

Angler Access to Schoharie Creek

Angler access to Schoharie Creek was first acquired in 1937, through the efforts of Art Flick who encouraged landowners to donate public fishing rights (PFR) to the state. Landowner donations of PFR were initially contingent on the then Conservation Department constructing a fish barrier dam at Prattsville to help exclude smallmouth bass. PFR consists of easements which allow public access to a streamside corridor 33 or 66 feet wide solely for the purpose of fishing. The PFR acquisition program was continued and presently accounts for 8.18 equivalent miles providing access to about 11.3 miles or 42 percent of the creek. One equivalent mile equals two miles of stream bank (one bank for two miles or both banks for one mile or any combination thereof). The DEC is currently paying landowners $15,000 per equivalent mile for fishing rights along the stream.

Eight parking areas on State Route 23A along Schoharie Creek between Tributaries 122 and 133 are frequently used by anglers. At one of these parking areas just downstream from Mosquito Point (Figure 1) a bronze plaque affixed to a boulder memorializes Art Flick who did so much to sustain the Schoharie Creek trout fishery and its trout anglers.

WATER QUALITY AND QUANTITY

Biological Assessment of Water Quality

A number of studies have been carried out to assess water quality in Schoharie Creek and Gooseberry Creek, its principal headwater tributary, through analysis of the streams' biota. In 1972, Cooper et al. (1973) found decreased macroinvertebrate community complexity in Schoharie Creek below Hunter and a drastic reduction in organisms in Gooseberry Creek below the Tannersville sewage treatment plant (STP) outfall. The water quality problems at Tannersville were attributed to the over-chlorination of waste water returning to Gooseberry Creek from the STP. Subsequent sampling of Gooseberry and Schoharie Creeks by Simpson in 1975

(Simpson 1976) further substantiated the findings of Cooper et al. (1973) regarding the impact of residual chlorine in about 330 feet of the stream below the Tannersville STP. Simpson (1976) also found differences in Schoharie Creek in stations above and below the confluence with Gooseberry Creek but was unsure whether the differences were due to different physical environments or the effect of the Tannersville STP. Nevertheless, enrichment from the discharge of nutrients to Gooseberry Creek resulting in oxygen deficiencies, was evident in both Schoharie and Gooseberry Creeks. A fisheries survey conducted in Gooseberry Creek in September, 1975, corroborated the findings of Simpson (1976). Population estimates disclosed that the standing crop of all fish below the STP outfall was only 57 percent of that for the station above the outfall and trout standing crop below the outfall was only four percent of that above.

During July and September of 1976, Preddice (1977) sampled the 7.2 miles of Schoharie Creek between Carr Road Bridge and Route 214 bridge upstream of Hunter (Figure 1). Preddice found no significant change in water quality as indicated by samples of aquatic insects collected at sites shared with the 1972 survey, but did find Shanty Hollow Brook (Tributary 141), a small tributary stream in Hunter, considerably degraded compared to Schoharie Creek. The summer of 1976 was cool and wet, minimizing impacts from enrichment.

Gooseberry Creek macroinvertebrates were again sampled during 1986 as part of a water quality survey of the Mohawk River drainage basin (Bode et al. 1986), principally to compare samples with those taken during 1975 at the same sites. The discharge permit in effect for the Tannersville STP in 1986 required dechlorination with sulfur dioxide. Nevertheless the 1986 water quality in Gooseberry Creek was impacted for a distance of 492 feet below the STP outfall. The impact was toxic and was thought to have been the result of intermittently high levels of chlorine (Bode et al. 1986). Samples composed only of large numbers of insects in early stages of development indicated recolonization of that habitat. Bode et al. (1986) speculated that fish populations below the outfall may have been affected by a low standing crop of aquatic insects, which are an important component of the diet of fish.

The most recent water quality survey of Schoharie Creek was conducted in June 1989 (Novak et al. 1990). Twelve stations were sampled including six in Schoharie Creek proper, four in Gooseberry Creek and one each in the Red Kill (Tributary 142) and Shanty Hollow Brook (Tributary 141). Water quality, as indicated by aquatic insects, was judged to be unimpacted with the exception of Shanty Hollow Brook, where dissimilarities with other aquatic communities sampled may indicate biological impairment. The Red Kill biota did not appear to be affected by discharge from the Whistle Tree STP located thereon. The Tannersville STP discharge had been diverted into a detention lagoon by 1989 and impacts to stream life immediately below the old outfall eliminated. However, during June, 1991, complaints of turbidity at the new outfall prompted investigation by regional fisheries and water staff. Facility inspection disclosed bacterial and algal growth in the outfall channel and a very discolored detention lagoon. Numerous dead midge larvae were floating on the plant effluent. The detention lagoon was subsequently equipped with an aeration device to improve dissolved oxygen (DO) and to air strip chlorine. Additional facility repairs included removal of six to eight inches of sand from the partially clogged sand filter beds by bulldozer. Unfortunately, sand in the filter bed effluent indicates that subsurface drainage tiles may have been crushed by the weight of the bulldozer. If damaged, those tiles need replacement and the remaining filter beds require renovation since sewage continues to pool on the surface of some beds. The Tannersville STP, a facility of the City of New York, requires continued remediation to improve treatment and upgrade effluent to SPDES requirements. The City of New York is under Consent Order to bring the treatment plant into compliance with permit conditions. Preliminary plans indicate replacement of the existing system with a biological treatment system followed by ultra-filtration. The present Order on Consent requires STP upgrade by 1999 but modification of that Order is currently being worked on by the DEC which may lead to earlier permit compliance (Personal communication, Frederick Seivers, P.E., NYSDEC Regional Water Engineer, Region IV, Schenectady).

Waste Assimilative Capacity

The waste assimilative capacities (WAC) of Gooseberry Creek and Schoharie Creek, from the mouth of Gooseberry Creek downstream to a point 2.2 miles upstream from the mouth of the East Kill, were analyzed during the summer and winter of 1985 (Anonymous 1988). Discharge inventories of effluent loads for both summer and winter are listed in Tables 7 and 8. Five of those discharges are or will be required to meet intermittent stream effluent limitations (ISEL) to maximize the creek's WAC. ISEL permit conditions specify discharges of no more than two milligrams per liter (mg/l) of ammonia, or a five day biochemical oxygen demand (BOD5) of five mg/l[a] and require maintenance of $\geq$ 7.0 mg/l DO in the receiving water. Of the remaining discharges, the one to the Red Kill has a permitted discharge of BOD of 10 mg/l, which is expected to be reduced in the future. The remaining permit restricts the discharge from Colonel's Chair into Schoharie Creek to a secondary level effluent with higher standards than ISEL. An eighth discharge of 45,000 gpd was listed to account for the many smaller plants or failing subsurface treatment systems which discharge directly or indirectly to Schoharie Creek. Since Tables 7 and 8 were completed, Liftside Transportation Corporation combined the effluent from Liftside and the uppermost Colonels Chair discharge at a 81,000 gpd capacity facility before discharging to Schoharie Creek. This change did not affect the findings of the WAC study which determined that only if all discharges were at ISEL, could Schoharie Creek assimilate an additional 130,000 gpd of treated

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[a]A BOD_5 of five mg/l is described as the amount of carbonaceous material in one liter of water which requires five mg/l of oxygen to decompose or oxidize in 5 days at 20C (68F).

discharge and still maintain DO standards. More recent refinements of the WAC model done in connection with the Village of Hunters proposal to construct a wastewater treatment system indicate an additional assimilative capacity of 220,000 gpd of sewage treated to ISEL (Personal communication, Frederick Seivers, P.E., NYSDEC Regional Water Engineer, Region IV, Schenectady).

Water Diversions

Water has been diverted from Schoharie Creek to Dolans Lake at Hunter (Figure 1) for many years, probably initially for ice harvesting on Dolans Lake, but more recently for snowmaking at Hunter Mountain Ski Area. Diversion for ice harvesting did not result in substantial consumptive use of Schoharie Creek since most water diverted from Schoharie Creek flowed through Dolans Lake into Shanty Hollow Brook and back into Schoharie Creek.

In 1980, a stream protection permit was issued to the Shanty Hollow Corporation to construct a 55 foot wingwall and structure to divert water to Dolans Lake in amounts up to 2 cfs when the stream flows were 10 to 25 cfs and up to 4 cfs when stream flows were from 25 to 40 cfs. When stream flows were 10 cfs or less no water could be diverted, but any water in excess of a 40 cfs stream flow could be diverted. Some time later and without any permit, the wingwall was extended across the entire creek. The wingwall was repaired without permits in the fall of 1988, 1989 and 1990. In 1988, Hunter Mountain Ski Area requested permission to construct an additional water diversion to service the western end of the ski area. At that time it was found that there was no effective mechanism in place to regulate the quantity of water diverted and no evidence that Hunter Mountain Ski Area was restricting the diversion of water in accordance with terms of the 1980 permit limits, which were based on an analysis of low flows and flow durations in Schoharie Creek at Hunter. Snowmaking facilities at Hunter Mountain are currently able to remove up to 9,000 gpm (20 cfs) from Dolans Lake.

Trout population sampling conducted since the 1950's has shown that before snowmaking began around 1960, there were, on average, equal numbers of trout upstream and downstream from the snowmaking water diversion point. Since snowmaking began there have been substantially less trout below the point of diversion than above. Although other factors may be partially responsible for the reduced trout population downstream of the diversion, it is our judgment that the available evidence - the instream flow incremental methodology (IFIM) model (see page 33) which predicts habitat loss with flow reduction and the diminished trout population below the diversion - demonstrates that the water diversion has caused significant damage to seven miles of the Schoharie Creek ecosystem from the diversion to the mouth of the East Kill.

While of much less magnitude than the diversion of Schoharie Creek to Dolans Lake for snowmaking, the diversion of water from Gooseberry Creek for snowmaking at Cortina Valley Ski Area may have impacted the aquatic life of Gooseberry Creek. Cortina Valley Ski Area removed water from Gooseberry Creek by excavating two diversions, damming the main creek and breaching beaver dams, over the years, in a piecemeal approach to supplying water for snowmaking. Those activities were remediated during 1989 and 1990 when Cortina Valley agreed to plug the diversion channels.

By order of the DEC Commissioner, the Village of Tannersville is authorized to withdraw up to 100,000 gpd (0.15 cfs) of water from Schoharie Creek as an auxiliary water source. A 500 gpm (1.1 cfs) pump, connected to a 12 inch pipe or vertical "t" intake about mid channel in Schoharie Creek, just downstream from the mouth of Cook Brook (Tributary 150), is used to pump water to Tannersville Reservoir (2.8 miles distant and 460 feet uphill) on a tributary of Allen Brook, which is tributary 1 of Gooseberry Creek. At drought or near drought stream flow the intake is above the water level and use of the pump would require the temporary damming of Schoharie Creek. This emergency system has never been used.

Classifications and Standards

Waters of the state are classified in Chapter X of New York Codes, Rules and Regulations (NYCRR) under statutory authority of Article 12 of the Public Health Law (NYS Department of State 1982). Water classifications are based on best usage of the water and range from AA, ultimately suited for drinking, culinary or food processing purposes, to D which is suitable for fishing.

Classifications of Schoharie Creek drainage basin waters are included in Parts 876.4 and 879.6 of Chapter X of 6NYCRR. Classifications and standards for Schoharie Creek, from source to the Route 23 bridge in Prattsville and Gooseberry Creek, as shown in Figure 1, are summarized here as follows:

Description	Classification and Standard		Approximate Miles
From NY Route 23 bridge at Prattsville to T116	B	B(t)	0.2
From T116 to 2.2 miles above T133	C	C(t)	12.7
From 2.2 miles above T133 to T140	C	C(ts)	4.7
From T140 to T142	B	B(ts)	1.3
From T142 to P656c	C	C(ts)	4.0
From P656c to Source	A	A(ts)	3.9
Gooseberry Creek from Mouth to Source	C	C(ts)	3.5

Waters with a classification of A, B or C and a standard of (t) for trout or (ts) for trout spawning have dissolved oxygen standards of at least 5 mg/l or 7 mg/l, respectively. Additionally, standards associated with the classifications address turbidity, color, solids (suspended, colloidal or settleable), oil and floating substances, taste and odor-producing substances, toxic waste and deleterious substances, coliform (bacteria), pH and total dissolved solids. All point source discharges to surface waters must meet SPDES permit limits established to protect the water quality standards as authorized by Title 3 of Article 17 of the Environmental Conservation Law (ECL) and defined in Part 703 of 6NYCRR (effective September 1, 1991).

The classifications and standards of tributaries to upper Schoharie and Gooseberry Creeks, exclusive of the Batavia Kill, East Kill and West Kill, are listed in Table 9. These listed tributaries amount to 105.7 miles of which 29.3 miles have standards of C(ts) or higher, 8.7 miles have standards of C(t) and the remaining 67.7 miles lack the t or ts standard.

GOAL AND OBJECTIVES

In consideration of Schoharie Creek's history, its present status and future prospects, the following goal and objectives have been formulated.

Goal

To provide and maintain suitable trout habitat to maximize wild trout production and sustain a viable trout fishery which may be augmented by stocking.

Objectives

Provide a mean catch rate of one trout for two hours of angling assuming fishing pressure does not significantly exceed 200 hours per acre per fishing season in Schoharie Creek and 150 hours per acre in Gooseberry Creek (a harvest of 0.1 pounds of trout per hour would be consistent with this catch rate and fishing pressure).

STRATEGIES

Waste Discharges

Discharge of sewage, industrial waste or other wastes or effluents to the waters of the state is unlawful without a written state pollutant discharge elimination system (SPDES) permit, issued by the DEC. The SPDES permit is the means by which effluent limitations are communicated to dischargers relative to classifications and standards of receiving waters. All permits for waste discharge to the Schoharie Creek watershed will be reviewed in relation to the receiving water classification, applicable water quality standards, the N.Y.S.

antidegradation, disinfection and phosphorus reduction policies.

Antidegradation

Additional protection to water is stipulated in Organization and Delegation Memorandum 5-40, written on 9 September, 1985 by then DEC Commissioner Williams. This policy states that water with a higher existing use than its assigned standard shall not be degraded unless necessary to accommodate significant economic and social development in the affected area and then only if the degraded water quality is still adequate to meet the existing usage of that water body. This policy is implemented through the SPDES and State Environmental Quality Review process (SEQR). SEQR considers the environmental implications of actions that are undertaken, funded or approved by state agencies.

Disinfection

Disinfection of effluents to Schoharie Creek and its tributaries above Schoharie Reservoir is required by New York City. Chlorine is the most commonly used biocide for STP effluents. SPDES permits limit total residual chlorine (TRC), the unreacted chlorine which enters the receiving water after contact with the effluent in a contact chamber. Current guidelines for TRC focus on a standard of 0.005 mg/l. They relate critical receiving water low flow conditions to effluent flows in their calculation but require alternative practices such as ultraviolet light or dechlorination where that ratio is

<30:1[b]. Dechlorination is problematic because it assumes reliable, accurate metering of chlorine and the chemical dechlorinating agent in the face of a variable flow of sewage effluent. It is expected that these assumptions are rarely met.

Subsequent to a 1976 DEC hearing on the Hunter Highlands housing project in Hunter, N.Y., the then DEC Commissioner required that the sewage treatment include extended aeration, removal of phosphorus and ammonia and disinfection of the treated effluents with ozone rather than chlorine. This decision was clearly precedent setting for at least the watershed. However, both ozone and chlorine are contact disinfectants which have the potential to harm non target organisms. Ultraviolet light is a better alternative, environmentally. It disinfects only that which it illuminates. New SPDES permits for discharges to the upper Schoharie Creek watershed should specify ultraviolet light where feasible as the primary means of disinfection, and must require dechlorination if chlorination is required by New York City as a backup means of disinfection. Ultraviolet light disinfection technology requires scheduled cleaning of apparatus so that exposure tubes do not become dirty and diminish light exposure intensity or penetration. Ozonation is preferable to chlorine as a primary means of disinfection for situations where ultraviolet light may be impractical.

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[b]DEC memo of Mr. Pagano, 3 July 1991 (see appendix).

Phosphorus Removal

The DEC Division of Water Technical and Operational Guidance Series (TOGS) 1.3.6 requires the removal of phosphorus (P) from waste water discharges to watersheds which drain into lakes. The policy applies to the upper Schoharie watershed because it flows into Schoharie Reservoir, a 1,146 acre New York City water supply reservoir. Thus, new discharges above 10,000 gpd must incorporate best treatment technology for P removal. New discharges of less than 10,000 gpd are permitted to the soil only and must receive primary treatment. New discharges from 10,000 to 50,000 gpd require P removal to 1.0 mg/l before discharge to the soil or surface water. Discharges above 50,000 gpd are limited to 0.5 mg/l P. Regardless of the design flow, applicants are required to provide a technical analysis of the suitability of soils for land disposal of the effluent. In light of the limited WAC of the Schoharie Creek and in consideration of the suitability of mountaintop soils for land disposal of wastes, additional development of the area may be inappropriate.

Thermal Discharges

In addition to the discharge limits provided by Part 703 of 6NYCRR, thermal discharges are regulated by Part 704 of 6NYCRR. For trout streams, no discharges over 70° F are permitted. From June through September or October through May, no discharge to trout streams shall be permitted which will raise the temperature of the stream by two or five degrees F, respectively, above the temperature of the stream before the addition of heat of artificial origin. From June through September, no discharge will be permitted which will lower the trout stream temperature more than two degrees F from what it was immediately before such lowering. Examples of projects with potential thermal problems include artificial ponds or lakes, large sewage discharges and construction of large roofs or parking areas exposed to solar heating where runoff is diverted to a stream. Holding basins and dry wells may be employed to temper runoff. Potential for thermal discharges will be examined during the review of projects during the SEQR process and mitigation recommended.

Stream Protection

The bed and banks of all trout streams, those with a (t) designation and all class AA, A or B waters are protected by Title 5 of Article 15 of the ECL and Part 608 of 6NYCRR which requires the issuance of a permit by DEC before any work may begin.

Review of applications for permits to work on streams provides an opportunity for DEC to advise applicants how to minimize damage to the stream bed and banks, and to prevent activities which are detrimental. Additionally, in connection with SEQR, the stream protection law provides a way to control water withdrawals from the creek or its tributary system where the banks need to be breached to access the water, or where stream shape must be changed to divert water.

Permits will be reviewed to mitigate or prevent activities which are detrimental to the aquatic community. These include actions which promote instability of the stream bed or banks causing excessive downstream transport of materials accompanied by turbidity, and resulting in sedimentation and the maceration or smothering of normally sedentary aquatic organisms including invertebrates and fish eggs (Flick 1974). Changes in stream course can also shorten streams, diminish aquatic habitat and increase stream velocity, which frequently causes accelerated scouring of the stream bed. Restriction of streams in culverts or other artificial beds, smaller in cross sectional area than the existing stream channel, can lead to wash out and damage downstream. Additionally, some culverts have proven to be a barrier to fish passage because of increased gradient, lack of holding or resting areas or inability of fish to enter the culvert due to downstream cutting or degradation of the stream bed.

Unprotected tributaries, those below a classification of B or lacking a standard of t or ts, will be surveyed to determine the presence of trout or trout spawning. The waters which currently lack the t or ts standard and in which trout or trout fingerlings are documented, will be listed for the next reclassification of Mohawk River drainage waters.

Hunter Mountain Ski Area Water Diversion

Several methods are available to determine adequate instream flows for aquatic life. Tennant (1976) provided a straightforward method of describing minimum flow regimes for fish, wildlife, recreation and related environmental resources, which is expressed as percentages of average annual flows according to time of year. He listed the following minimum flow descriptions:

Description of Flows	Recommended Base Flow Regimes	
	Oct.-Mar.	Apr.-Sept.
Flushing or maximum	200% of the average annual flow	
Optimum range	60-100% of average annual flow	
Outstanding	40%	60%
Excellent	30%	50%
Good	20%	40%
Fair or degrading	10%	30%
Poor or minimum	10%	10%
Severe degradation	10% of average flow to zero flow	

According to the above criteria, a 14 cfs instream flow at the Hunter Mountain water diversion would represent a good winter flow while a 28 cfs flow would be considered good from April through September. Unfortunately Tennant does not address special flow requirements for trout spawning and egg incubation, in the winter, nor does he support the differential flow requirements he presents in his paper for summer and winter. Instead he discusses 30 percent of average annual flow as the minimum year around flow needed to provide good conditions for aquatic life. This is equivalent to 21 cfs at the diversion.

Probably the most comprehensive method of evaluating stream flow requirements for aquatic habitat is the instream flow incremental methodology (IFIM) as described by Bovee (1982). Simplified, IFIM measures different habitat parameters in different habitat types at different flow rates to predict usable habitat over a wide range of stream flows. Data from IFIM are frequently presented as habitat response curves for aquatic organisms and their life stages, which show where habitat loss (or gain) is associated with change in flow. Flows below which habitat loss is accelerated are here called "critical flows".

Laroche and Moreland (1990) used IFIM to study three reaches in a seven mile section of Schoharie Creek between Hunter and the mouth of the East Kill during 1989. They compared their measurements with the habitat needs of brown trout and other organisms associated with the brown trout ecosystem: longnose dace, white sucker, two genera of mayfly and caddisfly and one genus each of stonefly and blackfly. Habitat response curves were then constructed for each species of fish and all six insect genera. Habitat response curves composited from the three study reaches for adult and juvenile brown trout showed critical flows of 0.4 (14 cfs) and 0.7 cubic feet per second (25 cfs)[c] per square mile of watershed (cfsm), respectively, at the diversion. The critical flow for brown trout spawning and incubation habitat is 0.5 cfsm (18 cfs). Habitat response curves for juvenile and adult longnose dace show critical flows between 0.6 and 0.9 cfsm (21 and 32 cfs). The white sucker fry habitat response curve appears to flatten

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[c]All instream flows reported by Laroche and Moreland for the Deming Road Bridge are adjusted to the Hunter Mountain water diversion for consistency.

out between 0.3 and 0.4 cfsm (11 and 14 cfs) and to decrease at higher flows. However, for white suckers, habitat for juveniles and adults appears to be limiting with critical flows at about 0.7 cfsm (25 cfs). Critical flows on response curves for the nymphal aquatic insects and their habitat generally occur between 0.5 and 0.7 cfsm (18 and 25 cfs) or higher.

A comparison of weighted usable habitat for different life history stages of aquatic organisms at each study segment, used by Laroche and Moreland (1990) showed significant losses of habitat as flows are reduced from 0.6 cfsm (21 cfs) to 0.3 cfsm (11 cfs) the minimum flow recommended by the authors[d]. Loss of brown trout spawning and incubation, juvenile and adult habitat, all critical during the snowmaking season, averaged 50, 24 and 23 percent, respectively. Ranges of percent loss for the same habitat types were 43-57, 18-31, and 14-27, respectively. Juvenile and adult longnose dace habitat was reduced an average of 30 and 36 percent, respectively. For both juvenile and adult white suckers, habitat was reduced an average of 20 percent, although habitat was diminished with increased flows from 0.3 to 0.6 cfsm at one high gradient riffle and one pool. Habitat for larval black flies was reduced by an average of 60 percent while the loss of stonefly habitat averaged 45 percent. Mayfly habitat loss averaged 47 percent for both genera. Loss of

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[d]It should be noted that Laroche and Moreland (1990) heavily weighted their analysis of minimum flow requirements to habitat needs of adult brown trout and did not optimally weigh needs of the total aquatic ecosystem.

habitat for two genera of caddisfly averaged 51 percent.

Raleigh et al. (1986) reported that a brown trout population can be maintained in rivers with habitat ratios of 1:3:3:7 for spawning and incubation, fry, juveniles and adults, respectively. Comparison of that ratio with ratios from the habitat supply curves in Laroche and Moreland (1990) for Schoharie Creek shows that spawning and incubation habitat is limiting[c] below 0.6 cfsm (21 cfs) and adult habitat is limiting above that flow.

The U.S. Fish and Wildlife Services (USFWS) 1981 interim regional policy for New England minimum stream flow recommendations provides a basis for determining aquatic base flows, the minimum flows considered necessary for the maintenance and propagation of aquatic communities[f]. For rivers with diversions such as Schoharie Creek, the USFWS recommends a minimum flow equal to 1 cfsm during the spawning and incubation period, considered here to be the months of October through April for trout. On this basis the minimum streamflow for Schoharie Creek at the diversion would be 36 cfs. In comparison the IFIM suggests that 18 cfs is adequate, however, this method does not account for anchor ice problems under low

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[c]Limiting in the sense of the brown trout life history stage ratios in Raleigh (1986). At flows of 0.6 cfsm or lower, less than one unit of brown trout spawning and incubation habitat is available for each seven units of adult habitat.

[f]Interim Regional Policy for New England stream flow recommendations, signed 13 February, 1981 by USFWS Regional Director Howard R. Larson.

flow conditions.

Permit conditions to restrict diversions of water from Schoharie Creek and provide for an adequate instream flow are essential. Diversion of water from the lake for snowmaking results in a loss of water to the creek and has a profound impact on aquatic life. Aquatic insects, an important trout food, spend the winter under rubble or debris on the stream bottom while trout eggs incubate all winter in the stream gravel. Adequate stream flows are needed to insure that these organisms and fish eggs remain covered with water and are not damaged by anchor ice formation.

The 1980 permit conditions which restricted the Hunter Mountain Ski Area water diversion were remarkably prescient in light of the foregoing discussion of the various model results available today to establish adequate in stream flows. It was, however, too liberal at the low flow levels. The 1980 permit prohibited water withdrawals only when stream flows were below 10 cfs at the diversion, however, the Tennant method indicates the need for maintenance of at least 21 cfs and our analysis of the IFIM demonstrates the efficacy of 21 cfs as the minimum needed to protect the total Schoharie Creek ecosystem in the affected reach. The need for curtailments in the diversion up to a flow of 40 cfs as provided for by the 1980 permit is supported by the USFWS policy which requires a flow of 36 cfs for brown trout spawning and incubation habitat.

Table 10 presents an analysis of the number of days in a given snowmaking year that a permit limit of 21 cfs would curtail snowmaking at Hunter Mountain Ski Area. During the period analyzed snowmaking would not have been possible on 25 percent of the days. This is a worse case analysis because values in Table 10 were derived from historic stream flow gauging station data at Prattsville and adjustments were not possible for water that had already been withdrawn at Hunter Mountain Ski Area (up to 20 cfs), or from Gooseberry Creek for the Cortina Ski area (up to 2 cfs) or from the Batavia Kill for Ski Windham (up to 8 cfs). Further, snowmaking would not have been necessary on some days or even possible on other days because of high air temperatures.

Cortina Valley Ski Area Water Diversion

Cortina Valley Ski area has indicated an interest in reestablishing a water diversion in Gooseberry Creek for the purpose of snowmaking. With a watershed area of 1.87 square miles, application of the USFWS New England base flow policy requires the maintenance of a minimum flow of 1.9 cfs at Clum Hill Bridge to provide adequate spawning and nursery habitat.

Village of Tannersville Water Diversion

The withdrawal of up to 0.15 cfs from Schoharie Creek to the Tannersville water supply is most likely to occur during drought conditions, when the stream flow is already at a very low level and the aquatic community is stressed. The auxiliary system should be used to skim water during runoff events in anticipation of drought conditions. Maintenance of maximum possible storage in Tannersville Reservoir would minimize the need for stream withdrawal when the stream community would most likely be adversely impacted.

Watershed Management

Agriculture and development can have a significant impact on a watershed and its tributary system. Stream Corridor Management, a Basic Reference Manual (Morton 1986) describes a number of watershed management problems, techniques for mitigating impacts on water quality and quantity and problem solving steps, all to alleviate environmental degradation. The manual also lists best management practices for a number of activities including agriculture. Municipalities should be encouraged to use the manual in writing codes and ordinances for development within their jurisdiction to help maintain existing water quantity and quality.

Some additional techniques for minimizing the impact from road construction work in the watershed are presented in pollution control specifications of the Department of Transportation (Anonymous 1978) and these should be incorporated in project permits where appropriate.

Habitat Management

Green belting, the maintenance of riparian vegetation and/or stream bank planting, is a usefull technique for fish habitat improvement. Streamside vegetation provides overhead cover which moderates water temperatures through overstory shading of the creek. Logical candidates to carry out this work are the principal stake holders, trout fishermen represented by such groups as Trout Unlimited or Theodore Gorden Flyfishers, in cooperation with the Division of Fish & Wildlife. Other trout habitat management which should be considered for upper Schoharie Creek is the clearing of tributary mouths to allow upstream passage of spawning trout. Those spawning and nursery streams which are inaccessible to Schoharie Creek trout should be identified and a plan developed for the removal of obstacles.

<u>Trout Stocking</u>

Schoharie Creek

Stocking rate calculations follow Engstrom-Heg (1990) in "Guidelines for Stocking Trout Streams in New York State", which includes fishing pressure in connection with assessments of wild trout abundance and habitat to provide for mean catch rates of one trout for two hours of fishing. Engstrom-Heg (1990) developed a system of stream management types which drives the calculation of stocking rates. The management types are based on stream biology, physical habitat and fishing pressure patterns and do not imply any judgement on the quality or value of any stream. Seasonal distribution of fishing pressure is another consideration in calculating stocking rates. Schoharie Creek fishing pressure fits the pattern 1 description of Engstrom-Heg (1990), in which less than 40 percent of the season's fishing occurs during April and more than 20 percent takes place after July first. Calculation of a Schoharie Creek stocking policy using the guidelines of Engstrom-Heg (1990) indicates an annual stocking of 19,250 BTY is appropriate.

For the calculation of stocking rates, upper Schoharie Creek was divided into six sections bounded by major tributary mouths or the Hunter Mountain Ski Area water diversion. The lowermost 6.5 miles, from the fish barrier dam at Prattsville to the mouth of the West Kill (Figure 1), has below average stream fertility, overhead cover and instream shelter and an abundance of trout competitors. No wild trout were collected at three stations sampled in this section during 1981 (Appendix). By the criteria of Engstrom-Heg (1990), this section is best described as Bs. It should be stocked in two increments to help insure that stream conditions do not compromise stocking success. Stocking should be delayed to allow for stream flow and water temperature to moderate to maximize stocked trout acclimation to stream conditions. Following the methodology of Engstrom-Heg (1990), the calculated stocking rate for this 74.1 acre section is 117 brown trout yearlings (BTY) per acre with 82 percent to be stocked in late April and the remainder in late May (Appendix).

In the 39.6 acres of creek between the mouth of the West Kill and the East Kill, 3.5 miles upstream (Figure 1), the stream is more habitat deficient than the section downstream, severely limiting the carrying capacity of the section. During 1958, the most recent year for which data are available, no wild trout were taken in either of the two stations in this Bs type section. From the methodology of Engstrom-Heg (1990), the stocking rate for this section is calculated to be about 81 BTY per acre, 66 per acre in late April and 15 per acre in late May (Appendix).

From the mouth of the East Kill to the Hunter Mountain Ski Area water diversion, 8.3 miles upstream (Figure 1), cover and shelter for trout is better than the downstream section Average wild yearling brown trout abundance was 12/acre for three stations, two sampled during 1972 and one sampled during 1978. However, this section, which is impacted by the Hunter Mountain water diversion, is best described as having Bs potential with a calculated stocking rate of 118 per acre. Engstrom-Heg (1990) recommended that 81 percent of the fish be stocked in the first increment for Bs waters fished at about 150 hours per acre (Appendix).

The 2.1 mile, 8.7 acre section from the Hunter Mountain water diversion to the mouth of Gooseberry Creek (Figure 1) is an As water, primarily because the section has good instream shelter and stream overstory. Wild trout biomass was about five pounds per acre in 1975 but no wild trout yearlings were collected. The calculated stocking rate for this section is 184 BTY per acre, with 69 percent in the first increment, according to Engstrom-Heg (1990) (Appendix).

Stream fertility diminishes upstream of Gooseberry Creek and the 3.5 miles from Gooseberry Creek to the Roaring Kill has a low carrying capacity due to low fertility and poor trout habitat (Appendix). Nevertheless, wild trout yearlings averaged 17, 20 and 26 per acre for brown, brook and rainbow trout, respectively, at two stations in 1981 and wild trout biomass was about 18 pounds per acre (Appendix). This Bs section of 10.3 acres has a calculated stocking rate of 44 BTY per acre of which 78 percent should be stocked in late April and the remainder in late May.

The upper most 1.7 miles and 3.4 acres of Schoharie Creek is habitat deficient and has low fertility. However, trout appear to benefit from a paucity of competitors and wild trout yearlings, all brown trout, numbered 240 per acre in 1975 (Appendix). A wild trout population, represented by 240 wild yearlings per acre, is capable of supporting a catch rate of about 0.4 trout per hour, according to the formula of Engstrom-Heg (1990), and precludes the need to stock when fished at 150 hours per acre. Wild trout biomass was about 21 pounds per acre in this section, all brown trout.

Appropriateness of a 19,250 BTY stocking policy for Schoharie Creek is supported by findings from the Schoharie Creek creel census. This census, conducted during 1971 and 1972, when the creek was stocked with 18,650 BTY, documented an average creel rate of 0.55 trout per hour with fishing pressure of 157 hours per acre (Fieldhouse 1973), slightly more than our current target catch rate. The catch rate was not determined during the 1971-1972 census. More recent aerial count data, although variable, have not indicated an increase in fishing pressure since the 1970's.

Percentage of the total number to be stocked for each section in late April and late May change between sections based on management type and rounding (Table 11). The numbers for each stocking increment and stocking point are listed in Tables 12 and 13.

Gooseberry Creek

Gooseberry Creek generally is an Aw type trout stream according to the criteria of Engstrom-Heg (1990). Habitat is generally good and although wild trout biomass does not represent $\geq$ 75 percent of the estimated trout carrying capacity, abundant wild yearling trout of three species appear able to support a fishery with a potential catch rate of about 0.47 fish per hour (Appendix). Gooseberry Creek should not be stocked.

Fishing Rules and Regulations

Experimental rules and regulations for trout and bass fisheries of upper Schoharie Creek have not met the objectives of the special regulations. Previous attempts to control bass in the trout portion of the creek by eliminating or reducing size limits are no longer warranted due to the limited number of black bass present above the barrier dam at Prattsville and the limited distribution of bass in the upper Schoharie Creek watershed. The 10 inch size limit on trout established experimentally in 1975 did not meet objectives. Evaluation of the experimental 1962-63 "no kill" reach was superficial. Until water diversion issues are resolved and fish habitat stability is assured, the upper Schoharie Creek should continue to be managed under general fishing regulations. Gooseberry Creek should also be managed under general fishing regulations.

RECOMMENDATIONS

1) Distribute this plan to appropriate public officials and interested citizens groups.

2) Survey all tributary sections of Gooseberry and Schoharie Creeks in Table 9 which do not have a C(t), C(ts) or higher standard; prepare the necessary documentation and recommendations for the upgrading of all such waters in which trout are found, as appropriate.

3) Conduct electrofishing surveys of Schoharie Creek at previously used sampling stations, and selected additional stations to update fish population data as necessary.

4) Recommend use of ultraviolet light (UV) as the primary means of disinfection of sewage effluent, with ozone as a second choice where conditions dictate. Scheduled maintenance of the UV systems should be required by permit conditions. Where chlorination is used as a backup treatment, require dechlorination.

5) No water should be diverted from Schoharie Creek which would cause instream flow at the Hunter Mountain water diversion to fall below 21 cfs. The diversion should be limited to no more than 4 cfs when stream flow is between 25 and 40 cfs.

Above a flow of 40 cfs no diversion should be permitted which would cause the flow in Schoharie Creek to fall below 36 cfs.

6) Stock Schoharie Creek with 19,250 spring yearling brown trout from the Prattsville fish barrier dam to the mouth of the Roaring Kill in late April and late May as listed in Tables 12 and 13.

7) Discontinue stocking Gooseberry Creek.

8) Continue the use of statewide fishing regulations for trout and black bass for Schoharie Creek and Gooseberry Creek, at least until more stable low flow conditions are achieved downstream from Hunter Mountain snowmaking water diversion.

9) Continue to purchase Schoharie Creek fishing rights and initiate the acquisition of fishing rights on Gooseberry Creek. Gooseberry Creek and Schoharie Creek upstream from tributary 142 are particularly deficient in PFR and are most in need of immediate attention.

10) Conduct a creel check of anglers on Gooseberry Creek and upper Schoharie Creek as soon as possible to determine catch statistics and whether catch rate objectives are being met.

11) Conduct aerial angler counts of upper Schoharie Creek and Gooseberry Creek anglers from 1994 through 1996, at least, using the same count sections as flown during 1984 through 1986 to determine current angler use.

12) Inspect and maintain the Prattsville fish barrier dam as needed.

13) Remove blockages to trout spawning and nursery area tributaries with equipment where necessary or, where possible, encourage sportsmen to open tributary mouths with hand tools.

14) Limit withdrawal of water from Gooseberry Creek by Cortina Valley Ski Area for snowmaking so that Gooseberry Creek flows are not less than 1.9 cfs as a result of diversion.

15) Review proposed projects in the upper Schoharie Creek watershed to insure against:

a. Increased water temperature

b. Reduced streamflow

c. Reduced groundwater contribution to streamflows

d. Increased turbidity or sedimentation

e. Reduced DO

f. Contravention of any other state water quality standard

g. Reduction in spawning or nursery stream access

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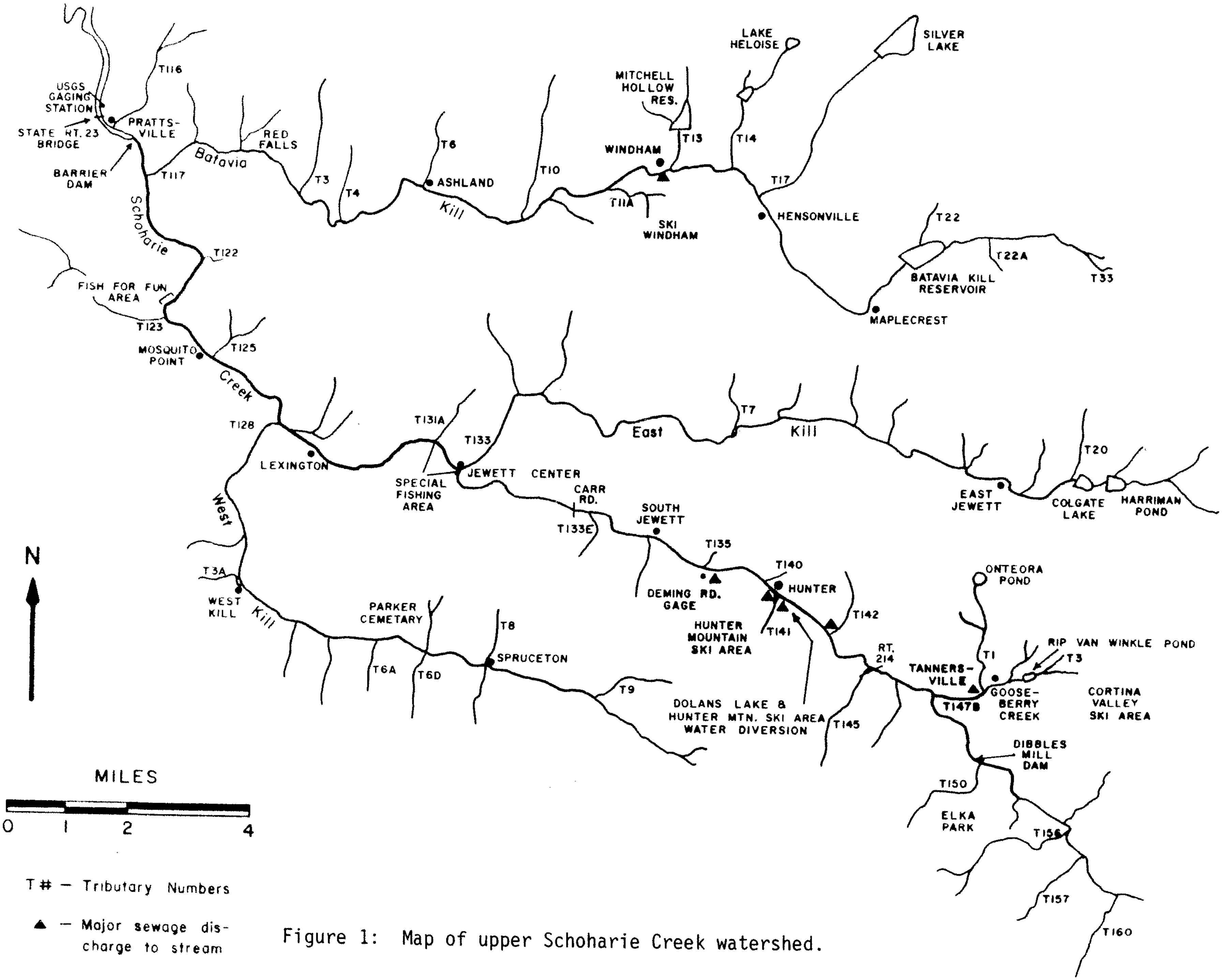

Figure 1: Map of upper Schoharie Creek watershed.

Table 1. Fish species collected from Schoharie Creek watershed upstream from the Prattsville fish barrier dam.

FAMILY CYPRINIDAE
CARPS AND MINNOWS

√central stoneroller Campostoma anomalum
√cutlips minnow Exoglossum maxillingua
√common shiner Luxilus cornutus
√golden shiner Notemigonus crysoleucas
bluntnose minnow Pimephales notatus
√blacknose dace Rhinichthys atratulus
√longnose dace Rhinichthys cataractae
√creek chub Semotilus atromaculatus
√fallfish Semotilus corporalis

FAMILY CATOSTOMIDAE
SUCKERS

√white sucker Catostomus commersoni
√northern hog sucker Hypentelium nigricans

FAMILY ICTALURIDAE
BULLHEAD CATFISHES

√brown bullhead Ameirus nebulosus
√stonecat Notorus flavus
√margined madtom Noturus insignis

FAMILY SALMONIDAE
TROUTS

√rainbow trout Oncorhynchus mykiss
√brown trout Salmo trutta
√brook trout Salvelinus fontinalis

FAMILY CYPRINODONTIDAE
KILLIFISHES

√banded killifish Fundulus diaphanous

FAMILY COTTIDAE
SCULPINS

√slimy sculpin Cottus cognatus

FAMILY CENTRARCHIDAE
SUNFISHES

√pumpkinseed Lepomis gibbosus
√smallmouth bass Micropterus dolomieu
√largemouth bass Micropterus salmoides

FAMILY PERCIDAE
PERCHES

√tesselated darter Etheostoma olmstedi
√yellow perch Perca flavescens

Table 2. Lengths at capture for age groups of upper Schoharie Creek brown trout, *Salmo trutta*, and smallmouth bass, *Micropterus dolomieu*, collected by The New York State Conservation Department (≤ 1970) and The New York State Department of Environmental Conservation (≥ 1971).

Species	Years	Mean Length of Fish (inches) By Age At Capture						
Brown Trout		Hatchery 1+	2+	Wild 1+	2+	3+	4+	5+
Schoharie Creek	1960's			6.6	9.3	12.0		
	1971-81	8.3		6.2	9.0	11.5	13.5	14.8
	1974-77*	8.5	10.6	6.7	9.4	12.0		
Region 4 Mean For Streams				6.3	9.5	12.2	14.1	
Smallmouth Bass								
Schoharie Creek	1934				7.3	8.6	8.6	9.0
	1963			5.3	7.7	8.8	9.9	
	1981			5.4	8.1	10.3		
Region 4 Mean For Streams				7.8	10.2	12.4	13.0	

*Fish from special fishing area between tributaries 131A and 133.

Table 3: Estimated Schoharie Creek and Gooseberry Creek trout biomass/trout carrying capacity in pounds per acre for stations located by proximity in miles up (+) or downstream (-) from tributary mouths.

Schoharie Creek

Location[a]	1954	1958	1961	1962	1963	1972	1975	1981
				Year				
116+.4	0.8/58[b]	1.0/34						1.5/53
122+.2	16.3/109	13.4/88						0.4/41
123-.4			2.0/58					
123			10.7/58	10.8/58	37.9/58			
123 (December)				4.3/15				
123+.1	13.2/88	0.0/34						6.7/74
129+.1		0.0/34						
129+.3	10.0/109							
131+.2	9.6/88	0.0/34						
133+2	9.6/109	4.6/58						
133+2.2						9.2+/88		
135-.1						8.1+/88		
136	6.7/109	5.3/58						
141							26.7/58	
142+.1	10.0/109							
145+.3		6.5/58					63.1/133	
148+.2	3.0/109	4.2/47						
150								12.2/34
155								23.4/34
157+.4							57.7/47	
158-.1	19.1/109							
158+.3	3.9/109	8.8/47.0						

Gooseberry Creek

Location	1974	1975	1976	1980	1984
			Year		
Mouth + 0.4					31.1/109
1-.5		0.4/-			
1-.45	0/15				7.1/77
1-.4					
1-.3	20.5/58	11.9/-			
1-.2					49.5/109
2-.1					32.2/68
3-.2			6.4/15	18.3/58	
3+.1				179.8/58	
3+.4				0/0	

[a]Location numbers represent tributaries. Plus or minus values represent miles upstream or downstream from mouths. Tributary numbers with no plus or minus values represent sites at the tributary mouth.

[b]Biomass estimates are derived from once through electrofishing surveys following the methodology of Engstrom-Heg (1990), or from population estimates obtained as part of evaluation of experimental special fishing area during 1972. Unless otherwise noted, surveys were conducted during the summer and generally in late summer.

Table 4: Angler trips and fishing hours per acre for Schoharie Creek from Prattsville to the Rt. 214 bridge east of Hunter, estimated from aerial angler counts.

Year	Angler Trips	Angler Trips/ Acre	Fishing Hours	Fishing Hours/ Acre
1960	9,129	74	25,013	202
1961	7,978	64	21,860	176
1962	4,507	36	12,349	100
1963	6,007	48	16,459	133
1971	5,172*	53	14,121	146
1978	7,274	75	19,931	205
1979	6,496**	67	17,799	183
1980	4,042	42	11,075	114
1984	3,445	36	9,439	97
1985	4,196	43	11,497	119
1986	5,580	58	15,289	158
Average	5,802	54	15,894	148

*Expanded from April through June data by dividing by 0.75.

**Expanded from April through July data by dividing by 0.8.

Acreage used for calculations was 124 through 1963 and 97 from 1971 on because the reach flown was shortened in 1971. Expansions were required to normalize data for comparison with years when entire season was flown. Divisors used for expansions represent expected proportion of seasonal fishing pressure during time sampled.

Table 5: Numbers of trout stocked in Schoharie Creek and Gooseberry Creek from 1942 through 1991 by species.

Year	Schoharie Creek Brown Trout	Schoharie Creek Rainbow Trout	Schoharie Creek Brook Trout	Schoharie Creek Total	Gooseberry Creek Brook Trout
1942	6,800	3,200	800	10,800	550
1943	7,100	2,400	1,000	10,500	800
1944	23,085	4,618	600	28,303	500
1945	400	300	600	1,300	500
1946	6,100	3,900	800	10,800	600
1947	7,500	4,500	1,350	13,350	500
1948	6,850	7,000	1,000	14,850	550
1949	7,500	6,800	825	15,125	871
1950	9,000	9,940	900	19,840	700
1951	10,470	7,100	1,150	18,720	700
1952	12,980	9,500	1,340	23,820	930
1953	64,300	8,250	1,530	74,080	1,070
1954	12,352	9,450	1,650	23,452	1,152
1955	10,350	5,720	1,470	17,540	1,025
1956	12,300	8,350	1,650	22,300	1,152
1957	13,160	9,440	1,850	24,450	1,352
1958	13,690	7,050	1,800	22,540	1,315
1959	20,805	-	-	20,805	800
1960	17,363	-	-	17,363	520
1961	17,090	-	-	17,090	600
1962	13,190	-	6,350	19,540	600
1963	13,200	-	6,350	19,550	600
1964	12,620	-	6,995	19,615	660
1965	10,105	-	6,350	16,455	600
1966	11,460	-	6,350	17,810	600
1967	11,260	-	5,434	16,694	572
1968	16,725	-	-	16,725	480
1969	15,930	-	-	15,930	482
1970	15,145	-	-	15,145	402
1971	18,650	-	-	18,650	452
1972	18,650	-	-	18,650	518
1973	18,650	-	-	18,650	480
1974	18,650	-	-	18,650	600
1975	18,650	-	-	18,650	595
1976	18,300	-	-	18,300	600
1977	18,250	-	-	18,250	540
1978	14,720	-	-	14,720	495
1979	9,525	-	-	9,525	558
1980	15,345	-	-	15,345	500
1981	11,454	-	-	11,454	415
1982	14,648	-	-	14,648	470
1983	14,912	-	-	14,912	429
1984	14,570	-	-	14,570	405
1985	18,127	-	-	18,127	378
1986	12,890	-	-	12,890	420
1987	14,630	-	-	14,630	NONE
1988	15,610	-	-	15,610	390
1989	13,380	-	-	13,380	410
1990	15,370	-	-	15,370	420
1991	14,430	-	-	14,430	420
Total Stocked	728,241	107,518	58,144	893,903	30,678

Table 5: Continued

Years Stocked	50	17	23	-	49
Average Number Stocked/year	14,564	6,325	2,528	17,948	626
Range of average total length	3.0-11.8	4.0-12.0	4.0-9.5	3.0-12.0	5.2-10.2
Average total length	8.2	6.4	7.6	8.0	8.6

Table 6: Wild (W) and hatchery (H) brown trout, <u>Salmo</u> <u>trutta</u>, numbers and pounds per acre collected by electrofishing in Schoharie Creek stations near Jewett.

Control Area For Special Fishing Area Study (Carr Road)
Number Per Acre

Age and Origin	1973	1974	1975	1976	1977	1975-1977 Average
1+H	40.3	11.3	18.0	14.1	23.9	18.7
1+W	3.2	4.6	2.8	1.8	8.1	4.2
2+H	1.4	1.8	2.1	3.2	1.1	2.1
2+W	3.9	5.6	2.8	1.1	0.4	1.4
3+H	0	0	0	0	0	0
3+W	0	0	4.2	0.7	0.4	1.8
All ages	49.8	23.3	29.9	20.9	33.9	28.23

Pounds Per Acre

	1973	1974	1975	1976	1977	
All Ages	9.8	5.8	9.3	7.5	6.5	7.3

Special Fishing Area (Bush Road)*
Number Per Acre

Age and Origin	1973	1974	1975	1976	1977	1975-1977 Average
1+H	32.8	41.3	31.9	62.7	26.5	40.4
1+W	9.0	8.7	1.8	10.2	19.3	10.4
2+H	0.3	7.8	2.1	5.4	9.3	5.6
2+W	11.7	6.3	4.2	3.3	1.5	3.0
3+H	1.2	0	0	0	1.2	0.4
3+W	0	1.5	2.4	1.8	0.9	1.7
All ages	55.0	65.6	42.4	83.4	58.7	61.5

Pounds Per Acre

	1973	1974	1975	1976	1977	
All ages	12.9	18.0	12.4	24.4	11.9	16.2

*The special fishing area was located east of Lexington, from the mouth of John Chase Brook, T131a, upstream 1.4 miles.

Table 7: Inventory of major effluent discharges to upper Schoharie Creek and Gooseberry Creek under summer conditions.

Dicharge	Receiving Stream	Flow MGD	Effluent Load	
Meadowbrook Equities	Gooseberry Creek	0.054	BOD5 = 5.0 mg/l NH3 = 1.7 mg/l TRC = 0.005 mg/l DO > 7.0 mg/l	Draft Permit
Tannersville (V) #002-6573	Gooseberry Creek	0.8	ISEL; TRC = 5 ug/l: Permit	
Whistle Tree Dev. #003 0821	Tributary 142	0.0125	BOD5 = 10 mg/l TRC = 0.5 mg/l	Permit
Hunter Highlands #006-1131	Tributary 141	0.08	ISEL: Permit	
Camp Loyaltown #010 4965	Tributary 138	0.0105	ISEL: Permit	
Colonel's Chair Estate (002) #010-1001	Schoharie Creek	0.0233	BOD5 = 5.0 mg/l NH3 = 1.3 mg/l	Future Permit
Colonel's Chair Estate (002) #010-1001	Schoharie Creek	0.03	BOD = 30 mg/l TOD = 135 mg/l	Permit
Liftside at Hunter	Tributary 140A	0.058	BOD5 = 5.0 mg/l NH3 = 1.3 mg/l DO => 7.0 mg/l TKN = 2.0 mg/l P = 0.5 mg/l	Proposed
Miscellaneous	Schoharie Creek	0.045	BOD5 = 30 mg/l NH3 = 12.5 mg/l	Assumed

* ISEL = Intermittent Stream Effluent Limits: BOD5 = 5.0 mg/l
NH3 = 2.0 mg/l
DO = 7.0 mg/l

TRC = Total Residual Chlorine

Table 8: Inventory of major effluent discharges to upper Schoharie Creek and Gooseberry Creek under winter conditions.

Discharge	Receiving Stream	Flow MGD	Baseline Effluent Load
Meadowbrook Equities	Gooseberry Creek	0.054	BOD5 = 5.0 mg/l NH3 = 1.7 mg/l TRC = 0.005 mg/l DO > 7.0 mg/l Draft Permit
Tannersville (V) #002-6573	Gooseberry Creek	0.8	ISEL; TRC = 5 ug/l: Permit
Whistle Tree Dev. #003 0821	Tributary 142	0.0125	ISEL TRC = 0.5 mg/l Baseline Load
Hunter Highlands #006-1131	Tributary 141	0.08	ISEL: Permit
Camp Loyaltown #010 4965	Tributary 138	0.0105	ISEL: Permit
Colonel's Chair Estate (002) #010-1001	Schoharie Creek	0.0233	BOD5 = 5.0 mg/l NH3 = 1.3 mg/l Future Permit
Colonel's Chair Estate (002) #010-1001	Schoharie Creek	0.03	TOD = 44.5 mg/l NH3 = 2.0 mg/l Baseline Load
Liftside at Hunter	Tributary 140A	0.058	BOD5 NH3 DO TKN P To be Determined
Miscellaneous	Schoharie Creek	0.045	TOD = 44.5 mg/l NH3 = 2.0 mg/l Baseline Load

* ISEL = Intermittent Stream Effluent Limits: BOD5 = 5.0 mg/l, NH3 = 2.0 mg/l, DO = 7.0 mg/l

TRC = Total Residual Chlorine

Table 9. Classifications, standards and lengths of upper Schoharie Creek tributaries and Gooseberry Creek tributaries (item numbers 280 through 291.2), exclusive of the Batavia Kill, West Kill and East Kill, by watershed identification number (WIN).

ITEM #	WIN	CLASS	STANDARD	MILES	ITEM #	WIN	CLASS	STANDARD	MILES
212	116	C	C	5.8	269	135	C	C	1.4
213	116	A	A	-	269	136	C	C	1.7
214	116-1	A	A(T)	.7	269	136-2	C	C	.2
214	116-3	A	A(T)	2.2	269	138	C	C	1.5
214	116-5	A	A(T)	.9	269.1	140	C	C(TS)	.2
215	116A	C	C	1.7	270	141	C	C	1.7
244	117A	C	C	.8	270	141-1	A	A	.8
244	118	C	C	1.6	-	141A	-	-	.1
244	119	C	C	.9	272	142	C	C(TS)	2.0
244	121	C	C	.5	272.1	142-1	C	C(T)	1.3
245	123	C	C(TS)	2.8	272.2	143	C	C	.7
246	123	C	C	1.3	274	144	C	C	.6
247	123-1	C	C(T)	1.6	275	145	C	C(TS)	1.8
248	123-1-1	C	C	1.0	276	145	A	A(T)	.5
248	123-1-2	C	C	1.0	277	145-1	B	B	1.2
249	123-2	C	C	1.0	278	145-2	C	C	.6
249	123-3	C	C	1.0	278	145-3	C	C	.7
249	123-4	C	C	1.1	279	147	C	C(T)	.7
249	123-5	C	C	.7	279	147A	C	C(T)	1.8
249	123-6	C	C	.6	280	147B	C	C(TS)	3.5
250	124	C	C	1.1	281	147B-1	C	C(TS)	1.6
250	124A	C	C	.7	282	147B-1	A	A	.4
250	124B	C	C	.5	283	147B-1	C	C	.5
250	125	C	C	.9	285	147B-1	C	C	.5
250	125-1	C	C	.6	287	147B-1-3	C	C	.3
250	126	C	C	1.0	288	147B-1-3	A	A	.6
250	127	C	C	1.5	290	147B-2	C	C(TS)	2.0
259	128A	C	C	1.8	290.1	147B-2-1	C	C	1.4
259	128A-1	C	C	1.7	290.1	147B-2-1-1	C	C	.7
259	128B	C	C	.7	291.1	147B-3	C	C(TS)	.2
259	128C	C	C	.9	292	150	C	C(T)	.5
259	128D	C	C	.9	293	150-P657-2-1	C	C	.5
259	131	C	C	.9	293	150-P657-2	C	C	1.7
259.1	131A	C	C(T)	2.8	293.1	150-1	C	C	.6
259.2	131A-1	C	C	2.1	295	153	C	C(TS)	.8
259	132	C	C	2.0	295	155	C	C(TS)	1.4
269	133A	C	C	1.0	296	156	C	C(TS)	2.6
269	133B	C	C	.8	297	156-4	C	C	.8
269	133B-1	C	C	.9	297	156-5	C	C	.5
269	133C	C	C	.7	298	156A	C	C	.6
269	133D	C	C	.7	299	157	C	C(TS)	1.7
269	133E	C	C	1.5	-	157-1	-	-	.1
269	133E-1	C	C	.6	299	159	C	C(TS)	1.4
269	133F	C	C	.6	301	160	C	C	1.6
269	133G	C	C	1.1	301	160-1	C	C	.6
269	133H	C	C	1.1	301	160-2	C	C	.7
269	133I	C	C	1.1					
269	134	C	C	1.2					

Table 10. Percent and (number) of days during November, December, January and February when Schoharie Creek flows at the Hunter Mountain water diversion were ≥ 21 cfs for water years 1980 through 1990*.

	November	December	January	February
1980	20.0 (6)	51.6 (16)	-	-
1981	100 (30)	100 (31)	0 (0)	96.4 (27)
1982	53.3 (16)	77.4 (24)	83.9 (26)	85.7 (24)
1983	56.7 (17)	100 (31)	90.3 (28)	100 (28)
1984	6.7 (2)	100 (31)	100 (31)	100 (29)
1985	86.7 (26)	100 (31)	32.3 (10)	42.9 (12)
1986	57.7 (17)	100 (31)	64.5 (20)	100 (28)
1987	100 (30)	100 (31)	100 (31)	100 (28)
1988	100 (30)	35.5 (11)	64.5 (20)	100 (29)
1989	100 (30)	58.1 (18)	0 (0)	14.3 (4)
1990	-	-	100 (31)	100 (28)
Average	68.0	82.3	63.6	83.9

*No attempt was made to adjust the data for water withdrawals which may have been made by Hunter Mountain Ski Area, Cortina Valley Ski Area or Ski Windham.

Table 11. Summary of recommended stocking of yearling brown trout, *Salmo trutta*, in Schoharie Creek.

Section	Miles	Acres	Number late April	Number late May	Total	Number per acre
Barrier Dam-T128	6.5	74.1	7,100	1,600	8,700	117
T128 - T133	3.5	39.6	2,600	600	3,200	81
T133 - Diversion	8.3	45.1	4,300	1,000	5,300	118
Diversion - T147b	2.1	8.7	1,100	500	1,600	184
T147b - T156	3.5	10.3	350	100	450	44
T156 - Source	1.7	3.4	0	0	0	0
Total	25.6	181.2	0	0	19,250	106
Total Stocked	23.9	177.8	15,450	3,800	19,250	108

Table 12. Recommended allocation of trout for stocking locations along Schoharie Creek from Prattsville fish barrier dam to the mouth of the East Kill (Tributary 133).

	Late April	Late May
Roadside parking area Highway 23A-parking area at town line/park boundary	700	200
Roadside parking area-above Wilcox residence DOT pulloff	1400	300
Roadside parking area-Highway 23A-second one above previous	1700	400
Roadside-Highway 23A-1/2 mi above Mosquito Point Bridge	1900	400
Roadside-Highway 23A-on bend with cobble boulders on bank or 1 mi upstream of Echo Valley Motel. Drive down dirt road at mi post 1056 under dry conditions	1400	300
Roadside parking area-Highway 23A, down from Lexington	300	50
Bridge-Highway 42-Lexington	650	200
Bridge-Bush Road-junction with 23A by Peak Real Estate	850	200
Roadside parking area-Highway 23A, above Jewett Town line west	500	100
Roadside-Highway 23A-Jewett Center park at Xenia Motel along East Kill mouth	300	50

Table 13. Recommended allocation of trout for stocking locations along Schoharie Creek from the mouth of the East Kill (Tributary 133) upstream to the mouth of Roaring Kill (Tributary 156).

	Late April	Mid May
Roadside - Highway 23A - MP 1098	950	200
Roadside - Highway 23A - around MP 1106	400	100
Roadside parking area - Highway 23A - 0.1 mi upstream from Little Timber Rd. (Carr Rd.)	550	100
Cemetary road, South Jewett - Maplewood Cemetary road to streamside	750	200
Bridge - Deming Road - Carry to creek - 3 ton bridge	600	150
Roadside - Highway 23A junction 296	400	150
Bridge - on Bridge St.	300	
Bridge - on Ski Bowl Rd (83) across from Hunter Ski area	350	100
Roadside - on Ski Bowl Rd (83) - about 1/2 mi above ski area - just above diversion ditch for ski center	400	200
Turn left on Highway 214 - stock from bridge	700	300
Turn on 23A - then take Bloomer Road toward Elka Park, immediately after crossing Gooseberry Creek bridge turn right on dead end road and continue to Kissley Garage and private camping area. Carry 80 yd across meadow - need help for this	100	50
Bridge - Elk Park Rd	250	50

APPENDIX 2

Mouth - Prattsville Barrier Dam - File Numbers 806, 807, 808, 813, 816, 818, 858, 884, 889, 904 and 932: Warm, none (62.5 mi)

CROTS WORKSHEET

STREAM Schoharie Creek SECTION Prattsville Barrier Dam - West Kill (T128)

WATERSHED Mohawk CODE MH82 STOCKING FILE NUMBER 932

STATION WIDTHS 118, 100, 64 SURVEY REFERENCE 1981

ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 94 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 6.5 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 74.1 ACRES (=[(A)/8.25]x(B)) (C)

NOTES

CARRYING CAPACITY FACTORS SURVEY REFERENCE 1981

STATION	F	K	N	
	2	1.7	1	T116+0.4
	1.5	1.7	1	@T122
	1.5	2	2	T123+0.1
MEANS	1.7	1.8	1.3	FxKxN= 4.0

VALUE OF: CC 57.4 LB/ACRE 0.75CC 43.1 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 0.6 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 25.8 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE ______

	BT	ST	RT	TOTAL
NO/ACRE	0	0	0	0
VALUE OF WY (from table 1) or ____	0	0	0	0
WILD TROUT BIOMASS LB/ACRE	0	0	0	.0 (F)

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE B_s FISHING PATTERN 1 STOCKING TABLE 5

MAXIMUM STOCKED BIOMASS (MSB) 24.6 LB/ACRE for PGT. ______ LB/ACRE for P&T (from stocking table. Remember to use WY multiplie

STOCKED BIOMASS LIMIT (SBL): 25.8 LB/ACRE (D)(0.75CC) - ______ LB/ACRE (F)WILD BIOMASS = ______ (for PGT lots)

or (E) ______ LB/ACRE (1.50CC) - ______ LB/ACRE (F)WILD BIOMASS = ______ (for P&T lots).

BIOMASS ADJUSTMENT 1 (G) PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)

(=SBL/MSB) 25.8 / 24.6 or ______/______

STOCKING RECOMMENDATIONS :

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x____	NO/ACRE for biomass (J)=(I)x	NUMBER STOCKED (=(J)x(C)) BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
RTE ~~MID~~ APRIL	96	96	96	7,114			7,100
STE MAY-~~JUNE~~	22	22	22	1,630			1,600

CROTS WORKSHEET

STREAM Schoharie Creek SECTION West Kill - East Kill (T133)

WATERSHED Mohawk CODE MH82 STOCKING FILE NUMBER 960

STATION WIDTHS 160, 52, 68 SURVEY REFERENCE 1982 width check

ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 93.3 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 3.5 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 39.6 ACRES (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS SURVEY REFERENCE 1958

NOTES

STATION	F	M	N	
	2	1	1	T129+0.1
	1	2	1	T131+0.2
MEANS	1.5	1.5	1	FxMxN= 2.25

VALUE OF: CC 37.4 LB/ACRE 0.75CC 28.0 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 0.6 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 16.8 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE ______

BT	ST	RT	TOTAL	
0	0	0	0	NO/ACRE

VALUE OF WY

BT	ST	RT	TOTAL	
0	0	0	0	(from table 1) or ____

WILD TROUT BIOMASS

BT	ST	RT	TOTAL (F)	
0	0	0	0	LB/ACRE

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE Bs FISHING PATTERN 1 STOCKING TABLE 5

MAXIMUM STOCKED BIOMASS (MSB) 24.6 LB/ACRE for PGT. ______ LB/ACRE for P&T (from stocking table. Remember to use WY multiplie

STOCKED BIOMASS LIMIT (SBL): 16.8 LB/ACRE (D)(0.75CC) - 0 (F)WILD BIOMASS LB/ACRE= 16.8 (for PGT lots)

or (E) ______ LB/ACRE (1.50CC) - ______ (F)WILD BIOMASS LB/ACRE= ______ (for P&T lots).

BIOMASS ADJUSTMENT 0.68 (G) PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)

(=SBL/MSB) 16.8/24.6 or ____/____

STOCKING RECOMMENDATIONS :

NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x 1	NO/ACRE for biomass (J)=(I)x 0.68	BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
~~MID~~ ATE APRIL	96	96	65.3	2,586			2,600
ATE MAY-~~JUNE~~	22	22	15.0	594			600

CROTS WORKSHEET

STREAM Schoharie Creek SECTION East Kill - Dolans Lake Diversion

WATERSHED Mohawk CODE MH82 STOCKING FILE NUMBER 960, 968

STATION WIDTHS 37,39,41,58,61,53 SURVEY REFERENCE 1982 width check

ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 44.8 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 8.3 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 45.1 ACRES (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS SURVEY REFERENCE

STATION	F	N	H	
1972	2	2	2	T133+2.2
1972	2	2	2	T135-0.1
1975	2	1	2	@T141
MEANS	1.5	1.7	2	FxNxH= 5.1

NOTES Mean "F" value reduced to 1.5 due to low total dissolved solids

VALUE OF: CC 67.5 LB/ACRE 0.75CC 50.6 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 0.86 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 43.5 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE

	BT	ST	RT	TOTAL	
WILD TROUT YEARLINGS	12	0	0	12	NO/ACRE
VALUE OF WY	0	0	0	0	(from table 1) or ____
WILD TROUT BIOMASS	2.8	0	0	2.8 (F)	LB/ACRE

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE Bs FISHING PATTERN 1 STOCKING TABLE 5

MAXIMUM STOCKED BIOMASS (MSB) 24.6 LB/ACRE for PGT. ______ LB/ACRE for P&T (from stocking table. Remember to use WY multipli

STOCKED BIOMASS LIMIT (SBL): 43.5 LB/ACRE (D)(0.75CC) - 2.8 (F)WILD BIOMASS LB/ACRE= 40.7 (for PGT lots)

or (E)______LB/ACRE (1.50CC) - ______ (F)WILD BIOMASS LB/ACRE= ______ (for P&T lots).

BIOMASS ADJUSTMENT 1 (G) PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)

(=SBL/MSB) 40.7 / 24.6 or ______/______

STOCKING RECOMMENDATIONS : NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x____	NO/ACRE for biomass (J)=(I)x	BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
ATE ~~MID~~ APRIL	96	96	96	4,330			4,300
ATE MAY-~~JUNE~~	22	22	22	992			1,000

CROTS WORKSHEET

STREAM Schoharie Creek SECTION Diversion - Gooseberry Creek (T147B)

WATERSHED Mohawk CODE MH82 STOCKING FILE NUMBER 973

STATION WIDTHS 32,36 SURVEY REFERENCE 1975 1982 width check

ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 34 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 2.1 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 8.7 ACRES (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS SURVEY REFERENCE ____

NOTES

STATION	F	H	N	
1975	2	3	3	T145+0.3
MEANS	2	3	3	FxHxN= 13.5

VALUE OF: CC LB/ACRE 115.7 0.75CC 86.8 1.50CC ____ (from table 3).

WIDTH ADJUSTMENT 0.98 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 85.1 LB/ACRE (D)

or 1.50CC (for P&T) ____ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE ____

BT	ST	RT	TOTAL	
0	0	0	0	NO/ACRE

VALUE OF WY

BT	ST	RT	TOTAL	
0	0	0	0	(from table 1) or ____

WILD TROUT BIOMASS

BT	ST	RT	TOTAL (F)	
5.0	0	0	5.0	LB/ACRE

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE Ac FISHING PATTERN 1 STOCKING TABLE 8

MAXIMUM STOCKED BIOMASS (MSB) 42.2 LB/ACRE forPGT. ____ LB/ACRE for P&T (from stocking table.Remember to use WY multiplie

STOCKED BIOMASS LIMIT (SBL): 85.1 LB/ACRE - 5.0 LB/ACRE= 80.1 (for PGT lots)
(D)(0.75CC) (F)WILD BIOMASS

or (E)____ LB/ACRE - ____ LB/ACRE= ____ (for P&T lots).
(1.50CC) (F)WILD BIOMASS

BIOMASS ADJUSTMENT 1 (G) PGT or ____ P&T (Adjustment is 1.0 if SBL is greater than MSB)

(=SBL/MSB) 80.1 / 42.2 or ____/____

STOCKING RECOMMENDATIONS :

NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x____	NO/ACRE for biomass (J)=(I)x	BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
LATE ~~MID~~ APRIL	127	127	127	1,105			1,100
LATE MAY-~~JUNE~~	54	54	54	470			500

CROTS WORKSHEET

STREAM Schoharie Creek SECTION Dorsey? Creek - Roaring Kill (T156)

WATERSHED Mohawk CODE MH 82 STOCKING FILE NUMBER 973

STATION WIDTHS 28, 20, 25 SURVEY REFERENCE 1981 survey and 1982 wild trout... ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 24.3 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 3.5 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 10.3 ACRES (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS SURVEY REFERENCE 1981

NOTES

STATION	F	H	N	
	1	2	1	@T150
	1	1	2	@T155
MEANS	1	1.5	1.5	FxHxN= 2.25

VALUE OF: CC 37.4 LB/ACRE 0.75CC 28.0 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 1 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 28.0 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE ______

	BT	ST	RT	TOTAL	
WILD TROUT YEARLINGS	17	20	26	60	NO/ACRE
VALUE OF WY	0.04	0.06	0.12	0.2	(from table 1) or ____
WILD TROUT BIOMASS	13.2	1.3	3.4	18.4 (F)	LB/ACRE

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE Rc FISHING PATTERN 1 STOCKING TABLE 5

MAXIMUM STOCKED BIOMASS (MSB) 14.8 LB/ACRE for PGT. ______ LB/ACRE for P&T (from stocking table. Remember to use WY multiplie

STOCKED BIOMASS LIMIT (SBL): 28.0 LB/ACRE - 18.4 LB/ACRE= 9.6 (for PGT lots)
(D)(0.75CC) (F)WILD BIOMASS

or (E)______LB/ACRE - ______ LB/ACRE= ______ (for P&T lots).
(1.50CC) (F)WILD BIOMASS

BIOMASS ADJUSTMENT 0.6 PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)
(G)

(=SBL/MSB) 9.6 / 14.8 or ______/______

STOCKING RECOMMENDATIONS : NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x0.6	NO/ACRE for biomass (J)=(I)x0.6	BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
ATTL MID APRIL	96	57.6	34.6	356			350
ATTL MAY-JUNE	22	13.2	7.9	82			100

CROTS WORKSHEET

STREAM Schoharie Creek SECTION Roaring Kill - Source

WATERSHED Mohawk CODE ______ STOCKING FILE NUMBER 973, 982

STATION WIDTHS 15 — 1975 SURVEY REFERENCE ____

ESTIMATED FISHING INTENSITY 150 HOURS/ACRE

MEAN WIDTH 15 FEET (A)

FISHING PATTERN 1

SECTION LENGTH 1.7 MILES (B)

SOURCE 1971-1972 Creel Census

SECTION AREA 3.4 ACRES (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS SURVEY REFERENCE 1975

STATION	F	H	N	
	1	1	3	T157+0.4
MEANS	1	1	3	FxHxN= 3

NOTES

VALUE OF: CC 47.0 LB/ACRE 0.75CC 35.3 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 1 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 35.3 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

WILD TROUT YEARLINGS SURVEY REFERENCE ______

BT	ST	RT	TOTAL	
240	0	0	240	NO/ACRE

VALUE OF WY

BT	ST	RT	TOTAL	
0.43	0	0	0.43	(from table 1) or ____

WILD TROUT BIOMASS

BT	ST	RT	TOTAL (F)	
>20.9	0	0	>20.9	LB/ACRE

(D)-(F)=

(E)-(F)=

= (SBL)

MANAGEMENT TYPE Bw FISHING PATTERN 1 STOCKING TABLE ______

MAXIMUM STOCKED BIOMASS (MSB) ______ LB/ACRE forPGT. ______ LB/ACRE for P&T (from stocking table.Remember to use WY multiplie

STOCKED BIOMASS LIMIT (SBL): ______ LB/ACRE - ______ LB/ACRE= ______ (for PGT lots)
(D)(0.75CC) (F)WILD BIOMASS

or (E)______ LB/ACRE - ______ LB/ACRE= ______ (for P&T lots).
(1.50CC) (F)WILD BIOMASS

BIOMASS ADJUSTMENT ______ PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)
(G)

(=SBL/MSB) ______/______ or ______/______

STOCKING RECOMMENDATIONS : NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x____	NO/ACRE for biomass (J)=(I)x	BT	ST	RT	TOTAL
MARCH-APRIL							
APRIL-MAY							
PGT							
MID APRIL							
MAY-JUNE							

CROTS WORKSHEET

STREAM Gooseberry Creek **SECTION** Mouth to Source

WATERSHED Mohawk **CODE** MH82-147b **STOCKING FILE NUMBER** 975

....

STATION WIDTHS 24,19,19,20,12.5,8,10 **SURVEY REFERENCE** 1980 1984

ESTIMATED FISHING INTENSITY 150 **HOURS/ACRE**

MEAN WIDTH 15.8 **FEET** (A)

FISHING PATTERN 2

SECTION LENGTH 3.6 **MILES** (B)

SOURCE Estimated from Schoharie Creek Creel Census

SECTION AREA 6.9 **ACRES** (=[(A)/8.25]x(B)) (C)

CARRYING CAPACITY FACTORS **SURVEY REFERENCE** ____

STATION	F	H	N	
	1	2	2	1980 T3-0.2
	2	2	3	1984 Mth-0.4
	2	2.3	2	1984 T1-0.4
	2	2	3	1984 T1-0.2
	2	1.3	2	1984 T2-0.1
MEANS	1.8	1.9	2.4	FxHxN= 8.2

NOTES WY value of 0.47 is close to target catch rate of 0.5 trout/hour negating the need to stock.

VALUE OF: CC 89.1 LB/ACRE 0.75CC 66.8 1.50CC ______ (from table 3).

WIDTH ADJUSTMENT 1 (from Table 4)

ADJUSTED VALUES 0.75CC (for PGT) 66.8 LB/ACRE (D)

or 1.50CC (for P&T) ______ LB/ACRE (E)

	BT	ST	RT	TOTAL	
WILD TROUT YEARLINGS	63	34	92	189	NO/ACRE
VALUE OF WY	.11	.10	.26	0.47	(from table 1) or
WILD TROUT BIOMASS	5.1	12.1	4.6	21.8 (F)	LB/ACRE

SURVEY REFERENCE 1980 1984 data expande

(D) (E) = (

MANAGEMENT TYPE A_W **FISHING PATTERN** 2 **STOCKING TABLE** ______

MAXIMUM STOCKED BIOMASS (MSB) ______ LB/ACRE forPGT. ______ LB/ACRE for P&T (from stocking table.Remember to use WY mult

STOCKED BIOMASS LIMIT (SBL): ______ LB/ACRE - ______ LB/ACRE= ______ (for PGT lots)
(D)(0.75CC) (F)WILD BIOMASS

or (E)______ LB/ACRE - ______ LB/ACRE= ______ (for P&T lots).
(1.50CC) (F)WILD BIOMASS

BIOMASS ADJUSTMENT ______ (G) PGT or ______ P&T (Adjustment is 1.0 if SBL is greater than MSB)

(=SBL/MSB) ____/____ or ____/____

STOCKING RECOMMENDATIONS : NUMBER STOCKED (=(J)x(C))

P & T	NO/ACRE (H) (from table	ADJUSTED for WY I=(H)x____	NO/ACRE for biomass (J)=(I)x	BT	ST	RT	TOTA
MARCH-APRIL							
APRIL-MAY							
PGT							
MID APRIL							
MAY-JUNE							

15 (12-75)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Phil Hulbert
FROM: Russ Fieldhouse
SUBJECT: Schoharie Creek Management Plan
DATE: September 14, 1993

The subject plan is ready for distribution.

Russ

Russell D. Fieldhouse
Fisheries Manager
Region IV

RDF:klc
Enc.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

M E M O R A N D U M

July 3, 1991

TO: Regional Water Engineers, Mr. Campbell and Bureau Directors

FROM: Mr. Pagano

SUBJECT: Water Quality Standards
Chlorine

Enclosed is interim guidance for the application of the Chlorine Standard of 0.005 mg/l which will be soon presented to the Environmental Board for proposed adoption. This supersedes my May 11, 1984 interim guidance.

This guidance was developed by the Water Division and Environmental Protection Bureau of Fish and Wildlife. It is based upon a two-year field study of chlorine impact upon aquatic life and literature review by several members of each Division.

The guidance, with rationale, will undergo the normal review and approval procedure for the Water Division Technical and Operating Guidance Series.

cc: Mr. Colquhoun, Environmental Protection
Mr. Skinner, Environmental Protection
Mr. Neuderfer, Environmental Protection
Mr. Zambrano, Water Quality
Mr. Newell, Asst. Director, Marine Resources
Mr. Colvin, Director, Marine Resources
Mr. Bromberg, Monitoring and Assessment
Mr. Myers, Monitoring and Assessment
Ms. Heitzman, Monitoring and Assessment

<u>Chlorine Standard</u>
<u>Interim Guidance for Application</u>
June, 1991

<u>THIS INTERIM GUIDANCE IS TO BE USED UNTIL ISSUANCE OF A DIVISION TOGS FOR APPLICATION OF THE CHLORINE STANDARD</u>

The total residual chlorine standard will be applied using the mass balance principle assuming complete mixing of the effluent with the receiving water at the point of discharge. Dependent on site-specific conditions, a mixing zone using less than the entire stream flow or width may be computed.

1. <u>FRESHWATER STREAMS</u>

Effluent limits will be developed using the following procedure:

a. For discharge situations with less than 30:1

1. Alternative practices or dechlorination should be required for new and/or modified facilities required to disinfect and/or facilities which apply chlorine for other purposes.

2. For existing discharges, the permit writer may allow continued chlorination if facility records demonstrate that the water quality based TRC can be regularly met. Further, if the chlorine is applied for disinfection, effective bacterial kill must also be demonstrated at the water quality based effluent limit.

If these conditions cannot be confidently verified, an alternate to chlorination (or dechlorination) should be required.

b. For discharge situations with dilution greater than 30:1 but less than 80:1, a TRC limit will be calculated using the water quality standard times the dilution times a factor of five (5).

Water Division responsible technical staff should make a judgement as to whether the water quality based TRC can be consistently met by the discharging facility <u>and</u> that effective disinfection or other process need will be accomplished.

If a positive finding is not possible, alternate processes or dechlorination is recommended.

c. For discharge situations with dilution greater than 80:1, water quality based effluent limits will not be specified.

Available dilution is to be determined under critical low flow (MA7CD10) conditions. The effluent limit is to be specified as a daily maximum.

Rationale

In the Spring of 1991, the Department (Water and Fish and Wildlife Divisions) completed a field study and evaluation of the fate and impact of chlorine disinfection upon aquatic life from treated wastewater discharges to freshwater streams. Coupled with literature review, key findings are:

1. A rapid five fold decay of residual chlorine upon discharge to a waterbody takes place for several reasons, during warm weather periods.

2. The decay factor diminishes with temperature as does chlorine toxicity. A reasonable presumption has thus been made that these two factors will effectively cancel, with the result that an 80:1 dilution would protect aquatic life under the proposed chlorine standard at as high as 2.0 mg/l effluent TRC.

   80 x 5 ug/l x 5 (decay factor) = 2000 ug/l = 2.0 mg/l

3. Discharges to streams with dilution ratio's of 30:1 or less would be allowed no more than 0.5 mg/l considering the factors noted above. At this maximum concentration, effective disinfection becomes questionable. Hence the recommended alternative disinfection or dechlorination to meet the conflicting needs of adequate disinfection and aquatic life protection.

   Note that this recommendation extends to facilities which apply chlorine for purposes other than wastewater disinfection as the same principles apply.

2. Lakes

A dilution ratio of 10:1 will be applied unless a site-specific diffusion study has been conducted which shows that actual dilution is different. Water quality based effluent limits will be developed applying the standard times an appropriate dilution factor times a factor of five (5).

Lake discharge facilities practicing chlorination will be treated the same as freshwater stream dischargers in accord with the guidance set forth above for the various dilution ratios.

Rationale

The factor of five (5) was derived from review of literature information and takes into account the rapid decrease in free and combined residual chlorine in ambient waters resulting from reaction with organic matter and other naturally occurring chemical constituents. Application of the factor is supported by the findings of the Department's recent study of chlorine residual in ambient waters.

3. Freshwater Notes

a. This interim guidance will be followed by normal TOGS development.

b. The interim guidance supersedes the May 11, 1984 memo by Mr. Pagano regarding chlorine standard application (attached).

c. The interim guidance applies to all discharges with residual chlorine to fresh surface waters except in the case of Zebra Mussel control. The latter use is controlled by special permit provisions developed by the Design Bureau and Fish and Wildlife's Environmental Protection Bureau.

d. Since the limit for detection of chlorine is currently 0.10 mg/l, effluent limits established under SPDES permits will be set at or above this limit.

4. Freshwater Variance

Dischargers may provide site-specific information regarding the impact of chlorine disinfection upon the protection of aquatic life to demonstrate reasonable variance from the above guidance.

5. Marine Waters

The Division is currently considering guidance beyond technology limits for implementation of the proposed chlorine standard.