FINAL EXHIBIT LIST PAGE NUMBERS NOT YET DETERMINED**

WATERSHED COMMUNITIES EXHIBITS

1	"MAILBAG	
2	"WATERSHED COMMUNITIES DOCUMENTS ZONING ORDINANCE OF THE T. OF MIDDLETOWN, MASTER PLAN OF THE TOWN OF MIDDLETOWN, MIDDLETOWN COMPREHENSIVE PLAN AND SUBDIVISION REGULATIONS OF THE T OF MIDDLETOWN	
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October 12, 2004

Hon. Richard Wissler
Administrative Law Judge
NYSDEC
625 Broadway, 1st Floor
Albany, NY 12233-1010

Re: In the Matter of the Application of BELLEAYRE RESORT at the CATSKILL PARK PROPERTY
Application Numbers: 0-9999-00096/00005/ 0-9999-00096/00009

Dear Judge Wissler:

Enclosed are the following three exhibits that were introduced by the Watershed Communities on August 26, 2004 together with an explanation of the relevance of each exhibit:

1. **Watershed Communities Exhibit #6 entitled: New York City Department Environmental Protection Guidance for Phosphorous Offset Pilot Programs, March 1997, prepared by: Bureau of Water Supply Quality and Protection, Engineering and Operation Division, Project Management Group.**

Appendix A to that document is entitled : Phosphorous Load and Offset Calculation. That section describes the "calculations required to determine pre- and post- development point and non-point source phosphorous loadings from the wastewater treatment plant site and the sites that will be contributing to the wastewater treatment plant's flow volume". These calculations: "form the basis for determining the amount of phosphorous that must be offset through the phosphorous offset mechanism." With respect to the calculation, applicants are instructed to "assign development categories and runoff coefficients(R) to each subbasin of the development site using the National Urban Runoff Program data (see Appendix E and "Results of Nationwide Urban Runoff Program" USEPA, 1993)." Appendix E identifies the pollutant loading coefficients; Appendix D specifies the annual average rain fall that is to be used in the calculation for each county within the watershed, and Appendix F identifies the BMP pollutant removal efficiencies. The purpose of this submission is to

demonstrate that for purposes of permitting new phosphorus discharges in a phosphorous restricted basin, DEP has already developed and published a methodology for determining the pre and post development phosphorous loadings that is much simpler than and does not require the site specific data being suggested by DEP in this proceeding.

2. **Watershed Community Exhibit No. 17 which is an United States District Court, Northern District of New York Decision dated February 6, 2003 in the matter entitled *Catskill Mountain Chapter of Trout Unlimited, Inc. et al. v. New York City*, 1:00-CV-511, Chief Judge Scullin.**

This Court Decision explains that the post-1996 turbidity problems in the Esopus Creek as being attributed primarily to New York City's point source discharge for the Shandaken Tunnel.

3. **Watershed Communities Exhibit No. 18 is a letter from Michael A. Principe, Ph.D. of the New York City Department of Environmental Protection to Thomas D. Engle regarding Shandaken Tunnel SPDES Permit Application No. 3-5150-00420/00001.**

This letter is New York City Department of Environmental Protection's comment letter in response to DEC's Draft SPDES permit for discharges from the Shandaken Tunnel issued for public comment on February 18, 2004. In that letter, DEP states as follows:

> The draft permit proposes that when the action levels are exceeded, DEP shall investigate the sources of the exceedance and propose measures to reduce turbidity from the sources. (Draft Permit Page 3). However, in reality, it is unlikely that exceedances and the discharges from the Tunnel will relate back to a single identifiable source of turbidity in the watershed, such as the failure or collapse of a particular stream bank. Rather, turbidity events are more likely to result from a storm, or snow melt that had occurred sometime prior to the effective discharge, and are unrelated to any particular source that can be located and addressed.....
>
> [T]he draft permit states that once the sources of exceedance are identified, "the identified sources shall be used to prioritize compliance actions to be taken in the schedule of compliance - action level items on page 9 of this permit." Thus, DEC relies on underlying assumption that the program set forth in page 9 - stream restoration, critical area seeding and conservation easements – will actually reduce turbidity in the Schoharie Watershed. This underlying assumption has not been established. We believe that these programs provide water quality benefit by, among other things, for stalling new potential

sources of turbidity in the watershed that by virtue of its geology and topography is prone to erosion. **Moreover, while the programs may lead to localized turbidity reductions during low flow conditions, we do not believe that they will significantly reduce turbidity exceedances under the permit, which are more directly related to severe wet weather events. It is these high flow storm events that are likely to lead to the most significant increase in turbidity in the Schoharie Reservoir and the Shandaken Tunnel. For the same reasons, we urge DEC to delete the reference to the "the expected on-going decreases in turbidity from the Shandaken Tunnel" in the SPDES fact sheet (page 2, FN 1).**

* * *

Finally, as discussed above, while stream restoration may prevent the further exacerbation of turbidity in the Catskill system, it is unproven to date that stream restoration of even a substantial stream area actually reduces turbidity in a measurable way."

In other words, the City's position with respect to it being held accountable for the turbidity coming out of the Shandaken Tunnel, is that (i) the turbidity is due to the severe weather conditions and the natural localized geology and topography and (ii) that best management programs such as critical area seeding, stream bank restoration and even conservation easements will not have a measurable impact on downstream turbidity. This position is in contrast to the City's position in this proceeding in which the City asserts that the proposed project may have significant turbidity impacts on the Ashokan.

These exhibits are submitted as further evidence that the potential TSS and phosphorous loadings from storm water discharges subject to the controls required in the draft SPDES permit and subject to the controls required to satisfy the NYC Watershed Rules and Regulations will not have a significant impact on the environment and thus do not warrant identification as an adjudicable issue.

Very truly yours,

Kevin M. Young

Enclosure

cc: Carol Krebs -DEC
Hilary Meltzer-NYC
Marc Gerstman- CPC
Dan Ruzow/Teresa Bakner- Crossroads

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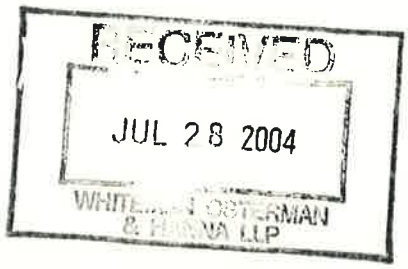
July 27, 2004



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Re: Crossroads Ventures, LLC
Delaware County – Issue on Community Character

Dear Counsel:

Enclosed please find a copy of Alan Rosa's résumé. This letter is to confirm that Alan is scheduled to make an offer of proof on August 24, 2004 on the issue of community character on behalf of Delaware County. Alan Rosa will be speaking as an individual who was previously the

supervisor of the Town of Middletown and a member of the Board of Supervisors for Delaware County. He will not be speaking in his capacity as Executive Director of CWC.

Very truly yours,

Kevin M. Young

Enclosure

Alan L. Rosa, Executive Director
Catskill Watershed Corporation

Alan is a native of the Dry Brook Valley near Arkville in Delaware County, where his family has lived for the better part of 200 years, and where he early on developed a love for the outdoors and a penchant for hunting and fly-fishing. He graduated from Margaretville Central School and holds certificates from Cornell University in Business Law, Business Economics and Accounting.

A former accountant and small business owner, Alan was elected supervisor of the Town of Middletown in 1990, and as such became a member of the Delaware County Board of Supervisors.

He helped organize the Coalition of Watershed Towns in 1991 in response to watershed regulations issued by the New York City Department of Environmental Protection which wanted to avoid filtering its daily supply of 1.2 billion gallons of Catskill and Delaware water. The coalition worked for the next six years to negotiate a fair deal for upstate communities faced with potentially suffocating watershed rules.

The struggle led to the landmark New York City Watershed Memorandum of Agreement, signed in January of 1997. The MOA called for the formation of the Catskill Watershed Corporation, a non-profit Local Development Corporation, to direct a number of city-funded environmental protection, economic development and education programs.

The CWC board of directors, which includes 12 elected officials from the 5-county Catskills, along with city, state and environmental representatives, elected Alan its first president in 1997. He became the CWC's acting executive director in December of 1998, a position which became permanent in April, 1999.

Alan manages a staff of 16 professional, technical and support personnel and oversees an annual operation and program budget of 21 million dollars.

He is a member of the Executive Committee of the Watershed Protection and Partnership Council, and assists in an advisory capacity with several partner agencies in the West of Hudson Watershed.

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Waterkeeper Comm Exh 1

Mailbag

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view on how we do things, but "so long as it works, don't need fixin." We try to look out for one another, 'neighborly ethic,' or at least that is the way it should be. It seems that the 'flatlander,' 'neauveau riche,' transplant, etc. wants to require the amenities from whence they came, or does someone have a vendetta, or a 'cooked up deal' with an outside hauler for a share in the action! There is no understandable reason for the town to not contract with Howard Ruff; through taxes it spreads the cost out more fairly and evenly. He's the sanitation ...neer in the business of col...ng whatever, not the town!

Robert F. Miller,
Andes

Jobs data

To The Editor:

I was in attendance at the public hearing regarding the Belleayre Resort at Catskill Park on the evening of January 14, but due to a family illness I was forced to leave before I had a chance to comment. My intended comments are as follows:

As the director of economic development for Delaware County it is my responsibility to promote the long-term economic viability of the county. In our current state, that means jobs—plain and simple. Delaware County is the fourth poorest county in New York State and the northern most county of the federally designated Appalachian Region, which reflects the rural poverty, long-term unemployment and lack of job opportunities that exist in the region.

According to US Census data, median family income in the Town of Middletown is more than over 40 percent lower than the statewide average. Further, while real wages have risen throughout the state during the 1990s, they have declined within the watershed. In 2000, the average private sector wage in Delaware County ($25,576) was nearly 81 percent lower than the statewide average (46,224).

The result is the exportation of the working age population. Delaware County is the second oldest county in the state and is aging at a faster pace than all other counties. This has serious implications for our future. Between 1900 and 2000, Delaware County grew by 2,055 people. Between 2000 and 2001, we shrank by 535. Coincidentally, this is slightly fewer than the number of full-time jobs to be created by this project.

What do 542 full-time jobs mean? It's a 4.3 percent increase in the number of private sector jobs throughout the entire county. This would partially offset the 4.7 percent of jobs lost in the region between 1990 and 2000. More locally, it represents a 17 percent increase in the number of jobs available in the towns of Shandaken and Middletown. To put these figures in perspective, the national economy shed just 1.5% of domestic jobs during the severe recession from which the country is tentatively emerging.

What's more, while these jobs may appear low paying to some, those familiar with the actual local wage structure would disagree. As stated above, the average annual private sector wage or salary in Delaware County is $25,576. The average annual wage at the Belleayre Resort at Catskill Park will be approximately $29,843. I would imagine there are quite a few people that would be interested in a 17 percent raise. Further, this figure excludes the tip income of bellhops, maids, waiters, waitresses, bartenders, etc., whom you are supposed to tip, and also excludes the locally invaluable benefit of health and dental insurance.

As for local spending, my personal experiences of staying at resort destinations lead me to believe it will be considerable. When was the last time you went on vacation without any "spending" money and without any interest in seeing the surrounding area? Laying aside that argument for the moment, I am just as excited about the amount of local spending that will be generated as a result of the 542 new full-time jobs being created.

This project is a rare opportunity; one that needs to be judged strictly on facts, and one that will not come around again.

Glenn Nealis,
Delaware County
Department of Economic
Development
Delhi

Swimming pool

ments for money, including Bovina.

Not too long ago I received information from the Delaware County Department of Aging that a certain developer has shown interest, in constructing a retirement home in this region. Therefore, may I suggest that if and when the project takes a more fruitful shape, then the developer is asked to include a swimming pool with the understanding that the pool be open to all Delaware County residents free of charge, or at least at reduced charge.

Since Bovina residents can and do use the Andes swimming pool, I, as a Bovina taxpayer, request the Bovina Town Board stick to their stand that Bovina does not contribute towards the construction of any swimming pool in the Village of Delhi.

Shyamal K. Sen Gupta,
Bovina Center

Stray cats

To The Editor:

This is to the person who ran over a cat on Rte. 28 by the Arkville Bridge Wednesday night.

My husband, son and myself had the unpleasant experience of finding the half-paralyzed cat, who had to drag himself by its front legs 50 feet up our driveway and suffer in the cold most of the night. We discovered it Thursday morning.

We don't know if he had owners, or if he was a stray but an animal should not have to suffer like that.

Maybe I should not be shocked because in this day and age people hit other people and drive off, but it sickens me.

People say animals should not be running around the neighborhood. That is true. It is also true people need to have a conscience. I don't know how some people can sleep at night.

If you are wondering what became of the cat, obviously he had to be put to sleep. He had a broken back.

I am glad that at least he didn't drag himself off into a snowbank and starve to death, in the cold.

Again to the cruel and heartless person who hit a cat on Rte. 28 in Arkville—try to picture yourself in the poor cat's place. Would you want help or would you want to drag yourself half

At Your Service

By Margaret Inge

I find myself writing this week's column from afar, gaining a ...ferent perspective on what is available in our mountains. One ...he most common laments heard locally is that shopping is limited. It is certainly true that the variety of items available in our area is smaller in volume than that available elsewhere; however, I am coming to believe that smaller may be better.

Here in Afar, a place that could also be called Mart-land, it is easy to get anything that everyone wants. That's right, as long as what you want is common and ordinary, it is available in volume.

At the Office Mart, you can get the basic software program, but the professional version of the same program requires a special order, which they promise will arrive in four or five business days, if it is in stock in the warehouse. Unfortunately, this doesn't seem good enough to me. I have been quite spoiled by the ability of my local office supply store's ability to get me almost anything overnight – and they call me when it arrives.

Young Scott needs a particular acrylic paint for a school proj...he is completing. There is no Art-Mart or Craft-Mart here in ...; nor does the Big Mart carry unusual types of paint – acrylic being unusual outside the domains of the fine arts. After a full hour of traveling from Mart to Mart, we finally located a reasonable facsimile of the desired paint at a small hardware store owned by a man who "started carrying this right after the art supply store closed a few years ago. My wife is an artist and couldn't find what she needed at the Mart."

It is my lament that I am not home, where I have three different forms of the desired paint. Among my local choices for those

2

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June 21, 2004

Hon. Richard Wissler
Administrative Law Judge
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625 Broadway, 1st Floor
Albany, NY 12233-1010

Re: In the Matter of the Application of BELLEAYRE RESORT at the CATSKILL PARK PROPERTY
Application Numbers: 0-9999-00096/00005/ 0-9999-00096/00009

Dear Judge Wissler:

At the Issue Conference held on June 9, 2004, you requested that the Watershed Communities submit copies of the following documents:

(1) Zoning Ordinance - Town of Middletown, New York, effective October 1, 2000;
(2) Town of Middletown Master Plan, adopted April 26, 1988;
(3) Middletown Comprehensive Plan; and
(4) Subdivision Regulations - Town of Middletown, Delaware County, New York, Approved by Town Board, July 11, 1989.

Copies are being distributed to all parties.

Very truly yours,

Kevin M. Young

Enclosure
cc: Carol Krebs -DEC
Hilary Meltzer-NYC
Marc Gerstman- CPC
Dan Ruzow/Teresa Bakner- Crossroads

wpdata\coalition of watershed towns\crossroads\040621 ltr Wissler.kmy

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ZONING ORDINANCE

TOWN OF MIDDLETOWN, NEW YORK

ADOPTED: APRIL 12, 1988
AMENDED: APRIL 23, 1992
AMENDED: JUNE 13, 1995
AMENDED:
APPROVED SEPTEMBER 12, 2000
EFFECTIVE OCTOBER 1, 2000

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ZONING ORDINANCE

Town of Middletown, New York

Section 101 Title

This document shall be known and may be cited as the "Town of Middletown, New York, Zoning Ordinance" and shall include this text, Schedule I, the Zoning Map, and the Development Limitations Overlay Maps.

Section 102 Enacting Clause

Pursuant to the authority conferred by Article 16, Section 261 of the Town Law of the State of New York, the Town Board of the Town of Middletown hereby adopts and enacts as follows.

Section 103 Purpose of Zoning Ordinance

The purpose of this Zoning Ordinance, its regulations and its zoning districts as outlined on the zoning map is to:

A) protect and promote the public health, safety, and general welfare of the town consistent with the objectives of Town Law 263,

B) guide the future growth and development in accordance with a master plan,

C) protect the character and the social and economic stability of all parts of the town, and to encourage the orderly and beneficial development of all parts of the town,

D) protect and conserve the economic and aesthetic value of land and buildings appropriate to the various districts established by this ordinance,

E) minimize conflicts among the uses of land and buildings,

F) provide a guide for public policy and action in the efficient provision of public facilities and services, and for private enterprise in building development, investment and other economic activity relating to uses of land and buildings,

prevent the pollution of air, streams and ponds; to assure the adequacy of drainage facilities; to safeguard the water table; and to encourage the wise use and sound management of the town's natural resources in order to preserve the integrity, stability and beauty of the community and the value of the land,

G) preserve the natural beauty of the topography of the town and to insure appropriate development with regard to these natural features,

H) encourage and make suitable provisions for the accommodation of solar energy systems and equipment and access to sunlight necessary therefore.

Section 104 Conflict With Other Laws

Whenever the requirements of this ordinance are at variance with the requirements of any other lawfully adopted rules, regulations, or ordinances, the most restrictive, or that imposing the higher standards shall govern.

Section 105 Interpretation

In their interpretation and application, the provisions of this ordinance shall be held to be minimum requirements, adopted for the promotion of the public health, safety, or the general welfare.

Section 106 Validity and Separability

Should any clause, sentence, subdivision, paragraph, section, or part of this ordinance be decided by a court of competent jurisdiction to be unconstitutional or invalid, such decision shall not affect the validity of the ordinance as a whole, or any part thereof, other than the clause, sentence, subdivision, paragraph, section or part so decided to be unconstitutional or invalid.

Section 107 Effective Date

This ordinance shall take effect ten days after publication in a newspaper having general circulation in the town, but said ordinance shall take effect from the date of its service as against a person served personally with a copy thereof, certified by the Town Clerk under the corporate seal of the town; and showing the date of its passage and entry in the minutes.

_____

Town Clerk, Town of Middletown

_____

Effective Date

ARTICLE II. DEFINITIONS

Section 201 General

For the purpose of this Ordinance, the following terms and words shall be interpreted as follows:

1) The word "person" includes a firm, association, organization, partnership, trust, company, agency, society or corporation as well as an individual.

2) Words used in the present tense include the future tense.

3) The singular includes the plural and the plural includes the singular.

4) The words "shall" and "must" are mandatory.

5) The words "used" or "occupied" include the words intended, designed or arranged to be used or occupied.

6) The word "lot" includes the words plot or parcel.

Section 202 Definition of Key Terms

Accessory Building - Any building which is subordinate to and which use is incidental to the use of the principal building located on the same lot. Where an accessory building is attached to the main building in a substantial manner, as by a wall or roof, such accessory building shall be considered part of the main building.

Accessory Use - A use subordinate to the main use. In no case shall such dominate in area, extent or purpose, the principal lawful use.

Acre - For the purpose of calculating lot area under this Ordinance, an acre shall be considered to consist of 43,260 contiguous square feet.

Adult Body Painting Studio - An establishment or business which provides the service of applying paint or other substance whether transparent or non-transparent to or on the human body and which is not open to the public generally, but excludes any minor by reason of age.

ARTICLE II. DEFINITIONS

Adult Book Store/Video Store - An establishment having as a substantial or significant portion of its stock-in-trade, books, magazines, other periodicals, films, slides, video tapes or adult toys/marital aides, and which establishment is customarily not open to the public generally, but excludes any minor by reason of age.

Adult Drive-In Theater - A drive-in theater that customarily presents motion pictures that are not open to the public generally, but excludes any minor by reason of age.

Adult Entertainment Cabaret - A public or private establishment which presents topless dancers, strippers, male or female impersonators, lingerie or other private modeling, exotic dancers or other similar entertainment, and which establishment is customarily not open to the public generally, but excludes any minor by reason of age.

Adult Massage Establishment - Any establishment having a fixed place of business where massages are administered for pay, including, but not limited to, massage parlors, licensed masseuse, licensed acupuncture, sauna baths and steam baths. This definition shall not be construed to include a hospital, nursing home or medical clinic or the office of a physician, surgeon, chiropractor, osteopath or duly licensed physical therapist or barber shops or beauty salons at which massages are administered only to the scalp, face, neck, or shoulders. This definition also shall exclude health clubs, hotels, motels or inns which have facilities for physical exercise, such as tennis courts, racquetball courts or exercise rooms, which do not receive their primary source of revenue through the administration of massages.

Adult Model Studio - Any establishment where, for any form of consideration or gratuity, figure models are provided to be observed, sketched, drawn, painted, sculptured, photographed, or similarly depicted by a person other than the proprietor, paying such consideration or gratuity and which is not open to the public generally, but excludes any minor by reason of age. This provision shall not apply to any school of art which is operated by an individual, firm, association, partnership, corporation or institution, which meets the requirements established by the New York State Education Law for the issuance of diplomas and is in fact authorized to issue and confer diplomas.

Adult Motel/Hotel - A motel/hotel which is not open to the public generally, but excludes minors by reason of age, or which makes available to its patrons in their

rooms, films, slide shows, or video tapes which if presented in a public movie theater would not be open to the public generally, but would exclude any minor by reason of age.

Adult Peep Shows - A theater or other establishment which presents material in the form of live shows, films or video tapes, viewed from an individual enclosure or private room for which a fee is charged and which is not open to the public generally, but excludes any minor by reason of age.

Adult Theater - A theater that customarily presents motion pictures, films, video tapes or slide shows, that are not open to the public generally, but excludes any minor by reason of age.

Adult Use - Any use or establishment constituting an adult book store/video store, adult drive-in theater, adult entertainment cabaret, adult massage establishment, adult motel/hotel, adult peep shows, adult theater, adult body painting studio, or adult model studio as defined herein.

Agriculture - The use of a parcel of land for agricultural purposes, including tilling of the soil, dairying, pasture, apiculture, arboriculture, horticulture, floriculture, aquatic farming, harvesting of trees and tree products, and animal husbandry. It includes the necessary accessory uses and structures for packing, treating, and storing of products, produce and equipment, provided that the operation of any such accessory use shall be secondary to that of normal agricultural activities.

Alteration - A change or rearrangement in the structural parts of a building or an enlargement, whether by extending to a side or by increasing the height or the moving from one location to another.

Alternative Energy Systems - Structures, equipment, devices, or construction techniques used for the production of heat, light, cooling, electricity, or other forms of energy, from solar, wind, water and other sources.

Animal Hospital - A business that treats animals and regularly houses them on the premises overnight and for extended periods for treatment.

ARTICLE II. DEFINITIONS

Animal Husbandry - The care and breeding of domestic animals, including but not limited to cattle, hogs, horses, poultry and sheep. For purposes of this Ordinance operation of a kennel shall not be considered animal husbandry. Animals for educational projects are exempted.

Apartment - See Dwelling, Multi-Family

Bed and Breakfast - An establishment in a private dwelling that supplies temporary accommodations to overnight guests for a fee. Meals may or may not be provided. Tourist homes, boarding houses, and inns are included here; however, rest homes or homes for the aged are not.

Building - A structure wholly or partially enclosed with exterior walls and a roof, affording shelter to persons, animals or property.

Bulk Storage - The storage of chemicals, petroleum products and other materials in above-ground containers for subsequent resale to distributors or retail dealers or outlets, or the general public.

Business and Professional Offices - Offices in which an occupation or vocation in a specified field is practiced: medical, law, engineering, surveying, insurance and real estate offices.

Camouflage - A means of concealing a building or other man-made structure that creates the effect of that the camouflaged object is part of the natural surroundings.

Camouflaging - The construction of facilities to house or support telecommunication towers or antennas so that the towers or antennas blend readily with the landscape, neighborhood, and adjacent architectural features. Examples of camouflaging that could be used are: silo and barn, windmill, and simulated tree.

Campground - A parcel of land used or intended to be used to provide two or more sites for the parking of travel trailers, placement of tents, or other temporary or movable sleeping accommodations.

Cell Tower - Any type of structure or building used for signaling or for any other form of communications.

Certificate of Conformity - A certificate issued by the Code Enforcement Officer to indicate that specified work has been completed to code specifications.

Certificate of Occupancy - A form of protection afforded the owner or occupant of a structure by serving as proof of compliance with the regulations in effect at the time of construction or alteration.

Civic Facility - Buildings, structure and uses owned and operated by the Town of Middletown and regularly used for neighborhood meetings and other forms of public assembly.

Clearcutting - Denuding the land vegetation, expressly trees, in excess of one acre, excluding commonly accepted agricultural activities.

Club - Any organization catering exclusively to members and their guests, or premises and buildings, for recreational or athletic purposes and not open to the general public, which are not conducted primarily for gain, provided there are no vending stands, merchandising or commercial activities, except as required for the membership and purposes of such club. Clubs shall include lodges, fraternal organizations, social and service organizations; gun, hunt and fish clubs, mutual benefit societies, and other like organizations.

Cluster Subdivision - A form of development for single-family residential subdivisions that permits a reduction in lot area and bulk requirements, provided there is no increase in the number of lots permitted under a conventional subdivision and the resultant land area is devoted to open space.

Code Enforcement Officer (CEO) - An individual appointed by the Town Board and given the responsibility to oversee and enforce all codes set forth in the Town relating to the maintenance of the general public welfare.

Co-located Antennas - Telecommunications facilities which utilize existing towers, buildings or other structures for placement of antenna(s) and which do not require construction of a new tower.

Commercial Recreation - A parcel of land which may include facilities for recreation purposes, utilized by the public for a fee. Activities include, but are not limited to, bowling alleys, ski slopes, tennis courts, golf courses, swimming

pools, movie houses, and drive-in theaters, health clubs, reducing salons and tanning parlors, and cooperative hunting preserves where a fee to hunt is required.

Commercial Storage - A structure or set of structures containing separate storage spaces of varying sizes leased or rented on an individual basis.

Condominium - A building or group of buildings, in which units are owned individually; and the structure, common areas and facilities are owned by all the owners on a proportional, undivided basis.

Cultural Recreation - Indoor or outdoor establishments promoting social and intellectual advancement such as libraries, museums, art galleries, concert halls and theaters, but excluding movie houses and drive-ins.

Development Limitations - An assessment of existing natural and manmade elements relating to land, water, air, plant, animal, people, and community character in Middletown and an indication of the suitability of particular areas for development.

Dish Antenna - Any concave, circular or dish-shaped device designed for receiving communication or television signals from space, but does not include conventional television, radio and amateur radio antennas.

Drive-In Use - An establishment, which by design, physical facilities, service, or by packaging procedure, encourages or permits customers to receive services, obtain goods, or be entertained while remaining in their motor vehicles.

Dump - Any place used for the disposal and leaving of paper, garbage, rubbish, trash, toxic chemicals and substances, and other waste material of any nature by the public or by any person.

Dwelling - A building designed or used as the living quarters for one or more families. The term dwelling shall include seasonal homes, modular homes, and mobile homes, provided that they meet all of the requirements of this Ordinance, the New York State Uniform Fire Prevention and Building Construction Code, and all other regulations or ordinances applicable to dwellings.

Dwelling, Farm Labor - A building containing only one dwelling unit and occupied by one family, members of which are employed on a farm, as hereinafter defined.

Dwelling, Multiple-Family - A residential building designed for or occupied by three or more families with the number of families in residence not exceeding the number of dwelling units provided.

Dwelling, One Family - A building containing only one dwelling unit and occupied by one family.

Dwelling, Townhouse - A one-family dwelling in a row of at least three such units in which each unit has its own front and rear access to the outside; no unit is located over another unit; and each unit is separated from any other unit by one or more common fire resistant walls.

Dwelling, Two-Family - A building designed for and occupied exclusively as a home or residence for not more than two families.

Dwelling Unit - A building or entirely self-contained portion thereof containing housekeeping facilities for only one family, including any domestic servants employed on the premises, and having no enclosed space (other than vestibules, entrances or other hallways or porches) and no cooking or sanitary facilities in common with any other "Dwelling Unit." A boarding house, dormitory, hotel, inn, nursing home or similar structure shall not be deemed to constitute a dwelling unit.

Eating and/or Drinking Establishment - A parcel of land which includes facilities primarily used for the sale of prepared food or beverages for public consumption.

Educational Institution - An institution, either public or private, providing full-time day instruction and a course of study which meets the requirements of the New York State Education Law or a nursery, day care or kindergarten which meets all pertinent requirements set by the New York State Education Law and/or the New York State Health Code.

Family - One or more individuals occupying a dwelling unit and living as a single household unit. No more than five persons, unless related by a legal adoption, blood or marriage, or lawful foster children, shall occupy a single family dwelling unit.

Farm - An agricultural operation where the principal income is from agricultural sources.

Farmer's Market - An anchorless retail center with a mix of small specialty shops with at least 50 percent of the vendors therein must offer agricultural products for sale.

Farm, Hobby - An agricultural operation where the keeping of animals is primarily for the enjoyment and/or food for the household.

Financial Guarantee - A financial security in an amount sufficient to guarantee the installation of basic public improvements. Such improvements may include, but are not limited to, public water supply, sewage disposal systems, storm drains and sewers, roads, pavement markings, traffic signs and signals and sidewalks. Acceptable financial securities must be approved by the Town Attorney and the Town Board and may be in one of several forms, including, but not limited to, a performance bond executed by a surety company, a certified check, an irrevocable letter of credit drawn in favor of the Town.

Flag Lot - A lot not meeting the required frontage along a public or private road and where access to this road is by a fifty-foot (50') strip of land.

Flea Market - An occasional or periodic market held in an open area or structure where individuals or groups of individual sellers offer goods for sale to the public.

Flood Plain - Any land area susceptible to being inundated by water from any source.

Forest Management - Management of natural vegetation for timber harvesting, firewood, wildlife habitat improvement, and water quality.

Garage, Private - An accessory building or part of a principal building used for the storage of one or more motor vehicles provided that no business, occupation or

service is conducted for profit therein. A carport or similarly covered area for the storage or housing of one or more automobiles, with or without walls, but not fully enclosed, is part of this definition.

Garage, Public - Any garage, other than a private garage, operated for gain and available on a rental basis for the storage of motor vehicles.

Garage Sale - The sale of used personal and/or household items by an individual or family from their home, porch, lawn or garage.

Habitable Floor Area - The total number of square feet of floor space within a building, which is enclosed and usable for human occupancy and/or the conduct of business. Unheated basements and attached garages are excluded.

Health Care Facility - A facility or institution, whether public or private, principally engaged in providing services for health maintenance, diagnosis or treatment of human disease, pain, injury, deformity or physical condition, including, but not limited to, a general hospital, special hospital, public health center, diagnostic center, treatment center, rehabilitation center, extended care facility, skilled nursing home, nursing home, and home health care agency.

Height - The vertical distance measured from the lowest elevation of the finished grade to the high point of a structure.

Home Occupation - An occupation or other subordinate use of a nonresidential nature which is conducted within a dwelling unit, or building accessory thereto, by an occupant of the dwelling unit, which is clearly incidental and accessory or secondary to the use of the property for residential purposes. Permissible home occupations include, but are not limited to: art studio; skilled or professional craftsmen; child care, either licensed or not, with no more than five children; dressmaking; teacher of music, dance or song, and limited to one pupil at a time; and the professional home office of a clergyman, physician, surgeon, dentist, lawyer, engineer, architect, accountant, real estate broker or insurance agent.

However, a home occupation shall not be construed to include such uses as the following: clinic or hospital, restaurant, animal hospital, kennel or other similar uses.

ARTICLE II. DEFINITIONS

Hotel - A facility offering transient lodging accommodations to the general public and providing additional service such as restaurants, meeting rooms, and recreation facilities.

Household Pet - An animal that is normally or can generally be kept within the immediate living quarters of a dwelling unit. Any member of the swine, sheep, bovine, poultry, or equine family of quadrupeds, deer, or reptiles having a venomous or dangerous nature are not to be considered household pets. Exotic birds and the pit bull variety of the canine family are not to be considered household pets under this definition.

Junk - Including, but not limited to, the outdoor storage or deposit of any of the following, which constitutes junk:

-- Two or more unregistered vehicles, that have been abandoned, wrecked, being held for storage dismantled or even partially dismantled;
-- Vehicle parts, tires
-- Old lawn mowers, which are no longer being used, snowmobiles, motorcycles, etc. that are no longer used;
-- Any build up of scrap metal, any appliances being deposited or any property in view of the public;
-- Any deposit of garbage such as papers, rags, old scrap wood piles, old furniture no longer intended for use;
-- Any unusable mobile homes such as any structure that is built on a permanent chassis and designed to be used as a dwelling unit, which is not currently inhabitable. This also includes but is not limited to mobile homes, travel trailers, campers, etc.

Junkyard -- Any area or parcel of land that has the outdoor storage or deposit of any of the items defined as junk in this ordinance. Any items listed as junk in this ordinance that are screened from public view, such as adjoining properties and/ or any road, with a wood fence at a minimum height of 8 foot that does not allow any area of view of the items being screened shall be the proper means of storing these items. Also any of these items listed as junk in this ordinance being stored within an enclosed building as long as any DOH, DEC, or DEP regulations are not violated then this will be an accepted standard.

Kennel - A commercial place or establishment for the care and/or breeding of four or more dogs.

Lot - A parcel of land occupied or used by one principal building or use with its accessory buildings and required open space and yards.

Lot, Area - The total horizontal area included within lot lines and shall be as determined by the most recent official records or recordings on the Middletown Tax Maps or by survey calculation. Land within road rights-of-way shall not be used to comply with the minimum lot area requirements.

Lot, Corner - A lot or parcel of land abutting upon two or more roads at their intersection, or upon two parts of the same road forming an interior angle of less than 135 degrees.

Lot, Coverage - The percentage of the lot area that is covered by the buildings or paved areas on the lot.

Lot, Depth - The minimum distance from the road right-of-way line of a lot to the rear lot line of such lot.

Lot, Line - Any boundary of a lot. Any lot line not a rear line nor a front line shall be deemed a side line.

Lot, Line, Front - The front of a lot shall be construed to be the portion adjacent to or nearest the road. On corner lots and through lots, all sides adjacent to roads shall be considered front yards.

Lot Line, Rear - The lot line generally opposite the front lot line.

Lot, Through - A lot which fronts upon two parallel roads, or which fronts upon two roads which do not intersect at the boundaries of the lot.

Lot Width - The distance between side lot lines at the front building line as prescribed by the front setback regulations.

Migrant Farm Labor Housing - A house or dwelling on the same lot as the farm, occupied by no more than 15 unrelated individuals, all of whom are employed on the farm on a seasonal basis.

Mineral Extraction - Operations where more than 1000 cubic yards of gravel, rock, stone, sand, fill, topsoil or minerals are extracted from the surface or below the ground for sale as an industrial or commercial operation, but does not include the process of grading a lot preparatory to the construction of a building.

Mixed Use Building - A building or structure with two or more different uses, such as, but not limited to, residential, office, manufacturing, retail, public or entertainment.

Mobile Home - A factory-built, one-family dwelling constructed on a chassis to facilitate its transportation to the site. Such structures shall be a self contained single unit (excludes modular homes) and shall meet the Mobile Home Construction and Safety Standards of the U.S. Department of Housing and Urban Development and the applicable codes of the New York State Uniform Fire and Building Code. A mobile home shall not be construed to be a travel trailer or recreational vehicle.

Mobile Home Park - A parcel of land under single ownership which has been specifically planned and improved for the long term placement (over 30 days) of three or more mobile homes for nontransient use.

Model Home - A dwelling unit used initially for display purposes which typifies the type of units that will be constructed in the subdivision.

Motel - A building or group of buildings providing individual sleeping accommodations complete with bathrooms for travelers. Each lodging unit has direct access to the outside and a parking spot. Swimming pools, restaurants and meeting rooms may exist as part of the complex.

Motor Vehicle Repair Shop - A building or portion of a building arranged, intended or designed to be used for making repairs to motor vehicles and operated for gain.

Non-Conforming Building, Use, or Lot - A building, structure, use of land or lot, lawfully existing at the time of enactment of this Ordinance, which does not conform to the regulations of the district or districts in which it is located.

Nursery or Greenhouse - Land or greenhouses used to raise flowers, shrubs, trees, and plants.

Open Space - An area between buildings, or between a building and a boundary line of the parcel, that is situated for recreation, gardening, or other outdoor activities conducive to the principal lot use and size. Such space must be free of undue hazards as well as being readily accessible to all those by whom it shall be used.

Outdoor Recreation - Any recreational use particularly oriented to and utilizing the outdoor character of a parcel, including, but not limited to, snowmobile, trail bike, jeep and all-terrain vehicle trails; bicycle trail, horse trail, playground, picnic area or similar use in which no physical alteration to the land occurs.

Parking Space - An off-street paved or unsurfaced space which is accessible and available for the parking of one motor vehicle.

Performance Bond - See Financial Guarantee

Performance Standards - A criterion established to control nuisances, including, but not limited to, noise, odor, smoke, toxic or hazardous matter, vibration, fire and explosive hazards, and glare or heat generated by, or inherent to, uses of land or buildings.

Permitted Principal Use - For the purpose of this Ordinance, any use which is allowed by right in a zoned district without review by the Planning Board.

Personal Wireless Telecommunications Services - Means commercial mobile services, unlicensed wireless services, and common carrier exchange access services.

Planned Unit Development - A tract of land upon which residential, commercial, or industrial buildings, or a mixture thereof are designed, maintained, or operated as a unit in single ownership or control by an individual,

partnership, corporation, or cooperative group. Such developments may have certain facilities in common, such as yards and open spaces, recreation, garages and parking areas, and are based upon a plan having flexibility of design, allowing for the modification of normal zoning district requirements.

Planning Board - The Town of Middletown Planning Board.

Public Facilities and Utilities - All village, town, city, county, state and Federal government owned buildings and land including, but not limited to, town halls and highway department garages. In addition are telephone, electric and cable television lines, poles, equipment and structures; water or gas pipes, mains, valves or structures; sewer pipes, valves or structures; pumping stations; telephone exchanges and repeater stations; and all other facilities, equipment and structures necessary for conducting a service by a government or a public utility.

Public Parks and Recreational Facilities - Land in public ownership set aside for public use, which may or may not have developed recreational facilities, such as playgrounds, tennis courts, baseball fields, picnic areas, bike and horse trails, swimming pool, and/or lavatories.

Recreational Vehicles and Equipment - Includes boats and boat trailers, pick-up campers or coaches (designed to be mounted on automotive or truck vehicles), motorized dwellings, travel trailers, and the like, and cases or boxes used for transporting recreational equipment, whether occupied by such equipment or not.

Religious Institution - Church, temple, parish home, convent, seminary, and retreat house.

Resort - A facility for transient guests where the primary attraction is generally recreational facilities or activities.

Retail Trade - An enclosed store engaged in selling goods or merchandise to the general public, for personal or household consumption, and rendering services incidental to the sale of such goods.

Road - A public or private way which affords the principal means of access to abutting properties.

Road Right-of-Way - The right-of-way line of a road as indicated by usage, dedication, or by deed or record.

Roadside Stand - A permanent or temporary structure used for the display, support, and protection of products with the intent to sell to buyers.

Seasonal Business - A retail or service establishment, not to include motor cross or snowmobile track, that is carried on for only a portion of the year.

Service Establishment - Establishments providing services, as opposed to products, to the general public, including, but not limited to, personal, business, repair, educational, and other personal convenience services, including, but not limited to, coin-operated laundry, cleaning and garment services, photographic studios, beauty shops, barber shops, shoe repair, funeral services and clothing rental.

Service Station - An establishment available to the public, operated for gain, and which is used for storage, repair, rental, greasing, washing, servicing, adjusting, fueling, or equipping of automobiles or other motor vehicles.

Setback, Front - The required open space extending across the entire width of the lot between the road right-of-way line and the front of the main building.

Setback, Rear - The required open space extending across the entire width of the lot between the rear lot line and the back of the main building.

Setback, Side - The required open space extending from the rear setback line and the front setback line between the side lot line and the side of the main building.

Shopping Center - A group of commercial establishments planned, constructed, and managed as a total entity with customer and employee parking provided on-site, provisions for goods delivery separated from customer access, aesthetic considerations and protection from the elements.

Sign - Any material, object, device, display, or structure, or part thereof, situated outdoors or indoors, which is used to advertise, identify, display, direct or attract attention to an object, person, institution, organization, business, product, service, event or location by any means, announcement, direction, advertisement

or any other similar message either free standing or printed on a building or structure.

Sign, Advertising - A sign which directs attention to a business, commodity, service or entertainment conducted, sold or offered at a location other than premises on which the sign is located.

Sign Area - The entire face of a sign, including the advertising surface and any framing, trim or molding, but not including the supporting structure, unless the support is used to form an integral background for the display. Both faces of a double-faced sign shall be included as surface area of a sign.

Sign, Billboard - See Sign, Advertising

Sign, Directional - A sign, either on or off premises, limited to providing information on the location of an activity, business, or event.

Sign Face - The area or display surface used for the message.

Sign, Free Standing - Any non-movable sign not affixed to a building.

Sign, Illuminated - A sign lighted by or exposed to artificial lighting, either by lights on or in the sign or directed towards the sign.

Sign, Off Premise - A sign unrelated to a business or a profession conducted or to a commodity or service sold or offered upon the premises where such sign is located.

Sign, Window - A sign that is applied to or attached to the exterior or interior of a window or located in such a manner within the building that it can be seen from the exterior of the structure through a window.

Site Plan - A plan of a lot or subdivision on which is shown topography, location of all buildings, structures, roads, rights-of-way, boundaries, all essential dimensions and bearings and any other information deemed necessary by the Planning Board.

Site Plan Review - A review and approval process, conducted by the Planning Board, whereby site plans are reviewed utilizing criteria stated in this Ordinance and as authorized by Town Law.

Special Permit Use - A use which, because of its unique characteristics, require individual consideration through a review procedure established by the Planning Board, and may require certain conditions and safeguards before being permitted.

Stable, Private - See Farm, Hobby

Structure - Anything constructed or erected, the use of which requires location on the ground or attached to something having a location on the ground.

Subdivision - The division of a lot, tract, or parcel of land into two or more lots, tracts, parcels or divisions of land for any purpose.

Substantial Improvement - Any extension, repair, reconstruction, or other improvement of a structure, the cost of which equals or exceeds 50 per cent of the fair market value of the structure, either before the improvement is started or, if the property has been damaged and is being restored, before the damage occurred. The term does not include any project for improvement of a structure to comply with existing State or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions.

Telecommunications Accessory Structure - Means accessory buildings and structures, including base stations, designed and used to shelter telecommunications, equipment and/or to support personal wireless telecommunication facilities and located on the same lot as a telecommunications facility or tower.

Telecommunications Antenna - Means an antenna designed to transmit or receive communications as authorized by the Federal Communications Commission ("FCC") including, but not limited to, radio, television, cellular, paging, PCS and microwave communications. Design examples of telecommunications antenna are described as follows: (a) whip; (b) panel; and c) dish. The term "Telecommunications Antenna" shall not include amateur radio operator's equipment as licensed by the FCC, or private, residential reception equipment.

Town House - See Dwelling, Town House

Use - The specific purpose or activity for which land or buildings are designed, arranged, or intended, or for which land or buildings are occupied or maintained.

Variance - Permission to depart from the literal requirements of this Ordinance.

Variance, Area or Bulk - A departure from the area setback, frontage, coverage, size or other requirements of the applicable zoning district, or a departure from any provision of this Ordinance except use.

Variance, Use - A variance granted for a use or structure that is not permitted in the zoning district.

Warehousing - Storage facilities operated for a specific commercial establishment or group of establishments in a particular industrial or economic field.

Watershed Area - That area in which all of the surface runoff is concentrated into a particular stream.

Wholesaling - Establishments or places of business primarily engaged in selling merchandise to retailers; to industrial, commercial, institutional, or professional business users, or to other wholesalers; or acting as agents or brokers and buying merchandise for, or selling merchandise to, such individuals or companies.

Wildlife Management - Management of natural wildlife and associated habitats with the intent of enhancing such.

Yard - An open space that lies between the principal or accessory building or buildings and the nearest lot line.

Yard, Front - See Setback, Front

Yard, Rear - See Setback, Rear

Yard, Side - See Setback, Side

Zero Lot Line - The location of a building on a lot in such a manner that one or more of the building's sides rest directly on a lot line.

Zoning Board of Appeals - The Town of Middletown Zoning Board of Appeals.

Zoning District - An area within the Town of Middletown for which the regulations and requirements governing land use and structures upon it are uniform.

ARTICLE III. DISTRICTS AND DISTRICT MAPS

Section 301 Establishment of Districts

For the purpose of promoting public health, safety, morals, and general welfare of the Town of Middletown, the town is hereby divided into the following districts:

A) Rural III (R-3)
B) Rural V (R-5)
C) Business Commercial (BC)
D) Hamlet I (H-1)
E) Hamlet 1/2 (H-1/2)
F) Industrial (I)
G) Development Limitations Overlay (DL)
H) Commercial/Industrial Floating Zone (CIFZ)

Section 302 District Map and Development Limitations Overlays

The boundaries of each of the districts listed in Section 301 are hereby established as shown on the duly adopted Zoning Map which accompanies this Ordinance and which, with all explanatory matter thereon and amendments thereto, is hereby declared a part of this ordinance. The development limitation overlays are also declared to be a part of this Ordinance.

A copy of the district map and overlays, including the latest amendments thereto, shall be kept up to date and filed in the Town Clerk's Office for the use and benefit of the public.

Section 303 Designation of District Boundaries

Where uncertainty exists with respect to the boundaries of any district, as shown on the Zoning Map, the following rules shall apply:

A) Where district boundaries are indicated as approximately following the center lines of streets, highways, streams or railroads, such center lines shall be construed to be such boundaries.

B) Where district boundary lines are indicated as following or approximately following plotted lot lines or other property lines as shown on the Town of Middletown Tax Map, such lot lines shall be construed to be such boundaries.

C) Where district boundary lines are shown separated from and parallel or approximately parallel to any of the features listed in paragraphs A and B above, such boundary lines shall be construed to be parallel to such features and at such distance there from as shown on the map. If no distance is given, such dimension shall be determined by the use of the scale shown on the Zoning Map.

D) Where a district boundary line divides a lot of record at the effective date of this Ordinance or any subsequent amendments thereto, the regulations for the less restricted part shall extend not more than 50 feet into the more restricted part, provided the lot has frontage on a road in the less restricted district.

Section 304 Determination of District Boundaries

In case of uncertainty as to the true location of a zoning district boundary line in a particular instance, the Code Enforcement Officer shall request the Zoning Board of Appeals to render a determination.

Section 305 Determination of Development Limitation Overlay Boundaries

Where uncertainty exists with respect to the boundaries or criteria of the Development Limitation Overlays, the Middletown Town Planning Board shall determine, during the subdivision review process, the extent of the development limitation(s) in question.

ARTICLE IV. DISTRICT REGULATIONS

Section 401 Application of Regulations

Except as hereinafter provided no building, structure or land shall be used or occupied unless for a use expressly permitted by, and in conformity with, the general and supplementary regulations specified in this Ordinance for the district in which it is located.

No building shall be erected, nor existing building be moved, altered, enlarged, or rebuilt, nor shall any open space surrounding any building be encroached upon or reduced in any manner, except in conformity with the yard, lot area and building location regulations herein after designated for the district in which such building or open space is located.

Section 402 Intent

The legislative intent of Article IV is to set forth land uses or activities which are permitted in the Town of Middletown, to specify and designate the districts in which each use or activity will be permitted, with or without special conditions, or after a special permit has been granted, and to establish appropriate density, area, and other bulk regulations which will be applicable within each district.

Section 403 Schedule of Regulations

Regulations for land uses or activities permitted in the various land use districts, or land uses or activities requiring special permits or conditions attached to them are set forth in Schedule I. Regulations for lot size, yards, building height and similar density, area and other bulk requirements are set forth in the following text. Schedule I is hereby adopted and made part of this Ordinance.

Section 404 Rural III District (R-3)

A) Description - This district includes all lands located within 500 feet of all New York State and Delaware County public high-ways shown on the district map and with direct minimum frontage and direct access to the public road.

B) Purpose - The purpose of this corridor district is to allow for a variety of mixed uses that, when developed, would be appropriate for the existing traffic type and volume and quality of road surface.

C) Permitted Principal Uses

1) One, one-family, or two-family dwelling per lot
2) One mobile home per lot
3) Agriculture
4) Forest Management Practices
5) Wildlife Management Practices

D) Permitted Accessory Uses - located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

1) Private garage
2) Parking (*)
3) Farm labor dwelling
4) Home occupation, home professional office (*)
5) Private swimming pool (*)
6) Garden house, tool shed, storage shed
7) Nursery/greenhouse, non-commercial
8) Roadside stand (*)
9) Recreational vehicles and equipment, Storage of (*)
10) Signs (*)
11) Dish antennas less than 39" in diameter (*)
12) Alternative energy systems, private
13) Exterior spot lighting (*)
14) Private stable, hobby farm, non-commercial agriculture (*)
15) Other customary accessory uses and buildings, provided such uses are clearly incidental to the principal use and does not include any activity commonly conducted as a business. The Middletown Planning Board will approve or disapprove of such "other customary accessory uses" in accordance with the Special Permit process.

E) Special Permit Uses - See Schedule I.

Special permit uses require an application for approval to the Middletown Planning Board. Site plan review shall also be required depending upon the nature and complexity of the application.

F) Density, Height, Area and Yard Requirements

1) Minimum lot size: 3 acres

2) Minimum frontage: 200'
3) Maximum height: 40'
4) Front setback: 75' from center line of State, County, Town and private roads, and, in every case, shall be at least 25' from the right-of-way.
5) Side and rear setback: 20'
6) Maximum lot coverage: 25%
7) Maximum lot depth to width ratio: 4:1

Section 405 Rural V District (R 5)

A) Description - This district includes all lands not described as part of any other district and generally includes most of the land in the Town of Middletown.

B) Purpose - The purpose of this district is to permit only low density, residential development and limited commercial development.

C) Permitted Principal Uses - See Schedule I.

D) Permitted Accessory Uses - Same as R-3.

Located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

E) Special Permit Uses - See Schedule I.

Special permit uses require an application for approval to the Middletown Planning Board. Site plan review shall also be required depending upon the nature and complexity of the application.

F) Density, Height, Area and Yard Requirements

1) Minimum lot size: 5 acres
2) Minimum frontage: 250'
3) Maximum height: 40'
4) Front setback: 75' from center line of roads and rights-of-way
5) Side and rear setback: 30'
6) Maximum lot coverage: 15%
7) Maximum lot depth to width ratio: 4:1

ARTICLE IV. DISTRICT REGULATIONS

Section 406 Business Commercial District (BC)

A) Description - This district consists of a corridor of land along New York State Route 28 from the village of Margaretville boundary line to and including the Delaware and Ulster Railroad recreational complex on the eastern side of the hamlet of Arkville.

B) Purpose - The purpose of this district is to encourage the location of a wide variety of commercial, retail and business establishments and uses.

C) Permitted Principal Uses - See Schedule I.

D) Permitted Accessory Uses - Same as R-3.

Located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

E) Special Permit Uses - See Schedule I.

Special permit uses require an application for approval to the Middletown Town Planning Board. Site plan review shall also be required depending upon the nature and complexity of the application.

F) Density, Height, Area, and Yard Requirements

1) Minimum lot size: 40,000 square feet, or 20,000 square feet with both public water and public sewer
2) Minimum lot frontage: 150'
3) Maximum Height: 40'
4) Front Setback: 75' from center line of State, County, Town and private roads, and, in every case, shall be at least 25' from the right-of-way.
5) Side and rear setbacks: 15'
6) Maximum lot coverage: 80%
7) Maximum lot depth to width ratio: 4:1

Section 407 Hamlet I (H-1)

A) Description - The unincorporated hamlets of New Kingston, Halcottsville, Dunraven and Clovesville and a portion of Arkville that is not in the B/C, Industrial or Hamlet ½ zones.

B) Purpose - The purpose of this district is to recognize the existing high density, predominantly residential settlements and to limit the intrusion of non-residential uses.

C) Permitted Principal Uses - See Schedule I.

D) Permitted Accessory Uses - Same as R-3.

Located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

E) Special Permit Uses - See Schedule I.

Special permit uses require an application for approval to the Middletown Town Planning Board. Site plan review may also be required depending upon the nature and complexity of the application.

F) Density, Height, Area, and Yard Requirements

1) Minimum lot size: One Acre
2) Minimum frontage: 50'
3) Maximum height: 40'
4) Front setback: Must be, at a minimum, equal to the average of the front setbacks of the two closest parcels with buildings on the same side of the road and within the H district and must be at a minimum of 10 feet.
5) Side and rear setback: Must be, at a minimum, equal to the average side and rear setbacks of the two closest parcels with buildings on the same side of the road and within the H district. Must be a minimum of 10 feet.
6) Maximum lot coverage: Shall not be more than the average lot coverage of the two closest parcels with buildings on the same side of the road and within the H district.
7) Maximum lot depth to width ratio: None

Section 408 Hamlet 1/2 (H-1/2)

A) Description - The residential portions of the unincorporated hamlet of Arkville that is not in the Business Commercial District or the Industrial District but is served by both public water and sewer.

B) Purpose - The purpose of this district is to recognize the area of public water supply, public sewer, the area of existing high density and predominantly residential settlement and to limit and control nonresidential uses.

C) Permitted Principal Uses - See Schedule I.

D) Permitted Accessory Uses - Same as R-3.

Located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

E) Special Permit Uses - See Schedule I.

F) Density, Height, Area, and Yard Requirement

1) Minimum Lot Size: 1/2 Acre
2) Minimum Frontage: 50'
3) Maximum Height: 40'
4) Front setback: Must be, at a minimum, equal to the average of the front setbacks of the two closest parcels with buildings on the same side of the road and within the H-1/2 District and must be at a minimum of 10 feet.
5) Side and rear setback: Must be, at a minimum, equal to the average side and rear setbacks of the two closest parcels with buildings on the same side of the road and within the H-1/2 District. Must be a minimum of 10 feet.
6) Maximum lot coverage: Shall not be more than the average lot coverage of the two closest parcels with buildings on the same side of the road and within the H-1/2 District.
7) Maximum lot depth to width ratio: None

Section 409 Industrial District (I)

A) Description - This district includes the industrial park located along the Arkville cut-off road and several adjacent properties.

B) Purpose - Its purpose is to provide for the establishment of industrial uses essential to the development of a balanced economic base and to regulate this development so it will not be detrimental or hazardous to the surrounding community.

C) Permitted Principal Uses

1) Manufacture of machinery, such as: carburetor and small machine parts, cash registers, sewing machines and typewriters, calculators and other office machines.

2) Fabrication of metal products, such as: baby carriages, bicycles, metal, foil, tin, aluminum, gold, etc; metal furniture, musical instruments, sheet metal products and toys.

3) Fabrication of paper products, such as: bags, book bindings, boxes and packaging materials; office supplies and toys.

4) Fabrication of wood products , such as: boats, boxes, cabinets and woodworking, furniture and toys.

5) Food and associated industries, such as: bakeries, bottling of food and beverages, food and cereal mixing and milling, food processing, food sundry manufacturing, ice cream manufacturing and manufacturing of spirituous liquor.

6) The manufacturing and processing of pharmaceutical and cosmetic products.

7) Office buildings for executive, engineering and administrative purposes.

8) Scientific or research laboratories devoted to research, design and/or experimentation and processing and fabrication incidental thereto.

9) Other uses of a light industrial or agricultural nature which involves only the processing, assembly, fabrication or packaging of previously prepared or refined materials.

10) Warehousing
11) Wholesaling
12) Bulk storage
13) Agriculture/forest and wildlife management
14) See Schedule I for additional permitted uses.

D) Permitted Accessory Uses - Located on the same lot with the permitted principal use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

1) Public garage and storage buildings, which are necessary to store any vehicles, equipment, or materials on the premises.
2) Signs (*)
3) Dish antennas (*)
4) Solar equipment
5) Exterior spot lighting (*)
6) Off-street parking (*)
7) Open space and picnic area for employees
8) Alternative energy system

E) Special Permit Uses - See Schedule I.

Special permit uses require an application for approval to the Middletown Planning Board. Site plan review may also be required depending upon the nature and complexity of the application.

F) Other Provisions and Requirements

1) No use shall result in or cause at any time dust, smoke, smog, observable gas, fumes or odors, or other atmospheric pollution, objectionable noise, glare, or vibration to be discernable beyond the property lines of the industry.

2) No use shall result in or cause a hazard of fire or explosion or other physical hazard to any adjacent building or to any plant growth or any land adjacent to the site of the use.

3) All industrial processes shall take place within an enclosed building. Industrial storage out of doors is permitted provided that such materials are shielded from view from public roads and adjacent non-residential district by fencing, landscaping or other appropriate measures.

4) All uses shall set aside not less than 25% of the lot to be devoted to seeding, planting, retention of the tree cover, or other landscaping. This area shall be used for no other purpose.

5) Each use in this district shall provide truck loading and unloading areas in an amount sufficient to permit the transfer of goods and products in other than a public road, off-street parking area or front yard.

6) Signs shall be permitted for advertising industrial activities on the premises which shall comply with the requirements of Section 542, Signs.

7) Industrial structures shall be located so as to be a minimum of 100' from any non-industrial district. This 100' buffer strip shall be perpetually maintained so as to provide visual screening and separation between the industrial and non-industrial uses.

8) Parking areas may be located in any of the required yard areas provided they are not less than 50' from a right-of-way line or 20' from a property line.

G) Density, Height, Area, and Yard Requirements

1) Minimum lot size: None
2) Minimum frontage: 100'
3) Maximum height: 50'
4) Maximum lot coverage: 75%
5) Front setback: 50'
6) Side and rear setback: 50'
7) Maximum lot depth to width ratio: None

Section 410 Development Limitations - Overlay (DL)

A) Description - This is an overlay and includes all lands shown on the Development Limitations Overlay Map(s) on file in the Town Clerk's office and hereby declared to be part of this Ordinance. The development limitations shown on the map(s) include:

1) Flood hazard areas, including but not limited to those areas identified by the Federal Insurance Administration on its Flood Hazard Boundary Map No. 01-08/360209B, dated May 15, 1985,and as may be amended.

2) Freshwater wetlands as defined and protected by the New York State Freshwater Wetland Act.

3) Steep slope areas of 15 per cent or more.

4) High elevation areas of 2500' or greater.

5) Watershed areas that have more than 50 per cent of the land in parcels less than 25 acres.

B) Purpose - The purpose of these overlay zones is to protect the town from over development in and around natural areas and manmade areas important to the people of the town of Middletown.

C) Determination of Applicability

1) The Code Enforcement Officer shall decide during the permit application process whether a particular proposal will be located within the Flood Hazard Area (application shall be referred to Planning Board) or within a New York State Freshwater Wetland area (application will be referred to the New York State Department of Environmental Conservation.)

2) The Planning Board shall, as part of the subdivision review process, determine the applicability of the DL requirements for a particular subdivision proposal. The Planning Board shall apply the DL requirements of minimum lot size and frontage to particular parcels when and only when two or more of the development limitations exist to any degree within the proposed parcel.

D) Permitted Principal Uses - Same as underlying district.

E) Permitted Accessory Uses - Same as underlying district.

Located on the same lot with the principal permitted use. Some accessory uses (*) are subject to additional conditions as set forth in Article V, Supplementary Regulations.

F) Special Permit Uses - Same as underlying district.

Special permit uses require an application for approval to the Middletown Planning Board. Site plan review may also be required, depending upon the nature and complexity of the application.

G) Other Provisions and Requirements

1) All new building construction may be permitted within the area designated as a Flood Hazard Area by Special Permit only. Parking, open space and other uses not posing any obstructions to water flow shall be permitted. It shall be the duty of the applicant to prove to the Planning Board's

satisfaction that all construction complies with Federal Floodproofing requirements.

2) Activities proposed within a designated wetland or within 100' of the wetland shall be subject to the guidelines and regulations of the New York State Freshwater Wetlands Act which, together with subsequent amendments, are hereby adopted.

H) Density, Height, Area, and Yard Requirements

1) Minimum lot size: two times the minimum required in the underlying district.
2) Minimum frontage: 50' more than underlying district
3) Maximum height: 40'
4) Front setback: Same as underlying district
5) Side and rear setback: Same as underlying district
6) Maximum lot coverage: same as underlying district
7) Maximum lot depth to width ratio: Same as underlying district

Section 411 Commercial And Industrial Uses Floating Zone (CIFZ)

A) Description - This district is not specifically shown on the Districts Map, but will be applied when applicable, to any and all land within the R-5 District.

B) Purpose - The purpose of this "floating zone" is to provide for the maximum protection of existing residential properties while, at the same time, acknowledging that it is nearly impossible to provide adequate locations for new commercial and new industrial uses in rural areas.

C) Permitted Principal Uses - None

D) Permitted Accessory Uses - Same as R-5 and I.

E) Applicability

1) Whenever a commercial or industrial use is proposed as a Special Use Permit Use in the R-5 District, the requirements of this Section shall apply.

2) The Code Enforcement Officer shall refer the application to the Planning Board which shall review the proposal under the Special Permit and Site

Plan Review process with the additional locational limitations listed below being considered first.

F) Locational Limitations

The proposed commercial or industrial use is not permitted unless the following requirements are met:

1) A minimum of 500 feet of continuous road frontage
2) A minimum of 100 feet for the side and rear setbacks
3) All other density, area, height and yard requirements of the R-5 District apply.

Section 412 Equivalent Uses

When a proposed land use activity is not specifically listed in Schedule I for a particular district but the proposed land use activity is similar in nature to a use already listed as permitted, the following procedure shall apply:

A) The Code Enforcement Officer shall refer the matter to the Town Planning Board for an interpretation as to whether the proposed use is an equivalent use.

B) The Planning Board shall report its findings to the Town Board and, if these findings are positive, make a recommendation that Schedule I of this Ordinance be amended to permit such equivalent use.

C) In no case shall a building permit be issued for an equivalent use until the Ordinance has been amended to permit such equivalent use in the appropriate zoning districts, with or without conditions.

Section 413 Other Regulations and Exceptions

Additional regulations and appropriate exceptions to the regulations of this Ordinance are set forth in Article V, Supplemental Regulations; Article VI, Special Permits and Site Plan Review; and Article VII, Non-Conforming Uses.

ARTICLE V. SUPPLEMENTARY REGULATIONS

GENERAL

Section 501 Applicability

Land uses and activities in the Town of Middletown which are regulated by this Ordinance shall be subject to additional requirements and to limitations and exceptions as set forth in this Article V.

LOT CHARACTER

Section 502 Required Open Space or Yard

A) No area necessary under this Ordinance to satisfy area, yard, or other open space requirements in relation to any lot, building, or use shall be counted as part of required open space in relation to any other lot, building or use.

B) Every part of a required open space or yard shall be open and unobstructed, except for ordinary building projections of sills, chimneys, eaves, and unroofed steps, provided that no such projections extend more than three (3) feet into the required yard. Fences, stonewalls, trees, and shrubbery are also excepted.

Section 503 Vision Clearance at Intersections

No obstructions to vision, such as shrubbery, brush, trees, earth, or structure, shall be permitted at road intersections within the triangle formed by the intersections of road center lines and a line drawn between points along such lines 30 feet distant from their point of intersection.

The Town shall have the authority, after proper notice to the property owner and review by the Planning Board, to open existing intersections to the standards in this Section.

Section 504 Landscaping Requirements

A) Where any permitted non-residential land use, multiple family development or mobile home park abuts an existing residential parcel or a vacant parcel where residential development could occur, a strip of land at least 20 feet wide shall be maintained as a landscaped area in front, side and/or rear yard which adjoin these uses.

B) In the Business/Commercial District, each nonresidential use shall have a strip of land at least 15 feet wide in any required rear and side yard, which shall be maintained as a landscaped area.

C) In a planned unit development, landscaping shall be as required by the Planning Board under its powers of site plan review and approval.

D) Required landscaping shall be installed and maintained in a healthy growing condition and shall take the form of any or all of the following: shade trees, deciduous shrubs, evergreens, well kept grassed areas or ground cover.

Section 505 Calculation of Lot Coverage

In determining percentage of coverage of a lot or size of yard, all principal buildings, roofed porches, garages, carports, other accessory buildings and paved parking and driveway areas shall be included.

Section 506 Zero Lot Line

When multiple dwelling construction takes the form of townhouse units, where each unit has one or both side walls in common with an adjacent unit, the side yard requirements shall double and shall apply only to the end unit in the row.

Section 507 Corner and Through Lots

Front yard setbacks and minimum road frontages are required on both road fronts. The two remaining yards shall be designated by the applicant as to which will be the rear yard and which will be the side yard.

Section 508 Flag Lots

Flag lots may be permitted by the Planning Board during the subdivision review process, where appropriate, to allow for the economical development of back land areas and only under the following conditions.

A) The access strip of land shall be a minimum of 50 feet wide and shall not exceed a grade of 10 per cent.

B) The minimum lot area requirement shall be calculated exclusive of the narrow access strip connecting the lot with the public road.

C) Minimum front, side and rear setback requirements shall be met, excluding the narrow access strip.

D) No more than one flag lot shall share an access strip.

E) Access strips shall be a minimum distance apart of at least the minimum frontage in the particular zone.

F) Access strip shall not be a right-of-way, but shall be owned in fee title by the owner of the "flag" parcel.

G) No further subdivision of a flag lot is permitted.

Section 509 Existing Lots

Not withstanding the limitations imposed by any other provisions of this ordinance, the Code Enforcement Officer shall issue a building permit for the construction of a permitted principal building or structure on a lot, which does not meet the minimum lot size and standard lot was on record in the office of the County Clerk prior to the enactment of this Ordinance.

Section 510 Cul-de-sacs

Frontage requirements on cul-de-sacs may be reduced to no less than 50 feet by the Planning Board during the subdivision review and approval process.

Section 511 Lot Size Averaging On A Single Parcel

Any parcel in the R-3 or R-5 Districts of the Town of Middletown, which is not subject to restrictions or covenants to the contrary, may be divided without a variance under the following conditions, all of which must be met by such division:

A) The average size of all lots created by such division must be not less than three acres in the R-3 District and five acres in the R-5 District.

B) No lot shall be created with an area less than two acres; and, in any case, not more than 20 per cent of the total parcels permitted shall be undersized.

C) Minimum road frontages and building setbacks shall be in accordance with the respective district regulations.

D) All lots created that are less than the minimum lot area normally required shall be required to prove suitability for on-site sewage disposal and water supply systems in accordance with Section 516 of this Ordinance.

E) All divisions occurring under this Section shall be classified and reviewed as either a minor or major subdivision under the Town of Middletown Subdivision Regulations.

F) No further division of any lot created by such division shall be allowable if such further division would result in an average size of less than three acres or five acres, respectively, for all lots created from the original parcel.

USES, GENERAL

Section 512 Height Exceptions

The height limitations of these regulations shall be waived for barns and silos, private home antennae, spires, belfries, cupolas, water tanks, ventilators, chimneys, solar equipment, windmills, transmission towers, flag poles, skylights, or other appurtenances usually required to be placed above the roof level and not intended for human occupancy.

Section 513 Structures to Have Access

Every building hereafter erected or moved shall be on a lot adjacent to a public road, or with access to a private road, and all structure shall be so located on lots as to provide safe and convenient access for servicing, fire protection, and required off-street parking.

Section 514 Off-Street Parking Requirements

For every building hereafter erected, altered, or changed in use, there shall be provided off-street parking spaces as set forth in the following:

USE	REQUIRED PARKING SPACES
Dwelling Unit (Single Family)	Two parking spaces per dwelling unit on the same lot with the main building.
Dwelling Unit (Multi-family)	One and one-half parking spaces per dwelling unit in the building(s) rounded off to the next highest whole number.
Office Uses Business, General & Governmental Professional Office Buildings but not including Medical Offices	One for each 300 sq. ft. of floor area.
Medical Uses Doctor's/ Dentist's office, clinic and Out-patient.	Two parking spaces, plus one space for every 200 square feet of office area.
Retail and Service Establishment	One parking space for every 100 square feet of floor area devoted to sales plus one space for each two employees.
Eating and Drinking Establishment	One parking space for every three seats plus one space for each two employees.
Industrial, Wholesale, Warehouse Storage, Freight and Trucking Uses	One parking space for every motor vehicle used directly in the business, plus additional parking as required by the Planning Board.
House of Worship, and other places of public assembly	One parking space for every three seats, or one space per 100 square feet of floor area, whichever is greater.
Hotels/Motels	One parking space per room, plus one space for every two employees.

Unspecified Uses	As required by the Planning Board based on for intensity, turnover, customers, employees and vehicles used.

Except for dwellings, all off-street parking spaces are to be arranged so that backing movements take place entirely within the parking area.

A) Dimensional Requirements

Each parking space shall have a minimum width of nine feet and a minimum length of twenty feet and shall be served by suitable aisles to permit access and automobile maneuverability into all parking spaces.

B) Location of Facility

All off-street parking facilities required under this Ordinance shall be constructed on or adjacent to the site of main use or on a lot adjoining the main use or directly across the road.

C) Off-street Loading Requirements

All commercial and industrial structures, erected after the adoption of this Ordinance, shall provide adequate off-street loading facilities. Such facilities shall be sufficient in size to eliminate the projection of vehicles into a street right-of-way.

Section 515 Performance Standards For Commercial And Industrial Uses

In all districts, commercial and industrial uses as defined in Schedule I that exceed the following standards measured at the property line, are not permitted. The Planning Board under its powers of site plan review and approval shall decide whether uses meet the standards. All existing commercial and industrial uses shall be required to meet the standards of this Section within 180 days of the effective date of this Ordinance. Uses shall meet State air and water pollution standards and shall not:

A) Emit noise in excess of 70 decibels, dbA scale, of a standard sound level meter.

B) Emit smoke in excess of Ringlemann Chart No. 2.

C) Emit noxious gases which endanger health, comfort, safety, or welfare of any person, or have a tendency to cause injury or damage to property, business or vegetation.

D) Cause, as a result of normal operations, a vibration which creates displacement of 0.003 of one inch at the property line.

E) Create glare by lighting or signs which could impair a driver's vision.

F) Cause harmful waste to be discharged into sewer, streams, or bodies of water, or to be stored on said property.

Section 516 Sewer and Water Facilities

All sewer and water facilities installed as part of any construction project or individual dwelling shall meet all applicable State, New York City and local regulations.

Section 517 Permit for Temporary Uses and Structures

The Planning Board may authorize the issuance of a temporary permit by the Code Enforcement Officer for incidental and non-conforming uses as follows:

A) Temporary uses incidental to a construction project. Such uses and structures may include the storage of building material and equipment,

B) Temporary real estate sales office for the sale of property on the premises,

C) Other Similar Temporary Incidental Uses.

Permit shall be conditioned upon agreement by owner to remove use on expiration of permit. Such permit shall be authorized for a period of one year and may be extended for two similar periods when the Code Enforcement Officer finds such work has been diligently pursued.

D) No temporary permit shall be required for the storage of building materials and equipment involved in the construction of one-family dwellings.

Section 518 Abandonment of Construction and Excavation

A) Within three months following the completion or abandonment of a construction project or the demolition or abandonment of a building or structure, all construction materials shall be removed from the site and excavation filled to normal grade by owner.

B) If the owner fails to cover over or fill such excavation after 30 days notice by the Code Enforcement Officer, the Town Board may order said excavation to be covered or filled and shall charge the owner of said property any costs connected therewith.

Section 519 Minimum Habitable Space

A) This Section Deleted

Section 520 Environmental Quality Review

The State Environmental Quality Review Act requires that local government examine the environmental impact of all actions they permit, fund, or construct. Article 8 and Part 617 of Title 6 of the New York Code of Rules and Regulations, and as may be amended from time to time, are hereby adopted by reference.

Section 521 Uses Not Permitted

Any use not specifically permitted as a principal, accessory or special permit use shall be deemed to be prohibited.

USES, SPECIFIC

Section 522 Accessory Buildings

A permitted accessory building or structure, except for farm purposes, may be located provided:

A) Such building shall not exceed 20 feet in height.

B) No building permit is required for any accessory use less than 144 square feet.

C) Such building meets the setbacks provided for in each district.

Section 523 Campgrounds

The following additional standards must be provided for in the site plan before a special permit for a campground can be issued:

A) Evidence that all State Health Department regulations of campgrounds will be met.

B) A 25 foot planted or natural landscaped border will be provided for on all perimeters of the campground property.

C) A minimum of ten acres of land will be used for the campground.

Section 524 Clearcutting

A) No clearcutting of more than one acre of land shall be allowed in the Town without a special permit.

B) Any clearcutting that is required for the building of a new road that is under subdivision review shall not require a special permit.

Section 525 Dish Antenna

A) All dish antennae shall be located in either the side or rear yards, unless the owner can prove his/her only "window of reception" is in the front yard. In the event that no "window of reception" is available on the ground, such antenna may be placed on the roof of the dwelling structure.

B) The location and design of the dish antenna shall minimize the visual impact on adjacent property.

C) Antennas less than 39" in diameter are not regulated.

ARTICLE V. SUPPLEMENTARY REGULATIONS

Section 526 Dumps

The operation or maintenance of a dump is hereby prohibited in the town of Middletown except under the following conditions.

A) A municipality-operated transfer station and/or landfill for which proper approvals and licenses are current may be permitted as a special use permit.

B) Any person may dispose of noncommercial or nonindustrial rubbish, waste material and garbage on the property upon which such rubbish, waste material and garbage is produced. No permit is required.

C) Any person may dispose of materials incident to the demolition of structures or land clearing within the Town of Middletown, including rocks, concrete, masonry, bricks, wood, glass, metal, and non-asbestos roofing materials. No permit is required.

No materials, garbage, rubbish, or structures related to dumps, as permitted in this Section 526, shall be closer than 50 feet to any lot line.

Section 527 Exterior Spotlighting

In no case shall any exterior spotlighting be directed toward the highway so as to interfere with the vision or attract the attention of the driver of a motor vehicle, nor shall the light be directed toward any other lot or cause excessive illumination of adjacent lots.

Existing spot lighting shall have 90 days after the effective date of this Ordinance to comply with the standards of this Section.

Section 528 Garage Sales

Garage sales shall be limited to 15 days per calendar year. Any garage sale operating for more than 15 days per calendar year shall be classified as a seasonal business and subject to the requirements of such.

ARTICLE V. SUPPLEMENTARY REGULATIONS

Section 529 Home Occupations

Must meet the following conditions:

A) The occupation or activity shall be carried on wholly within the principal building or within a building or other structure accessory thereto.

B) Not more than two persons outside the resident household shall be employed in the occupation or as assistants.

C) There shall be no exterior display or sign except as permitted under this Ordinance, no exterior storage of materials and no other exterior indication of the home occupation or variation from the residential character of the lot or of the surrounding neighborhood.

D) No offensive odor, noise, vibration, smoke, dust, heat or glare shall be produced.

E) The home occupation shall not generate traffic in any greater volume than would normally be expected, and any need for parking generated by the occupation shall be met off the street and in accordance with the regulations of this Ordinance.

Section 530 Household Pets

The keeping of exotic animals or reptiles not defined as a household pet or listed under the animal husbandry definition shall require a special permit. Any property owner keeping animals not considered household pets shall be required to apply to the Planning Board within 90 days of the effective date of this ordinance for a special permit.

Section 531 Junk and Junkyards

The provisions of the State Junkyard Law (General Municipal Law, Section 136) are hereby adopted by reference and shall apply to all junkyards as defined in this Ordinance. Where this ordinance conflicts with the State Junkyard Law, this Town Zoning Ordinance shall take precedence. Junkyards are allowed by special permit only as set forth in Section I.

In addition the following conditions shall apply to any approval:

1) junk as defined in this Ordinance shall not be located within:

   a) one hundred (100) feet of any adjoining property line;
   b) five hundred (500) feet of any public park, church, educational facility, nursing home, public building or other gathering place;
   c) two hundred-fifty (250) feet of any stream, water course, lake, pond, wetland, or other body of water;
   d) one hundred (100) feet from any ROW, public road, street, or highway;

2) As a condition of approval, it shall be required that the facility be completely enclosed by an eight (8) foot high wood screened fenced area or completely contained within a building.

3) As a condition of approval, a junkyard, upon commencing operations or thereafter during its operation, shall not be in violation of any regulation of the New York State Department of Health (DOH), New York City Department of Environmental Protection (DEP), New York State Department of Environmental Conservation (DEC) or any other regulating agency.

Section 532 Mineral Extraction

In any district, the removal of more than 1000 ton per year of soil, sand, gravel or quarried stone for sale, except when incidental to or connected with construction of a building on the same premises, requires a Department of Environmental Conservation (D.E.C.) permit.

Section 533 Mobile Homes

Individual mobile homes shall be subject to all the regulations pertaining to detached one-family dwellings, in addition to the following standards:

A) The mobile home shall be provided with anchors and tie-downs, at least at the corners, attached to concrete footings installed below the frost line or embedded in concrete runners or a concrete slab which may be provided as the mobile home stand. Suitable anchors known as corkscrews are acceptable.

B) The mobile home will be provided with skirts to screen the space between the mobile home and the stand. Such skirts shall be made of concrete block or a permanent material similar to that used in the mobile home and providing a finished exterior appearance, and shall be installed within four months from date of issuance of permit for the mobile home.

C) Any construction or storage space, additional rooms, or enclosed patios or carports shall have a finished exterior appearance. No exposed building paper, wallboard or other impermanent and unfinished material will be permitted.

D) The mobile home bears the seal required by the State of New York or an equivalent acceptable to the State of New York.

E) No additions shall be made to a mobile home except a canopy and/ or porch open on three sides, or an addition made by the mobile home manufacturer and/or built in conformance with New York State Uniform Fire Prevention and Building Code Regulations.

Section 534 Mobile Home Parks

A) Mobile Home Park Permit

1) No person shall construct or operate a mobile home park without first obtaining site plan approval and a permit.

2) Application for a Mobile Home Park permit shall be made to the Planning Board, and shall be accompanied by a site plan in accordance with the procedures outlined in this Ordinance.

3) The Board may accept, accept with recommended changes, or reject plans.

4) Existing mobile home parks shall file a site plan of the existing park with the Code Enforcement Officer. When an expansion is planned, an application for a permit shall be required.

B) Mobile Home Park Standards

1) The minimum lot area for a mobile home park shall correspond with the zone the park is in i.e. R-5, R-3, etc. and contain at least 8,000 square feet per mobile home site.

2) Sewage disposal and water supply systems shall have the approval of the New York State Department of Health and shall conform to the requirements of any ordinance or local law of the Town governing such systems, whichever is more restrictive.

3) The area shall be well drained and shall have such grades and soil as to make it suitable for mobile homes.

4) No mobile home shall be less than 30 feet from any other mobile home. This includes porches, carports, decks & additions.

5) Each mobile home site shall provide suitable connections to a central sewage disposal system, to an approved water sup-ply system, and an underground electrical service approved by the Board of Fire Underwriters.

6) Garbage and refuse shall be collected and removed from the premises at least once a week. All refuse shall be stored in flytight, watertight, rodent-proof containers, which shall be located not more than 15 feet from any mobile home.

7) A public telephone shall be provided for each mobile home park, and fire extinguishers, approved by the local fire district officers, shall be furnished so that no mobile home shall be more distant than 15 feet from such extinguisher.

8) The outside burning of garbage, trash, or rubbish is prohibited.

9) All mobile homes and other structures such as accessory structures shall be set back at least 75 feet from the center of any road or ROW and must be 25 feet from any internal access road edge.

10) All access roads within a mobile home park must be at least 50 feet wide and built to standards acceptable to the Town Board of the Town of

Middletown as set forth in the Subdivisions Regulation and as may be amended from time to time.

11) Off-street parking spaces shall be provided containing at least 180 square feet per space. Three such spaces shall be furnished for every two mobile homes.

12) All entrances and exits, internal access streets and public spaces shall be adequately illuminated.

13) A sign(s) is permitted according to the procedures set forth in Section 542, Signs.

14) A strip of land at least 20 feet wide shall be a buffer zone on the outside line of the property.

15) The operator of a mobile home park shall keep a register in which there shall be noted the name and permanent address of every mobile home owner situated in the park, the registration number of same, the date it was admitted, and the date of its removal. Such register shall be signed by the owner of the mobile home or the person bringing the same into the park.

16) Upon consideration of the intensity of development and total number of mobile homes proposed, the Planning Board may require the reservation of not more than 10 percent of the gross area of the mobile home park for the exclusive use of the residents therein for recreational purposes. The minimum area for such purposes shall not be less than one acre.

17) Sale of mobile homes shall be permitted at any properly licensed mobile home park.

18) Each mobile home shall have a sign on the lot identifying the lot number as permitted by Section 542, Signs.

19) All mobile homes in mobile home parks shall be installed according to the standards in Section 533, Mobile Homes.

20) Two accessory buildings shall be allowed per mobile home site.

21) There must be designated parking for two cars per mobile home site.

Section 535 Model Homes

The Planning Board may authorize, pursuant to Section 305 G) of the Town of Middletown Land Subdivision Regulations, the Code Enforcement Officer to issue permits for model homes in proposed subdivisions.

Model homes on display, not intended to be occupied and sold as is and where located, shall be required to meet all setback requirements and shall provide for adequate off-street parking spaces as prescribed by this Ordinance.

Section 536 Hobby Farms, Private Stable

No animals shall be pastured or housed within 100 feet of any neighboring dwelling.

Section 537 Planned Unit Development (PUD) Districts

A) Purpose

It is the intent of this section to permit the establishment of a use classification entitled "Planned Unit Development" (PUD), where the following objectives shall be sought:

1) Creation of a more desirable community environment than would be possible through strict application of zoning regulations found elsewhere in this Ordinance.

2) Preservation and enhancement of community natural resources such as water bodies, wetlands, forests, significant topographic and geologic features, and other area of scenic and ecological value.

3) Efficient use of a site to facilitate adequate and economical construction and maintenance of streets and drainage facilities, and water supply and sewage systems.

4) Innovation and variety in the type and design of residential development, providing a wide choice of living environment, occupancy tenure, and housing cost.

5) Open space allocation and maintenance by private initiative as an integral part of residential development.

B) Site Area and Location

1) The minimum site area for a planned development shall be 30 contiguous acres.

2) Not less than 35 percent of the gross area of a PUD shall be devoted to common open space. Such land is to be owned or controlled jointly by all residential property owners within the PUD District and is to be used for recreational purposes or preserved in its natural state. The common open space shall include lands having a significant ecological, aesthetic, and recreational characteristics, with topography, shape, dimension location, access, and improvements suitable for its intended purpose.

C) Permitted Uses

1) Residential: may be any type, including cluster subdivision, condominium, townhouse dwellings and related accessory uses as provided elsewhere in this Ordinance.

2) Non-residential: may be permitted, or required, where such uses are designed to serve primarily the residents of the PUD District.

D) Intensity of Use

1) The maximum number of dwelling units that may be approved in a PUD shall be computed by dividing the total gross acreage of the site by the appropriate number of dwelling units per acre for the district in which such site is located as provided in Article IV. The maximum number of dwelling units shall not be approved if, in the judgement of the Planning Board, the site plan does not indicate adequate design and management of open space areas according to the following criteria:

a) provision of recreational facilities
b) protection or enhancement of wildlife habitats
c) protection of surface water quality
d) protection or enhancement of scenic quality

E) Other Zoning Regulations

With the exception of minimum lot areas, building heights, lot and yard requirements, and the limitations imposed by Section 410, Development Limitations overlay for double lot size and increased frontage, the PUD shall comply with all other provisions of this Ordinance.

F) Utilities

All uses situated in a PUD shall be served by central water and sewer systems. All water, sewer, and gas lines, and all other lines providing power and communication service, shall be installed underground in the manner prescribed by the state and local agencies having jurisdiction.

G) Ownership

1) The land proposed for a PUD may be owned, leased or controlled either by an individual, corporation, or by a group of individuals or corporations. The applications shall be filed by the owner, or jointly by all owners of the property included in the application. In the case of multiple ownership the approved plan shall be binding on all owners.

2) Restrictions and Covenants shall be established and filed of record prior to conveyance of any lots. No buildings or structures may be erected on such common lands except as shown on the approved site plan.

H) Organization

A cluster development shall be organized as one of the following:

1) A Homeowners' Association approved by the Federal Housing Administration for mortgage insurance as a Planned Unit Development, and the Town Board.

2) A Homeowners' Association approved by the Town Board upon recommendation of the Town Attorney. Whenever a Homeowners' Association is proposed, the Town Board shall retain the right to review and approve the articles of incorporation and charter of said Homeowners' Association, and to insure that the intent and purpose of this section are carried out.

3) Any other arrangement approved by the Town Board, upon recommendation of the Town Attorney, as satisfying the intent of this section, including condominiums and special districts.

I) Homeowners' Association

When considering the application, the Planning Board shall on part, require the cluster development to meet the following conditions:

1) Be established as an incorporated non-profit organization operating under recorded land agreements through which each lot owner and any succeeding owner is automatically subject to a charge as provided in the charter of the Homeowner's Association.

2) Title to all common property, exclusive of land set aside for public schools, shall be placed in the Homeowners' Association, or definite and acceptable assurance shall be given that it automatically will be so placed within a reasonable period of time to be determined by the Planning Board.

3) Each lot owner shall have equal voting rights in the Association and shall have the right to the use and enjoyment of the common property.

4) Once established, all responsibility for operation and maintenance of the common land and facilities shall lie with the Homeowners' Association.

5) Dedication of all common land areas shall be recorded directly in the Subdivision Plat, or shall be referenced on the Plat to a dedication in a separately recorded document. Resubdivision of such areas is prohibited. The dedication shall:

a) save the Title to the common property to the Homeowners' Association free of any cloud of implied public dedication,

b) commit the developer to convey the areas to the Homeowners' Association at the approved time to be determined by the Planning Board,

c) grant easements of enjoyment over the area to the lot owners,

d) give the Homeowners' Association the right to borrow for improvements upon security of the common areas,

e) give it the right to suspend membership rights for non-payment of assessment or infraction of published rules.

6) The Homeowners' Association life shall be perpetual, and it may purchase insurances, is authorized to pay taxes, shall specify in its charter and by-laws an annual homeowner's fee and provision for assessments, and shall establish that all such charges become a lien on each property in favor of said Association. The association shall have the right to proceed in accordance with all necessary legal action for the foreclosure and enforcement of liens, and it also shall have the right to commence action against any member for the collection of any unpaid assessments in any court of competent jurisdiction.

7) The developer shall assume all responsibilities as previously outlined for the Homeowners' Association until a majority of the dwelling sites are sold, at which time the Homeowners' Association shall be established automatically.

J) Deeds

Each deed to each lot sold shall include by reference all recorded declarations, such as covenants, dedications, and other restrictions (including assessments and the provisions for liens for nonpayment of such).

K) Site Plan Approval

1) Prior to issuance of a building permit for a planned unit development, a site plan shall be submitted to and approved by the Planning Board in accordance with Article VI.

2) Nothing contained in this section shall relieve the owner or his agent, or the developer of a proposed planned unit development from receiving Subdivision Plat Approval in accordance with the Town's Land Subdivision Regulations. However, no additional site plan shall be required after the PUD has received Final Plat Approval.

3) Prior to Site Plan Approval or Final Subdivision Plat Approval, the developer shall file with the Planning Board a performance bond or other acceptable guarantee, including, but not limited to, a certified check or letters of credit in the full amount of the required improvements, to insure the pro-per installation of all public and lot improvements shown on the Final Subdivision Plat or Site Plan, and a maintenance bond to insure proper maintenance of all common lands until the Homeowners' Association is established. The amount and period of said bonds or other guarantees shall be determined by the Planning Board, and the form, sufficiency, manner of execution, and surety shall be approved by the Town Attorney and the Planning Board.

L) Approval of Planned Unit Development

A PUD may be approved only by resolution adopted by the Town Board upon recommendation of the Planning Board.

Section 538 Public Utility and Facilities

Public utility substations and similar structures, shall comply with the following:

A) Facility shall be surrounded by a fence set back from property lines in conformance with district regulations for front, side and rear yards.

B) Landscaped area at least 15 feet wide shall be maintained in front, side and rear yards.

C) Utility poles and attendant lines will be allowed, as necessary, in all districts.

Section 539 Parking, Storage or Use of Recreational Equipment

A) Recreational vehicles or other equipment may be parked or stored on any parcel of land provided it complies with the front, side and rear setback requirements and further that it not be parked closer to the front lot line than the principal building.

B) No such equipment shall be used for living sleeping, or housekeeping in excess of 14 days in a 60 day period when parked or stored on an individual parcel or in any location, except an approved campground, without a permit.

C) Existing recreational vehicles shall be brought into compliance with this standard within 180 days of the effective date of this Ordinance.

Section 540 Roadside Stands

The stand shall contain no more than 200 square feet of floor space.

Any stand used for the sale of agricultural products raised by the owner of the stand shall not require any permits.

Any commercial stand shall require a Special Permit as outlined in the Ordinance.

Section 541 Seasonal Business

All seasonal use businesses or establishments must comply with the parking requirements of this Ordinance within one year of the adoption date of the Ordinance.

Section 542 Signs

A) Permit Required

A sign permit is required for the erection or alteration of all signs within the Town of Middletown except for residential and farm identification nameplates, trespass and posted signs and window signs. Just repainting a sign is not considered an alteration.

Signs shall be permitted as an accessory use only according to the standards and conditions listed below.

B) General Provisions

1) Signs must be constructed of durable material, maintained in good condition, and must not be allowed to become dilapidated, faded, peeled or blistered.

2) Every sign shall be designed and located in such a manner as to: not impair public safety; not restrict motor vehicle clear vision; not be confused with any traffic sign or signal; and not prevent free access to any door, window or fire escape.

3) Signs may be illuminated by a steady light provided the lighting does not illuminate nor cause excessive glare upon adjacent properties and public highways.

4) Flashing or oscillating lights or signs that move or appear to move are not permitted unless necessary for public safety and welfare.

5) Banners, pennants, ribbons, streamers, spinners or similar moving, fluttering or revolving devices are permitted unless banners, pennants, ribbons,etc are a threat to public safety.

6) No freestanding sign shall exceed the building it is accessory to or is not to exceed 25 feet in height, including frame, above grade level.

7) No sign shall be erected within a public right-of-way. All signs shall be set back at least 10 feet from all property lines and the public road right-of-way line. No sign shall overhang across property lines or above public rights-of-way. Exception is temporary banners for community functions which are permitted in the public right-of-way.

8) No sign shall be erected on a public utility pole or traffic control structure.

9) None of the standards in this Section shall apply to road name and traffic control signs erected by the New York State Department of Transportation, Delaware County Highway Department, or the local Town of Middletown

Highway Department. Other signs necessary for public safety and welfare shall also be exempt.

10) No off-premise signs other than directional signs indicated in C) Specific Signs permitted.

11) All existing signs, at the time of enactment of this regulation, shall be allowed to remain as long as they are properly maintained and their use remains current.

C) Specific Signs

The following signs are permitted in any district:

1) Professional residence-office and home occupation signs not exceeding (8) eight square feet total.

2) Directional signs shall be permitted in all districts and shall be no larger than 6 square feet regardless of the number of faces.

3) Trespass or Posted Signs

Trespassing or posted signs shall be allowed in all districts when such signs comply with existing laws and regulations for posting property. However, the minimum distance between signs shall be 75 feet.

4) Temporary Signs

a) No fee is to be charged for the erection of temporary signs.

b) Signs advertising the sale or lease of property shall not exceed eight (8) square feet in area. No more than one "for sale" or "for rent" sign is allowed per property. Such signs shall be removed upon signing of a contract of sale or a lease.

c) Other temporary signs shall not exceed 32 square feet in area per face with the maximum of two faces.

d) Temporary signs listing the architect, engineer or contractor and/or owner on premises where construction, renovation or repair is in progress. Such signs must be removed within seven (7) days of the completion of the work or event.

e) Grand opening signs may include banners, flags, pennants, ribbons, streamers, spinners, or similar moving fluttering or revolving devices, which shall be subject to a one (1) month limit.

5) Window signs and wall signs not exceeding 50 per cent of the total display window area or total aggregate wall area are permitted. Wall area is defined as width times height.

6) Residential or farm identification name plates not exceeding one per property and four (4) square feet in area are permitted.

7) One sign per entrance identifying a Residential Development or Mobile Home Park is permitted, said sign shall not exceed (8) eight square feet.

8) School, church, or other institutional identification signs are permitted but shall not exceed one per public road frontage and not to exceed 12 square feet in area.

9) Business, retail service and industrial identification signs shall be limited to one on-premise sign per public road frontage, not exceeding 32 square feet per face, with a maximum of (2) two faces.

10) Where one building contains more than one business or service, the sign may be 16 square feet per face with a limit of two faces and may include additional square footage of (3) three square feet per face with a limit of two faces for each business or service located in the building.

11) Awnings, whether fixed or retractable, that contain writing or advertising are considered to be signs, whether in the open position or not. Such awnings requires a permit and the writing or advertising is limited to 50% of the awning area.

Section 543 Swimming Pools

No private swimming pool shall be constructed or installed without first obtaining a Zoning Permit from Town of Middletown. There is no charge for this permit.

A) Accessory to Single-Family Dwellings

Such pool and their equipment shall be no closer than 10 feet to any side or rear property line and will comply with all front setback for the District involved.

B) Accessory to Residential Developments

Swimming pools accessory to residential developments, whether clustered single-family dwellings, seasonal dwellings, bungalow colonies, camps or multi-family dwellings, shall be of permanent construction and shall be located no closer than the existing setbacks within each district.

C) Non-Residential

Swimming pools that are part of non-residential uses, whether commercial or noncommercial, such as hotels, motels, clubs, campgrounds, day-use recreational facilities or institution, shall be of permanent construction and shall be located no closer than the existing setbacks within each district.

D) Drainage

The proposed drainage of such pool shall be adequate and will not interfere with the public water supply system, with existing sewage and drainage facilities, with the property of others or with public highways.

E) Designation

Such a swimming pool shall be deemed a building or structure under all applicable provisions of the Building and Plumbing Codes of the Town of Middletown. No permit shall be granted for the construction of any such swimming pool unless and until the construction plans therefore, together with plumbing plans and location map, in conformity with the above, have been filed with the Town Building Department.

F) Fencing and Screening

There shall be erected and maintained a close-type fence or other type of enclosure, in accordance with State Law, approved by the town, completely enclosing the area in which such swimming pool is situated, such fence or enclosure to be not less than (4) four feet in height above ground level, and any fence portion thereof to be supported by posts at intervals of not more than (10) ten feet. A close-type swimming pool fence is a fence that has openings no larger than (16) sixteen square inches each with the bottom or base of the fence contiguous to the ground or deck of the swimming pool. Such fence or other protective enclosures may include on or more gates or doors, provided such gates or doors are equipped with self-closing devices and self-latching devices at all times when such swimming pool is not in use. In lieu of the aforesaid self-closing and self-latching devices, such gates or doors may be so constructed as to be capable of being closed and locked, provided such gates or doors are closed and locked at all times when swimming pool is not in use.

Section 544 Parking and Storage of Certain Vehicles

No more than one automotive vehicle or trailer of any kind or type without current license plates shall be parked or stored on any lot other than in completely enclosed buildings or so they are visually screened from the road and other properties. Operational farm vehicles shall be exempt. Not more than one unlicensed vehicle may be offered for sale by the owner, for a period of not longer than (3) three months.

All existing unlicensed vehicles shall be required to comply with the standards in this Section and in Section 531, Junk and Junkyards, within one year of the effective date of this Ordinance.

Section 545 Fences

All fences within the Town of Middletown shall not encroach upon a public right-of-way or interfere with vehicular or pedestrian traffic or interfere with visibility on corner lots, and shall not encroach upon a property line without mutual consent.

Section 546 Adult Uses

A) Adult uses, due to their nature, have serious objectionable characteristics that can have a significant impact on the neighborhood and community in which they are located, particularly when located in close proximity to residential areas and recreational/commercial areas. The objectionable characteristics of these areas are further heightened by their concentration in any one area thereby having deleterious effects on adjacent areas. The uncontrolled proliferation of such uses would be inconsistent with the Town as a primarily residential and family oriented community as well as a recreational destination. Such uses can contribute to the blighting or downgrading of areas in which they are located as a result of their related potential for an increase in crime and the undermining of the economic and social welfare of the community. The special regulations deemed necessary to control the undesirable secondary effects arising from adult uses are set forth below. The primary purpose of these controls and regulations is to preserve the integrity and character of the residential community. The provisions of this section have neither the purpose nor the effect of imposing a limitation or restriction on the content of any communicative materials, or to deny access by adults to adult uses.

B) No adult use shall be established except upon the receipt of a Special Permit approval from the Planning Board in accordance with Section 806 (C) of this Ordinance and the provisions herein. All adult uses shall be allowed in the district(s) as identified in Schedule I of this Ordinance.

Adult uses shall conform to the following requirements:

1) an adult use shall not be located within a five hundred (500) foot radius of any property currently in residential use inside hamlet boundaries. An adult use shall not be located within a one hundred (100) foot radius of any property currently in residential use in the R-5 and R-3 districts.

2) no adult use shall be located within a five hundred (500) foot radius of another adult use.

3) no adult use shall be located within a five hundred (500) foot radius of any religious institution, educational institution, public park or recreational facility, civic facility or day care center.

4) no more than one adult use shall be located on any lot.

5) no adult use shall be located in any building that is used in whole or in part for residential uses.

6) the required setbacks shall be doubled for each district herein and shall be measured from the property line of the premises.

7) all building openings, including doors and windows shall be located, covered or screened in such a manner as to prevent a view into the establishment from any public street, sidewalk, or parking area.

8) as a condition of approval of any adult use, there shall be a restriction that no person under the age of 18 years shall be permitted into or on the premises.

9) any sign for an adult use shall conform to all signage requirements of this Ordinance as per Section 542. All signs should be attached to the building, no free standing shall be allowed.

10) no loud speakers or sound equipment shall be used by adult uses that can be heard by the public from outside the establishment

Section 547 Personal Wireless Telecommunications Service Facilities

A) General Provisions

1) The placement, construction, and modification of all personal wireless telecommunications facilities within the boundaries of the Town of Middletown, shall be permitted only by a Special Permit, upon Site Plan Approval pursuant to Article VIII herein and the issuance of a building permit, and subject to all the provisions of this chapter and all other applicable Regulations.

2) All new telecommunications antennas which are not attached to telecommunication towers shall comply with the provisions of this chapter.

3) All telecommunications towers existing on October 1, 2000 shall be allowed to continue their usage as they presently exist. New construction, other than routine maintenance on an existing telecommunications tower, shall comply with the requirements of this chapter.

B) Specific Provisions

1) Co-location Preferred. Whenever possible, new telecommunication facilities shall be sited on existing telecommunications facilities or in areas already in use for telecommunications and/or utility distribution lines in order to preserve the aesthetic and scenic value of the town. Except in cases where mechanical, structural or regulatory factors prevent co-location, applicants cannot be denied or denied space on a telecommunications tower provided the applicant pays a reasonable fee to the owner of the telecommunication tower.
2) Location. Applicants for telecommunication towers shall locate, erect and site the towers in accordance with the following priorities with one (1) being the highest priority and eight (8) being the lowest priority.

a) on existing towers or structures;
b) co-location on a site with existing towers or structures;
c) on Town of Middletown properties;
d) on fire district properties;
e) in industrial districts;
f) in commercial districts;
g) other developed municipal properties;
   i) Delaware County properties
   ii) New York State properties

h) in residential districts.

Upon filing an application for a permit for a telecommunications tower, the applicant shall submit a report demonstrating the applicant's review of the above locations in order of priority demonstrating technologically the reason for the site selection. If the site selected is not the highest priority, then a detailed explanation as to why sites of higher priority were not selected should be included in the application.

Notwithstanding the above, the Planning Board may approve any site location within an area in the above list of priority areas if the alternative site provides reasonable services and meets the minimum needs of the service provider and the Planning Board, in writing, finds it is in the best interest of the health, safety and welfare of the Town.

3) Applicants for a special permit to place, construct or modify personal wireless telecommunication facilities within the Town of Middletown shall submit the following information to the Planning Board for its referral to the professional engineer or consultant for review and recommendation:

a) Visual environmental assessment for ("Visual EAF"), landscaping plan and visual assessment report including appropriate modeling and photography assessing the visibility from key viewpoints identified in the Visual EAF, existing tree lines, and proposed elevations.

b) Preliminary report prepared by a licensed professional engineer describing:

i) feasibility of the co-location on existing structures and telecommunication facilities,
ii) applicant's full map and grid coverage in the tow,
iii) surrounding topography in relation to the line of sight transmission,
iv) available road access, electric power and land-based telephone, required improvements for construction activities, including those within the public's right-of-way or land zoned or controlled by the Town of Middletown,
v) identity of location, ownership and usage of currently existing telecommunication facilities within the Town,
vi) plans for construction of telecommunications accessory equipment building or structure and landscaping plans,
vii) proposed mitigation measures for visual impacts,
viii) proposed safety measures.

c) In the case of an application for a telecommunications tower, additional information shall be provided describing: the telecommunications tower's height and design, including a cross-section of the structure; the telecommunication tower's compliance with applicable structural standards; the telecommunications tower's capacity, including the

number and type of telecommunications antennas it can accommodate and the basis of the calculation of capacity.

d) In the case of a telecommunications antenna mounted on an existing structure, additional information shall be provided indicating; the existing structure's suitability to accept the telecommunications antenna; the proposed method of affixing the telecommunications antenna to the structure; and complete details of all fixtures and coupling, and the precise point of attachment shall be indicated.

e) Demonstration of a need for proposed telecommunications facility showing the impracticality of upgrading or expanding an existing site.

f) Demonstration that the proposed site is the most appropriate site within the immediate area for the location of the cellular telephone facility.

g) Inventory of existing telecommunication facilities within the Town outlining opportunities for shared use as an alternative to the proposed use. The applicant must demonstrate that the proposed telecommunications tower or telecommunications antenna cannot be accommodated on an existing approved telecommunications tower or facility.

h) Description of the applicant's long range plans which project market demand and long range facility expansion needs within the Town.

i) Proof of certified mail announcements to all other telecommunications providers in the area declaring the applicant's sharing capabilities and/or siting needs.

j) A map showing the location of the premises for which the permit is sought and sketch plan showing all features of the facility necessary for providing road access, electrical service, land based telephone line connection and/or microwave link capability within the proper boundaries of the proposed location.

k) Certification by a New York State Licensed Professional Engineer (PE) that the facility will comply with Federal Communications Commission ("FCC") regulations for radio frequency ("RF") emissions.

l) Such other information as may be required by the Planning Board or its engineer or consultant.

c) Special Permits Used for Professional Wireless Telecommunication Service Facilities Shall be Subject to the Following General Conditions:

1) Separation Distance. Telecommunication facilities shall be separated from all residential dwellings by a distance of no less than 500 feet.

2) All telecommunication facilities shall comply with zoning set back regulations in the affected zone. In any event, a structure shall be set back a distance at least equal to its fall zone as certified by a New York State Licensed Professional Engineer plus an additional 50% of its fall zone. Additional set backs may be required by the Planning Board in order to provide for the public safety, health and welfare.

3) Minimal Visual Impacts. All telecommunications towers and telecommunications antennas shall be sited to have the least possible visual effect on the environment.

4) Lighting. Telecommunications towers shall not be artificially lighted unless otherwise required by the Federal Aviation Administration or other federal, state or local authority.

5) Material and Paint. Telecommunications towers and telecommunication antennas shall be of a galvanized finish or painted gray above the surrounding tree lines, and gray or green below the tree lines; the mountings of telecommunications antennas should be nonreflective an of the appropriate color to blend with their background.

6) Screening

a) Vegetative Screening

i) Where a personal wireless telecommunications facility abuts residential or public property, the following vegetative screening shall be provided: Native evergreen shrubs or trees capable of forming a continuous hedge at least five feet in

height within two (2) years of planting to effectively screen a telecommunications tower base and accessory facilities;

ii) Additional screening may be required by the Planning Board to screen portions of the telecommunications tower from nearby residential property or important views.

b) Architectural Screening. Creative design measures to camouflage facilities by integrating them with existing buildings and among other existing uses is preferred.

7) Height. The size of telecommunications sites should be limited to the minimum required to provide the proposed telecommunication services.

8) Access Road. Existing roadways shall be used for access to the site whenever possible.

9) Telecommunications Accessory Structures. Telecommunications support facilities such as vaults and equipment rooms, utilities and other support structures should be screened, placed underground, depressed, earth bermed or sited below the ridge line to the greatest extent feasible particularly in areas of high visibility.

10) Telecommunications Antennas. Due to their high visibility, dish and parabolic telecommunications antennas should be located at as low an elevation as possible without compromising the function of the device, preferably on the sides of buildings or ground mounted on slopes below the ridge line wherever possible, rather than elevated on telecommunications towers. Microwave and satellite dishes should be of mesh construction wherever possible.

11) Utility Service. Electrical and land based telephone and/or microwave utilities extended to serve telecommunication sites shall be underground.

12) Security Provisions. Each site should have a security program including physical features such as fencing, anti-climbing devices or elevating ladders on telecommunications towers and/or monitoring either by staff or electronic devices, to prevent unauthorized access and vandalism.

13) Safe Zone. Telecommunications towers should be designed so that in the event of failure, they will fall within the set back area of the site and/or away from adjacent development.

14) Noise. Noise producing equipment should be sited and/or insulated to minimize noise impacts on adjacent properties.

15) Annual Inspection and Report. Telecommunications towers over 100 feet in height shall be inspected annually by a licensed professional engineer, and a copy of the inspection report submitted to the Town Building Inspector.

16) Removal. All telecommunications facilities, including, but not limited to antennas, towers and accessory structures shall be dismantled and removed from the site when they have been inoperative or abandoned for two years. Applicants shall post a bond or other suitable undertaking as a condition of the special permit in order to guaranty removal of abandoned structures.

17) Post Installation Field Report Identifying the Facilities Coverage Area, telecommunications Towers Maximum Capacity, Committed Capacity and Unused Capacity, if any, and co-located users of the telecommunications tower shall be submitted to the Town.

D) The Planning Board May Grant the Special Permit, Deny the Special Permit or Grant the Special Permit with Written Stated Conditions.

Denial of the special permit shall be by written decision based upon substantial evidence submitted to the Board.

ARTICLE VI. SPECIAL PERMIT AND SITE PLAN REVIEW

Section 601 Special Permit

A) Purpose

It is the intent of this section to use special permits to control the impact of certain uses upon areas where they will be incompatible unless conditioned in a manner suitable to a particular location.

B) Administration

The Town Planning Board will administer the review and granting of Special Permits.

C) Procedure

1) The Code Enforcement Officer shall refer the completed Special Permit Application to the Planning Board within 10 days after receiving a completed application.

2) The application for a Special Permit shall be accompanied by a fee, three sets of preliminary plans, and/or other descriptive matter to clearly portray the intentions of the owner. Such plans shall show location of all buildings, parking, traffic access and circulation drives, open spaces, landscaping, all existing structures and usages within 200 feet of the site boundaries, and other information necessary to determine if the proposed special use meets the requirements of this Ordinance.

3) The Planning Board shall hold a public hearing within 62 days after the completed application is submitted. There shall be at least five days notice to the public of the hearing.

4) The Planning Board shall render a decision, at a regular or special meeting, either approving, approving with conditions, requiring site plan review, or denying a special permit application within 62 days of the public hearing. A special permits application must be referred to the County Planning Board when required by General Municipal Law 239 m.

5) A Special Permit shall be construed to be authorization for only one particular special use and shall expire if the special use shall cease for more

than six months for any reason. Special uses inherently of a seasonal nature, including, but not limited to, nature centers, campgrounds, recreation areas, and roadside stands shall have a period extended to 12 months prior to expiration of special permits.

D) Standards Applicable To All Special Permit Uses

All special uses necessarily require site plan review. Site plan review may be waived if, in the opinion of the Planning Board, the following standards and conditions have been satisfied:

1) Location, use and size of structure, nature and intensity of operations involved, size of site in relation to it, and location of site with respect to existing or future streets giving access, are such that it will be in harmony with orderly development of the district.

2) Location, nature and height of buildings, walls, fences and signs will not discourage the appropriate development and use of adjacent land and buildings or impair their value.

3) Special use shall not conflict with the Comprehensive Plan.

4) Operation of any special use shall not be more objectional to nearby properties by reason of noise, fumes, vibration, or flashing lights than would be the operation of any permitted use.

5) Necessary provisions have been made to assure that all surface runoff to adjacent properties does not exceed levels in existence prior to construction.

6) Solar access of adjacent properties is not obstructed by said use.

7) All State Environmental Quality Review requirements have been met.

If said conditions and standards are not met, a Site Plan Review shall be undertaken in accordance with Section 602, Site Plan Review.

No Special Permit shall be issued for a use on a property where there is an existing violation of this Ordinance or other town law or regulation.

Section 602 Site Plan Review

A) Purpose

The intent of this section is to set forth additional general standards applying to certain land uses and activities. The nature of these uses and activities require special consideration of their impacts upon surrounding properties, the environment, community character and the ability of the town to accommodate development consistent with the objectives of this Ordinance and the Comprehensive Plan.

B) Administrative

The Planning Board, at a public meeting, shall, pursuant to Town Law, Section 274-a, review and approve, approve with modifications, or disapprove site plans before a building permit is issued.

C) Procedure

1) Preapplication Conference - A preapplication conference shall be held between the Code Enforcement Officer and applicant to review the basic site design concept and generally determine the information to be required on the site plan.

2) Submission of Site Plan and Supporting Data - The applicant shall submit a site plan and supporting data to the Code Enforcement Officer a minimum of 14 days prior to the regular monthly meeting. Included, shall be the following information (a-i) presented in drawn form and accompanied by written text. The Code Enforcement Officer, as a result of the pre-application conference, may waive any of the requirements below (a-i) prior to the submission of a formal site plan when, in his or her discretion, such requirements are not material to the project under review. The Planning Board may overrule any waivers so granted and require compliance with these requirements before accepting a site plan submission. Additionally, the Planning Board shall have the power to grant waivers of any of these requirements.

a) Survey of property showing existing features, including contours, large trees, buildings, structures, streets, utility easements, rights-of-way, streams, bodies of water, land use, zoning and ownership of property.

b) Site Plan showing, scale, north arrow, section, lot, and block numbers of all adjoining properties, building location and land use areas.

c) Traffic circulation, parking and loading spaces and pedestrian walks.

d) Landscaping plans, including site grading, landscape design, and open spaces.

e) Preliminary architectural drawings for buildings to be constructed including floor plans, exterior elevations and sections.

f) Preliminary engineering plans including street improvements, storm drainage, water supply and sanitary sewer facilities.

g) Engineering feasibility study of any anticipated problem which might arise due to proposed development as required by the Planning Board.

h) Construction sequence and time schedule for completion of each phase for buildings, parking and landscaped areas.

i) Description of proposed uses, including hours of operation, and expected number of employees, volumes of business and volumes of traffic generated.

3) Public Hearing

The Planning Board may conduct a public hearing of the site plan. If it is determined that a public hearing is desirable, then such public hearing shall be conducted within 62 days of the receipt of the application and the Board shall mail notice of said hearing to the applicant at least ten days before such hearing and with at least five days public notice in a paper of general circulation in the Town.

4) Site Plan Review

Prior to rendering a decision the Planning Board shall review the site plan, public hearing comments, and supporting data and take into consideration the following:

a) Harmonious relationship between proposed uses and existing adjacent uses.

b) Maximum safety of vehicular circulation between the site and the street.

c) Adequacy of interior circulation, parking and loading facilities with particular attention to pedestrian safety.

d) Adequacy of landscaping and setbacks to achieve compatibility with, and protection of, adjacent residential uses.

e) Factors deemed necessary by the Planning Board for the health, safety, and welfare of the public.

The Planning Board may require changes or additions in relation to yards, driveways, and landscaping, to insure safety, to minimize traffic difficulties, and to safeguard adjacent properties. Should changes or additional facilities be required by the Board, final approval of site plan shall be conditional upon satisfactory compliance by owner with the changes or additions.

Any owner wishing to make changes in an approved site plan shall submit a revised site plan to the Planning Board for review and approval.

5) Decision

The Planning Board shall, within 62 days of the public hearing, if one is held, or within 62 days of the date of the meeting at which the site plan and supporting data was submitted, either approve, approve with conditions, or disapprove the site plan. The decision shall be in writing to the applicant. If a public hearing is held the Board shall give the County Planning Board ten days notice of such hearing. If no public hearing is held the site plan must be referred to the County Planning Board.

6) Financial Guarantee as a Condition of Site Plan Review

The Planning Board may require, as a condition of site plan approval, that the owner provide a financial guarantee in an amount it determines to be in the public interest, to ensure that the proposed development will be built in compliance with the accepted plans.

ARTICLE VII. NON-CONFORMING USE

Section 701 General

Lots, structures, uses of land and structures and characteristics of use which lawfully existed at the time of the enactment of these regulations and which would be prohibited or restricted under the terms of these regulations may be continued subject to the following provisions.

Section 702 Intent

It is the intent of this regulations to permit non-conforming uses to continue until they are removed, but not to encourage their survival.

Section 703 Construction Approved Prior to Adoption of Ordinance

Nothing herein contained shall require any change in plans, construction, or designated use of a building for which a building permit has been heretofore issued and the construction of which shall have been diligently prosecuted within three months of the date of such permit.

Section 704 Transference

Non-conforming use rights, subject to the provisions of this Article, remain with the land when title is transferred.

Section 705 Enlargement

No non-conforming uses shall be enlarged or increased, nor extended to occupy a greater area of land than was occupied at the effective date of this Ordinance.

Section 706 Changes

Once changed to a conforming use, no building or land shall be permitted to revert to a non-conforming use. A non-conforming use may not be changed to other than a conforming use.

Section 707 Discontinuance

Whenever a non-conforming use has been discontinued for a period of one year, such use shall not thereafter be re-established, and any future use shall be conforming with the provisions of this Ordinance.

ARTICLE VII. NON-CONFORMING USE

Section 708 Restoration and Repair

A) Damage or Destruction

If a non-conforming building or land use, or part thereof, has been damaged or partially destroyed by any cause, it may be rebuilt or restored as such non-conforming building, structure or land use only if reconstructed or restored with the same or less floor area and cubic content, and with the same or an improved general site layout as that of the original structure or use.

B) Approval of Plans

Approval of the reconstruction or restoration plan by the Planning Board shall be required and the Board may impose conditions on such approval if such conditions would improve an otherwise bad situation and bring the nonconforming use or activity more into compliance with this Ordinance.

Section 709 District Changes

Whenever the boundaries of a district shall be changed so as to transfer an area from one district to another district of a different classification, or whenever the text of this Ordinance shall be changed with respect to uses permitted in a district, the foregoing provisions shall also apply to any non-conforming buildings or uses therein.

Section 710 Unsafe Structures

Any structure or portion thereof declared by the Code Enforcement Officer or other proper authority to be unsafe by reason of fire or any other natural or unnatural occurrence shall, within six months, be removed or restored to a safe condition.

If the owner fails to remove or restore the building or structure, the Code Enforcement Officer shall, by Certified Mail, inform the owner that he/she has 30 days to correct the situation. If no progress is made, the Town Board may order the unsafe structure to be removed and shall charge the owner of the property any costs connected therewith.

ARTICLE VII. NON-CONFORMING USE

Section 711 Alterations

A non-conforming structure may not be reconstructed or structurally altered during its life to an extent exceeding in aggregate cost 50 percent of the full value of said structure, unless the structure shall be changed to a conforming use.

Section 712 Displacement

No non-conforming use shall be extended to displace a conforming use.

Section 713 Moving

Should any structure be moved for any reason for any distance, it shall thereafter conform to the requirements for the district in which it is located after it is moved.

Section 714 Existing Undersized Lots of Record

A) Any recorded lot held in single and separate ownership prior to adoption of these regulations and which area and/or width and/or depth are less than minimum requirements specified herein for the district, may be considered as complying with these regulations and no variance therefore shall be required, provided that the minimum yard requirements set by these regulations are met.

B) A lot of non-conforming size may be subdivided if each and every subdivision of such lot is purchased by the owner or owners of the adjoining properties to increase the size of said owner's property.

Section 715 Mobile Homes

Existing mobile homes that, for whatever reason, are to be replaced on the same lot and/or on the same site shall only be replaced with a mobile home meeting the requirements of Section 533 of this Ordinance and the construction standards of the New York State Uniform Fire and Building Code.

ARTICLE VIII. ADMINISTRATION

Section 801 Enforcement

The duty of administering and enforcing the provisions of this Code is hereby conferred upon the Code Enforcement Officer. He shall be appointed by the Town Board and receive compensation as the Town Board shall determine.

Section 802 Duties and Procedures of the Code Enforcement Officer

A) Administer the Zoning Law

The Code Enforcement Officer shall review all applications for building permits and, if the minimum requirements of this Code are met, he shall issue a permit.

If the applicant's plans do not meet the zoning requirements, he must deny the permit. The Code Enforcement Officer may not use discretionary judgement. He must enforce the "Letter of the Law."

B) Referral to the Zoning Board of Appeals

An applicant, after he has been denied a building permit, may appeal the Code Enforcement Officer's findings to the Zoning Board of Appeals (ZBA) for an interpretation or a variance. Should an appeal be requested, the Code Enforcement Officer shall notify the Secretary of the ZBA of the request and forward all necessary supporting information.

C) Referral to Town Planning Board

Any application for a special permit, change of zoning district or use that requires a Site Plan Review shall be forwarded by the Code Enforcement Officer to the Secretary of the Town Planning Board along with all supporting information.

D) Cite Zoning Violations

For any plans, constructions, building, use of premise found in violation of this Code, the Code Enforcement Officer shall order the responsible party, in writing, to remedy the conditions. He shall have the authority to secure from the Town Justice a stop order to constrain the continuance of violation,

or apply to the Supreme Court or any other court of competent jurisdiction on the Town's behalf, to issue a court order enabling the Town to enter the property and to cure any such violation. Nothing herein shall be construed to cause the Town to refrain from exercising its own police power.

E) Report to Town Board

A monthly report to the Town Board and copy to the Planning Board describing and enumerating actions taken and permits issued shall be given.

F) Public Record

The Code Enforcement Officer shall file all permit actions with the Town Clerk.

G) Appearance Ticket

The Code Enforcement Officer shall be authorized to issue and serve appearance tickets, returnable in local criminal court, in connection with a violation of this Ordinance.

Section 803 Permits Required

No use or structure shall be established, erected nor land developed until a permit has been issued by the Code Enforcement Officer who shall issue such permits in accordance with regulations in this Code.

A) Preapplication Conference with Planning Board

Preapplication conferences with the Town's Planning Board are encouraged for all applicants seeking permits for nonresidential uses or non-farm uses.

B) Application

All applications for permits shall be in writing, signed by the owner, on forms furnished by the Code Enforcement Officer and shall be filed with the officer and briefly state:

1) Nature and definite purpose of the building or use sought.

2) Description of the property and buildings to be placed thereon.

3) Statement of any restrictions by deed or other instrument of record.

4) An agreement to comply with this Ordinance and all other laws, ordinances and regulations that may be applicable.

5) Such other information as the Town Board, the Planning Board, the Board of Appeals or Code Enforcement Officer may require.

6) Sign an application for a Sewage Disposal Inspection from the New York City Department of Environmental Protection, Bureau of Water Supply, that the Code Enforcement Officer shall forward.

C) Action

The Code Enforcement Officer shall act upon all applications for building permits (which includes all supporting documents such as building plans and specifications, etc.) within 20 working days from the day of application. Such official shall issue or refuse to issue such permits.

D) Refusal

Where the proposed construction, alteration or use of the building or lot is in violation of any of the provisions of this Ordinance or when a Special Permit or site plan approval is needed, the permit shall not be issued. Such refusal shall be in writing, a copy of which shall be sent to the applicant. Such refusal will enable the applicant to submit an appeal to the Zoning Board of Appeals, or the Town Board or Planning Board, as specified elsewhere in this Ordinance, for relief from the Code Enforcement Officer's decision.

E) Term

A permit shall become void 12 months from the date of issuance unless substantial progress has been made since that date on the project described therein; provided, however, that the permit shall be renewed by the Code Enforcement Officer for an additional 12 months upon application therefor.

Additional extensions shall be subject to approval by the Zoning Board of Appeals.

F) Exceptions

1) Farm Structures

The provisions of this Article VIII shall not apply to any farm building or use as defined in Article II of this Ordinance.

2) Maintenance and Repair

No building permit shall be required for normal maintenance and repair work, for painting, interior decoration, roof repairs or maintenance, landscaping and the construction of a structure, such as a utility shed or animal shelter, where the total floor area is 144 square feet or less.

G) Environmental Assessment

Until authorized by the appropriate lead agency, no building permit shall be issued for any proposed building or land use which requires an environmental assessment in accordance with the State Environmental Quality Review Act of 1975 and any County or Town rules and regulations enacted pursuant thereto. Such application shall be referred to the appropriate lead agency for a determination as to whether an environmental impact assessment will be required.

H) Fees

All fees shall be paid at the office of the Town Clerk upon filing an application. Fees shall be in accordance with the Town of Middletown standard fee schedule, as set by resolution of the Town Board.

Section 804 Certificate of Occupancy

A) Applicability

1) No land shall be occupied or used and no building hereafter erected, altered or extended shall be used or changed in use until a Certificate of Occupancy shall have been issued by the Code Enforcement Officer stating that the building, addition or alteration, or proposed use thereof complies with the provisions of this Ordinance.

2) No nonconforming use shall be maintained, renewed, changed or extended without a Certificate of Occupancy (certificate of existing use, therefore) having first been issued by the Code Enforcement Officer.

3) All Certificates of Occupancy shall be applied for coincident with the Application for a Building Permit. Said Certificate shall be issued within 10 days after the erection or alteration shall have been approved as complying with the provisions of this Ordinance.

4) The Code Enforcement Officer shall maintain a record of all certificates and copies shall be furnished upon request to any person having a proprietary or tenancy interest in the building affected.

5) No permit for excavation for, or the erection or alteration of, or repair to any building shall be issued until an application has been made for a Certificate of Occupancy.

B) Refusal

If the Code Enforcement Officer, after such final inspection, refuses to issue a Certificate of Occupancy, he shall state such refusal in writing with the cause, and immediately thereupon mail notice of such refusal to the applicant at the address indicated on the application.

C) Temporary Certificate of Occupancy

If use or occupancy of land, a building, or part thereof, is desired prior to completion of all details proposed in the application for which a Building Permit was issued, the Planning Board, upon request, may authorize the Code Enforcement Officer to issue a temporary Certificate of Occupancy. A letter of credit, or equal security, of sufficient amount to complete all unfinished improvements, may be required by the Planning Board before a Temporary Certificate is authorized.

D) If a building permit is issued for a shell (a partially completed dwelling), alterations, or structural repairs, the Code Enforcement Officer shall issue a Certificate of Conformity. Such Certificate shall state that the work applied for under the permit has been completed according to existing codes, rules, and regulations. In addition, the form shall indicate that any further work to be done will require a new building permit.

Section 805 Board of Appeals

A) Creation, Appointment and Organization

A Board of Appeals shall consist of five members appointed in accordance with Section 267 of the Town Law. The Town Board shall designate a chairman, and from its membership the Board of Appeals shall appoint a secretary and shall prescribe rules for the conduct of its affairs. No person who is a member of the Town Board shall be eligible for membership on such Board of Appeals.

B) Powers and Duties

The Board of Appeals shall have all the powers and duties prescribed by statute and by this Ordinance, which are more particularly specified as follows:

1) Interpretation

Upon appeal from a decision by an administrative official, to decide any question involving the interpretation of any provision of this Ordinance, including determination of the exact location of any district boundary if there is uncertainty with respect thereto.

2) Appeals for Variances

Upon denial of a building permit by the Code Enforcement Officer, the Zoning Board of Appeals shall hear requests for variances.

3) Area Variance

a) Area variances may be granted where setback, frontage, lot size, density or yard requirements of this Ordinance cannot be reasonably met. The Zoning Board of Appeals, in its findings, must find that "Practical Difficulty" was present.

b) In determining "Practical Difficulty", the Zoning Board of Appeals shall respond in its findings to each of the following questions:

i) How substantial the variance is in relation to the zoning requirement.

ii) Whether a substantial change will be produced in the character of the neighborhood, or whether a substantial detriment to adjoining properties will be created.

iii) Whether the difficulty can be eliminated by some method other than a variance which is feasible for the applicant to pursue. In the case of side yard variances in particular, it is frequently feasible, proper and possible for the applicant to alter the plot plan to locate a proposed structure or addition in a new location which does not require a variance.

iv) Whether, in view of the manner in which the difficulty arose and in consideration of the above factors, the interests of justice will be served by allowing the variance.

v) Proof of severe economic hardship, or ability to improve access to solar radiation for energy uses, may be grounds for granting an area variance. In granting any area variance the Board of Appeals shall prescribe any conditions that it deems necessary or desirable.

c) The following shall not be considered in determining "Practical Difficulty."

i) The owner is merely inconvenienced.

ii) The owner is prevented from building a second or subsequent structure.

iii) The owner is prevented from building a structure as large as he/she would like, provided he/she can build one of reasonable size.

iv) A larger building will merely improve the efficiency of a business or yield more profit.

4) Use Variance

a) A use variance may be granted by the Zoning Board of Appeals only after the findings of the Zoning Board of Appeals establish that "Unnecessary Hardship" exist.

b) In determining whether "Unnecessary Hardship" exists, the Zoning Board of Appeal's findings must establish each of the following criteria:

i) The land in question cannot yield a reasonable return if used only for a purpose allowed in that zone. A promise of greater yield by allowing a prohibited use is not to be considered.

ii) The use to be authorized by the variance will not alter the essential character of the neighborhood and is compatible with the area.

iii) The use to be authorized by the variance will not be contradictory or detrimental to the spirit or intent of the Zoning District or Zoning Law itself.

iv) That the hardship claimed is not self-created.

C) Procedure

1) All applications for variances shall be in writing on forms established by the Zoning Board of Appeals. They are available from the Code Enforcement Officer. The effective date of all applications to come before the ZBA will be the date of the next regularly scheduled meeting.

2) Every application shall refer to the specific provisions of the law involved and establish the details of why the variance should be granted.

3) Upon receipt of the completed application the Zoning Board of Appeals shall:

a) Schedule a public hearing within 45 days.

b) Arrange publication of notice of public hearing in the Town's official newspaper.

c) The applicant shall notify all landowners within 500 feet of the applicant's parcel by certified mail.

d) All use variances submitted to the Board of Appeals shall be referred to the Planning Board for review as to the conformance with the objectives of the Comprehensive Plan. No decision shall be made by the Board of Appeals until such Planning Board review has been completed and a report issued. If the Planning Board fails to issue its report within 30 days, the Board of Appeals shall assume that a favorable report has been issued.

e) Refer application to the County Planning Board as required by General Municipal Law Section 239, if required.

f) Comply as required by State Environmental Quality Review Law.

4) Within 30 days of the public hearing, or 62 days where cases are referred to the County Planning Board, the Zoning Board of Appeals shall render a decision. If matter was referred to the County Planning Board, a copy of the Zoning Board of Appeals' findings and decision must be sent to the County Planning Board.

Section 806 Planning Board

A) General

In all cases where this Ordinance requires authorization an, approval of plans by the Planning Board, no building permit shall be issued by the Code Enforcement Officer except upon authorization of and in conformity with the plans approved by the Planning Board.

B) Site Plan

The Town hereby authorizes the Planning Board to review and approve, to approve with modification, or to disapprove site plans.

C) Special Permits

The Planning Board is further authorized to issue special permits upon determination that the public health, safety and welfare shall be served and neighboring properties will not be injured.

The effective date of the special permit application will be the date of the next regularly scheduled meeting.

D) Referrals and Reports

The Town Planning Board will receive referrals from the Zoning Board of Appeals on certain actions and will prepare and submit reports to the Zoning Board of Appeals.

Section 807 County Planning Board

The Zoning Enabling Laws require that any of the following local zoning actions be referred to the County Planning Board prior to action by the local board. Any proposal for a special permit, variance, site plan approval, change in the zoning law text or map (rezoning, amending the zoning law) which would affect the real property lying within a distance of 500 feet from the boundary of:

A) Any county,
B) Any town,
C) Any village,
D) Any existing or proposed county or state park,
E) Any right-of-way of any county or state road or parkway,
F) Any stream or canal owned by the county,
G) Any existing or proposed county or state owned land on which a public building or institution is situated

must be referred to the County Planning Board who shall have 30 days from date of County receipt to take action on the matter.

Section 808 Violations

A) Complaint of Violations

Whenever a violation of this Ordinance occurs, any person may file a complaint in regard thereto. All such complaints must be in writing, signed, and shall be filed with the Code Enforcement Officer who shall properly record such complaint and immediately investigate and report thereon to the Town Board.

B) Notice of Violation

Whenever, in the opinion of the Code Enforcement Officer, after examination and inspection, there appears to exist a violation of any provision of this Ordinance, or of any rule or regulation adopted pursuant thereto, he/she shall serve a written notice of violation. Such notice of violation shall inform the recipient of:

1) The nature and details of such violation,

2) Recommended remedial action which, if taken, will effect compliance with the provisions of this Ordinance and with rules and regulations adopted pursuant thereto,

3) The date of compliance by which the violation must be remedied or removed.

C) Stop Work Order

In case of noncompliance with this order within allotted time, the Code Enforcement Officer, by reason of the defective or illegal work in violation of the provision or requirement of this Ordinance the continuance of a building operation is contrary to public welfare, shall order in written form all further work to be stopped, and may require suspension of work until the conditions in violation have been remedied.

D) Abatement of Violation

Appropriate action proceedings may be taken at law, or in equity to prevent unlawful construction or to restrain, correct or abate the violation, or to prevent the illegal occupancy of a building, structure or premises; or to prevent illegal act, conduct a business in or about any premises, shall be written in addition to penalties otherwise prescribed by law.

E) Penalties

Violators of this Ordinance will be notified by the Code Enforcement Officer via Certified Mail. If the violations have not been removed within 20 days of the date of receipt of letter, a summons will be issued subjecting the violator to fines of not more than $100.00 per day, commencing at the termination on the ten-day grace period.

Section 809 Amendments

A) Procedure for Amendments

1) Official notice must be given and a public hearing held by the Town Board as required by law prior to approval of amendments or other such modifications as mentioned herein.

2) Each petition requesting a change of zoning regulations or district boundaries shall be typewritten, signed by the owner, filed in triplicate, and accompanied by the required fee.

3) Every such proposed amendment shall be referred to the County Planning Board, when applicable, and to the Planning Board for a report to the public hearing. The Planning Board may require a plan of proposed development for which a zoning district change is sought to assist said board in the understanding of the case.

4) If a protest against such change, signed by the owners' of 20 percent or more of the area of land included in such proposed change, or of that immediately adjacent extending 100 feet therefrom, or of that directly opposite thereto and extending 100 feet from the street frontage of such opposite land, such amendment shall not become effective except by the

favorable vote of at least four members of the Town Board as set forth by Section 265 of the Town Law of the State of New York.

5) Before adopting any proposed amendment to this Ordinance, the Town Board shall assess the environmental impact of such amendment in accordance with the State Environmental Quality Review Act and may determine that an environmental impact statement on such amendment shall be prepared.

6) In approving subdivision plats which involve modifications of the zoning regulations, the Planning Board may make such zoning changes only after these have been disclosed at the public hearing required by the Land Subdivision Rules and Regulations for the Town. Changes made pursuant to this section are at the discretion of the Planning Board and must be made in accordance with the provisions of Section 28l of Article 16 of Town Law of the State of New York and Section 107 B) of the Town of Middletown Subdivision Regulations.

SCHEDULE I

TOWN OF MIDDLETOWN ZONING ORDINANCE
TYPES OF USES AND DISTRICTS
SEE SECTION 521

P - PERMITTED
SP- SPECIAL PERMIT
SPR- SITE PLAN REVIEW
X- NOT PERMITTED

	DISTRICTS					
	R-3	R-5	BC	H 1/2	H-1	I
RESIDENTIAL USES						
ONE-FAMILY DWELLING (PER LOT)	P	P	P	P	P	P
TWO-FAMILY DWELLING (PER LOT)	P	P	P	P	P	P
MULTI-FAMILY DWELLING	SP	SP	SPR	SP	SP	SP
MOBILE HOME	P	P	P	P	P	X
MOBILE HOME PARK	SP	SP	SPR	SP	SP	X
CLUSTER SUBDIVISION	SP	SP	SPR	SP	SP	X
CONDOMINIUM	SP	SP	SPR	SP	SP	X
TOWN HOUSE DWELLING	SP	SP	SPR	SP	SP	X
MIGRANT FARM LABOR DEVELOPMENT/HOUSING	SP	SP	X	X	X	X
AGRICULTURAL/NATURAL RESOURCE						
AGRICULTURAL, COMMERCIAL	P	P	X	X	X	P
FARM	P	P	X	X	X	P
NURSERY/GREENHOUSE, COMMERCIAL	SP	SP	SPR	SP	SP	X
CLEARCUTTING	SP	SP	SPR	SP	SP	SP
FOREST MANAGEMENT	P	P	P	P	P	P
WILDLIFE MANAGEMENT	P	P	P	P	P	P
PERSONAL WIRELESS TELCOMMUN. SERVICE FACILITY	SP	SP	SP	SP	SP	**SP**
FARMER'S MARKET	SP	X	SPR	X	X	SP

SCHEDULE 1

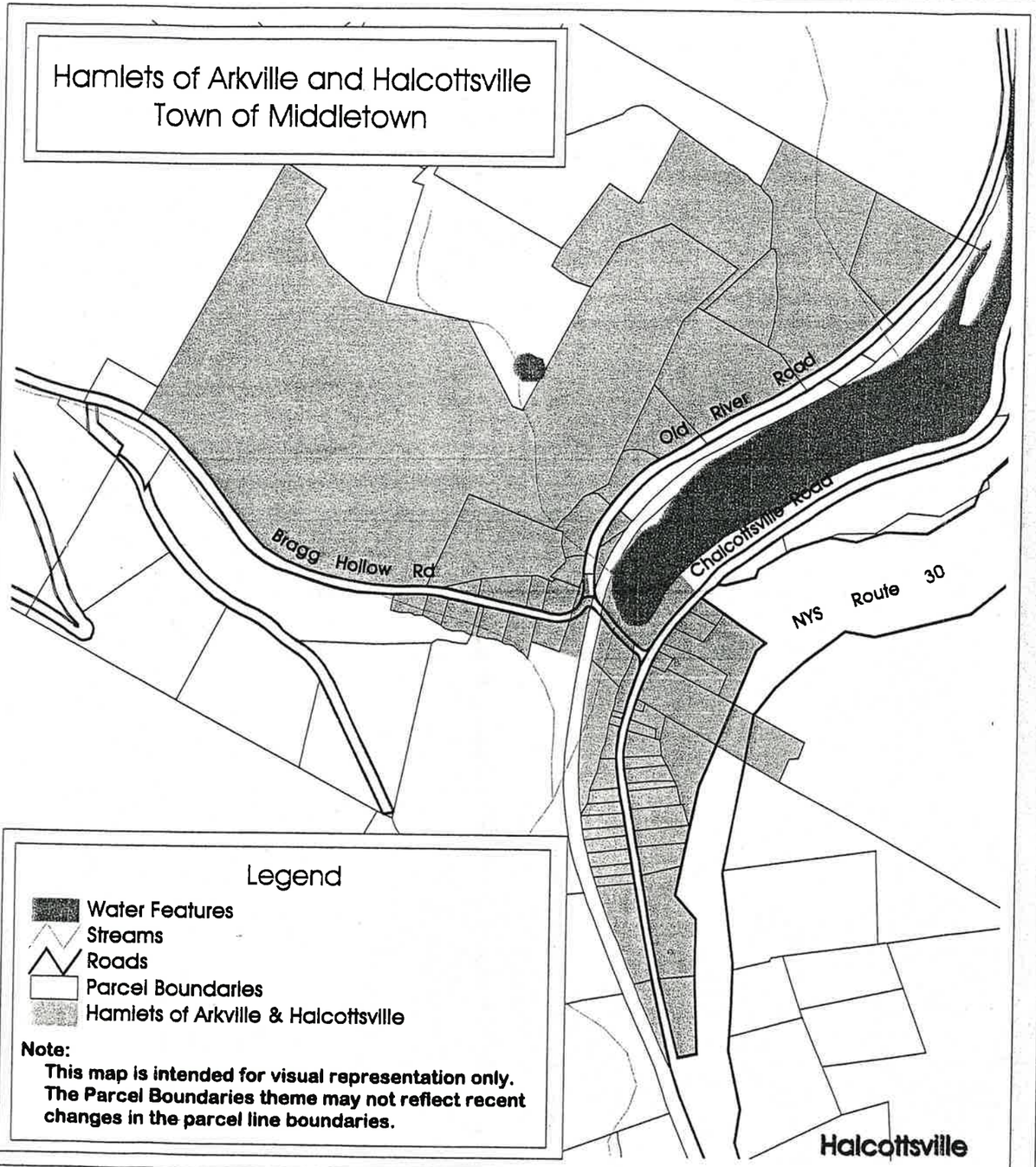
	R-3	R-5	BC	H 1/2	H-1	I
PUBLIC USE						
CULTURAL/RECREATION	SP	SP	SPR	SP	SP	SP
EDUCATIONAL INSTITUTION	SP	SP	SPR	SP	SP	SP
HEALTH CARE FACILITY	SP	SP	SPR	SP	SP	X
PUBLIC FACILITIES/ UTILITIES	SP	SP	SPR	SP	SP	SP
PULIC PARKS/ RECREATIONAL FACILITIES	SP	SP	SPR	SP	SP	SP
RELIGIOUS INSTITUTION	SP	SP	SPR	SP	SP	X
AIRPORT/HELIPORT	SP	SP	X	X	X	SP
CEMETERY	SP	SP	SPR	SP	SP	X
COMMERCIAL USES						
ADULT USES	X	SP	SP	X	X	SP
ANIMAL HOSPITAL	SP	SP	SPR	X	X	X
BED & BREAKFAST	SP	SP	SPR	SP	SP	X
BLDG. & FARM SUPPLY	SP	SP	SPR	SP	SP	X
BUSINESS/PROF. OFF	SP	SP	SPR	SP	SP	X
CAMPGROUND	SP	SP	X	X	X	X
CAR WASH	SP	X	SPR	X	X	X
CLUB	SP	SP	SPR	SP	SP	X
COMMERCIAL RECREATION	SP	SP	SPR	SP	SP	X
COMMERCIAL STORAGE, ENCLOSED	SP	SP	SPR	SP	SP	X
CRAFT/ANTIQUE MARKET	SP	X	X	X	X	SP
DRIVE IN USE	SP	SP	SPR	SP	SP	X
EATING & DRINKING ESTAB.	SP	SP	SPR	SP	SP	X
FLEA MARKET	SP	SP	SPR	SP	SP	X
HOTEL	SP	SP	SPR	SP	SP	X
JUNKYARD	SP	SP	SPR	X	X	X
KENNEL	SP	SP	SPR	X	X	X
MIXED USE BUILDINGS	SP	SP	SPR	SP	SP	SP
MODEL HOMES	SP	SP	SPR	SP	SP	X
MOTEL	SP	SP	SPR	SP	SP	X
MOTOR VEHICLE, BOAT/ TRAILER SALES	SP	SP	SPR	SP	SP	X

SCHEDULE 1

	R-3	R-5	BC	H 1/2	H-1	I
MOTOR VEHICLE, REPAIR SHOP	SP	SP	SPR	SP	SP	X
OUTDOOR RECREATION	SP	SP	SPR	SP	SP	SP
PARKING GARAGE	SP	SP	SPR	SP	SP	X
RETAIL TRADE	SP	SP	SPR	SP	SP	X
RESORT	SP	SP	SPR	SP	SP	X
SEASONAL BUSINESS	SP	SP	SPR	SP	SP	X
SERVICE ESTABLISHMENT	SP	SP	SPR	SP	SP	X
SERVICE STATION	SP	SP	SPR	SP	SP	X
SHOPPING CENTER	SP	X	SPR	X	X	X
SUMMER CAMP	SP	SP	X	X	X	X
INDUSTRIAL USES						
ALTERNATIVE ENERGY SYSTEMS, COMMERCIAL	SP	SP	SPR	SP	SP	P
BULK STORAGE	SP	SP	X	X	X	SP
ENCLOSED MANUFACTURING	SP	SP	SPR	SP	SP	P
LIGHT INDUSTRY	SP	SP	SPR	SP	SP	P
MINERAL EXTRACTION	SP	SP	SPR	X	X	SP
OIL & GAS DRILLING	SP	SP	X	X	X	SP
SANITARY LANDFILL	X	X	X	X	X	X
SAWMILL, LUMBERYARD	SP	SP	SPR	SP	SP	SP
WAREHOUSING	SP	SP	SPR	X	X	P
WHOLESALING	SP	SP	SPR	X	X	P

*COMMERCIAL/INDUSTRIAL FLOATING ZONE APPLIES TO R-5 ONLY.

Hamlets of Arkville and Halcottsville
Town of Middletown

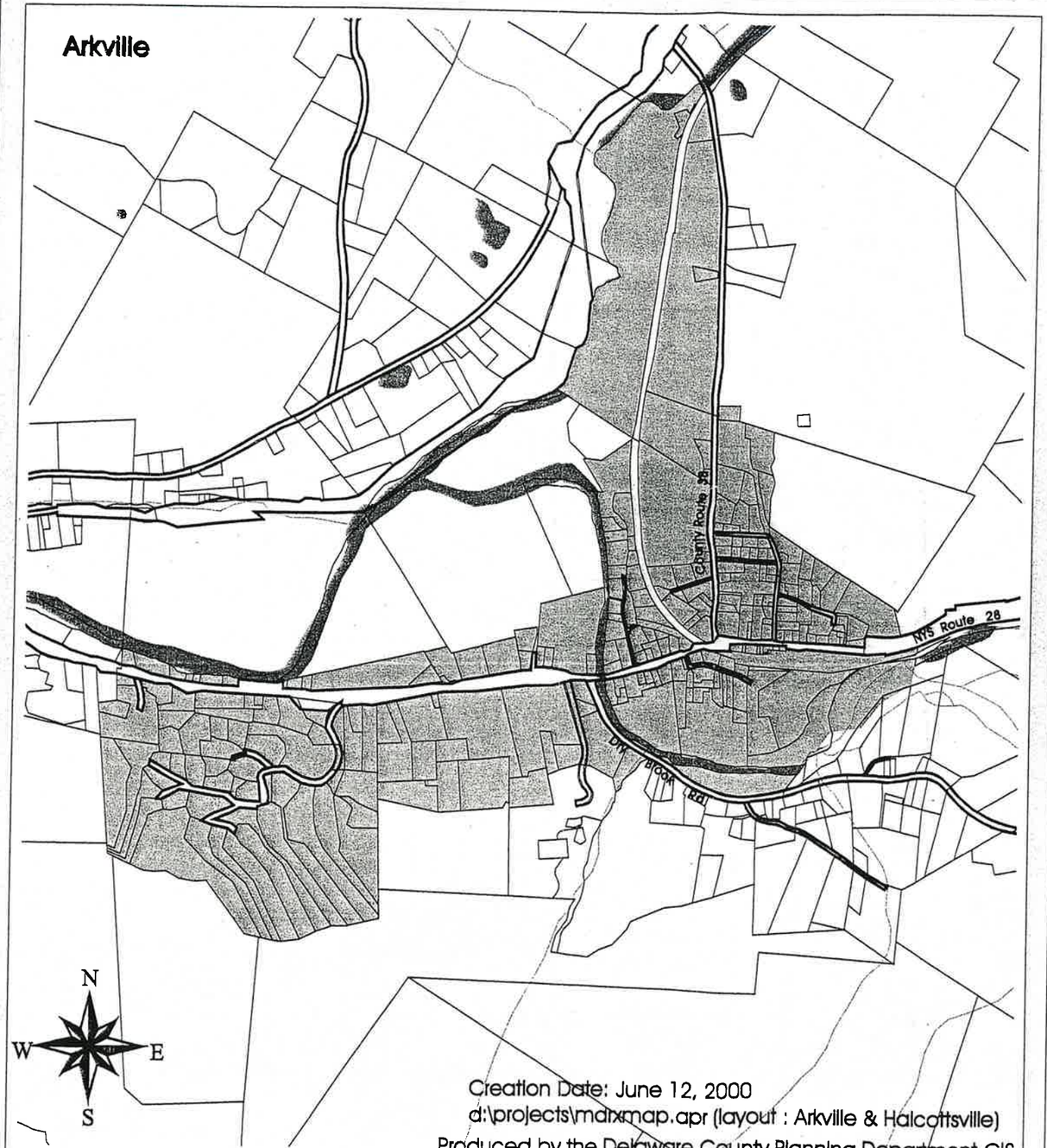


Legend

- Water Features
- Streams
- Roads
- Parcel Boundaries
- Hamlets of Arkville & Halcottsville

Note:
This map is intended for visual representation only. The Parcel Boundaries theme may not reflect recent changes in the parcel line boundaries.

Arkville



Creation Date: June 12, 2000
d:\projects\marxmap.apr (layout : Arkville & Halcottsville)
Produced by the Delaware County Planning Department GIS

Hamlets of Dunraven and New Kingston
Town of Middletown

New Kingston

Dunraven

New Kingston Rd

Thompson Hollow Rd

John Tuttle Rd

County Route 6

NYS Route 30

NYS Route 28 & 30

County Route 3

N

W E

S

500 0 500 1000 Feet

500 0 500 1000 Feet

Legend

- Water Features
- Streams
- Roads
- Parcel Boundaries
- Hamlets of New Kingston & Dunraven

Note:

This map is intended for visual representation only. The Parcel Boundaries theme may not reflect recent changes in the parcel line boundaries.

Produced by the Delaware County Planning Department GIS

Creation Date: June 12, 2000
d:\projects\mdrxmap.apr (layout : New Kingston & Dunraven)

2

DOCUMENTS FILE

4/26/88
Town Board Minutes

ADOPTED
4/26/88

TOWN OF MIDDLETOWN MASTER PLAN

INTRODUCTION

Why the plan? What is planning? What kind of planning is best for the Town of Middletown? The Middletown Town Planning Board has heard these questions many times. The answers are not simple.

Whether we realize it or not, governmental planning is all around us. Many aspects of our day-to-day lives are being planned or perhaps programmed. In our complex social structure, this is necessary and even desirable if we are to preserve our resources and assets and avoid ever greater chaos in the future. The real question we should be asking ourselves, then, is not whether planning is being done, but whether we are a part of it and are sure that is is the most desirable and the best planning that can be done.

Within Middletown, planning can establish logical patterns of land use which are based upon the needs and desires of the community. Attractive, carefully developed, orderly communities have inherently sound economic foundations. When we permit haphazard, disorganized and unattractive development, we allow the destruction of the very essense of sound community life. In effect, we require those people who take pride in their property to subsidize the exploitation of their community by the few entrepreneurs whose sole interest is in securing a maximum profit from real estate development.

There are many reasons why the Middletown Town Board chose to participate in a planning program. Individual planning, as it had existed in Middletown from its very early settlement, could no longer protect and preserve the very qualities that the citizens of the town had come to expect. Listed below are other considerations that indicate the need for planning in Middletown.

- Since 1950 the number of landparcels under 10 acres has nearly quadrupled (593 to 2,283). This trend is likely to continue as more and more people seek rural living areas.
- Land ownership in Middletown has changed considerably in the past 38 years. In 1950, 10 per cent of land parcels in the town were owned by nonresidents. By the end of 1987, over 60 per cent of Middletown landowners were nonresidents; i.e., seasonal residents.
- The number of residential units in Middletown has increased from 1,216 in 1950 to 2,424 in 1980. Although the construction of new homes is not always obvious from day to day, their cumulative impact is substantial.
- Planning and building,.until recently, were done primarily by local people who were familiar with soil and water conditions in Middletown. Today, much of the building is done by individuals who have purchased property for a second home. Many seek advice on local conditions, but a few do not and ultimately can cause problems with building foundations and water and septic systems.
- "Let's keep Middletown the way it is". This comment has been heard many times. Individual planning will not maintain the rural, open and small-town character that is the town of Middletown. Thoughtful planning and careful consideration of the environment can insure that new development will not be a burden to the community and will not cause irreversible damage to the land.

- Being against big government is very popular, but very few towns have presented viable alternatives for protecting their resources. Middletown people feel that whatever planning and regulating is done should be done by the local government. As the people of Middletown begin to take an active role in the planning process, the town will be better able to make reasonable choices for the future of the area and to do so locally.

This document is the result of many years of work for the Middletown Town Planning Board. The preparation of the Master Plan is but one step in the continuing planning process. The translation of community needs and objectives into a physical plan requires an understanding of the interdependence of all community activities. The values of the past must be related to the needs of the present and future. The plan must be flexible so that proposed solutions may be modified as local needs and objectives change.

The plan which is presented here is based on an inventory of natural resources and a review of man's current impact on the land. The capability of the land to withstand various uses is a major factor in determining how to direct change and protect resources. Other factors which affect health, safety prosperity and welfare of local residents have also been considered, such as economy, recreational opportunities, historical assets, population trends, transportation patterns, and local government services.

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TOWN OF MIDDLETOWN MASTER PLAN

Goals and Objectives

The formulation of goals and objectives is an important part of the planning process. Along with the investigation of physical, social and economic elements, the goals of the community provide further direction for change. The end result is a master plan which can be implemented through a variety of administrative legal programs. As values and circumstances change, so do community goals. Thus, goal forming, planning and town action are a continuing process, adopting to changing needs and aspirations.

1) To preserve and extend the enjoyment of peace and tranquility of residents on their land and to provide an improved quality of life for the Town.
2) To conserve the land, water, forest, mineral, historic and scenic resources of the Town for the use and enjoyment of all its residents.
3) To prevent degradation of the quality of the surface and groundwater supply.
4) To encourage the properly regulated and soundly built development of housing, business, industry and community facilities according to a master plan of balanced use.
5) To assure that every dwelling and place of work is supported by an adequate supply of potable water, sewage treatment and disposal, solid waste disposal, energy and access.
6) To promote the safe, efficient, and attractive circulation of pedestrian and vehicular traffic.
7) To provide adequate land and resources for recreation and preservation of the Town's rural character.
8) To maintain a balanced and equitable tax base.
9) To protect buildings and people from the harm of flood, fire, detrimental land use, and impairment of their natural resources.

Middletown possesses an exceptional heritage of natural resources that constitute the basis of the Town's lifestyle, economy and well-being. Protection of these resources is central to the achievement of many of the goals listed. The Master Plan presents a coordinated framework within which both development and environmental protection can take place.

TOWN OF MIDDLETOWN PLANNING QUESTIONNAIRE

Analysis and Discussion Guide

The Middletown questionniare was developed by the Middletown Town Planning Board. It was distributed to town taxpayers to gather community opinions on land use issues and to encourage the participation of local citizens in their town's planning program.

On May 14, 1980, 2,246 questionnaires were mailed to all taxpayers (one per household) using mailing labels prepared from the 1980 town tax rolls. Questionnaires were sent to all taxpayers in the town of Middletown, including those in the villages of Margaretville and Fleischmanns. Of the 2,246 mailed, 783, or 35 per cent, were returned. As samplings go, this is an excellent return (15 per cent is generally considered adequate) and should provide a good representation of community sentiment.

The following analysis is based on three types of information coming from the questionnaire: 1) tabulations of responses to each question, 2) tabulating responses from different groups of respondents to specific questions, and 3) comments included by respondents on the returned questionnaire.

LAND SETTLEMENT AND LAND USE PATTERNS

There has been a significant increase in the number of second home owners in the town of Middletown during the past decade. The survey indicated that, of those responding, 53 per cent were seasonal landowners. These people are attracted to the area because of its wilderness atmosphere, isolation, and recreational amenities, including the hunting and fishing opportunities that are found nearly every where in the town.

Many of these respondents, however, are concerned that, as this development continues unchecked and without guidelines, the rural qualities and small-town atmosphere of Middletown will diminish. As the town developes and grows, it is important that the qualities that make Middletown an attractive place to live, buy land, and retire are protected.

The majority of opinions gathered here are from seasonal landowners (53%). The rest, or 47 per cent, include permanent residents from all areas within the town of Middletown, including the villages of Margaretville and Fleischmanns. Excluding the responses from the two villages, the percentage of seasonal landowners responding to the survey increases to 64 per cent of the total. Many of these seasonal landowners have plans to retire to this area.

Most of the respondents to the survey have owned their land in Middletown for less than 20 years (76%). The results are more interesting when we compare permanent and seasonal landowner responses. Nearly 40 per cent of the permanent landowners have owned their land for more than 20 years while only 12 per cent of the seasonal landowners have owned their property for more than 20 years. In addition,

nearly 30 per cent of all seasonal landowners bought their land in the last five years. This represents a high rate of land sales in the town, and a continuatio of this trend is expected well into the future.

Why do people buy land in Middletown? Most respondents indicated the wilderness atmosphere and recreational aspects of the area as a primary reason for buying land. Retirement and the rural, small-town atmosphere were also listed by many. Seasonal landowners preferred the isolation and recreational qualities, while permanent landowners enjoy the rural small-town atmosphere qualities of the town. Other reasons listed by respondents for buying land included investment purposes, friendly people job related and simply "...just needed a place to live".

Most respondents (88%) indicated that the primary use of the property was for a private residence (including year-round and vacation). Almost 75 per cent of the seasonal landowners indicated that their propery included a home or mobile home. Other uses listed by seasonal landowners included speculation and private recreation. Year round land owners listed very few "other uses", but 18 per cent of the rural town respondents listed farm operation, and 11 per cent of the Fleischmann respondents listed commercial/business/resort operation.

Most of those respondents who listed farming as the primary use of their land have owned their land for more than 20 years and are permanent residents. Because many of the farms in Middletown are operated by longtime residents of the community, farmland will either (1) be handed down through a family and remain in operation, (2) eventually be purchased by a developer and subdivided and sold into building sites since there are so few people buying farms, or (3) the viable cropland will be purchased by operating farms and the rest will be subdivided for sale.

Farmland is decreasing in Middletown. The change from agriculture to a recreation/second home characteristic is dependent on a series of economic factors which are difficult for local residents to control. However, as conversions of the land occur, it would be advisable for the town to be prepared to ensure that the land use changes proceed in a rational manner.

A total of 705 houses and mobile homes were listed by respondents. There were 626 houses and 79 mobile homes. Most of the houses, or 41 per cent, were constructed prior to 1939; although 28 per cent had been constructed later than 1970. Mobile homes are a more recent addition to the Middletown landscape. Only 5 per cent were listed as existing prior to 1960, while 67% were added to the community since 1970. Houses were identified as either for year-round occupancy or for seasonal use. Those identified by the respondents as for year-round use and occupancy were for the most part constructed before 1939 (53%). Houses used as a vacation or second home are newer; and, in fact, 70 per cent of those in our survey were constructed since 1960.

Finally, there is a strong indication that smaller land parcels are beginning to shape the community. This is reflected in the high number of residential parcels (88%) listed by respondents. Most of the survey respondents (79%) own less than 15 acres. This figure is 78 per cent and 80 per cent respectively for seasonal and permanent landowner responses. Looking more closely at the data, however, we find that permanent, rual-town landowners (those not residing in the two villages or hamlets) own a significant number of the larger parcels of land. Fully 26 per ce of the permanent, rural residents indicated that they owned more than 100 acres compared to only 5 per cent of the seasonal landowners. Future landowners in Middletown will continue the trend to purchase small, generally under 15 acres, building or recreational parcels.

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One thing is clear, the rural qualities of the town are valued by both those buying land today and those who have been settled in Middletown for many years. This atmosphere must be protected. It is difficult to determine whether the isolation, the wilderness atmostphere, the beautiful scenery or the recreational amenities are the "frosting on the cake" or the "essential ingredients" for the reasons why people choose to buy land in Middletown. For a community like Middletown, it is important to see that, as development occurs, the qualities which attracted people here in the first place are not damaged or forgotten.

Throughout the country, speculative land buyers are purchasing large tracts of farmland and other lands and quickly subdividing these lands into many smaller lots. As these subdivisions occur, it will be extremely important that local governments review the changes to make sure they are being conducted in a rational manner. Protecting the rural, small-town character of Middletown is a primary planning goal. It is up to the local people working together to make sure the future is a pleasant and prosperous reality and not something that might have been.

ATTITUDES TOWARD LAND USE ISSUES

As in many towns in Delaware County, landowners in Middletown felt that vacation homes have made no appreciable change in the scenery (43%). Seasonal landowners felt vacation homes improved the scenery (47%), while surprisingly 25 per cent of the year-round population felt they actually detracted from the scenery. On the other hand, 64 per cent of all respondents felt that the siting and placement of mobile homes in Middletown actually worsened the quality of the scenery. There appears to be consensus among the respondents that mobile homes are necessary and affordable dwelling units for many people. Their major concerns focused on the units' maintenance and landscaping.

The majority of respondents (58%) felt that mobile homes should be restricted to mobile home parks, although one-third of the respondents disagreed. Mobile home parks were least supported by permanent, rural-town respondents, where 40 per cent saw no need for the parks. Again, comments were most concerned with the appearance of mobile homes. Standards for siting and sewage seem more in tune with what the community wants than any measure that would require mobile homes to locate only in mobile home parks.

When asked whether the quality of Middletown's lakes and streams had deteriorated, in recent years, over 20 per cent of the respondents said 'yes'. Only 11 per cent of the respondents thought the quality of their drinking water had deteriorated, although 28 per cent of the respondents from the town's hamlets felt that it had. As more and more land is subdivided and homes with individual water supplies and sewage disposal systems are constructed, the quality of the water will become a more visible concern for all.

The need for employment, especially for local young people, was most evident with the respondents. A large majority (77%) felt the community should encourage more industrial development. Margaretville respondents overwhelmingly supported the issue that additional employment opportunities must become available (92%).

Reactions to the possibility of industry locating in this area were tempered with concerns about maintaining a wholesome environment. It is important that, if

industry is encouraged, it be located in areas or developed in a manner that would not cause any undue hardship on the environment or the community.

ATTITUDES TOWARD PLANNING AND PLANNING ISSUES

Responses toward land use regulations were more positive than one might expect. Zoning regulations were favored by 53 per cent, and subdivision regulations were favored by 52 per cent of the total number of respondents. Seasonal respondents were most supportive of these two land use controls, while permanent respondents were less supportive.

Comments for the most part were positive for the development of minimal land use controls. Minimum lot size suggestions ranged from one to five acres. Many comments listed reservations with zoning rules and regulations that may become too excessive for this rural environment, but most agreed Middletown needs to do something. Other comments listed building codes and sanitary codes as important measures to be considered by the community. Junkyard regulations were listed by many respondents as a high priority.

Regardless of the type of regulation deemed important, most respondents (88%) felt that any planning and regulating proposed for Middletown be developed at the local planning board level. As one respondent wrote, "I applaud your efforts to ...let local people control the value of their property. Now is the time to establish a common vision of the 'quality of life' in the area. A firm sense of purpose .... will avoid erratic development, overuse or detrimental density and speculative disaster in the community. The protection and retention of the beauties of this area for the benefit of future generations is in your hands."

Finally, respondents were asked what they felt was needed most in Middletown in the next ten years. Industry/employment were listed by 59 per cent of the respondents Additional recreational facilities were listed by 38 per cent of the respondents. Among the most popular requests here were an easing of use and access restrictions on the Pepacton Reservoir, a public swimming pool, youth center, and senior citizen center. Town road improvements and the need for zoning and other land use controls were listed by at least 25 per cent of the respondents. Town road improvement comments were mostly limited to the need for public improvement to private roads. This particular issue may become a major concern in years to come.

Seasonal respondents listed, in addition to the four mentioned above, the following items as high on their list: more stores/commercial establishments, community pride, mobile home/mobile home park controls, maintenance of the community's rural quality, tourism promotion, building/sanitary codes, protection from pollution of the land and waters, and fair taxing. Permanent year-round landowners, after the top four listed previously, felt a most urgent need for the following: junkyard controls, community pride, more stores and litter controls.

It certainly appears likely that Middletown will continue to grow in the next ten years. How will it grow; what will the town look like; and what will be the effects on the community's natural resources, government services, taxes and people? No one can accurately answer these questions today, but the town can be prepared for the future through surveys and meetings and further studies to determine what the community's present and future needs will be.

Growth is important to the economy of the area; new people and new jobs prevent the area from becoming stagnant. But it is equally important to insure that this growth does not detract from the quality of the area's environment and lifestyle. Only if new development is encouraged with careful thought and concern for the community will the future be promising.

This is the task that lies before the people of Middletown, to plan, encourage and guide growth with care, always keeping in mind the community qualities that its citizens deem important. The scenery, recreational attributes, and the small-town, rural atmosphere are all equally important.

With the opinions of all considered, it is advisable at this time to formulate a set of community guidelines and goals for future development. In doing so, landowners and citizens alike should be assured that those qualities they value most in the town will be protected.

TOWN OF MIDDLETOWN

LAND USE REPORT

INTRODUCTION

Recreational land development is a controversial subject. Attitudes toward it vary widely. Some people see it as an opportunity to stimulate rural economies and increase local tax revenues, while others view it as a threat to the environment, fearing irreparable damage will result as woodlands and farmlands are subdivided into recreational lots and second homes constructed. In Middletown nearly 1,000 housing units out of a total of 2,424, as counted by the 1980 Census, are classified as occasional use, vacant and seasonal. Tourism and the vacation home industry are big business.

It has not always been this way. The town's isolation, wilderness atmosphere and rugged terrain made life difficult for the early settlers. Eventually the valleys and hills were cleared for farming and lumbering industries. Arkville, Margaretville, Clovesville, Halcottsville, Kelly Corners, and several other hamlets, including Lumberville, were bustling with activity to serve the needs of the farmers and lumbermen. Today, farming is predominate only in the New Kingston Valley, and the lumber industry has less significance, while second homes, tourism and outdoor recreational activities, such as hunting and fishing, are now the lifeblood of the community.

In Middletown, the effects of recreational lot subdivisions and second homes is visible everywhere. Much of this development has been completed without regard to the possible impacts on neighboring properties and the community as a whole. Many of the vacation homes and mobile homes, once considered to be seasonal, are now occupied on a year-round basis; and, as a result, roads, water supplies, and sewage disposal systems have become inadequate.

Agricultural lands generally suffer most as development occurs because these areas are more level, better drained, and usually more accessible. In Middletown most new subdivisions have occurred on abandoned farmland and, as a result, have driven up the price of good agricultural land for everyone. The agricultural district in Middletown has shown the farmer that the community does regard

farming as an important asset and does wish to do all it can to prevent its disappearance.

New development in the form of more recreational land and second homes will continue at a rapid pace in Middletown. The recreational amenitites that the town has to offer, including hunting, fishing, skiing and just plain hiking or walking in the woods, will appeal to people for many years. If Middletown is to retain its appeal, the Town must begin to plan for and review all new recreational developments. Preserving the town's rural, isolation, and wilderness atmosphere has been identified by the landowners to be of primary importance.

When the Middletown Town Planning Board determined that a plan for the future was necessary, they found that they needed to acquire a solid data background upon which to base such a plan. The first step to acquire this background was a survey and analysis of Middletown's existing land use. Such a study not only showed the current uses of land in the town, but also indicated general trends in growth and development. The land use map and analysis examined the relationships of land usage in Middletown.

U.S. Census figures indicate that while Middletown's population grew by only 2.6 per cent from 1970 to 1980, the total number of housing units increased by 27.0 per cent. Mostly in the form of second homes and vacation homes, this trend is likely to continue well into the future. As a basic step toward intelligent planning for this expected growth, the Middletown Town Planning Board, in cooperation with the Delaware County Planning Board staff has undertaken this land use survey.

PURPOSE

The purpose of a land use study establishes some important aspects of community planning. Community planning consists of organizing better patterns and uses of land and natural resources for the future. In order to determine what land use patterns are needed for the future, the community must first determine the problems and effects of past land use patterns.

Another purpose of the land use study was to inventory the types and extent of land uses that have developed in the past. After measuring past land use patterns, ratios are established between land usage and population estimates to

determine future land use needs. Compatible land use relationships in the form of a land use plan can be developed by studying past land uses and future land use needs. Elimination of poor land use mixtures will help prevent depressing land values as well as providing for the creation of aesthetic amenities such as the conservation of forests, streams and water impoundments.

Public management and expenditures for the future will depend a great deal upon present use and relationships of land usage. Such services as police and fire protection, road maintenance and water and sewer services can be quite expensive if required to service sprawling and incompatibly mixed land uses.

The following report describes the characteristics of existing land uses in Middletown. A complete tabulation of all land uses has been made. The methodology of the land use survey follows.

LAND USE SURVEY METHODS

Prior to the survey itself, it was necessary to develop a land use classification system. A land use classification system developed by the Office of State Planning for a Land Use and Natural Resource Inventory (LUNR) of New York State was adopted in part for the town's use. The LUNR system identifies over 50 land uses. For the purpose of a land use inventory in Middletown, this was too complex. By combining several categories, the land use classifications were reduced to 10. They are: farmland, brushland, woodland, water, wetlands, residential, commercial, industrial, recreation, and public and semi-public. Utility and road rights-of-way are not shown on the map but are included in the summary of this report.

LUNR is available in map overlay form for the entire state of New York. However, the statewide land use interpretations did not fit the needs of this survey for two reasons: First, the land use interpretations were made in 1978 (more up-to-date data was needed); and second, the interpretations did not identify farmland as it occurs in Delaware County. Dairy and beef cattle farms in Middletown require large amounts of pastureland. LUNR interpreted most of this pastureland as non-farmland. Consequently, a more accurate interpretation of farmland was required.

Improving the LUNR interpretations required air photo interpretation by the Town Planning Advisory Service staff. While improvements were made on the classifications of farmland and brushland, it was, at the same time, possible to update the changes in land use that had occurred from 1972 to 1982. Location of all working farms on the town base map made possible an accurate interpretation of pastureland - both permanent pasture and summertime grazing areas. Areas where grazing animals are trucked to pasture were identified if possible.

The use of large-scale (1" = 400') air photography allowed the Planning Board the opportunity to update and improve on the LUNR interpretation. This required (1) a knowledge of working farms, (2) field trips with and without the Planning Board, and (3) an understanding between the Planning Board and the land use interpreter on the exact criteria used for assigning land use classifications.

After the map was completed the task of measuring each parcel of land began. Using a special instrument called a planimeter, the process was completed quickly and accurately. The planimeter is a device that, when drawn around the edges of each parcel, will calculate the area within the parcel. After all land use parcels were measured, the results were tabulated, and a summary of the amount of each land use in the town was produced.

DEFINITIONS OF LAND USE CATEGORIES

Before each category can be defined a number of limitations related to the scale of the map must be listed. First, it is not possible to identify all parcels of land. A minimum of four acres has been selected for identification on the map, although there are some exceptions listed in the definitions. Second, boundary-lines between each category have been generalized; the map represents the town as a whole and is not specific to each area. Third, power lines are visible but are not placed in a separate category, and this is true with roads and any railroad rights-of-way in the town.

Farmland

All lands that relate directly to agricultural productivity are shown. Cropland, meadowland, pastureland, summertime grazing lands and farm headquarters are mapped in this category. In many cases brush and small trees will occur as will inactive or abandoned farmland in this category. However, the general character of the land remains agriculture.

Brushland

All lands recently removed from agriculture but not yet committed to woodland. Areas with no physical or visible indicators of present agricultural use represent one end of the spectrum. After several years of inactivity, brush will appear and, unless clipping practices are carried out, small trees will begin in another few years. Grazing is often present at this time, and it is difficult to identify such areas without supplemental information. The other end of the spectrum is the point at which small trees consistently outnumber the brush and when the trees reach a point where their crown cover is more than 50% of the area. It is often difficult to consistently identify an accurate boundary between brushland and woodland. Most of the lands in this category will, in a few years, be committed to woodland.

Woodland

Woodland ranges from mature forests and mature plantations at one end to heavy brush with small trees at the other. When young saplings consistently outnumber the brush and other small bushes and when the trees have a crown cover of more

village roads are mapped. Commercial resorts, which range in size from converted farmhouses to luxury resort hotels with attached outdoor recreational activities, are shown. Full-sized outdoor recreation facilities are not included here but can be found in the recreation category.

Industrial

Areas devoted to product manufacturing and research, including storage, shipping and warehousing. Also found here is heavy manufacturing such as lumber mills, dairy processing and chemical plants. Various types of surface mining operations such as stone quarries and sand and gravel pits are mapped in this category.

Outdoor Recreation

While extensive areas of private and public lands are used for outdoor recreation, including hunting, fishing, hiking, etc, this category includes activities for which specific areas have been developed and which constitute the predominant use of land. These areas include golf courses and ski areas (including adjacent county clubs or lodge-like facilities) developed beaches, public swimming pools, campgrounds, fair grounds, public parks, shooting ranges, and other private or community recreation facilities, tennis courts, baseball diamonds, etc. and their related parking facilities.

Public and Semi-Public

All municipal buildings, education institutions, religious institutions, health institutions, military facilities, solid waste disposal areas, open dumps, sanitary landfills, cemeteries, water supply treatment facilities, power generating stations, correctional institutions, road equipment centers, welfare centers and county homes.

Roads

The total area in roads is computed by multiplying total miles by a common road right-of-way width. For town roads the right-of-way is 50 feet, for county roads and state highways, the right-of-way width is 60 feet.

than 50%, the area is classified woodland. Young plantations usually less than five years old are not visible on air photos and will at this time be classified as brushland.

Water

Natural and artificial ponds, lakes, and reservoirs greater than four acres are identified. Streams and rivers whose segments average more than 50 feet in width are mapped as areas. Water bodies that are part of other uses, water or sewage treatment plants, industrial uses, and those that occur within extractive areas are not included. Small farm ponds are not included if they are less than four acres.

Wetlands

For the most part wetlands are confined to relatively level lands. However, some may be found on slopes due to rock structure or underlying clay hardpan. In either case, wetlands may have varying water levels and are not just swamps. Shrub wetlands range from waterlogged areas with no standing water to areas with a maximum of three feet of water and vegetation predominately of shrub size or smaller. Wooded wetlands are covered with varying depths of water for much of the year, with vegetation mainly of trees.

Residential

Residential areas are based on housing density. Single residences are not mapped as areas. As housing density increases, or a street or subdivision pattern occurs, lot size, measured in lot frontage, becomes the key factor. Villages and hamlets are classified residential where the character of the neighborhood is residential. Residential strip development is shown where four or more residences occur within a 1,000 foot highway frontage. Second home or vacation home developments are mapped as residential. Apartment buildings, condominiums and mobile homes, if they meet the above requirements, and mobile home parks, where three or more trailers are parked, are mapped residential.

Commercial

Areas predominately connected with the sale of products and services. Central business sections of villages down to single commercial activities along town or

State Land Use Classifications

FOREST PRESERVE

Constitutional amendment in the 1880's authorized these areas as forever wild lands. No timber can be cut although the area is open to the public for recreational purposes. These lands are situated within the Adirondack and Catskill Parks.

REFORESTATION AREAS / MULTIPLE USE FOREST

These lands are devoted to reforestation, wildlife, and recreation. The cutting of timber is permitted. The Reforestation areas were added when in 1929 the state legislature authorized the acquisition of up to an additional 1,000,000 acres outside the Adirondack and Catskill Park. The Multiple Use Forest Lands were acquired after 1960 to add to the Reforestation areas.

WILDLIFE MANAGEMENT

Authorized by the Conservation Law, the lands were formerly federally owned. They are open to the public for recreation and are devoted to preserving wildlife habitat.

LAND USE ANALYSIS

The town of Middletown is basically rural in nature. Extensive agricultural areas exist in the New Kingston Valley, while isolated family farms are still found along many other town roads north and east of State Route 28. Forestland predominates within the "blueline" of the Catskill Park as the State of New York owns much of this land. The main traffic corridor in Middletown is along State highways number 28 and 30; and it is along here that many of the business and retail establishments serving the general population and seasonal crowd are located. Land uses by category and acreage are presented in Table I and Figure I. The uses of land are summarized below.

Woodland

The town of Middletown has over 42,600 acres of woodland which covers 68 per cent of the town's total area. An isolated wilderness when first settled, all of the forestland that we see today is second and third growth. The land was originally cleared to accomodate farming and for raw materials for the early lumber industries.

The past 50 years have seen a steady increase in the number of acres of woodland, a trend expected to continue. A decline in dairy farming and other agricultural activities has left marginal cropland and pastureland to grow into brush. In time the natural progression of the land converts to woodland. Second home construction and farm improvements to clear more land for pasture and crops has not kept pace with forest regrowth. As a result, woodland will continue to close in on abandoned open lands.

The State of New York owns 6,689.3 acres in 54 parcels of forest preserve in Middletown. Most of this land is forested and most is located within the "blueline" of the Catskill Park. This land along with many other large tracts of private forest provide many acres of land for hunting and hiking. Proper management of this important resource in Middletown is essential. A recent landowner survey indicates that the scenic vistas of the wooded hills and the abundance of wildlife in the forest was one of several reasons for buying land in Middletown.

Brushland

When agriculture is no longer profitable and the land has been left alone for several years, brush gradually appears. This type of land cover amounts to a little over 16 per cent of the town total area, or about 10,100 acres. It is found predominately in areas where working farms once existed. In Middletown significant areas of brushland are found along almost every road and in particular along Mill Brook, Huckleberry Brook, Hubble Hill, Batavia Kill, Route 30 toward Roxbury and the Little Red Kill. Land in this category is also found on the upper slopes of valleys still actively engaged in agricultural activities.

Residential

The villages of Margaretville and Fleischmanns and the hamlets of New Kingston, Halcottsville, Kelly Corners and Arkville account for most of the 771 acres classified as residential. Seemingly a low figure for a highly visible use of land, the number of acres do not take into account any land associated with scattered individual housing so prevalent in the town. When rural residences are clustered close together around a lake, along a rural highway or in a recreational subdivision, then the area is classified residential. In Middletown residential clusters appear in Bellayre Village, along various parts of Routes 28 and 30 and along Dry Brook Road.

Scattered rural housing is increasing in many areas of Middletown. Recreational lot subdivisions along the Red Kill, on Hubbel Hill, up Bragg Hollow, on Dimmick Mountain and in Thompson Hollow and Winter Hollow originally intended as second home areas now find many of these dwellings being converted to year-round living units. The development of rural land is continuing at an alarming rate. Although new development is always welcome, care must be taken when designing the new subdivision to avoid water supply and sewage disposal problems and to insure adequate road layout construction and maintenance.

Commercial

Commercial uses of land in Middletown amount to 173 acres, or about 0.3 per cent of the total area. The central business districts in Margaretville and Fleischmanns and in Arkville account for most of the acres. Scattered commercial establishments are also found along state Routes 28 and 30.

Industrial

A lumber industry, the old landfill, a junkyard and several gravel pits account for most of the 88 acres classified industrial.

Recreation

Developed outdoor recreational areas account for 374 acres, or about 0.6 per cent of Middletown's total area. The Kass Inn Golf Course, Herrick Park, Margaretville Central School grounds, the golf driving range, Fleischmanns ball fields, the Delaware and Ulster Railroad site in Arkville and the grounds surrounding several resorts account for this acreage. The figure does not consider the thousands of acres available on private lands where hunting and hiking are permitted, nor does it include the 664 acres of New York City Reservoir property or the 6,700 acres of New York Forest Preserve located in the Catskill Park. Hunting, hiking, fishing, and sightseeing are popular forms of recreation that area well suited to the town's hilly and wilderness terrain.

Public/Semi-Public

Churches, cemeteries, firehouses, post offices, school buildings, town and village lands and structures cover about 86 acres, or about 0.1 per cent of the total area of the town.

Farmland

Nearly 7,000 acres, or about 10.9 per cent of Middletown's total land area, is still used for agricultural purposes. Most of this land is found north and east of Route 28 and is more heavily concentrated in the New Kingston Valley. Agricultural District No. 3 encompasses most of Middletown's remaining farms and serves notice to all that this use of land is still valued and important to the community.

Although lands devoted to crops and pasture have declined greatly from 50 years past, the present volume of milk and crops produced remains a large part of the local economy. Economic conditions resulting from new or present government programs and land speculation may have an effect on the farm community in the next few years.

In Middletown, when farmland is abandoned, it does not sit empty for long. Usually the farm is sold intact by the farmer to a land developer who then divides the farm into recreational lots of between five and 10 acres. The lots are usually purchased by people from the New York City metropolitan area seeking a rural escape to their hectic lifestyles. Vacation homes soon begin to appear across former pasture and cropland. This scenario is common in Delaware County and in particular Middletown where nearly a dozen of these types of land conversion schemes are found. Maintaining the very ideals - rural character, rugged terrain, cleared fields, forested hills, isolation wilderness atmosphere - that appealed to the many people who have purchased property in Middletown is an important goal that must be pursued.

Water

The total area of the town covered by water is about 641 acres or roughly 1.0 per cent of the total area. The estimate is calculated by measuring the surface waters of several lakes and ponds, including Wawaka Lake, Lake Switzerland, the Pepacton Reservoir and several other smaller unnamed ponds. The East Branch of the Delaware River is also included in the total by measuring the amount of surface water found in a five and one-half mile stretch from the Pepacton Reservoir to where Dry Brook empties into the river. The figure is not reflective of the area of surface waters found in the many smaller streams and tributaries that flow in the town.

The protection of the town's water bodies, rivers, streams, and groundwater is becoming more important every day. Seasonal and year-round housing has occurred in great numbers in every watershed in Middletown in recent years. The New York City Bureau of Water Resources owns land around the Pepacton Reservoir area which supplies drinking water to New York City. Sanitary inspectors from the City actually patrol the entire watershed, which includes all of Middletown, to monitor and inspect the installation of all new septic systems. Continued efforts will be necessary to monitor new construction and new and defective septic systems to insure that no contamination of the community's water resources will occur.

Wetlands

Mapped wetlands account for only 38 acres, or less than 0.1 per cent of Middletown's total area. Wetlands play a vital role in providing flood and storm protection, pollution control, and a habitat for wildlife and water fowl. A New York State Freshwater Wetland Act provides protection to wetlands greater than 12.8 acres from encroachment of buildings.

Roads

Town, County and State highways and their rights-of-way cover nearly 1,000 acres, or 1.6 per cent of Middletown's land area. There are 23 miles of State road, 14 miles of County highway, and 114 miles of town road. Many additional miles of private roads and jeep trails are also found in Middletown.

Miscellaneous

About 14 miles of transmission lines bisect the town in an east-west direction. The New York City Department of Water Resources owns 664.2 acres in four parcels, and New York State Department of Environmental Conservation owns 6,689.3 acres in 54 parcels of Forest Preserve. New York City's land surrounds Pepacton Reservoir while most of New York State's land is found within the Catskill Park.

SUMMARY

Although Middletown is primarily wooded and agricultural in nature, the development of the community into a resort and second home atmosphere has been successful. The villages of Margaretville and Fleischmanns and the hamlet of Arkville generally reflect the hustle and bustle normally found in small resort areas. The people are attracted to this area by the ski areas, the Catskill Park, Kass Inn, the Pepacton Reservoir, the newly opened train excursion and generally to the peace and quiet tranquility they can enjoy in their rural homes. The scenery, the isolation-wilderness atmosphere and friendliness of the local people will continue to attract the seasonal visitor.

The farm community remains strong throughout the town but must remain alert to survive in today's economy. The land market will place additional burdens on the farmers' struggle to survive. The stark differences between cleared fields and pastureland and woodlands appeal to many people. Farmers and farmland must be preserved for Middletown to retain its attractive atmosphere.

To insure that this way of life and character is maintained, the Middletown Town Planning Board, by working on the report, has completed an important step toward the development of a townwide plan.

TABLE I.

MIDDLETOWN LAND USE

	Acres	% of Total
FARMLAND	6,862	10.9 %
BRUSHLAND	10,086	16.1
WOODLAND	42,613	67.9
WATER	641	1.0
WETLANDS	38	0.1
RESIDENTIAL	771	1.2
COMMERCIAL	173	0.3
INDUSTRIAL	88	0.1
RECREATION	374	0.6
PUBLIC / SEMI-PUBLIC	86	0.1
ROADS	988	1.6
TOTAL	62,720 acres*	100.0 %

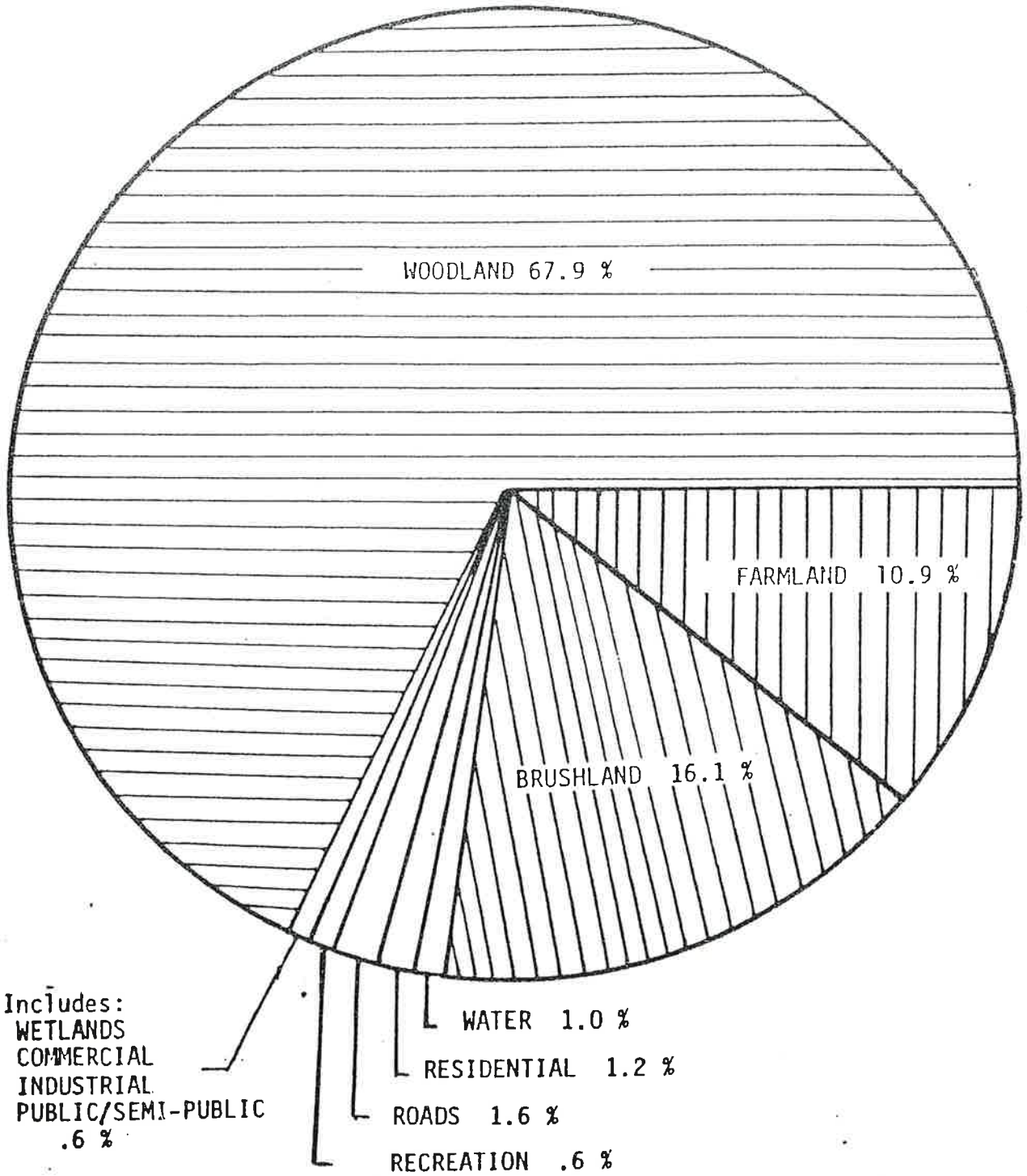
New York City owned lands . . . . . 664.2 acres - 4 parcels
New York State owned lands . . . . . 6,689.3 acres - 54 parcels
Transmission lines . . . . . 14 miles

Middletown Total Area - 98 square miles

Source: Delaware County Planning Board, Town Planning Advisory Service, December 1982.

FIGURE I.

MIDDLETOWN LAND USE



Source: Delaware County Planning Board, Town Planning Advisory Service December 1982

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MIDDLETOWN TOWN OFFICIALS

MIDDLETOWN TOWN PLANNING BOARD

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PROLOGUE

Changing landscapes have been a part of everyday life in the Catskills for many years. When settlers first came to this area, they had their choice of land on which to settle. Land was plentiful, and people were scarce.

The region, once covered by extensive stands of hemlock, experienced change in the late 1700's as farms began to appear. The tanning industry, reaching its peak in the late 1800's, exploited the forests and left the area's hemlock stands devastated. Other lumbering industries moved in. Clear cutting of hardwoods for use in the acid industry continued into the 1930's resulting in large forest areas being denuded.

As these events were taking place, land was also being cleared for agriculture which was slowly evolving into the area's most important industry. Flood plains, steep hillsides, mountain tops, and rocky lands were all being cleared for farming purposes. Gradually many of the smaller and more marginal farms were abandoned. Land that was once in agricultural production was left untended for many years. The result being that the region, once stripped of most of its forest resources, has seen much of it return in the form of mature second or third growth forests.

Today, many of the scars left behind by groups of people who cared little for the future of the Catskills have all but disappeared. Agriculture has emerged as a primary industry. Manufacturing and industrial sites have also been added to the landscape in many towns and villages. Because of the present attraction of the region, with its cleared fields, forested areas, and genuine small-town character, other more serious types of land use conflicts may begin to appear.

The nearness of many large and growing population centers in the United States Northeast, combined with increased affluence, leisure time, and improved highways, has opened the area to increased land use pressures. Coupled with a decrease in farm acreage, a great deal of land has been released for use as recreation and vacation home development. The division of farms into numerous lots of less than 10 acres, many with second homes, has created new pressures for local governments.

Small rural roads, that once served farms years ago and have since been abandoned, are now being required for access to many new homes. With the introduction of cottages, mobile homes, trailers, and old busses as vacation homes, the appearance of the area is again

being altered. As more and more vacation homes are built, the resulting demand for services, such as road maintenance, snow removal, fire protection, police protection and ambulance services may go beyond the current capabilities of local government.

Protecting the rural, small-town character of the community is a primary planning goal. An individual landowner's decision to alter the use of this land by selling subdivided lots to prospective home builders or to a land speculator/developer is based on many factors. In most cases the decision to change the land use is made only after careful consideration has been given to the effects that the change will have on the environment and community. Sometimes land use decisions are not made in the best interest of the community and are not compatible with the environment. These types of land use decisions may lead to increases in town taxes, a decline in agricultural activity, substandard housing, deterioration of the countryside scenery and generally contribute to haphazard and inefficient uses of the land.

Change is inevitable. The town does not exist in a vacuum apart from the rest of the world. It is up to local people working together to make sure the future is a pleasant and properous reality and not something that might have been.

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INTRODUCTION

Why plan? What is planning? What kind of planning is best for the Town of Middletown? The Middletown Town Planning Board has heard these questions many times. The answers are not simple.

Whether we realize it or not, governmental planning is all around us. Many aspects of our day-to-day lives are being planned or perhaps programmed. In our complex social structure, this is necessary and even desirable if we are to preserve our resources and assets and avoid ever greater chaos in the future. The real question we should be asking ourselves, then, is not whether planning is being done, but whether we are a part of it and are sure that it is the most desirable and the best planning that can be done.

Within Middletown, planning can establish logical patterns of land use which are based upon the needs and desires of the community. Attractive, carefully developed, orderly communities have inherently sound economic foundations. When we permit haphazard, disorganized and unattractive development, we allow the destruction of the very essense of sound community life. In effect, we require those people who take pride in their property to subsidize the exploitation of their community by the few entrepreneurs whose sole interest is in securing a maximum profit from real estate development.

In April of 1976, the Delaware County Planning Board approved contracts with eight area towns (Andes, Bovina, Davenport, Delhi, Franklin, Meredith, Roxbury, and Stamford) who helped to establish and later support the Town Planning Advisory Service (TPAS) program. The TPAS program would provide ongoing technical planning assistance to local planning boards in member towns. Since its formation, the TPAS program has gradually gained new towns and villages into the planning service, including the towns of Hamden, Hancock, Harpersfield, Kortright, and Middletown, and the villages of Hobart, Hancock, and Stamford.

There are many reasons why the Middletown Town Board chose to participate in this planning program. Individual planning, as it had existed in Middletown from its early settlement, could no longer protect and preserve the very qualities that the citizens of the town had come to expect. Listed below are other considerations that indicate the need for planning in Middletown.

- *Since 1950 the number of land parcels under 10 acres has more than tripled. This trend is likely to continue as more and more people seek rural living areas.*

- *Land ownership in Middletown has changed considerably in the past 34 years. In 1950, 5 per cent of land parcels in the town were owned by nonresidents. By 1984 nearly 60 per cent of Middletown landowners were nonresidents; i.e., seasonal residents.*

- *The number of residential units in Middletown has increased from 1,216 in 1950 to 2,424 in 1980. Although the construction of new homes is not always obvious from day to day, their cumulative impact will be substantial.*

- *Planning and building, until recently, were done primarily by local people who were familiar with soil and water conditions in Middletown. Today, much of the building is done by individuals who have purchased property for a second home. Many seek advice on local conditions, but a few do not and ultimately can cause problems with building foundations and water and septic systems.*

- *"Let's keep Middletown the way it is." This comment has been heard many times. Individual planning will not maintain the rural, open and small town character that is the town of Middletown. Thoughtful planning and careful consideration of the environment can insure that new development will not be a burden to the community and will not cause irreversible damage to the land.*

- *Being against big government is very popular, but very few towns have presented viable alternatives for protecting their resources. Middletown people feel that whatever planning and regulating is done should be done by the local government. As the people of Middletown begin to take an active role in the planning process, the town will be better able to make reasonable choices for the future of the area and to do so locally.*

This document is the result of two years of monthly work sessions between the Town Planning Advisory Service and the Middletown Town Planning Board. The preparation of the Comprehensive Plan is but one step in the continuing planning process. The translation of community needs and objectives into a physical plan requires an understanding of the interdependence of all community activities. The values of the past must be related to the needs of the present and future. The plan must be flexible so that proposed solutions may be modified as local needs and objectives change.

The plan which is presented here is based on an inventory of natural resources and a review of man's current impact on the land. The capability of the land to withstand various uses is a major factor in determining how to direct change and protect resources. Other factors which affect health, safety, prosperity and welfare of local residents have also been considered, such as economy, recreational opportunities, historical assets, population trends, transportation patterns, and local government services.

THE VALUES OF THE PAST MUST BE RELATED TO THE NEEDS OF THE PRESENT AND FUTURE

THE PLANNING PROCESS

What is Community Planning?

A comprehensive planning program is a method used by communities to guide development in a rational manner, keeping in mind the values and desires of the local citizens. In order to preserve the scenic, small town qualities considered desirable by a community, it is necessary to manage growth through the utilization of a town development plan. One of the main duties of the local planning board is to prepare and assist in the implementation of such a plan.

A planning program consists of four basic stages:

1. *Statement of goals and objectives*
2. *Basic mapping and data gathering*
3. *Plan preparation*
4. *Plan implementation*

FORMULATE GOALS

The first stage in a planning program is the formation of a general statement of community goals and objectives. By such a statement, a planning agency expresses the values and goals that residents of the town hold in regard to future development of that town. This statement forms a basis for the formation of the Comprehensive Plan.

GATHER BACKGROUND DATA

Before any plans can be made, it is necessary to examine and analyze local data (economic, population, land use, mapping, etc.) in order to reveal the needs and problems of the community. Since a plan is only as accurate as the data and research upon which it is based, it is necessary to gather sound information. The research, mapping and analysis are needed in order to evaluate the community's present environment and its potential for growth and economic development.

PREPARE COMMUNITY PLAN

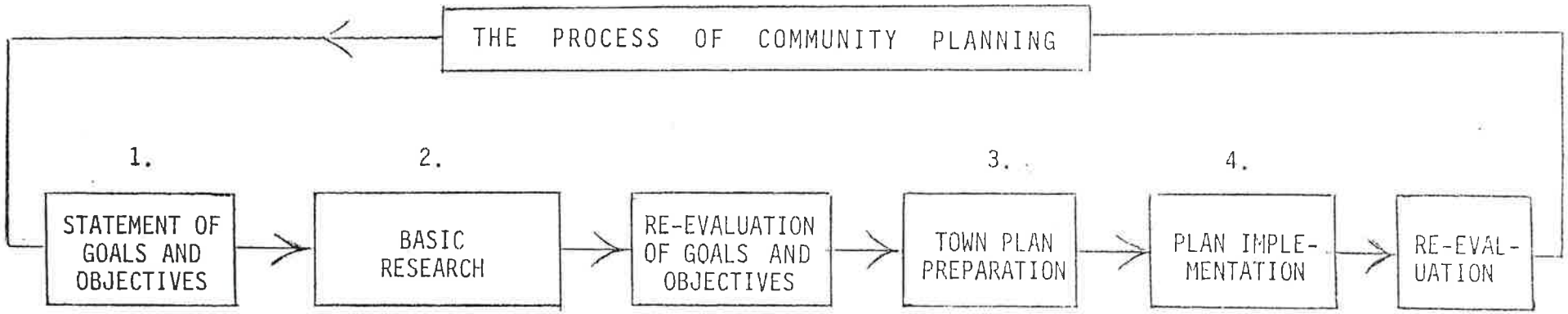
Once the goals and objectives have been stated and research accomplished, a development plan can be prepared for the community. Such plan is an attempt to show how the goals and policies of the community may be realized in the next 10 to 20 years. The plan synthesizes the available information, and organizes it in such a way as to suggest solutions to present and future needs. A comprehensive plan may include a land use plan, a transportation plan, a natural resource plan, a community facilities plan, or any combination of these. To be effective, the plan must be carried out continuously by a community - not sometime twenty years into the future.

PLAN IMPLEMENTATION

The success of a plan depends upon the way it is implemented by the community. A development plan is put into operation in several ways. One way is to require minimum standards for development, such as building codes, subdivision regulations or land use codes. Another way might be to utilize a capital improvement program which would provide a guide for scheduling projects to be undertaken in the coming years.

Public understanding of the development plan and the means for carrying it out are an important part of the planning process. Emphasis must be placed on involving local leaders (residents, governing bodies, school boards, county boards of supervisors, etc.) in the development of the plan so that they may understand and support its proposals.

The chart on the next page outlines the four steps of the planning process and lists some of the work elements which are undertaken within each step of the local planning program.



PLANNING BOARD WORK ELEMENTS

1.	2.	3.	4.	
. public meetings . citizen participation . questionnaires/ surveys	. mapping . current physical characteristics -flood hazard areas -wetland/water bodies -drainage characteristics -steep slope areas -elevation -fire districts -school districts -agricultural districts -State lands -general soils -historic resources . land use analysis . population/ economic data . cultural resource survey	. public meetings . citizen input	. land use plan . transportation . public facilities . recreation . water/sewer studies . historic preservation plan	. land use regulations -zoning -subdivision regulations -building code -junkyard regulations -official map -capital improvement program

GOALS AND OBJECTIVES

The formulation of goals and objectives is an important part of the planning process. Along with the investigation of physical, social and economic elements, the goals of the community provide further directions for change. The end result is a comprehensive plan which can be implemented through a variety of administrative legal programs. As values and circumstances change, so do community goals. Thus, goal forming, planning and town action are a continuing process, adapting to changing needs and aspirations.

The plan for the community must reflect the needs and desires of the citizens and landowners. Hence, early in the planning process the Town Planning Board sought direction from the people through a planning questionnaire (See Appendix A) and through informational meetings. This section sets forth the community goals and the means or ways to achieve them. A goal may be distinguished from an objective by considering an objective as one of the short-term steps toward achieving the goal.

BY SETTING GOALS AND WORKING TOWARD THEM - COMMUNITIES CAN PLAN FOR THEIR FUTURE

GOAL	OBJECTIVES	MEANS OF ACHIEVEMENT
Maintain and Protect the Town's Natural Resources	1. Monitor and maintain air, water and forest quality 2. Understand the impact of man's activity on our natural resources 3. Promote an understanding of the importance of the town's natural resources through a citizen awareness program 4. Encourage the proper design and management of recreation activities	1. Enforce existing regulations 2. Natural Resource Plan 3. Open space and Recreation Plan 4. Educational programs on environmental topics
Forest resources are important to the economy of the town. They provide for the conservation of soils, watersheds, scenic beauty, recreation and wildlife habitats, and are a principal recreation resource in the town. Water resources, including streams, lakes and wetlands, impact all of the community. Watershed management is essential to maintaining the area's natural environment.		
Preserve and Enhance the Small-town, Rural Quality	1. Direct development into and around existing hamlets and villages and away from those portions of the town where significant physical limitations to growth exist. 2. Encourage support of local civic organizations 3. Develop means of expressing local concerns	1. Public meetings and communications with other groups 2. Provide aid in securing sources of funding for community projects 3. Land Use Plan 4. Implementation of a Land Use Code
Development, particularly residential use, will put less strain on needed services if it occurs at planned locations rather than haphazardly throughout the area. The Margaretville-Arkville Revitalization Committee has made great strides towards preserving and enhancing the character of the Margaretville-Arkville area.		

GOAL	OBJECTIVES	MEANS OF ACHIEVEMENT
Identify and Maintain High Quality Agricultural Lands for Agricultural Use	1. Protect good farm lands from undesirable development pressures 2. Encourage land uses which lend support to the agricultural industry 3. Monitor and maintain the quality of the natural environment	1. Support agricultural districts 2. Rural Development Plan 3. Land Use Code

Agriculture is of primary importance to the town's economy. Farming also maintains land in open space which is essential to preserving the rural character of the community.

Conflicts occur because lands favorable for farming are often ideal for other types of development. By identifying valuable agricultural lands and providing protection from competing uses, the community through its actions will encourage agricultural uses.

Preserve Cultural Heritage	1. Encourage reuse of older buildings 2. Preservation of historic sites 3. Develop local awareness	1. Historic preservation inventory and plan 2. Acquire available grants assistance for preservation work 3. Tours and public education

GOAL	OBJECTIVES	MEANS OF ACHIEVEMENT
Maintain and Improve Local Housing Quality and Site Quality	1. Encourage development in areas best suited for town services and with physical suitability 2. Assure safety and health of community residents 3. Encourage improvements/upkeep of existing units 4. Provide housing for all income levels	1. Building Code 2. Subdivision Code 3. Land Use Plan 4. Provide information on available assistance grants
Encourage Local Employment Opportunities	1. Encourage light industry 2. Maintain a healthy agricultural sector 3. Strengthen area resources a. Recreation b. Clean air/water c. Open space d. Transportation network e. Community services	1. Business expansion incentives 2. Economic Development Plan 3. Good local services to attract industry 4. Capital Improvement Program

The M*ARK Board has developed programs and strategies to assist in the implementation of both goals listed above.

GOAL	OBJECTIVES	MEANS OF ACHIEVEMENT
Provide Necessary Community Facilities and Services	1. Good educational facilities 2. Decide on present and future needs 3. Encourage volunteer efforts 4. Consider all age and income groups 5. Provide public utilities when feasible and require (water, sewer, solid waste) 6. Proper highway maintenance 7. Require new road development to be constructed using town standards	1. Highway improvement and maintenance plan 2. Abandonment procedures for unused roads 3. Subdivision Regulation 4. Capital Improvement Plan

Road maintenance cost is a major budget item in rural communities and must be kept at an affordable level. Development along previously unimproved or nonmaintained roads will cause unrealistic financial strain on the community.

COMMUNITY RESOURCE INVENTORY / MAPPING

Before any plans can be made, it is necessary to examine and analyze local data (economic, population, land use, mapping, etc.) in order to reveal the needs and problems of the community. Since a plan is only as accurate as the data and research upon which it is based, it is necessary to base the statement of goals and objectives on sound information. It is also important to know how the land is being used now in order for a community to decide how it should be used in the future. Therefore, it is important to develop a set of maps that show existing uses of the land and, also, any existing deficiencies of the land.

NATURAL RESOURCE INVENTORY

OVERVIEW

A major component in developing the comprehensive plan was the inventory of the community's natural resources. The resources represent the various environment systems which, through time, may be affected by human activities. Because of the sensitive natural balance of many of these environmental systems, it is important that the planning process carefully analyze each system and consider what levels of human development should be permitted within each one.

The following pages define the components of the natural resource inventory. An explanation of their importance to the community and how this importance is treated in the planning process is also described. The list below shows the data that was gathered for the town in order to provide a rational basis for the plan.

- *topographic considerations*
- *water resource considerations*
- *soil considerations*
- *forest considerations*

STEEP SLOPES, FLOOD AREAS, SOIL TYPES & FOREST LANDS are LIMITS TO THE WAY LAND CAN AND SHOULD BE USED

TOPOGRAPHIC CONSIDERATIONS

Steep Slope

Comprehensive slope information is an essential element in the planning process. Relating land use to topography can help to minimize damage to the environment and to avoid extensive site alterations.

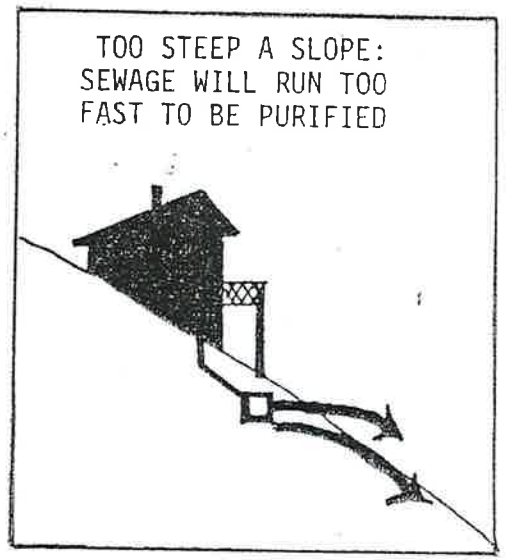
As one measure of topography, slope indicates the percentage incline of the land. A vertical cliff has a slope of 100 per cent, while a flood plain has a slope close to zero. Areas of slight slope usually present the fewest limitations to development and can be developed with few engineering problems or damage to the environment. Steep slopes can mean high construction costs, unstable soil, and sewage disposal problems. Moderate slopes may be developed but to do so often requires tampering with the landscape and relatively high costs.

The findings of a steep slope analysis should be reflected in the intensity limitations and the types of uses permitted in various parts of the town. By avoiding development on inappropriately sloped areas, a community can be assured of minimizing the adverse affects of development on soil stability, water quality, and other natural resources.

A steep slope map has been prepared of Middletown that identifies those areas with a slope of 15 per cent or greater. Generally these areas are too rugged and otherwise poorly suited to accommodate development of a substantial nature. Three of the most common difficulties associated with slopes of 15 per cent or more are:

1. *Sewage disposal - soils on steep slopes are often very shallow, making it impractical to install on-site disposal systems.*
2. *Drainage - the removal of trees and the erection of buildings will increase runoff.*
3. *Street layout - changes in elevation make proper grades, alignments and safe intersections very difficult.*

NOT BUILDING ON A STEEP SLOPE WILL MINIMIZE DAMAGE TO THE ENVIRONMENT



See STEEP SLOPE MAP next page

Generally, steep slopes are wooded, and this asset should be protected. Wooded slopes are not only a protection against erosion, flooding and drainage problems, but also are an addition to the scenic value of the countryside.

Elevation and Contours

see elevation map next page

In Middletown, the range of elevation is just over 1,240 feet above mean sea level and is found underneath the Pepacton Reservoir in the original channel of the East Delaware River as it crosses into the Town of Andes. The highest point in Middletown is located among Dry Brook Ridge in the southern section of the town just above Huckleberry Brook Road and is about 3,460 feet above mean sea level.

The East Branch of the Delaware River divides the Town nearly in half. South of the River the Middletown landscape is one of narrow stream valleys and steep hillsides. Ridges and peaks in this area regularly reach 2,800 feet, and several areas rise to more than 3,000 feet. The land found north of the East Branch is much less severe with regard to topography. Slopes are more gentle; and, although there are several points in excess of 3,000 feet, the character of the area is more suited for agriculture and residential settlement.

ELEVATION IS AN IMPORTANT PART OF LOCAL WEATHER CONDITIONS

Local Weather Variations

Climate and local weather patterns play an important role in the lives of the people in Middletown. The variations in certain aspects of the climate can create limitations to the types of uses possible for a piece of land. Local weather variations in the town are primarily related to elevation. The higher an air mass rises; the cooler it becomes; and the amount

SNOW REMAINS LONGER ON NORTH SLOPES AND THE GROWING SEASON IS SHORTER

of moisture it can hold decreases. Depending on the season, a rise of 300 to 400 feet represents a drop of 1 degree Fahrenheit. Differences in temperature and precipitation found locally can be explained by difference in elevation.

One of the most obvious local weather variations in the community is related to slope. Slopes facing to the north have a lower level of insolation than do slopes facing to the south. Snow will remain longer in the spring, vegetation and crop growth will be slower and have a shorter season, and heating requirements for homes will be greater on north facing slopes. On the other hand, slopes facing southward are the first to have the snow melt and to have vegetation growth begin. Agricultural crops have a greater chance of maturing without frost damage in the fall; the extra heat from the sun also reduces heating requirements for homes.

THE EXTRA HEAT (on south facing slopes) HELPS REDUCE HOME HEATING REQUIREMENTS

Winds can have both positive and negative effects on local weather patterns. In summer, winds tend to have a cooling effect on warm slopes, but in winter they can cause drifting snow and an increase in heat loss from buildings. During the summer months, the prevailing winds are generally from the south and southwest; thus these slopes have an advantage during hot weather. In the winter the prevailing winds are from the northwest; south and southeast facing slopes have the advantage as they are in a wind shadow and are protected from cold winds and storms.

SOUTH SLOPES ALSO PROVIDE SHELTER FROM THE NORTHERLY WINTER WINDS

Because vegetation type, rock surface exposure, and soil type, in addition to slope, winds, and elevation, affect the local weather patterns, only a generalized statement can be made of the relationship of local weather variation and building. In order to indicate where the greatest limitations are in the town, a map has been prepared showing north facing slopes and elevation. Although no part of the town is considered unsuitable for human use and habitation, it does indicate those areas which may be less desirable than others for various types of development.

WATER CONSIDERATIONS

Planning requires a complete inventory of water resources. This involves the mapping of lakes, ponds, rivers, streams, drainage patterns, areas subject to flooding, and wetlands.

see water resources map next page

Drainage Characterisitics

The East Branch of the Delaware River provides the drainage for all but a few acres of land in the Town of Middletown. Many tributaries drain into the East Branch and are identified here as secondary yet important watersheds. Mill Brook, Dry Brook and the Plattekill provide drainage for extensive areas of the town. Smaller watersheds include Thompson Hollow, Winter Hollow, Bull Run, Bragg Hollow, Batavia Kill and the Red Kill.

Water is an important and plentiful resource in Middletown. Everyone is dependent on the water system in one way or another. We need water for drinking and bathing, crop production, industry, and recreation. Because water flows across property lines, and, indeed, municipal boundaries, it is important that every individual become aware of what his/her actions will do to the water quality.

ABUNDANT PURE WATER IS A VALUABLE RESOURCE NOT TO BE TAKEN FOR GRANTED

Flood Hazard Areas

Areas subject to flooding include lands adjoining rivers, streams, lakes, ponds, or wetlands where flooding results from spring snowmelt, heavy rains or other weather conditions. Flood hazard areas, as defined by HUD in accordance with the National Flood Insurance Program, 1973, are shown. Be identifying these areas, it is possible to restrict development to open space uses which are tolerant of flooding and do not obstruct the flow of flood water. Financial loss can thus be avoided for both the community and private citizens who might otherwise build in, or might be affected by, building in these areas.

Wetlands

Wetlands are perhaps the most critical of all water resource considerations due to their extreme senstitivy to development. These areas are subject to periodic or continual innundation by water and are commonly referred to as bogs, marshes or swamps.

The New York State Freshwater Wetlands Act, 1975, has drawn attention to the special importance of wetlands. Wetlands provide unique habitats for many forms of wildlife and vegetation. Wetlands are efficient cleansers of water. Marshes and swamps filter out many of the sediments and pollutants carried by streams. Wetlands are also important in minimizing flood damage. They can absorb great amounts of water during heavy rainfall and spring runoff. This can mean reduced peak flood flows and decreased flood damage.

The development limitations of wetlands must be taken into consideration in planning. The physical characteristics of wetlands in many cases make construction costly and impractical. Deep, mucky soils with insufficient drainage may be too unstable to support foundations; high water levels may result in flooded homes or eroded yards and frost-heaved roads. By considering these factors, the community can work to avoid irreparable damage to its environment.

Although no official mapping of wetlands for the New York State Wetlands Act in Delaware County has occurred, these areas have been identified for our purposes. Using the New York State Land Use and Natural Resource Inventory, 1972, and information available from U.S. Geological Survey quadranges of the town, a wetlands map was prepared.

WETLANDS HELP TO MINIMIZE FLOOD DAMAGE

Other Hydrologic Considerations

Development limitations presented by other hyrologic features should also be cnsidered. Flooded basements, erosion, or the settling of foundations may occur in areas with high water tables. Areas with poor drainage are unsuitable for proper sewage-effluent disposal. Moreover, improper siting of construction in relation to water resources may mean costly site alteration later.

Environmental damage may result from failure to consider hydrologic features. Plant and animal species are destroyed. Streams also provide extensive recreational opportunities which development may endanger.

SOIL CONSIDERATIONS

Proper siting of development can be determined only after a thorough analysis of soil types within the community. Soils differ according to variations in particle gradation, behavioral characteristics, depth to bedrock, and drainage capability. Each of these factors is important in determining how much and what kind of development the land is capable of supporting. A thorough soils analysis can help to avoid high development and construction costs.

Soil bearing capacity is a major consideration in determining development capability. This is particularly important when considering the feasibility of on-site sewage effluent disposal. On-site sewage systems installed on soils with improper drainage may result in the contamination of groundwater and runoff into a public water supply or bodies of water used for recreational purposes. In low-lying areas, where drainage occurs too slowly, certain types of development can result in flooded homes and roads.

A SOILS ANALYSIS CAN HELP AVOID HIGH CONSTRUCTION COSTS

see soils map next page

MAP SYMBOL	SOIL ASSOCIATION	PERCENT OF ASSOCIATION	SLOPE RANGE	AGRICULTURAL CAPABILITY CLASS	DRAINAGE CLASS	TYPICAL USES AND OTHER CHARACTERISTICS
DEEP SOILS WITH FRAGIPANS DEVELOPED IN GLACIAL TILL						
2	Lackawanna Asso (extremely stony, moderately steep)					Well-suited for woodland and wildlife habitat. Steep slopes, slowly permeable fragipan, and surface stoniness are primary concerns in the uses of this association.
	Lackawanna	75	15 - 35	VII	Well	
	Minor Soils	25				
4	Lackawanna-Oquaga Association (moderately steep)					Uses include pasture, woodland and wildlife habitat. Slope makes operation of farm machinery very difficult. All uses are affected by steep slopes, variable depths to bedrock and a dense, slowly permiable fragipan. Potential uses are woodland, wildlife habitat, and some types of recreational development.
	Lackawanna	40	15 - 35	VI	Well	
	Oquaga	35	15 - 35	VI	Well	
	Minor Soils	25				
5	Lackawanna-Wellsboro Asso (sloping					Much of this is open land used for general farming or it is idle. Some idle land is reverting back to woodland. Potential is good for hay and pasture. Slow permeability and seasonal wetness must be considered where homesites are planned.
	Lackawanna	45	3 - 15	III	Well	
	Wellsboro	30	3 - 15	II	Moderately Well	
	Minor Soils	25				

SOILS: TOWN OF MIDDLETOWN (continued)

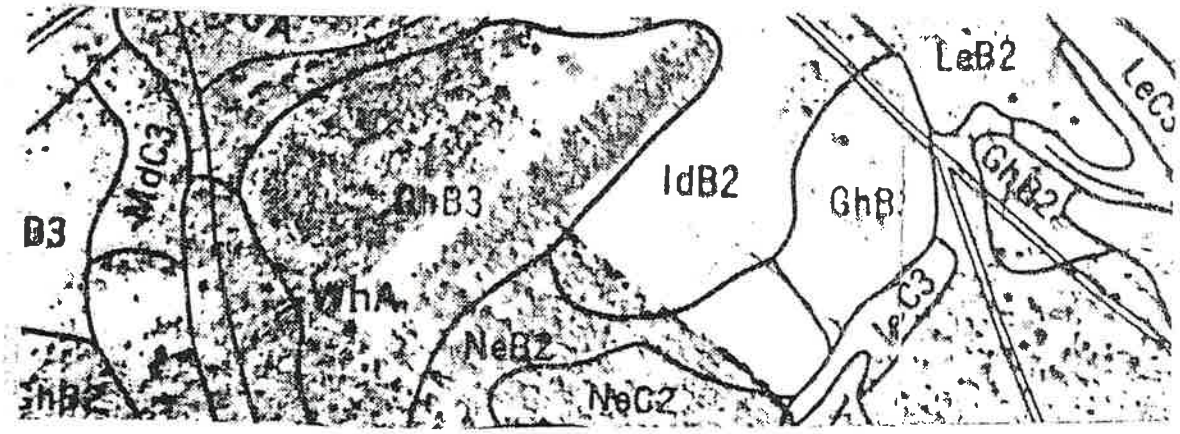
MAP SYMBOL	SOIL ASSOCIATION	PERCENT OF ASSOCIATION	SLOPE RANGE	AGRICULTURAL CAPABILITY CLASS	DRAINAGE CLASS	TYPICAL USES AND OTHER CHARACTERISTICS
11	Wellsboro Asso (sloping)					
	Wellsboro	60	3 - 15	III	Moderately Well	Open land used for general farming. Potential is good for hay and pasture. Slow permeability and seasonal wetness are of primary concern.
	Minor Soils	40				
12	Wellsboro Asso (extremely stony, sloping)					
	Wellsboro	65	3 - 15	VII	Moderately Well	Much is already in woodland in which it has good potential. Some areas are used for hay and permanent pasture. The extremely stony surface makes it difficult to operate farm machinery. Seasonal wetness, surface stoniness, and slowly permeable fragipan are the most limiting factors for community development.
	Minor Soils	35				
13	Wellsboro-Morris Asso (sloping)					
	Wellsboro	45	3 - 15	III	Moderately Well	Used for crops, pasture and woodland. Many acres once cultivated are now used for hay and permanent pasture. Seasonal wetness and the slowly permiable fragipan are of primary concern in the use of this association.
	Morris	30	0 - 15	III	Poor	
	Minor Soils	25	0 - 15			
	MODERATELY DEEP AND SHALLOW SOILS					
15	Arnot-Oquaga-Rock Outcrop Asso (very steep)					
	Arnot-Rock outcrop	60	35 - 90	VII	Moderately Well	Woodland and wildlife habitat are predominate uses. Shallowness to bedrock, many bedrock outcrops, very steep slopes, and surface stoniness affect all uses. Potential recreational development such as lo ut points.

MAP SYMBOL	SOIL ASSOCIATION	PERCENT OF ASSOCIATION	SLOPE RANGE	AGRICULTURAL CAPABILITY CLASS	DRAINAGE CLASS	TYPICAL USES AND OTHER CHARACTERISTICS
18	Oquaga-Lackawanna Asso (moderately steep)					Much of the area that was once farmed is reverting back to woodland and wildlife habitat. Some areas used for pasture. Steep slopes, variable depths to bedrock, and dense slowly permeable fragipan are limiting factors for all uses. Many areas have aesthetic value and there is some potential for some types of recreational development.
	Oquaga	50	15 - 35	IV	Well	
	Lackawanna	20	15 - 35	IV	Well	
	Minor Soils	30				
	DEEP SOILS DEVELOPED IN GLACIO-FLUVIAL DEPOSITS					
22	Chenango Asso (nearly level)					Used primarily for agriculture for which it has potential. Most areas are favorable for community development. A few areas are subject to flooding on rare occasions. It is a good source of sand and gravel.
	Chenango	65	0 - 15	II	Well	
	Minor Soils	35				
23	Tunkhannock Asso (gently sloping)					Used for pasture, cultivated crops, woodland, and wildlife habitat. It is a good to fair source for sand and gravel and is favorable for community development. A few areas may be subject to flooding on rare occasions.
	Tunkhannock	75	0 - 15	II	Well	
	Minor Soils	25				
	DEEP SOILS DEVELOPED IN ALLUVIAL DEPOSITS					
24	Barbour-Basher Asso (nearly level)					Contains some of the best soils for agriculture in the town. Flooding hazard and wetness are primary concerns for community development.
	Barbour	50	3 - 5	II	Well	
	Basher	20	0 - 3	II	Moderately Well	
	Minor Soils	30				

Soil bearing strength also influences site suitability for various uses. Proper soils provide good, stable support for various development purposes. Settling and shifting can occur in areas where the soil is not capable of supporting foundations.

Soil information can be important economically to a community. It can indicate areas of exceptionally high agricultural or commercial forest potential. Topography, soil drainage capacity, and bearing strength are also important qualifications in planning recreation development areas.

The soil information presented here is taken from the Delaware County General Soil Map and accompanying soil interpretation chart. The general soil map is useful to obtain a general idea of the soils in the town. It can be used to compare different parts of the town or to learn the location of large tracts that are suitable for a certain kind of use. A general soil map is a useful guide in managing a watershed, or in planning community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road or building. An on-site investigation of the soils to determine slope, depth, stoniness, drainage and other features that affect their management is required. (See Soil Associations chart and soils map on the preceding pages).



A DETAILED SOILS MAP IS USEFUL TO BUILDERS, FARMERS AND PLANNERS

FOREST CONSIDERATIONS

Although the principal use of land in the town is for residential purposes and a large portion of the land is devoted to agriculture, the majority of land cover is woodland and is used by a variety of people for many different activities. These activities include hunting, fishing, occasional and selective timber harvest, hiking, skiing, picnicking and other recreational uses. It is clear that the forest can provide long-term economic returns to the community if it is managed correctly and is free from the implications of uncontrolled development.

Many residential home owners in this area have switched from heating homes with oil to wood. As nonrenewable energy sources become more and more costly, an increased demand will probably take place on the area's woodlands as a source of household fuel. This could lead to a serious mismanagement of the town's forest resources.

Indiscriminate use of the forest will endanger the use of other important natural resources that exist within the environment. Trout require cold water (less than 70 degrees Fahrenheit) and a high dissolved oxygen concentration. For this reason, cutting in close proximity to streams, thus removing the shade, and clear-cutting anywhere in a watershed must be done only after consideration is given to effects on fish life and bank erosion. Proper forest management can also help to sustain the natural whitetail deer population.

INDISCRIMINATE USE OF THE FOREST WILL ENDANGER THE USE OF OTHER IMPORTANT NATURAL RESOURCES

SOCIAL AND ECONOMIC ELEMENTS

OVERVIEW

Social and economic factors are also major plan components. The relationships of these factors, their effects on present and potential land usage and their relationship to natural resources must be considered in making land use decisions.

Social and economic elements include the feelings of the people about their community, the character of the community, and land use commitments in the form of capital investment in land, building, and improvements. The location of present investments in roads and other service and commercial facilities is an important factor in locating sites for future growth.

A comprehensive study of a community's land use is not complete without an analysis of the people who inhabit the area. The population's age and sex composition, living and working habits, and housing situation are all factors that affect future land use decisions.

On the following pages the importance of these factors to the area and their role in the planning process is described. The factors considered include the following:

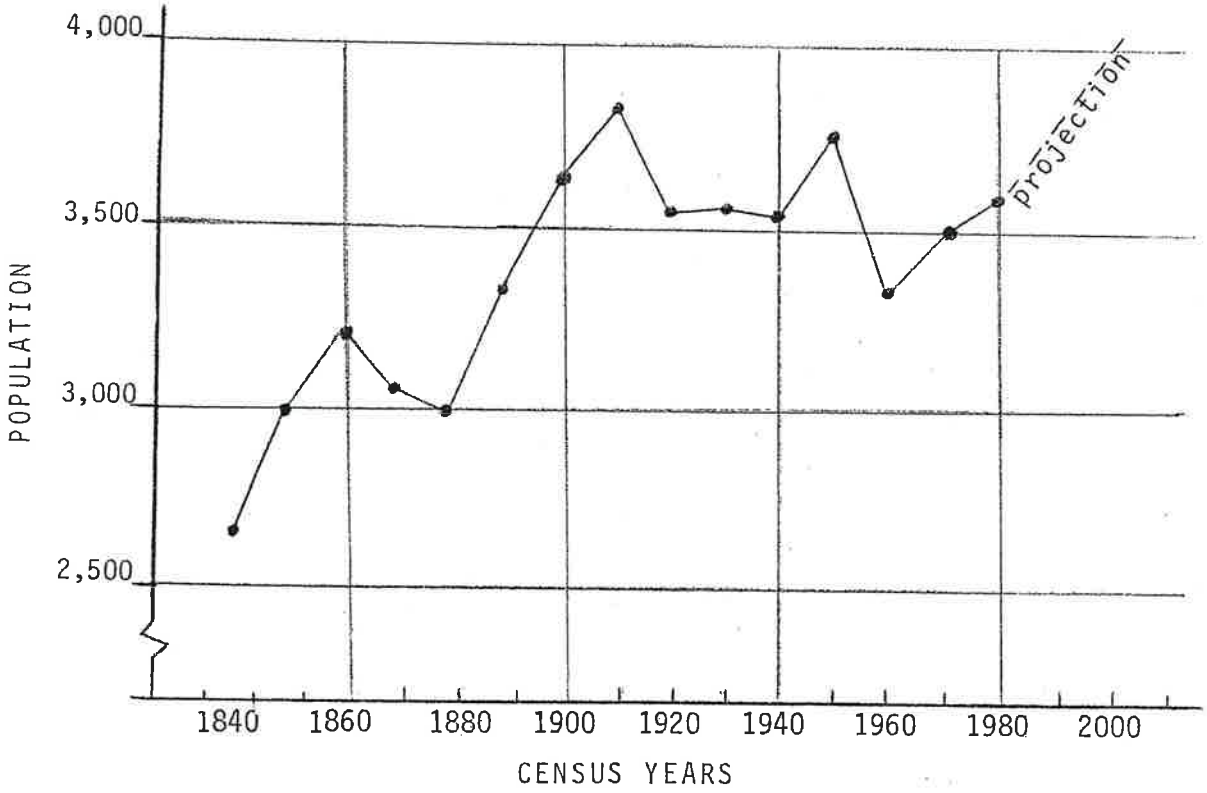
- *Population/Housing*
- *Existing Land Use*
- *Agricultural Districts*
- *Human Settlement*
- *Transportation*
- *State Lands / Public Lands*
- *Recreation*
- *Historic Resources*

POPULATION CHARACTERISTICS

According to the U.S. Census, resident population in Middletown increased by only 89 people between 1970 and 1980 which represents an increase of only 2.6%. A look at the graph below indicates that since 1920 Middletown's population has remained fairly constant, except in 1950 and 1960. The construction of the New York City reservoirs and tunnels brought large numbers of people seeking work prior to 1950. Many of these people then left the area following the completion of the reservoir.

TOWN OF MIDDLETOWN - POPULATION TRENDS

1840 - 2000



Source: U.S. Census

Comparing Middletown's population growth to Delaware County's as a whole shows that the town is running slightly behind the average. When the population of the villages of Margaretville and Fleischmanns are removed from the town statistics, then the figures show that the rural area grew at a very fast pace in the last ten years.

POPULATION COMPARISONS 1950 - 1980

Year	Population	% Change	Delaware County Population	Delaware County % Change
1950	3,737	-	44,420	-
1960	3,310	11.4	43,540	-2.0
1970	3,466	4.7	44,718	2.7
1980	3,555	2.6	46,824	4.7

Source: ***U.S. Census of Population***

Seasonal Residents

A survey of land ownership patterns in Middletown indicates that more and more land is being purchased by people not residing year-round in the town. During the past four years the number of parcels owned by non-residents has increased from 110 to 1,628. In 1950 only 11 per cent of all land parcels were owned by people not living in Middletown; today the figure is approaching 60 per cent.

The table on the following page shows that most of those people not residing in Middletown but owning land

0% OF THE TOWN'S LAND PARCELS ARE OWNED BY SEASONAL RESIDENTS

O W N E R S H I P P A T T E R N S

Town of Middletown

(including villages)

	1950	1960	1970	1980	1983	1984
Town of Middletown	935 *(89%)*	817 *(75%)*	855 *(53%)*	1,101 *(45%)*	1,070 *(41%)*	1,104 *(40%)*
Nearby Towns	6 *(1%)*	9 *(1%)*	24 *(1%)*	25 *(1%)*	34 *(1%)*	35 *(1%)*
Metropolitan New York City	90 *(8%)*	216 *(20%)*	643 *(39%)*	1,111 *(45%)*	1,263 *(48%)*	1,334 *(49%)*
Other New York State	6 *(1%)*	28 *(3%)*	66 *(4%)*	113 *(5%)*	119 *(5%)*	119 *(4%)*
Other States	7 *(1%)*	23 *(2%)*	35 *(2%)*	92 *(4%)*	134 *(5%)*	140 *(5%)*
Foreign	1	1	5	5	1	-
TOTALS	1,045 *(100%)*	1,094 *(100%)*	1,628 *(100%)*	2,447 *(100%)*	2,621 *(100%)*	2,732 *(100%)*

NOTE: 935 = Number of parcels
(89%) = Per Cent of Total

Source: Delaware County Tax Department, Delaware County Planning Board

See Also: *Trends in Land Subdivision and Parcel Ownership, Delaware County, 1950-1980,* Delaware County Planning Board Report, October 1982 - Updates in November 1983 and September 1984.

in the town are from the New York City Metropolitan area. Many of the nonresidents who buy land here use it on a part-time/vacation basis only. Later, however, many decide to retire to the county and become year-round residents with the same need for town services (road maintenance, snow removal, emergency, etc.) as the long-time residents.

Age Distribution

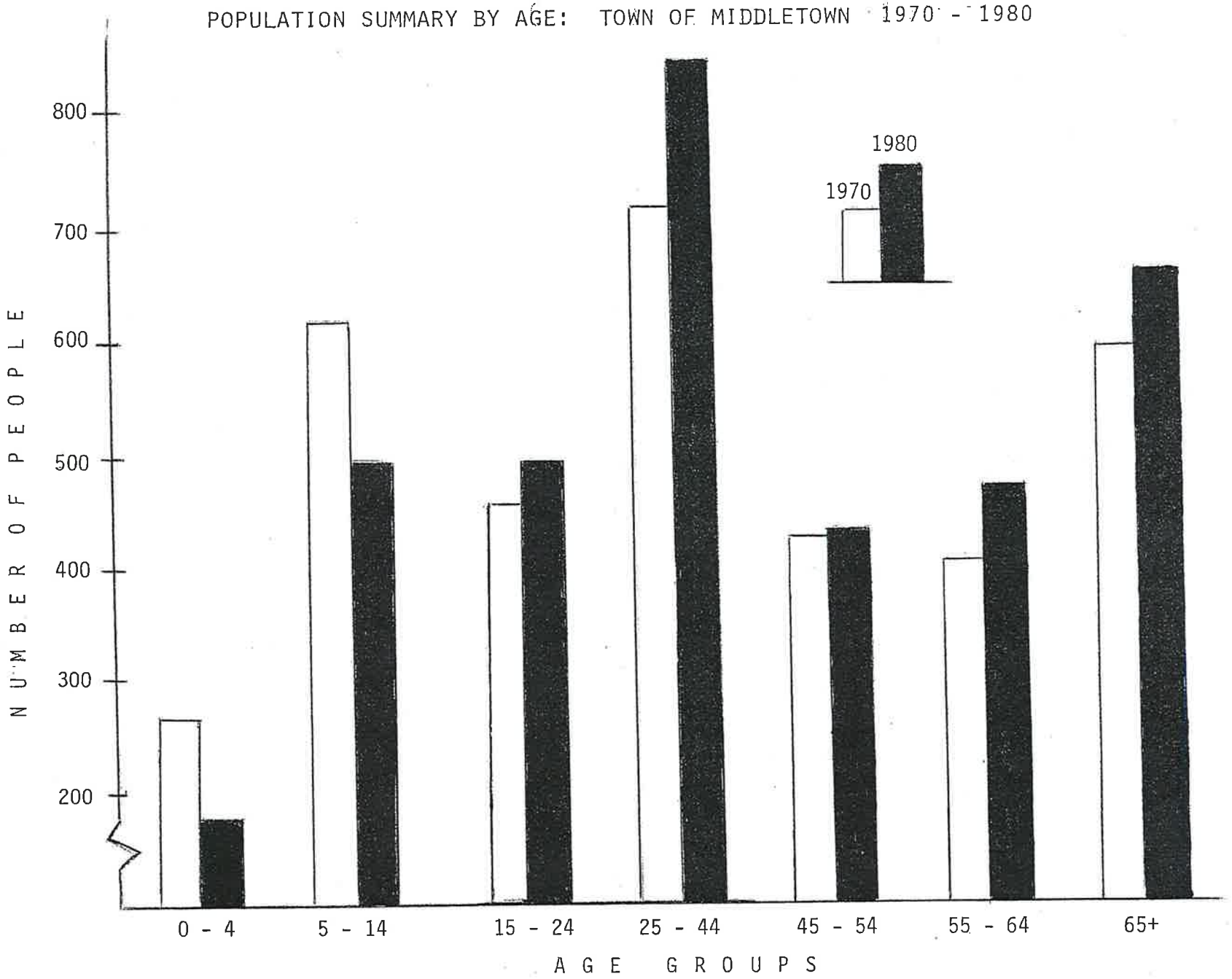
In Middletown, nearly 20 per cent, or one of every five, of the resident population is over 65 years of age. The per cent is likely to increase significantly in the next few decades. The retired population requires more public services and support from the remainder of the population in the work force. The charts below and on the following pages illustrate population trends in Middletown.

MIDDLETOWN'S MEDIAN AGE IS THE HIGHEST IN THE COUNTY

M E D I A N A G E

	1970	1980
Town of Middletown	36.6	39.1
Village of Margaretville	-	41.9
Village of Fleischmanns	-	43.9
Delaware County	30.6	32.2

POPULATION SUMMARY BY AGE: TOWN OF MIDDLETOWN 1970 - 1980



Source: U.S. Census of Population, 1970 and 1980

POPULATION BY AGE
1970 - 1980

Town of Middletown

AGE	1970 POPULATION	1970 PERCENT DISTRIBUTION	1980 POPULATION	1980 PERCENT DISTRIBUTION	AVERAGE ANNUAL CHANGE 1970 - 1980 NUMBER	AVERAGE ANNUAL CHANGE 1970 - 1980 PERCENT
0 - 4	268	7.8 %	174	4.9 %	-9.4	-3.5 %
5 - 14	617	17.8	494	13.9	-12:3	-2.0
15 - 24	453	13.1	486	13.7	3.3	0.7
25 - 44	713	20.6	845	23.8	13.2	1.9
45 - 54	426	12.3	428	12.0	-	-
55 - 64	405	11.7	469	13.2	6.4	1.6
65+	584	16.8	659	18.5	7.5	1.3
TOTAL	3,466	100.0 %	3,555	100.0 %	8.9 %	0.3 %

MEDIAN AGE.....(36.6 years) .....(39.1 years)

Source: U.S. Census of Population - 1970, 1980; Delaware County Planning Board

Employment

Employment opportunities within the Town of Middletown are limited. While the number of people employed in the agricultural sector continues to decline, increases have occurred in the categories of Professional/ Managerial and Sales. In Middletown the hospital and the school system are the two largest employers. Other employment opportunities exist with several small manufacturing firms, commercial establishments, forest related industries and for others as independent businessmen. In addition, some people commute to Delhi and to as far away as New York City.

JOBS OF EMPLOYED-POPULATION
YEARS AND OVER BY OCCUPATION: 1970 - 1980

Town of Middletown

OCCUPATIONAL GROUPS	1970 NUMBER	1970 % DIST.	1980 NUMBER	1980 % DIST.	AVERAGE ANNUAL % CHANGE
Professional/Managerial	247	20.1 %	294	24.3 %	1.9 %
Farmers, Farm Managers, Laborers	154	12.5	100	8.3	-3.5
Sales, Clerical and Kindred	202	16.4	282	23.4	4.0
Craftsmen, Foremen, Operators	414	33.7	385	31.9	-0.7
Service Workers, including Private Household	213	17.3	146	12.1	-3.1
Total	1,230	100.0 %	1,207 %	100.0 %	-0.2

Source: U.S. Census of Population, 1970, 1980

Family Income

Middletown median family income in 1980 was $13,569. This figure is less than the county median of $16,072 and nearly one-third less than the New York State median family income of $20,180. As a result of the rural, small-town nature of the area, general day-to-day living expenses are less than they would be in urban areas. However, many of these dollars are lost during the winter season as heating costs for many of the poorly insulated, older homes are high.

1980 MEDIAN INCOME

DELAWARE CO.....16,072

NEW YORK.....20,180

FAMILY INCOME - 1980

Town of Middletown

Income	Number of Families	Per Cent
under - $5,000	92	9.1 %
5,000 - 7,499	132	13.0
7,500 - 9,999	100	9.9
10,000 - 14,999	253	25.0
15,000 - 19,999	141	13.9
20,000 - 24,999	113	11.2
25,000 - 34,999	83	8.2
35,000 - 49,999	73	7.2
50,000 and over	25	2.5
	1,012	100.0 %

Source: U.S. Census - 1980

HUMAN SETTLEMENT

According to the 1980 Census, there are 2,424 total housing units in Middletown. About 838, or 35 per cent of these housing units, are considered seasonal or for

occasional use. There were also 226 mobile homes counted by the 1980 Census, and this represents a little more than 9 per cent of all housing units in Middletown.

The number of new housing units, both seasonal and year-round, has increased significantly in the past 10 years. A great deal of the town's housing stock is concentrated in the two villages, several hamlets, and along routes 28 and 30; however, most of the new units are being constructed in the more rural areas of the town. Winter Hollow, Bragg Hollow, Hubbel Hill, and Hog Mountain are some of the areas in Middletown where new homes (mostly seasonal) now outnumber the cows in the pasture. The table below shows trends in types of housing since 1960.

HOUSING UNIT TRENDS

Town of Middletown

	TOTAL HOUSING UNITS	MOBILE HOMES	MULTI-(2+) FAMILY	SEASONAL/ OCCASIONAL USE
1960	1,391	36	43	NA
1970	1,909	69	185	235
1980	2,424	226	282	838

Source: U.S Census - 1960, 1970, 1980

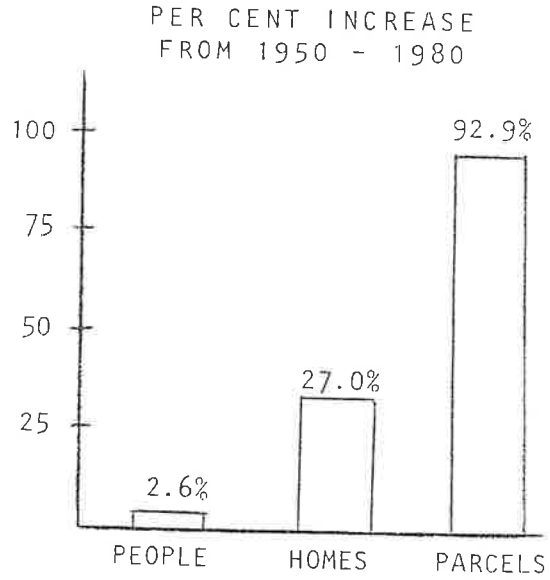
Housing stock trends between 1960 and 1980 show an increase in the number of new homes and mobile homes. Since 1960 new homes have increased by 1,033, or nearly 74 per cent. The number of mobile homes has more than tripled in ten years since 1970. To many people, a mobile home is the answer to the high cost of owning a home. Some choose to retire or to

begin their working years in a mobile home, while for others it serves as a vaction or second home. Whatever the reason, mobile homes have become a part of the Middletown landscape.

Seasonal dwellings represent about 35 per cent of the total housing stock in Middletown. It is expected that the number of seasonal units will show a steady increase in the future years as more and more urban residents seek to escape the city to rural areas offering recreation and relaxation.

A parcel size inventory of the past 30 years shows a significant increase in smaller size lots in Middletown. The table on the next page shows that lots between two and ten acres have increased from 125 in 1950 to 1,044 in 1984. The trend toward smaller lots indicates that a change is taking place in Middletown, from an agriculturally based community to a more recreation/vacation home community.

In summary, housing patterns, including the location and types, help determine an area's character. Permanent, year-round housing has occurred in large part along or close to major transportation routes and the village and hamlet areas. Seasonal dwellings have located, for the most part, along town roads. These two types of settlement patterns are addressed in the plan. Permanent, year-round homes and new services are encouraged to develop in and around the town's existing villages and hamlets, crossroad communities, and along highways already settled. Second home growth should be accommodated where access is available and where the impact on natural resources is minimal.



PARCEL SIZE IN ENTORY

Town of Middletown

(excludes villages)

PARCEL SIZE IN ACRES	1950	1960	1970	1975	1980	1983	1984
Under one Acre	383 (37)	405 (37)	496 (31)	548 (27)	570 (23)	588 (22)	589 (22)
1 - 1.99	85 (8)	87 (8)	173 (11)	262 (13)	379 (15)	397 (15)	401 (15)
2.0 - 4.99	77 (7)	92 (8)	207 (13)	339 (17)	487 (20)	537 (21)	556 (20)
5.0 - 9.99	48 (5)	60 (5)	155 (10)	262 (13)	356 (15)	405 (16)	488 (18)
10.0 - 24.9	80 (8)	88 (8)	201 (12)	250 (12)	271 (11)	299 (11)	306 (11)
25.0 - 49.9	48 (5)	50 (5)	103 (6)	117 (6)	120 (5)	126 (5)	128 (5)
50.0 - 99.9	69 (7)	81 (9)	115 (7)	107 (5)	115 (5)	118 (5)	116 (4)
100.0 - 249.9	225 (22)	198 (18)	154 (9)	141 (7)	130 (5)	132 (5)	130 (5)
250.0 - 500	29 (3)	28 (3)	22 (1)	18 (1)	14 (1)	14 (1)	13 (.5)
Over 500 Acres	1 -	5 -	2 -	3 -	5 -	5 -	5 -
TOTALS	1,045(100)	1,094(100)	1,628(100)	2,042(100)	2,447(100)	2,621(100)	2,732(100)

NOTE: 383 (37) = Number of Parcels (Percent of Total)

Source: Delaware County Planning Department; Delaware County Tax Rolls

See Also: *Trends in Land Subdivision and Parcel Ownership, Delaware County, 1950-1980,* Delaware County Planning Board Report, October 1982 - Updates in November 1983 and September 1984.

EXISTING LAND USE

Overview

Past and present patterns of land use play an important role in planning for tomorrow. The character of a community is a product of its land use composition and its natural resources. Early in the planning process the Town Planning Board decided that a major goal would be to assure that the integrity of the area's character would remain.

See Land Use Map next page

The use of land over time is greatly influenced by the economic condition of the area and its location in relation to new development. Historically the economy of this town was based upon agricultural activities which require a large amount of land space. With the gradual decline of this land use, much land has returned to an "inactive" state, i.e., brushland or forestland.

The land use map, which was developed for the town, is used to analyze the existing land use pattern. Such a study should determine the quantities of various uses. A land use analysis points out areas of conflict and inefficient development as well as specific areas which are involved in the efficient use of land.

The table on page 37 summarizes the findings of a 1983 land use inventory and report completed in Middletown. Definitions for each type of land can be found within the report which is included in its entirety in Appendix B.

EXISTING LAND USE - 1983

Town of Middletown

Land Use	Acres	Per Cent
Farmland	6,862	10.9 %
Brushland	10,086	16.1
Woodland	42,613	67.9
Water	641	1.0
Wetlands	38	0.1
Residential	771	1.2
Commercial	173	0.3
Industrial	88	0.1
Recreation	374	0.6
Public/Semi-Public	86	0.1
Roads	988	1.6
Total	62,720	100.0 %

Source: Middletown Land Use Report, Town Planning Advisory Service, December 1983

Transitional Lands

Transitional lands shown on the land use map as "brushland" represent a large portion of town land area which is experiencing change in use. Generally these lands are becoming brush and tree covered after many years of being used for crops or pasture. They are in a process of natural succession from meadow to forest. The 1983 land use inventory shows that over 10,000 acres,

or 16 per cent of the land area in the town of Middletown, is undergoing this type of change.

The significance of this category is that it represents the location where future land use decisions and further changes in use are likely to occur. As agricultural use of a piece of land ceases, the land becomes available for a different use, usually for the development of camp or second home lots.

There are many reasons why this transition from agriculture occurs. In some cases the soil or climatic conditions prove to be too poor to continue farming. In other cases taxes become too much of a burden; and, in still others, when the opportunity to sell the land is one where it would be unwise to refuse, the transition of the land will occur. In almost every case, the change is due to economic pressure.

Agricultural Districts

New York State's Agricultural Districts Law was passed to help maintain viable agriculture in the face of land speculation and development pressures. Farmers form a district by making a voluntary commitment of their land to agriculture for a period of eight or more years. In return, they can get relief from property tax increases if their assessment exceeds a certain ceiling figure.

Agricultural District Number 3 encompasses most of the best areas for continued farm use in Middletown. Continuation of agriculture and the discouragement of development in areas best suited for farming is an important concept in this plan. Maintaining agricultural lands is important to the future of the area.

see map ... next page

TRANSPORTATION

The automobile provides the principal means of travel in Middletown. Years ago the railroad was important for moving goods and people. Although the right-of-way of the Ulster and Delaware Railroad has been purchased by the Catskill Rail Committee and parts of the old line are now being used as a tourist excursion, the rail corridor is no longer a part of the town's transportation network. Bus transportation in Middletown is available and provides daily service to and from New York City and Oneonta via State Route 28, with local stops in most communities along the way. Airplane traffic and service is very limited to Middletown residents. Several private airfields are located in nearby towns, while Oneonta Airport, providing service to and from New York City, is 40 miles away.

Historically roads in Delaware County evolved from the original foot, horse and carriage paths made by early settlers. The road patterns were based primarily upon the convenience of delivering products to the marketplace and commuting short distances for social purposes. Although the purpose of the transportation system has not changed over the years, its demands and importance have been greatly increased. People are more dependent upon urban centers for shopping, entertainment, public services, and emergency services, such as health care and fire protection. As the mode of transportation has changed from horse and buggy to automobiles, trucks and busses, so too has the importance of road maintenance and design. The heavier and faster cars of today need broader and more stable surfaces which are regularly maintained. The responsibility for such maintenance eventually falls on the local government and often accounts for a major share of local expenditures.

see highway map

next page

The road network in Middletown provides adequate transportation to all areas linking the scattered population with employment and service centers. Roads within the town have been classified by their use: (1) primary roads (State Routes 28 and 30); (2) major collector (county highways); (3) minor collector (town roads - paved): (4) rural roads (unpaved town roads providing access to the more rural areas); (5) seasonal/limited use roads providing access to the most remote areas.

How the land area surrounding a highway is used plays a key role in the needs and demands of that particular stretch of road. A secondary road that provides adequate access for two or three farming families is not likely to withstand the pressures of a new twenty-unit housing or mobile home development. When a town agrees to accept the streets within a new subdivision into their total road system, they must then take on the added costs of yearly maintenance and snow clearance.

Another example of the relationship between adjacent highway uses and the road itself is evident along parts of the state and county highways. Better roads invite development, sometimes to the point where the original purpose of the road is lost. The primary purpose of these roads is to move volumes of traffic at high speeds over long distances. Because the route is in good condition and well maintained, development (both residential and commercial) has occurred along these highways. Care must be taken that the spacing of driveways to new uses are not so close together that the speed limit must be lowered, thus defeating the primary purpose of the road.

Problems also occur along the more remote town roads. Many of these roads cannot withstand the strain of fuel oil delivery trucks, moving vans, and other trucks drawing mobile homes. Road shoulders are neither wide enough nor firm enough on many roads to accommodate off-road parking. Land uses which will generate traffic that could ultimately cause road surface problems to existing highways need to be encouraged to locate where roads are adequate.

PUBLIC LANDS

Public lands in many towns are important in the planning process. Besides being exempt from local property taxes, their potential for public uses and recreation needs to be considered. The New York State Department of Environmental Conservation owns over 10 per cent of the land in Middletown,

6,689 acres on 54 parcels of forest preserve. Most of this land is forested and most is located within the "blueline" boundaries of the Catskill Park. New York City's Department of Water Resources is also a large landowner in Middletown. The City maintains about 664 acres in four parcels surrounding and including Pepacton Reservoir.

RECREATION

Hiking, fishing, hunting or just walking through the woods are just a few of the many kinds of recreational activities available almost anywhere in the town. Every year more and more people are discovering the opportunities for recreation in Middletown. Care should be taken to anticipate problems that might arise.

The Plan identified earlier the number of seasonal homes that have grown steadily during the past 20 years. It is important that second home development be carefully monitored so as not to destroy the natural environment they set out to enjoy.

HISTORIC RESOURCES

The existence of historic resources, i.e., historic sites, buildings, districts, etc., gives character and distinction to the community. The tangible remains of the past - old churches, schools, cemeteries, commercial structures - are not only evidence of past ways of life but also contribute to the character and individuality of the community by providing a sense of identity and a sense of place.

Historic preservation should be part of the implementation of this Town Plan. Properly managed, historic resources can provide residents with a sense of pride and confidence in their community.

SEE HISTORIC RESOURCES MAP next page

TOWN PLAN

LAND USE PLAN

The purpose of the Land Use Plan is to establish an overall framework of land use relationship which will serve as a basis for guiding the future settlement pattern in the town for the benefit of all. As a result of the planning process, combining physical and social factors which suggest appropriate uses for the land and by relating them to the goals and objectives established, a land use plan for the future of the town has been developed.

ADJACENT LAND USES SHOULD RELATE TO EACH OTHER

LAND USE CATEGORIES

Five categories of land use are proposed to suggest the most appropriate kinds of activity for the area.

Hamlet/Village

Characteristics

Areas that have witnessed some degree of concentrated development and which provide limited commercial and public/semi-public services to the outlying areas of town. Sewer and water supply systems may exist.

Recommended Uses

Uses should be directed toward the expansion of existing public services and facilities. Medium to high density residential, recreation, commercial and business establishments. An intermixture of uses common and appropriate to rural centers of population.

Density Guidelines

Lots should be limited to a three-quarter acre minimum where a community lacks public water or sewer. Should allow for larger lots to prevent conditions which may occur from future development that would lead to the contamination of individual water supply systems. Density may be reduced where public water and sewer are present.

SEE LAND USE PLAN MAP FOLLOWS PAGE 45

Town Residential

Characteristics

Areas at the periphery of existing centers and along major traffic corridors which have witnessed continued settlement of residential and commercial use. High volume roads that are used by both residents and out-of-town travelers who may relate the attractive or unattractive visual quality to the whole town.

Recommended Uses

Use in this category should recognize the settlement orientation as characterized by existing patterns. An intermixture of uses, including residential, commercial and industrial uses. Because of the importance of keeping these principal roadways visually attractive, it is recommended that a process for site plan review be used to assure that nonresidential uses do not create visual distractions adjacent to the highway.

Density Guidelines

One acre minimum. It is important to realize that this major category identifies and controls development along the major highways in town. One of its prime functions is to protect these principal highway corridors and to discourage intensive development along them. To recognize this possible development and to guard against future high density development would protect the safety of the highway from over use and would also protect the visually attractive area from the highway.

Rural Residential

Characteristics

Land areas that are not directly accessible to major traffic corridors. Areas less suited for concentrated development and which have an open or rural character. Scattered dwellings

(both seasonal and year around), farming, forest cover and inactive farmland are characteristic of this category.

Recommended Use

Low density residential, limited agricultural uses and recreation. Will include much of the land in the town that was farmland but no longer used for this purpose and has since grown up to brush and small tree cover. Uses in this category should have minimal impact on the environment and should be consistent with maintaining the existing rural settlement character of the area.

Density Guidelines

Two to five acres. Since much of the land in this category represents marginal farmland, it is possible to assume that it may also have a number of development limitations (soils, wet areas, bad drainage, etc.). It is essential that, if development is to take place in this area, a site plan review be carried.

Agriculture

Characteristics

Major characteristics are active agricultural activities, low density residential, inactive farmland, and scattered commercial / business uses. Much of this farmland has been committed to an agricultural district.

Recommended Uses

It is intended to encompass those lands best suited to the continuation of productive agricultural use. Recommended uses are for agriculture and low density residential. Nonfarm uses should not interfere with agricultural activity.

NON-FARM ACTIVITIES SHOULD BE DISCOURAGED ON SOILS BEST SUITED FOR FARMING

Density Guidelines

Nonfarm lots should be designed to provide for the continuation of active agricultural operations and compatible operations and to protect and encourage the retention of best agricultural lands in active farm use.

Natural Resource Management/Land Conservation

Characteristics

Areas with limiting physical properties: flood hazard areas, wetlands, steep slopes, heavily forested areas, large public land holdings, other unique features and historic sites. Current uses include: scattered residential, farmland, brush and woodland. These areas are visually attractive from roads and add to the rural atmosphere and attractive scenic quality of the town.

Recommended Uses

Best use for these lands include: agriculture, recreation, woodland, and open space. Its purpose as an overlay district is to protect the natural environment as well as to provide for nonintensive open space recreational activities. The continued retention of these lands in an undeveloped state will provide for an everlasting rural atmosphere that has both scenic and outdoor recreational amenities.

Density Guidelines

No density guidelines are provided. Those applicable to the underlying district can be used. As an overlay district, it is suggested that an on-site investigation precede the location of any structure or alternative use of the landscape.

SUMMARY

It is important to understand that it is the mix of these types of land uses that creates the character of the community. For instance, in the town a small percentage of the land is developed. There are few businesses and commercial activities, a good deal of agricultural uses, some scattered residential development and some undeveloped land. Since one of the community's goals is to maintain the character of the area, it is important to recognize that it is these proportions which make the character what it is. Changes, for instance, in developed land or loss of forest area would significantly change the quality of the area. However, some changes can be accommodated in the future; and, if the proposed Land Use Plan is used to guide these changes the character and quality of the area will remain much as it is today, while providing attractive living conditions and a growing economy.

OTHER CONSIDERATIONS

COMMUNITY FACILITIES

Community facilities refer to public, semi-public and privately sponsored services operated for the benefit of a community. Examples of these facilities: (1) public buildings needed for administration, education, culture, recreation, health, safety and service; (2) public works - various utilities, waste water treatment and solid waste disposal; and (3) public open space for recreation, parks, and other forms of leisure time activity. The demand for more and varied community facilities and services increases as a community's development expands, population increases, old facilities become outmoded, and living standards and public expectations change.

Community facilities can often be grouped according to their levels of administration and how the service functions.

Facilities that are fully supported through public funds and are open to serve the total population of an area are generally considered to be "public" facilities. These are normally associated with the various levels of government - Federal, State, county, town, village, school, fire and other special districts.

Community facilities may also be of a "semi-public" nature. That is, facilities that are normally open to the general public but would often have "membership" requirements and are of a non-profit nature. Funding for such facilities may be received directly from the private sector, or they may be supported through contributions from public funds. Clubs and civic organizations often fall into this category.

In preparing this plan, it is important to determine the level of development that will maintain the rural character and lifestyle now enjoyed - yet produce sufficient revenue to allow for needed community services and facilities. A brief illustration may serve to explain this further: Let's suppose a town road one mile long costs $12,000 annually to maintain and plow. Now suppose there are two houses on this road, and the rest is undeveloped. The tax revenue from the property on the road is $10,000 annually. In this situation, it is costing the town more to maintain this road than they receive in taxes. If a higher level of development were encouraged and attracted 10 new houses, evenly spaced along the mile of road, it would not change the rural, open character of the area, but would increase the property value such that the town would be getting as much from the area in taxes as they are spending in services.

Encouraging high quality property development makes good sense for the town's residents, because it increases the tax base without creating a significantly greater demand for services.

It is important to inventory the town's existing community facilities and services to anticipate the amount of growth the town can support before new facilities are necessary. In such an inventory, the town can identify areas of need which are currently being neglected.

ENCOURAGING HIGH QUALITY DEVELOPMENT MAKES GOOD SENSE FOR THE TOWN

Funding community services and facilities occurs on several levels of government and through various mechanisms. The town's budget is funded by Federal, State and local money. The portion which is raised locally makes up a part of each property tax bill. The County and the school district account for the remainder of the tax bill. Local assessment practices and taxation policies can affect land use quite directly; thus any land use plan should be in harmony with local spending and revenue raising practices. Another means of funding frequently used for long-term investments in facilities; for instance, a new town hall, is municipal bonds. The Town sells securities which it pays interest on in return for cash. These bonds may run for short terms - a year or two - or for 20 or more years.

A TOWN'S ABILITY TO FINANCE SERVICES IS DIRECTLY RELATED TO THE VALUE OF PROPERTY IN THE TOWN

Following is an inventory and description of the community facilities and services, public and semi-public (for instance, churches and civic groups) followed by conclusions and recommendations for the future. Locations of the facilities listed are shown on the Community Facilities Map as well as other maps showing school districts, fire districts, roads, and recreational facilities.

see facilities map next page

Schools

The town of Middletown is served primarily by the Margaretville Central School System. A small portion of the town, including Bragg Hollow, Halcottsville, the Batavia Kill and a part of Hog Mountain, are within the Roxbury Central School District. Additionally, the Grand Gorge Area Board of Cooperative Educational Services (B.O.C.E.S.) serves the town of Middletown.

SCHOOLS ARE IMPORTANT TO THE ATTRACTIVENESS OF A COMMUNITY

Because the benefits of education accrue to society as a total group, much of the cost of public education is apportioned to the State. Schools in Delaware County, on the average, receive over 50 per cent of their revenues from the State; the remainder is collected locally by means of the property tax system.

School facilities provide more than teaching areas. Many community functions; such as dances, club meetings, theater and recreation programs occur here too. In many ways the school system is seen as the hub of a community. The quality of a school system is one of the first items investigated by persons considering moving into a community.

Libraries

Middletown residents and landowners have several libraries within their community. The Margaretville Central School, the Skeene Memorial Library in Fleischmanns and the Erpf Cultural Center in Arkville have many fine volumes available to the public. In addition, the Four County Bookmobile visits Middletown several times a year.

see special districts map on previous page

Post Offices

Seven U.S. Post Offices are located in the town. They are Margaretville, New Kingston, Arkville, Fleischmanns, Halcottsville, Kelly Corners, and Denver. A Post Office located in Halcott Center also provides part of the town with rural delivery routes.

Fire Protection

Homes and property in Middletown are protected by five separate fire districts. The Middletown-Hardenburgh District is the largest and, along with Arena and Middletown No. 1, provides protection to Margaretville, Fleischmanns and most other rural areas of the town. The hamlets of Halcottsville and Arkville are protected by their own small department. Mutual aid is common and often comes from departments in other towns.

Health Care

A 50-bed community hospital located near the Village of Margaretville on Route 28 provides excellent health care facilities

to the town's people and surrounding communities. Larger, more specialized hospitals are located nearby in Binghamton, Albany, Oneonta, and Kingston.

Ambulance service is available to all areas of the town, and several private doctors have offices in Margaretville, providing residents with specialized services.

Police Protection

The New York State Police maintains a satellite barracks just south of Margaretville and provides regular patrols within the town. The Delaware County Sheriff's Department and the New York City Board of Water Supply Police assist when problems occur.

Solid Waste

The Town of Middletown participates in the Delaware County Landfill operation. Residents are encouraged to bring their trash to a transfer station in the town, and it is then hauled to the County landfill in Walton. Private trash collection is also available to many areas of the town.

Water Supply

Most of the residents in the town of Middletown obtain their water from on-site wells and springs. These individual systems are susceptible to contamination in areas where development of adjacent and upstream lands occurs without regard for groundwater protection.

The villages of Margaretville and Fleischmanns and the Hamlet of Arkville have public water supplies. Although these public systems provide many people with a good supply and quality of water, the protection of this supply from contamination is an important consideration.

Sewage Treatment

Most landowners in the town of Middletown have individual on-lot disposal systems of the septic tank or seepage pit variety. The village of Margaretville and the hamlet of Arkville are connected together on a public sewer system designed and constructed by New York City for protection of their water supplies.

Individual, on-site sewage disposal systems, the most common and most practical way to dispose of sewage in rural areas, must be planned and constructed in a proper manner. New systems must be designed and installed according to regulations of the New York State Department of Health and should be inspected for compliance with these standards. The local town building inspector and New York City inspectors should be responsible for overseeing each new installation.

THE INSTALLATION AND LOCATION OF SEWAGE SYSTEMS SHOULD BE MONITORED BY THE TOWN

Recommendations

- *As new homes, both vacation and year-round, are constructed, careful thought and consideration must be given to the location and capacity of the well water supply and on-lot sewage disposal systems.*
- *Librarires are an essential element to rural, small-town living. Additional education programs and continued access by the public should be emphasized.*
- *Fires in rural areas often result in the complete destruction of a building, often because of the long distance the local fire company must travel. Therefore, it is important to identify all potential fire hazards in order to minimize potential loss due to fire in the rural areas. Fire chiefs can make periodic inspections of buildings and develop programs on how owners can reduce or eliminate the threat of fire. Fire extinguishers in key areas can be of great value. Abandoned buildings, if beyond salvage, should be torn down in order to create a safer situation.*

- *Few opportunities for public or private recreation exist outside activities sponsored by the school. Individual recreation on private lands is simply not available to many sectors of the population. Funding sources are available for a variety of year-round programs for both young and old. The Town should support any well-conceived plan for additional public recreation facilities.*

TRANSPORTATION

The transportation system of the town of Middletown is based almost soley upon the road network that allows movement of people by vehicles such as cars, trucks and buses. Other means of transportation, such as air and rail vehicles, are not as important.

Many problems may develop with a local road system as the intensity of use of that system changes. Where once a farmer took his produce to market on a flatbed or pickup truck, today much larger vehicles are used, including heavy milk tank trucks These larger vehicles require higher road standards than were needed 50 years ago. Through the planning process, this type of problem may be minimized. In order to protect itself, the Town may set minimum road construction standards to which all new roads must conform before a new subdivision is approved. This would insure that, before the Town takes over a new road in the town, the road would be properly constructed and improved.

IN ORDER TO PROTECT ITSELF, THE TOWN MAY SET ROAD CONSTRUCTION STANDARDS

The Town may also want to officially determine which roads will be kept cleared in the winter months and which will not be opened by municipal plowing. Also, it may be desirable to develop a priority listing for the future construction or reconstruction of roads in the town. This would allow the town to organize its finances to insure the future availability of money needed to complete the tasks.

A final highway consideration is the review of the existing road system to insure that all existing roads are needed. It is

sometimes the case that a road has not been used for years, but it remains on the system. This situation may cause future problems for the town if someone should decide to build along such a road.

Recommendations

- *Well constructed and maintained roadways are essential to the future of the area. Roads must be safe and enjoyable to travel in order for the communities to maintain a healthy economy and solid tax base. Roads are one of the primary factors influencing people's choices concerning where to live and where to conduct their business. It is recommended that new development occur primarily along existing county roads since the Town pays less per mile locally to maintain them. The added snow removing capacity on county roads makes them the logical choice.*

- *Because State highways are designed for higher volumes and higher speeds, it is recommended that along these corridors driveways be kept to a minimum for safety; and that businesses and commercial establishments provide curbing for one exit and one entrance onto the State highway. This is important in preventing accidents because: it limits access and egress to specific spots, prevents several cars from pulling in or out simultaneously; and it promotes more orderly parking lot flow.*

  The Route 28 Corridor between Arkville and Margaretville is a very important stretch of highway to consider. As more and more commercial uses are located in this area, a reduction in the speed limit and controls of ingress and egress must be considered.

- *It is recommended that the Town Highway Superintendent begin working with the Planning Board in developing a five-year road improvement and maintenance schedule.*

- *The Town should take advantage of State aid for new surfacing projects.*

- *The Town should continue to post those roads without year-round residents as seasonal use roads which are not plowed but otherwise maintained. Continued use of town roads as snowmobile access trails is also encouraged.*

RECREATION

Recreation is a term that means different things to different people. One person's recreation time may be spent by casually walking through the woods, while another person may prefer a vigorous game of basketball. Indeed, for some recreation may be a summer day of "planned inactivity" on the hammock in the backyard.

Recreation, though difficult to define, seems to include the following dimensions: it involves the individual directly in the experience; he or she enters into it voluntarily; it occurs mostly during leisure time; it is done for enjoyment, satisfaction and gratification. Recreation tends to contribute to the well-being of the individual and society as a whole.

Many types of recreation are dependent upon the utilization of the area's natural resources. Fishing, hunting, hiking, snowmobiling and various other forms of outdoor recreation are popular, and the natural resources that support them are valuable. As the popularity of outdoor recreation increases, more and more pressure will be placed upon the natural resources of the area to support recreation activities. This pressure, if too great, may jeopardize these valuable natural resources and result in damage to the area and its economy.

The planning program needs to consider the recreation needs particular to its own population. Outdoor, resource oriented recreation needs are often used by both residents and nonresidents, but other types of recreation needs may exist in the community. These are facilities that provide recreation opportunities

primarily to local citizens, such as community parks, ball fields, and picnic areas. There may also be a need for organized recreation programs that would accommodate both the young and the old in the communities. An inventory of existing facilities and activities illustrates what exists today in the town and makes recommendations for the future based upon trends and expected needs.

Within the town of Middletown are various areas open for recreation. Facilities include:

Catskill Park - generally the southern part of the town containing nearly 7,000 acres of State owned land and almost 700 acres in and around the Pepacton Reservoir. Most of this land is accessible by the public for hunting, hiking, and fishing.

Kass Inn - Golf course on Route 30

Ball Fields and Playgrounds - at the Margaretville Central School

Lighted Ballfield - in Fleischmanns

Golf Driving Range - on Route 28 outside Margaretville

Galli-Cursi Movie Theatre - in Margaretville

Numerous Swimming Holes - on private lands

Erph Cultural Center - in Arkville

Delaware and Ulster Railroad - in Arkville

Evergreen Bowling Lanes - outside Margaretville

Numerous Rod and Gun Clubs

Arkville Park - for annual fair and other activities

Firemen's Field - in Margaretville for annual Firemen's Field Days

Belleayre and Highmount Ski Areas - located just over the town line in Ulster County

see recreation map next page

Also available to many residents are a number of snowmobile and cross-country ski trails that are open during the winter season.

Recommendations

Recreation has many characteristic forms, some are important than others; and people have many different recreation needs and desires. The task of the Planning Board is to assess these needs and to develop a recreation plan that is coordinated with the land use goals of the community.

- *Recreation programs should be provided for all age groups, especially youth who account for a large share of the population and who have the most time available. Coordination of all recreation programs and facilities with the county and surrounding towns is essential in order to stretch existing resources. In most cases, providing for more recreation for all ages does not involve large sums of money, rather organization of existing available resources.*

- *The Delaware and Ulster Railroad has been a great asset to the town. A plan to expand the rail ride to Halcottsville is nearly complete. The town should work together to provide riders with a visually attractive and pleasing view.*

HOUSING

In order for the town of Middletown to prosper, safe and healthy conditions must be available. As some residences deteriorate beyond repair, they need to be replaced. New homes built by new residents moving into the area and existing residences need to be maintained to basic safety and health standards. Although the town outside the village is predominately rural, most new developments are in residential growth. As indicated earlier in this report, construction of and replacement of new homes and mobile homes, both seasonal and

year-round, have increased steadily over the past 30 years. Housing unit growth in Middletown has grown by about 3 per cent per year since 1970 and is expected to increase in the future. Most of these new homes will be seasonal/vacation homes.

Many factors affect where people live; therefore, it remains to be seen if these growth trends do continue. Certainly the available jobs in the area, the availability of lots to be built upon, and price of new housing will affect this trend. Also, the cost of the energy will play a major role in future determination of where people decide to live and when they decide to move. People may be unable to maintain current commuting patterns. On the other hand, the higher energy costs could cause business and industry to decentralize in order to reduce transportaion costs. Such a decentralization would tend to increase local economies, thus increasing development.

Nonresident land ownership has increased and this will lead to the construction of more homes. Much of this new growth in the building of new homes and the subdivision of lots has occurred in the more rural areas of the town. The lack of new homes in the hamlet areas may be due to the desire for larger lots than can be found within the hamlets, or, an "isolationist" attitude of new homeowners who want greater privacy.

The *Land Use Plan* encourages growth of residential development in areas where natural resources are well suited and where access and community facilities (water and sewer) are now available. The plan proposes increased development in and near hamlets and town centers where available. Agricultural lands should not be pressured into residential use but should remain in food production. Improvement of the transportation network and community facilities should enhance the area's ability to attract good quality development which will promote the tax base of the town.

Housing in Middletown is predominately single-family, owner occupied. Low vacancy rates suggest little speculative

house building in the area. Rental units occur mostly within the hamlets and usually in converted older homes.

The main alternative to building a single-family house, now too expensieve for many to afford, is a mobile home. In the future we can expect pressure in this area of development to be high. Mobile homes can be attractive, safe living units; but care must be exercised in their selection and placement.

Recommendations

- *Middletown should consider establishing more areas within the town for use as mobile home parks. Such parks could provide efficient fire protection, garbage disposal, water and sewer services and adequate transportation facilities. Individual mobile homes should follow guidelines for safety and health, especially tie-downs, accessibility of fire equipment, and sanitary systems.*

- *Seasonal homes may, in the future, become increasingly used as permanent dwellings. As this transition occurs, problems can arise, including: (1) inadequate water and septic systems; (2) accessibility of fire and emergency vehicles; (3) traffic and road maintenance; and (4) school and public services impacts. Due to these potential problems, it is recommended that the town consider guidelines for existing seasonal units so that these potential hazards are avoided early. New subdivisions intended for seasonal homes should be permitted only after the developer has complied with Planning Board requirements to mitigate these problems.*

- *Year-round housing is adequate at present. Elderly and low to medium income rental units may be necessary in the future. The median age of Middletown residents is increasing rapidly and will result in the need for more specialized housing units. The town should work to attract and support any efforts to this end.*

EMPLOYMENT AND ECONOMY

As is true with much of the country, the unemployment rate in the Delaware County labor area has fluctuated up and down over recent years, with the January 1985 rate at 7.8 per cent and approximately 1,500 people out of work.

An increase in the working population should be a goal for the economy of the future. Such persons can be attracted by making the community an attractive place to live and by providing access to work locations and services.

The table on the following page shows type of employment and the number of Middletown residents employed by each industry group. In Middletown, professionals and related services employ the most people. Other industry groups employing large numbers include the manufacturing category and the wholesale and retail trade category. The number employed in service and retail trade is generally a good indicator of positive economic activity.

The numbers employed in construction and in the entertainment and recreation categories grew rapidly between 1970 and 1980.

Recommendations

- *The town of Middletown should encourage further industrial development in the form of light and clean industry. Public water and sewer is available to many places and an anxious work force lives in the area. The establishment of such an industry would further strengthen the economic base in Middletown and provide for continued economic growth and opportunities so vital to the quality of life in the area.*

THE TOWN SHOULD CONCENTRATE ON ATTRACTING SMALL-SCALE INDUSTRY

EMPLOYMENT BY INDUSTRY: 1970 - 1980 TRENDS

Town of Middletown

(Number of Persons Employed By Place of Residence)

INDUSTRY GROUPS	1970 NUMBER	1970 % DIST.	1980 NUMBER	1980 % DIST.	AVERAGE ANNUAL % CHANGE
Agriculture & Forestry	101	8.2 %	59	4.9 %	-4.2 %
Construction	80	6.5	140	11.6	7.5
Manufacturing	170	13.8	190	15.7	1.2
Transportation, Communications & Utilities	118	10.0	65	5.4	-4.5
Wholesale and Retail Trade	294	23.9	195	16.2	-3.4
Finance, Insurance & Real Estate	26	2.1	54	4.5	10.8
Professional, Related Services	380	30.9	363	30.1	-0.4
Entertainment & Recreation	7	0.6	116	9.6	155.7
Public Administration	54	4.4	25	2.1	-5.4
Total Employed	1,230	100.0 %	1,207	100.0 %	-0.2 %

Source: U.S. Census - 1970, 1980

IMPLEMENTATION

The plan can do little to influence the future of the town of Middletown by itself. It is advisory and must depend upon the willingness of persons and groups, public and private, to translate its proposals into actions.

Unless and until some type of commitment is made, the town will continue to change in a haphazard, sometimes harmful manner, in response to speculative interests. If this process continues, the responsibilities for decisionmaking will gradually pass on to a higher level of government. Neither of these alternatives is acceptable. The responsibilities for the town's development and management of its resources is a local one and should be accomplished, for the most part, by programs administered by the Town.

Regardless of governmental actions, private individuals will perform a major role in the implementation of the Comprehensive Plan, for these individuals still retain the decision to invest both their time and money in any particular community. As residents of the municipality, they will also be called upon to support local governmental programs, both at the polls and through the payment of taxes. Thus, a blending of public and private actions is necessary to attain the desired community development.

UNLESS AND UNTIL SOME TYPE OF COMMITMENT IS MADE, THE TOWN WILL CONTINUE TO CHANGE IN A HAPHAZARD, SOMETIMES HARMFUL MANNER

PUBLIC ACTIONS

Here are some of the ways through which local government may carry out the Comprehensive Plan.

Zoning Ordinance

This type of local ordinance divides the entire community into several zoning districts and establishes regulations for each type of district. Generally the zoning ordinance may regulate: the use of land and buildings; lot dimensions and size; the bulk and height of structures; the location of buildings on the lot; and the uses and buildings which are accessory to the principal use of the land. The purpose of the zoning ordinance is to protect existing development and to provide some control over future development. However, these regulations should be reasonable and in accordance with the community's comprehensive plan.

Subdivision Regulations

Another legal device, but one that is administered by the local planning board, is subdivision regulations. These try to encourage good subdivision design as well as require the installation of needed physical improvements. These regulations may establish standards for: the size and shape of blocks and lots; the location, width, and grade of streets; the location and installation of street utility improvements; and the dedication of land for park and recreational purposes. The regulations also establish procedures in which the planning board reviews and either approves or disapproves a subdivider's plan.

Capital Improvement Program

Another device, but one that the governing body imposes on itself, is the capital program. Basically, this program is a plan of capital projects which the local government proposes to undertake during a six-year period. Specifically, the capital program must include: a description of the proposed project, its estimated cost, and its priority; the method by which the project will be financed and an estimate

of the effect upon municipal operating costs for each of the three years following the completion of the proposed projects.

What is capital project? It is public physical betterment or improvement, such as street widenings, studies and surveys relating to community improvement, or the acquisition of land or rights in land. Once the capital program is enacted by the legislative body, no capital project may be undertaken unless it is included in the program as originally adopted or amended.

The purpose of the capital program is to provide a long-range plan for the orderly development of municipal facilities within the financial resources of the community. The planning board, because of its overall knowledge of community development, should be one of the parties responsible for the preparation of the capital program.

OTHER CONTROLS AND PROGRAMS

There are other governmental controls and programs available to New York State communities which regulate or encourage development. Some of these are as follows:

Sanitary Code

A sanitary code provides, among other things, for the manner in which septic tank systems are installed and maintained. Such a code may control the manner in which garbage and refuse are stored and disposed of. The installation and maintenance of swimming pools may also be controlled by such a code. The sanitary code of the State of New York was designed to enforce the New York State Public Health Law. As an alternative the code may be local but with the same objectives, including environmental considerations.

Auto Junkyard Ordinance

The storage and disposal of junk cars has prompted the adoption of auto junkyard ordinances in many communities. Again, the State of New York has such an ordinance. A municipality may, if it chooses, adopt the state ordinance or may write its own. The purposes are to minimize the impact of littering the landscape with hundreds of discarded automobiles and to control the environmental impact of burning such bodies to remove unwanted combustibles.

Mobile Home Ordinance

A mobile home ordinance may provide for the control of mobile homes on individual lots as well as mobile homes in mobile home parks. The typical ordinance may control licensing requirements, setbacks from roads, structures and property lines, accessibility; including street design and parking standards, water supply system, sewerage system, recreation areas and maintenance. Some communities will have mobile home controls in their zoning ordinance; some have a separate mobile home ordinance; and some have both.

Site Plan Review

A relatively new power the town board may retain or delegate to the planning board is that of site plan review. After approval of a zone change request by the town board or other specified actions approving a new use at a specific location, a set of guidelines allowing review of the detailed location of buildings, provision of parking and utilities, signs, screening and landscaping and access and circulation facilities for the project. This allows adjustment of the project to the surrounding community.

LOCAL CO' OL OPTIONS

CONTROLS / REGULATED ELEMENTS	Waste and Sewage	New Road Standards	Forest Management	Mobile Homes and Mobile Home Parks	Wetlands Areas	Flood Hazard Areas	Refuse and Salvage Operations	Signs	Water Quality	Subdivision of Land	Location of Development	Land Use
Sanitary Code	X											
Road Specifications		X										
Timber Harvesting Standards			X									
Trailer Ordinance				X								
Wetlands Ordinance					X							
Flood Plain Ordinance						X						
Junkyard Ordinance							X					
Sign Ordinance								X				
Natural Resource Ordinance			X		X	X			X			
Subdivision Regulations	X	X		?	?	?			?	X		
Site Plan Review of New Developments	X	X	?	X	?	X	?	X	?	?	?	?
Land Use Regulations	X	X	X	X	X	X	X	X	X		X	X
Land Use and Development Code	Can contain any or all elements											

? - Indicates Partial Control
Each of the elements can be separately administered

	Sanitation	Mobile Home	Junk Yard	Subdivision Regulations	Zoning	Natural Resources
1. Enabling Authority	NYS San. Code Pt 75 PHL -Art.II	Art. 16 Para. 130	Art. 16 Para. 136	Art. 16 Para. 276	Art. 16 Para. 261	Art. 8 & 24
2. Who Adopts & is Responsible?	T.B./V.B.	T.B./V.B.	T.B./V.B.	Pl. Bd. *	T.B./V.B.	T.B./V.B.
3. Who Enforces?	E.O.	E.O.	E.O.	Pl. Bd.	E.O.	E.O.
4. Adoption Procedure: a. Public Hearing Required?	1	1	1	1	3	1
b. County Review Required?	No	No	No	No	Yes	No
c. Public Hearing Needed for Amendment?	Yes	Yes	Yes	Yes	Yes	Yes
5. First Appeal To:	T.B./V.B.	T.B./V.B.	T.B./V.B.	Courts	Z.B.A.	T.B./V.B.
6. Form of Approval:	Permit	Permit or Park License	License	Plat Endorsement	Permit	Permit
7. Who Keeps Records	E.O. or T.C.	E.O. or T.C.	T.C.	Pl. Bd.	T.C.	T.C.
8. Can Application Fee be Charged?	Yes	Yes	Yes	Yes	Yes	Yes

*Must be approved by Resolution by T.B./V.B.

Legend:

T.B./V.B.	-	Town Board or Village Board
E.O.	-	Enforcement Officer
T.C./V.C.	-	Town Clerk or Village Clerk
Pl. Bd.	-	Planning Board
Z.B.A.	-	Zoning Board of Appeals

Building Code

In addition to development controls that deal with the use of land, there are other development controls that regulate the buildings and other structures that go on the land. A building code contains standards and requirements for construction. New York State has developed uniform standards (New York State Fire Prevention and Building Code) which is applicable in Middletown. The purpose is to ensure that all structures built meet minimum standards regarding health, safety and welfare.

Middletown also has established a building permit system requiring the issuance of a permit for construction after review of the suitability of location with regard to flood plains. A similar permit system can be adopted for wetlands and natural features, but not addressing the details of construction.

Tax Exemptions

A method which attempts to encourage development, rather than regulate it, is granting of tax abatements or exemptions. Municipalities may grant these exemptions to non-profit organizations which use land and/or buildings for educational, public recreational, or historical purposes. For example, a historical society which has acquired land and buildings for preservation purposes may be eligible for a property tax exemption.

Loans and Grants-in-Aid

The Federal and State governments have realized that communities cannot financially support all of the programs that they would desire to undertake. Consequently, both these governments have created numerous loans and grants-in-aid programs to assist the localities in meeting their present and future needs. This financial assistance may include: grant for the acquisition

and development of park lands; grants for the preparation of comprehensive plans; grants for detailed sewer and water studies; loans for the construction of basic public works; and loans and grants for urban and rural renewal projects.

Summary

There are many methods and techniques available to municipalities to assist them with the implementation of the comprehensive plan. The above-mentioned devices should serve only as an illustration of some of the ways through which local governments may regulate, guide, and encourage present and future community development.

FEDERAL AND STATE CONTROL OF LAND USE

There are numerous Federal and State laws that both directly and indirectly control land use. First, through legislation controlling air and water pollution discharges and water supply and location, density and type of development are affected. Also, legislative programs that provide aid for sewage treatment systems, for example, have a significant impact on where growth will take place.

In addition to these, the Federal Government affects land use through the National Flood Insurance Program and the Army Corps of Engineers Wetlands and Flood Plain Permit Program. The State too controls land use through its own wetlands and flood plain laws, stream protection permits, the Wild and Scenic Rivers Act, utility lines and power plant siting, the use of land for solid waste disposal purposes, and surface mining reclamation programs.

If a community wishes to undertake its own code enforcement program, many of the above elements can be incorporated into it. This allows speedier local review and issuance of permits without

the bureaucratic delays that often accompany State or Federal review. The community must write into its codes and ordinances the State and Federal objectives and policy to accomplish this, however, and assure adequate review.

PRIVATE ACTIONS

Some of the ways through which local governments may implement the Comprehensive Plan have been explored, but what are some of the means available to private individuals? As stated previously, individuals may invest both time and money in the improvement of their community. Once this investment decision has been reached, the efforts of these individuals may have considerable impact upon local development.

One of these private efforts could simply be a "paint-up, clean-up" campaign in which an area of the community is given a new look and thereby, hopefully, provide a stimulus for revitalization. Another effort should be the preservation and restoration of a municipality's historical structures and sites. Individuals may also band together to form development corporations with the intention of constructing industrial, residential, or commercial developments. If properly located and well designed, these new activities can assist the community in achieving a desirable development pattern.

IMPLEMENTATION PROGRAM

There are several options available to a municipality in setting up its program. Each of the above can be adopted as separate regulations complete with administrative provisions and definitions and procedures. They can be adopted as ordinances, which require publication in full following adoption, or as local laws which require certification of five copies to the Secretary of State within five days of adoption but eliminates publication.

Instead of individual regulations, some of the above can be telescoped into other ones. For example, mobile homes and junk yards can be incorporated into zoning or site plan review ordinances. Sanitation and road construction standards can be built into subdivision regulations as well.

Another option that can be considered is a development code that includes sections on land use, subdivision, wetlands, mobile homes, sanitation, etc. and a common administrative section, thus building all of the above into a single code package.

All of the options have advantages and disadvantages that the municipality needs to consider before action is proposed.

REGIONAL RELATIONSHIP

The town does not exist in a vacuum. It depends upon surrounding communities to supplement some of the services which it cannot fulfill, such as employment, transportation, shopping, and medical care. It is important to identify those agencies that maintain a direct interest in the activities and planning programs of the town. Strong regional planning relationships are necessary to provide a coordinative and cooperative approach to solving problems confronting local communities and to avoid duplication of effort wherever possible. There are several regional agencies which can assist the local planning effort, including:

Delaware County Planning Board

The County Planning Board, appointed by the Board of Supervisors, provides several different planning functions. They provide technical and advisory services to local municipalities throughout the county; they are a liaison between the municipalities and the various State and Federal agencies and programs; and they maintain a data bank of information on planning. One

of the important activities of the Board is the Town Planning Advisory Service Program. The preparation of this Comprehensive Plan and the reports and land use study leading up to it are the result of a cooperative planning project between the Town and the County Planning Board staff.

Policies and programs of other county agencies will also affect local planning programs and should be kept in mind throughout the planning effort. These agencies are the County Highway Department, the U.S. Department of Agriculture Soil Conservation Service, the Delaware County Soil and Water District, and the Cooperative Extension Service.

Southern Tier East Regional Planning and Development Board

Located in Binghamton, this Board performs regional planning functions for its eight member counties of Broome, Chenango, Cortland, Delaware, Otsego, Schoharie, Tioga and Tompkins. It is composed of four voting members from each county, including the chairman of the county legislative body. The Board and its staff have identified eight functional areas of concern and have also identified within these categories issues and needs concerning problems, goals and objectives in long-range terms to provide a broad framework of future development, as well as more specific and short-term policy formulations to serve as recommendations to the various levels of government involved in development planning in the region. Additionally, the Regional Planning Board has 'A-95' Review powers under the Intergovernmental Cooperation Act of 1968.

Eastern Susquehanna River Basin Water Resources Planning Board

Includes seven participating counties which prepared a comprehensive plan for the management and development of water and related resources. The participating counties include Broome, Chenango, Cortland, Delaware, Madison, Otsego and Tioga. Staff effort was provided by the State Department of Environ-

mental Conservation. The Comprehensive Water Resources Plan has been developed to provide water resources needs in the basin under the two principal objectives of environmental quality and regional development. The environmental quality objective is to protect, conserve and restore water and related resources to the levels of quality consistent with continued or increased well-being of residents of the basin. The regional development objective is to insure the availability of water resources and facility capacity to support a reasonable rate of economic growth in the region.

Catskill Center for Conservation and Development, Inc.

A private, non-profit organization headquartered in Arkville, New York. The Center is a citizen organization with professional staff concerned with sound environmental planning and management in the seven-county Catskill region.

With the expiration of the Catskill Study Commission and the failure of the State Legislature to act on their recommendations, there is no official policy-making body for the Catskill Region. During May 1976, revised legislation to create a land resources management plan for private lands and a master plan for State lands was submitted by NYS Department of Conservation but was not enacted by the legislature.

State agencies which may affect local planning are:

Department of State, Division of Community Affairs

This office provides financial and technical assistance to local governments and administers the U.S. Department of Housing and Urban Development (HUD) Comprehensive Planning and Management Assistance Program in the state.

Department of Environmental Conservation

This department is charged with the administration of State lands under several divisions: the prevention and abatement of water, air and noise pollution; and the administration of fish and wildlife laws. Specific duties of D.E.C. having a potentially direct bearing on Middletown include:

- *Coordination of the HUD National Flood Insurance Program under which Middletown has applied and has been certified eligible for federally subsidized flood insurance for those townspeople located in a flood hazard area.*
- *Investigation and recommendation to the Legislature for classification and designation of any waterway that would meet the criteria of the N.Y.S. Wild, Scenic and Recreational Rivers System.*
- *Implementation and coordination of the Freshwater Wetlands Act of 1975 regulating development affecting wetland areas of 12.4 acres or larger. Under the provisions of this Act, the town may assume certain responsibilities with the approval of D.E.C. for the administration of this provision in lieu of which the county will have ninety days to exercise such option, after which control will revert to the State.*

CONTINUED PLANNING PROGRAM

Besides its role in the administrative and implementation of this Plan, there are a variety of ongoing tasks which the Town Planning Board must carry on:

- *First is to promote the public discussion and understanding of the Plan so that the implementation will be better accepted locally.*

- *The job of designing land use control programs for consideration by the community is also urgent. After enactment, it will be necessary to monitor and evaluate the results of these programs to ensure their effectiveness.*
- *The Planning Board needs to further identify areas of special importance from a natural and cultural resources standpoint and make recommendations on them concerning conservation/preservation strategies.*
- *And, finally, this Plan should be continually updated and further detailed to reflect change in the area's goals and objectives.*

APPENDIX A

QUESTIONNAIRE RESULTS

A P P E N D I X B

LAND USE REPORT

APPENDIX C

1980 CENSUS

1980 CENSUS OF POPULATION, CHARACTERISTICS OF PEOPLE AND HOUSING
PREPARED BY THE NEW YORK STATE DATA CENTER, NYS DEPT OF COMMERCE
FOR INFORMATION CALL (518) 474-6221

STATE OF NEW YORK COUNTY 025 MIDDLETOWN TOWN

AGE/YEARS	TOTAL	MALES	FEMALES
UNDER 1	33	16	17
1 AND 2	76	38	38
3 AND 4	67	33	34
5	23	13	10
6	39	21	18
7 TO 9	145	80	65
10 TO 13	230	116	114
14	53	25	28
15	55	26	29
16	65	33	32
17	65	48	17
18	53	22	31
19	42	17	25
20	35	14	21
21	34	14	20
22 TO 24	137	64	73
25 TO 29	252	120	132
30 TO 34	215	113	102
35 TO 44	378	183	195
45 TO 54	428	202	226
55 TO 59	236	100	136
60 TO 61	97	44	53
62 TO 64	136	58	78
65 TO 74	416	194	222
75 TO 84	187	72	115
85 +	56	20	36
TOTAL POP	3545	1682	1873
MEDIAN AGE	39.1	36.7	41.4

PERSONS OF SPAN ORIG	
MEXICAN	4
PUERTO RICAN	24
CUBAN	2
OTHER	15
BY RACE	
WHITE	42
BLACK	
AM IND-ESK-ALEUT	
ASIAN-PAC ISL	
OTHER	5

MARITAL STATUS	TOTAL	MALE	FEMALE
SINGLE	641	350	291
NOW MARRIED	1678	837	841
SEPARATED	78	29	49
WIDOWED	320	57	263
DIVORCED	170	71	99

HOUSING UNITS(ALL TYPES)	2424
URBAN	
RURAL	2424
YEAR ROUND HOUSING UNITS	2034
OCCUPIED	1414
VACANT	620
SEASONAL/MIGRATORY UNITS	390
AGGREGATE ROOMS IN YEAR ROUND UNITS	11637
MEDIAN ROOMS IN YEAR ROUND UNITS	5.0

RACE/ETHNICITY	UNDER 5	5-17	18-64	65+
TOTAL	170	478	2510	387
WHITE	163	441	2345	385
BLACK		5	13	1
AM IND-ESK-ALT				
ASIAN-PAC ISL				
OTHER	3	7	13	1
SPANISH ORIGIN	3	15	21	5
WHITE				
BLACK				

OCCUPIED HOUSING UNITS BY PERS IN UNIT	TOTAL	TENURE OWNER	TENURE RENTER
1 PERSON	389	295	154
2 PERSONS	495	405	90
3 PERSONS	222	170	52
4 PERSONS	166	137	29
5 PERSONS	84	68	16
6+ PERSONS	60	43	17
MEDIAN PERSONS/UNIT	2.15		
MEAN PERSONS/UNIT	2.58		

PERSONS/ROOM(UNITS)	TOTAL	OWNER	RENTER
1.00 LESS	1354	1039	315
1.01 - 1.50	56	33	23
1.51 +	5	4	1

WHITE	3522
BLACK	17
AM IND	4
ESKIMO	
ALEUT	
JAPANESE	1
CHINESE	
FILIPINO	
KOREAN	
ASIAN IND	2
VIETNAMESE	
HAWAIIAN	4
GUAMANIAN	
SAMOAN	
OTHER	5
URBAN POP	
RURAL POP	3545
FAMILIES	970
HOUSEHOLDS	1414

ROOMS--YEAR ROUND HOUSING UNITS			
1 ROOM	21	4 ROOMS	447
2 ROOMS	65	5 ROOMS	361
3 ROOMS	235	6+ ROOMS	905

CONDOMINIUM UNITS	
RENTER OCCUPIED	
VACANT FOR SALE	
OTHER VACANT	

	UNITS	AGGREGATE ROOMS	PERSONS	PERS/ROOM
OCCUP HOUSING UNITS	1414	8308	3531	.43
OWNER OCCUP	1056	6651	2737	.41
RENTER OCCUPIED	358	1657	794	.48
VACANT YR ROUND UNITS	620	2929	N/A	
FOR SALE ONLY	42	236	N/A	
MORE THAN 6 MO	19	N/A	N/A	
FOR RENT ONLY	54	129	N/A	
MORE THAN 2 MO	29	N/A	N/A	
OCCASIONAL USE	448	N/A	N/A	
OTHER VACANT	96	2564	N/A	
BOARDED UP	4	N/A	N/A	

VALUE OF OWNER OCCUP NONCONDO HOUSING UNITS	
LESS THAN 10000	24
10000 - 14999	40
15000 - 19999	86
20000 - 24999	91
25000 - 29999	89
30000 - 34999	80
35000 - 39999	56
40000 - 49999	91
50000 - 79999	84
80000 - 99999	7
100000 - 149999	3
150000 - 199999	
200000 +	
MEDIAN VALUE	29700

AGGREGATE VALUE-OWNER OCCUP AND VACANT FOR SALE UNITS-(000)	NONCONDO	CONDO
OWNER	21489	
VACANT	836	

Notes for Tables on Page 1

Prepared by Southern Tier East Regional Planning and Development Board
For information call (607) 724-1327

Suppression To maintain the confidentiality of respondents, data that could be traced to particular persons is suppressed, i.e., not released. When small geographic areas are summarized, total counts are always reported: total population, total housing units, year-round units, occupied/vacant status, and count of persons and households in each race or Spanish origin group. Characteristics are suppressed if the following thresholds are not met.

- Characteristics of persons (other than race or Spanish origin) are shown only if there are 15 or more persons in the geographic area. Even when the geographic area has 15 or more persons, cross-classification by race or Spanish origin may result in complimentary suppressions. (see Race by Age).
- Year-round housing characteristics require at least 5 year-round units; family, household and occupied housing characteristics require 5 occupied units; owner/renter characteristics require at least 5 owner and at least 5 renter in the summarized area to avoid suppression.

As a check for possible suppressions in other tables refer to total population count, housing unit count and count of persons by race (never suppressed). Suppressions occur infrequently at the numicipal level.

Persons of Spanish Origin is a provisional count, as is Race. Both are subject to change after the long form sample census is tabulated. These are the only provisional counts reported. (NOTE: Spanish origin is not a race category).

Race/Ethnicity by Age If all reported race categories contain at least 15 persons, no suppression occurs. If more than 2 race categories are reported and any single category has less than 15 persons, the under - 15 category and one other category are summed and reported in "other".

If only 2 race categories are reported and 1 has less than 15 persons, both categories are summed and reported in both "total" and "other", i.e., the total is reported twice.

Housing Units (All Types) includes all housing units, that is, houses, apartment, mobile homes, groups of rooms or single rooms intended for occupancy as separate living quarters.

Occupied Housing Units (renter occupied, owner-occupied, and vacant) includes all owner and renter occupied units and all vacant year-round units (by category).

Value of Owner Occupied Non-condominium Housing Units includes only single-family units on less than 10 acres which have no commercial or medical office on the property. Mobile homes, multi-family units, and houses on more than 10 acres are excluded from value calculations.

Urban/Rural are type-of-race concepts rather than specific areas on maps. The urban population comprises all persons living in urbanized areas (roughly, areas of approximately 1,000 persons per square mile) and in places of 2,500 or more outside urbanized areas. Rural population consists of every one else.

STATE OF NEW YORK COUNTY 025 MIDDLETOWN TOWN

CONTRACT RENT-OCCUP UNITS	
UNDER 50	5
50 - 99	40
100 - 119	40
120 - 139	46
140 - 149	4
150 - 159	56
160 - 169	18
170 - 199	26
200 - 249	33
250 - 299	4
300 - 399	2
400 - 499	
500 +	
NO CASH RENT	46
MEDIAN RENT $	150
AGGREGATE RENT-(000)	
RENTER OCC	9806
VAC FOR RENT	1026

OCCUPANCY STATUS	
OWNER OCC AND VAC FOR SALE NONCONDO	
OCCUPIED	652
VAC FOR SALE	28
RENTER OCC PAYING CASH AND VAC FOR RENT	
OCCUPIED	274
VAC FOR RENT	31

HOUSEHOLD RELATIONSHIP	
FAMILY HOUSEHOLD	
HOUSEHOLDERS	970
SPOUSES	815
RELATIVES	1133
NONRELATIVES	93
NON FAM HOUSEHOLD	
MALE HHOLDER	165
FEMALE HHOLDER	279
NONRELATIVE	76
GROUP QUARTERS	24
INSTITUTION	24
OTHER	

YEAR ROUND UNITS AT ADDRESS	
1 UNIT	1537
2 - 9 UNITS	276
10 + UNITS	6
MOBIL HOME/TRAILER	215

RELATED CHILDREN BY AGE	
UNDER 5	170
5 - 17	655

RACE OF HOUSEHOLDER	TOTAL	OWNER	RENTER
WHITE	1401	1047	354
BLACK	7	7	
AM IND/ESK/ALEUT	3	3	
ASIAN/PAC IS	2	2	
OTHER	1	1	
SPANISH ORIG HHOLDERS	19	15	4
WHITE	18	18	
BLACK			

PERSONS IN HHOLD	TOTAL	MALE	FEMALE
1 PERSON HHOLDS	389	134	255
2+ PERSON HHOLDS			
MARRIED COUPLE	815	N/A	N/A
OTHER FAMILY	155	44	111
NON FAMILY	55	31	24

PLUMBING FACILITIES IN YEAR ROUND UNITS

	TOTAL	TOTAL OCCUP	OWNER OCCUP	RENTER OCCUP
COMP PLUMBING	1951	1370	1027	343
INCOMP PLUMBING	83	44	29	15

OCCUPIED HOUSING UNITS W/ 1.01+ PERS/ROOM	
PERS IN OCCUP UNITS	188
OWNER OCCUP	118
RENTER OCCUP	70
UNITS W/O COMP PLUMBING	3
OWNER OCCUP	2
RENTER OCCUP	1
PERSONS W/ COMP PLUMBING	173
PERSONS W/O COMP PLUMBING	15

PERSONS IN OCCUP UNITS W/O COMP PLUMBING	93

HOUSEHOLD TYPE--PERS UNDER 18

IN HOUSEHOLD		HOUSEHOLDS WITH 1+ PERSONS UNDER 18	
HHOLDER OR SPOUSE	1		
OWN CHILD OF HHOLDER			
IN MARR-COUPLE FAM	617	MARR-COUP FAM	344
OTHER FAMILY	161	OTHER FAMILY	
OTHER RELATIVES	47	MALE HHOLDER	25
NON RELATIVES	27	FEMALE HHOLDER	73
IN GROUP QUARTERS		NONFAM HHOLD	5
INMATE			
OTHER			

HOUSEHOLDS W/ 1+ NONRELATIVES	110

HOUSEHOLD TYPE-PERSONS 65+	
IN FAMILY HHOLD	
HOUSEHOLDER	224
SPOUSE	139
OTHER RELATIVE	50
NONRELATIVE	12
IN NON FAMILY HOUSEHOLD	
MALE HHOLDER	45
FEMALE HHOLDER	154
NON RELATIVE	11
IN GROUP QUARTERS	24
INMATE	24
OTHER	

PERS IN HHOLDS W/ PERSONS--60+	65+
1 PERSON HHOLDS	227	186
2+ PERSON HHOLDS		
FAMILY	370	282
NON FAMILY	18	16

AGE OF HOUSEHOLDER	HOUSEHOLDER UND 65	65+
UNITS W/ 1+ PERS 65+		
TOTAL	61	423
OWNER OCCUPIED	48	338
RENTER OCCUPIED	13	85

	NO.	%
PERSONS SUBSTITUTED	20	.56
YEAR ROUND UNITS SUBST	18	.88

POPULATION ALLOCATIONS

PERSONS NOT SUBST W/ 1+ ITEM ALLOCATED	
PERSONS W/ 1+ ITEMS ALLOCATED	417
RELATIONSHIP ALLOCATED	78
SEX ALLOCATED	47
AGE ALLOCATED	111
RACE ALLOCATED	78
ORIGIN ALLOCATED	192
MARITAL STATUS ALLOCATED	
(FOR PERSONS 15+)	39

HOUSING ALLOCATIONS

YR ROUND UNITS NOT SUBST W/ 1+ ITEMS ALLOC	
UNITS W/ 1+ ITEMS ALLOCATED	336
VACANCY STATUS ALLOCATED	38
DURATION OF VACANCY ALLOCATED	56
UNITS AT ADDRESS ALLOCATED	62
ROOMS ALLOCATED	20
PLUMBING FACILITIES ALLOCATED	30
TENURE ALLOCATED	33
VALUE ALLOCATED	53
CONTRACT RENT ALLOCATED	27

Notes for Tables on Page 2

Prepared by Southern Tier East Regional Planning and Development Board
For information call (607) 724-1327

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- Year-round housing characteristics require at least 5 year-round units; family, household and occupied housing characteristics require 5 occupied units; owner/renter characteristics require at least 5 owner and at least 5 renters in the summarized area to avoid suppressions.

As a check for possible suppressions in other tables refer to total population count, housing unit count and count of persons by race (never suppressed). Suppressions occur infrequently at the municipal level.

Contract Rent - Occupied Units includes only single-family units on less than 10 acres with no commercial or medical office on the property. Mobile homes are excluded.

Occupancy Status (owner occupied and vacant for sale non-condominium) and (renter occupied paying cash and vacant for rent) both include only single family units on less than 10 acres with no commercial or medical office on the property. Mobile homes are excluded.

Spanish Origin Householder counts are subject to modification after sample (long form) tabulations are complete. Only Spanish origin and Race counts are subject to revision.

Allocation Tables In a computerized editing process, missing or inconsistent entries were allocated, i.e., assigned. For housing data, the assignment is based on related information reported on the housing unit or on information reported for a similar unit in the immediate neighborhood. The general procedure for population allocations is to assign an entry consistent with entries for other persons with similar characteristics.

The allocation process is designed to enhance the quality of the data (for instance, Age was reported in two places on the census form. If this information was omitted in one place, but reported elsewhere, the appropriate age allocation is added in the editing process).

TOWN OF MIDDLETOWN: 100% CENSUS DATA

1990 CENSUS OF POPULATION, CHARACTERISTICS OF PEOPLE AND HOUSING
PREPARED BY THE NEW YORK STATE DATA CENTER, NYS DEPT. OF COMMERCE
FROM SUMMARY TAPE FILE2--FOR INFORMATION CALL (518) 474-6005

SUMMARY FOR THE TOTAL POPULATION OF MIDDLETOWN TOWN DELAWARE COUNTY

HOUSEHOLDS BY TYPE AND AGE OF HOUSEHOLDER

	COUPLE	OTHER FAM MALE	OTHER FAM FEMALE	SINGLE PERS MALE	SINGLE PERS FEMALE	NON FAMILY MALE	NON FAMILY FEMALE
15-19	1			1	4		
20-24	23	3	4	10	10	4	4
25-34	125	12	25	34	28	11	1
35-44	136	13	27	14	4	5	1
45-54	159	4	20	15	18	6	5
55-64	173	6	17	20	45	2	5
65-74	142	3	15	27	74	2	6
75+	56	5	3	13	72	3	2
TOTAL	815	44	111	134	255	31	24

UNITS BY PRICE

	ASKED-SPECIFIED	NON CONDO	CONDO
UNDER $20000		7	
$20000-24999		4	
$25000-29999		6	
$30000-39999		4	
$40000-49999		6	
$50000-59999			
$60000-69999		1	
$70000-79999			
$80000-99999			
$100000-149999			
$150000-199999			
$200000+			
MEDIAN	28100		

UNITS BY RENT

ASKED-SPECIFIED	
VAC FOR RENT	
UNDER $50	1
$50-$79	1
$80-$99	2
$100-$119	5
$120-$139	11
$140-$159	8
$160-$179	
$180-$199	1
$200-$249	2
$250-$349	
$350-$499	
$500+	
MEDIAN	133

YEAR ROUND UNITS AT ADDRESS

1	1537	6	21
2	138	7	4
3	72	8	
4	33	9	
5+	6	10+	6
MOBILE HOME/TRAIL	215		

HOUSEHOLDS W/ PERSONS	
UNDER 6	253
6-17	372
18-24	241
25-34	356
35-44	291
45-54	331
55-64	251
65+	484

MEDIAN ROOMS YR RND UNITS

TOTAL	5.2
OCCUPIED	5.6
OWNER	6.0
RENTER	4.3
VACANT	4.3
FOR SALE	5.3
FOR RENT	3.6
OTHER	4.3

OCCUPIED UNITS WITH 1.01+ PERS/ROOM BY PLUMBING FACILITIES

TYPE OF HOUSEHOLDER	TOTAL	COUPLE	OTHER FAM MALE	OTHER FAM FEMALE	NON FAMILY MALE	NON FAMILY FEMALE
COMPLETE	20	2	4			1
INCOMPLETE	2	1				
OWNER OCCUP						
COMPLETE	15					
INCOMPLETE	1	1				
RENTER OCCUP						
COMPLETE	5	2	4			1
INCOMPLETE	1					

ALLOCATION STATUS BY SUBSTITUTION STATUS

AGE	NOT ALLOCATED NOT SUBST	NOT ALLOCATED SUBST	ALLOCATED NOT SUBST	ALLOCATED SUBST
0-6	194	1	1	
6-14	456	1	15	
15-19	272	2	6	
20-24	198		8	
25-29	242	1	9	
30-34	205		7	
35-44	382	3	13	
45-54	415	1	12	
55-59	226	3	7	
60-64	226	3	4	
65+	625	5	29	

TYPE OF HOUSING UNIT

SPECIFIED OWNER OCCUPIED AND VACANT FOR SALE	
NONCONDOMINIUM	680
CONDOMINIUM	
OTHER OWNER OCCUP AND VACANT FOR SALE	
2+ UNITS AT ADDRESS	97
1 UNIT ON 10+ ACRES	173
W/ COMMERCIAL ESTAB	42
MOBILE HOME/TRAIL	136

VACANCY STATUS BY BOARDED UP STATUS

	FOR SALE	FOR RENT	SOLD/ RENTED	OCCAS USE	OTHER VAC
BOARDED UP				1	3
NOT BOARDED UP	42	34	28	447	65

PERSONS IN FAM HHOLD

HOUSEHOLDER	970
SPOUSE	815
CHILD	992
BROTHER/SISTER	25
PARENT	34
OTHER RELATIVE	82
PARTNER/ROOMMATE	16
ROOMER/BOARDER	41
PAID EMPLOYEE	5
OTHER NONRELATIVE	31
IN NONFAMILY HHOLD	
HHOLDER ALONE	389
HHOLDER NOT ALONE	55
PARTNER/ROOMMATE	25
ROOMER/BOARDER	19
PAID EMPLOYEE	3
OTHER NONRELATIVE	29
IN GROUP QUARTERS	
INMATE OF INST	24
OTHER	

AGE

	TOTAL	MALE	FEMALE
0-4	174	84	90
5-9	206	113	93
10-14	288	141	147
15-19	280	146	134
20-24	206	92	114
25-29	252	120	132
30-34	215	113	102
35-39	210	96	114
40-44	168	87	81
45-49	184	91	93
50-54	244	111	133
55-59	236	100	136
60-64	233	102	131
65-69	242	120	122
70-74	174	74	100
75-79	110	48	62
80-84	77	24	53
85+	56	20	36
TOTAL	3555	1682	1873

HOUSEHOLD TYPE

IN HOUSEHOLD	90
HHOLDER/SPOUSE	93
OWN CHILDREN	147
HUSB-WIFE FAM	134
MALE HHOLDER	114
FEMALE HHOLDER	132
OTHER RELATIVES	102
HUSB-WIFE FAM	114
MALE HHOLDER	81
FEMALE HHOLDER	93
NON RELATIVES	133
IN FAM HHOLD	136
IN NONFAM HHOLD	131
IN GROUP QUARTERS	122
INMATE OF INST	100
OTHER	62

PERSONS

	UNDER 6	6-17
N/A		1
	135	482
	9	27
	32	93
	11	19
	1	2
	4	10
	4	16
		7

HUSB-WIFE

W/ OWN CHILD	
UNDER 6 AND	
6 TO 17	1
UNDER 6 ONLY	13
6 TO 17 ONLY	2
NO OWN CHILD	7
MALE HHOLDR	
W/ OWN CHILD	
UNDER 6 AND	
6 TO 17	
UNDER 6 ONLY	1
6 TO 17 ONLY	
NO OWN CHILD	2
FEMALE HHOLDR	
W/ OWN CHILD	
UNDER 6 AND	
6 TO 17	
UNDER 6 ONLY	4
6 TO 17 ONLY	
NO OWN CHILD	

COUNT OF FAMILIES AGE OF HOUSEHOLDER

15-24	25-34	35-44	45+
2	24	17	4
13	40	9	1
2	33	92	88
7	28	18	42
	2		1
1	1		1
	4	8	3
2	3	5	13
	6	3	2
4	6	2	
	13	19	10
		3	43

Notes for STF2 Tables

Prepared by Southern Tier East Regional Planning and Development Board
For information call (607) 724-1327

Allocation and Substitution of Age Missing or inconsistent age entries were estimated in a computerized editing process. When a person processed had no report of age, or the entry was unacceptable, the age allocated to him or her was obtained from the last person processed who had the same general set of characteristics. Age allocations were drawn from persons of the same sex, household relationship, and marital status with similar characteristics of other household members.

The edit process also allows substitution of a full set of characteristics for persons or a housing unit when there was indication that a housing unit was occupied, but no information on the questionnaire. Non-interviews after repeated callbacks were substituted as were questionnaires that encountered irretrievable mechanical failures.

The edit process was designed to enhance the quality of the data, ensuring that assigned entries closely correspond to the age distributions of similar persons who actually reported age in the census. Nonetheless, areas with high allocation and substitution rates are more susceptible to error and bias. Areas with a substitution rate of 20 percent or more will be flagged in Census Bureau printed reports.

Household Type A household consists of all persons living in a housing unit. The householder is the person who filled out Column 1 of the questionnaire. The number of householders equals the number of housing units in complete count data.

Families are two or more persons, including the householder, who are related by birth, marriage or adoption and who live together as one household. A person maintaining a household alone, or with unrelated persons, is regarded as a household but not as a family.

Group quarters include persons in living arrangements, such as nursing homes or rooming houses, which are not households. Institutional group quarters include correctional facilities, mental hospitals, nursing homes, etc. Noninstitutional group quarters have 9 or more persons unrelated to the person in Column 1 and include communes, rooming houses, dormitories, military barracks, missions, etc.

Specified Vacant for Sale Vacant year round single family units, on less than 10 acres, with no commercial establishment on the premises. Vacancy status was determined by the enumerators at the time of the census, by questioning owners, neighbors, agents and others.

Specified Vacant for Rent Vacant year round units offered for rent, and vacant units offered for sale or rent, excluding units on 10 acres or more.

TOWN OF MIDDLETOWN: 100% CENSUS DATA

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

TOTAL POPULATION	3555	PERSONS BY AGE AND SEX	TOTAL	MALE	FEMALE	RACE AND SPANISH ORIGIN BY AGE AND SEX	TOTAL	MALE	FEMALE
IN URBANIZED AREAS	0					WHITE			
OTHER URBAN	0	UNDER 1	44	9	35	UNDER 5	169	35	134
RURAL	3555	1 AND 2	66	11	55	5 TO 14	428	252	236
FARM (1980 DEF)	98	3 AND 4	64	15	49	15 TO 59	1990	952	1038
FARM (1970 DEF)	114	5	11	2	9	60 TO 64	197	90	107
NONFARM (1980 DEF)	3457	6	44	16	28	65 AND OVER	650	277	373
NONFARM (1970 DEF)	3441	7 TO 9	141	65	76	BLACK			
UNWEIGHTED COUNT	915	10 TO 13	240	139	101	UNDER 5	0	0	0
100 PERCENT COUNT	3555	14	58	32	26	5 TO 14	6	2	4
		15	40	22	18	15 TO 59	21	13	8
PERSONS BY RACE		16	86	47	39	60 TO 64	7	0	7
WHITE	3494	17	58	52	6	65 AND OVER	9	9	0
BLACK	43	18	58	20	38	AM IND-ESK-ALT			
AMER INDIAN	0	19	38	5	33	UNDER 5	0	0	0
ESKIMO	0	20	49	25	24	5 TO 14	0	0	0
ALEUT	0	21	16	9	7	15 TO 59	0	0	0
JAPANESE	1	22 TO 24	141	58	83	60 TO 64	0	0	0
CHINESE	0	25 TO 29	259	104	155	65 AND OVER	0	0	0
FILIPINO	0	30 TO 34	208	129	79	ASIAN-PAC ISL			
KOREAN	0	35 TO 44	378	183	195	UNDER 5	0	0	0
ASIAN INDIAN	5	45 TO 54	455	216	239	5 TO 14	0	0	0
VIETNAMESE	0	55 TO 59	231	98	133	15 TO 59	0	0	0
HAWAIIAN	7	60 AND 61	74	32	42	60 TO 64	0	0	0
GUAMANIAN	0	62 TO 64	137	58	79	65 AND OVER	0	0	0
SAMOAN	0	65 TO 74	401	177	224	SPAN ORIGIN			
OTHER	0	75 TO 84	208	89	119	UNDER 5	0	0	0
OTHER (RACE NEC)		85 AND OVER	50	20	30	5 TO 14	14	2	12
SPANISH	0	18 AND OVER	2703	1223	1480	15 TO 59	15	11	4
NOT SPANISH	5	21 AND OVER	2558	1173	1385	60 TO 64	17	5	12
		65 AND OVER	659	286	373	65 AND OVER	2	2	0
SPANISH ORIGIN AND RACE		TOTAL	3555	1633	1922				
NOT OF SPAN ORIGIN	3507								
MEXICAN	0	WOMEN 15 TO 44 BY MARITAL STATUS	15-24	25-34	35-44				
PUERTO RICAN	33								
CUBAN	0	SINGLE	199	36	15				
OTHER SPANISH		EVER MARRIED	49	198	180				
WHITE,BLACK, AMER		MEAN CHILDREN EVER BORN	.2	1.3	2.6				
INDIAN, ESKIMO,									
ALEUT, ASIAN AND		PERSONS IN GROUP		OWN CHILDREN BY					
PACIFIC ISLANDER	15	QUARTERS BY TYPE		FAMILY TYPE					
OTHER RACE (NEC)	0								
SPANISH ORIGIN BY RACE		TOTAL	24	MARRIED COUPLE	556				
TOTAL	48	TOTAL INST	24						
WHITE	48	MENTAL HOSP	0	IN FAMILY W/					
BLACK	0	AGED HOME	24	MALE HHOLDER	50				
AMER INDIAN, ESKIMO,		OTHER INST	0						
ALEUT, ASIAN AND		TOTAL OTHER GROUP		IN FAMILY W/					
PACIFIC ISLANDER	0	QUARTERS	0	FEMALE HHOLDER	182				
OTHER RACE (NEC)	0	COLLEGE DORM	0						
		MIL BARRACKS, OTHER	0						

FAMILY HOUSEHOLDS BY PRESENCE OF OWN CHILDREN AND FAMILY TYPE	MARRIED COUPLE	MALE HHOLDR	FEMALE HHOLDR
W/ OWN CHILD			
TOTAL	329	39	63
WHITE	326	39	63
BLACK	3	0	0
AM IND-ESK-ALEUT	0	0	0
AS-PAC ISL	0	0	0
SPAN ORIG	0	7	0
NO OWN CHILD			
TOTAL	516	27	38
WHITE	513	27	33
BLACK	0	0	5
AM IND-ESK-ALEUT	0	0	0
AS-PAC ISL	3	0	0
SPAN ORIG	7	0	0

NON FAMILY HHOLDS BY RACE AND SPAN ORIGIN	
TOTAL	402
WHITE	400
BLACK	7
AM IND-ESK-ALEUT	0
AS-PAC ISL	7
SPAN ORIG	2
SUBFAMILIES BY TYPE	4
MARRIED COUPLE	8
W/ OWN CHILD	7
# OF CHILDREN	5
W/O OWN CHILD	5
FATHER-CHILD	2
MOTHER-CHILD	0
PERSONS PER SUBFAMILY	0
	2.3
PERSONS BY ANCESTRY	0
SINGLE GROUP	0
DUTCH	75
ENGLISH	288
FRENCH	26
GERMAN	231
GREEK	0
HUNGARIAN	52
IRISH	247
ITALIAN	139
NORWEGIAN	0
POLISH	70
PORTUGUESE	9
RUSSIAN	49
SCOTTISH	81
SWEDISH	9
UKRANIAN	10
OTHER	156
MULTIPLE ANCESTRY	1608
ANCESTRY NOT SPECIFIED	
OTHER	230
NOT REPORTED	290

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

PERSONS IN MULTIPLE ANCESTRY GROUPS		PERSONS 5+ BY AGE LANGUAGE SPOKEN AT HOME AND ABILITY TO SPEAK ENGLISH	5-17	18+	PERSONS 25+ BY YEARS OF SCHOOL COMPLETED	TOTAL	WHITE	BLACK	AM IND-ESK-ALT	ASIAN-PAC ISL	SPAN ORIGIN
ENGLISH/OTHER	527										
FRENCH/OTHER	136	SPEAKS ONLY ENGLISH	642	2436	ELEM (0-8)	488	481	0	0	0	11
GERMAN/OTHER	543	OTHER THAN ENGLISH			HIGH SCHOOL						
IRISH/OTHER	736	SPANISH SPOKEN			1 TO 3 YEARS	498	486	12	0	0	8
ITALIAN/OTHER	230	SPEAK ENGLISH WELL			4 YEARS	791	785	6	0	0	2
POLISH/OTHER	169	OR VERY WELL	8	23	COLLEGE						
		SPEAK ENGLISH NOT			1 TO 3 YEARS	304	304	0	0	0	0
PERSONS BY NATIVITY AND PLACE OF BIRTH		WELL/NOT AT ALL	14	11	4+ YEARS	320	303	14	0	0	9
NATIVE	3355	OTHER LANGUAGE									
BORN IN STATE OF RESIDENCE	2908	SPEAK ENGLISH WELL			PERSONS 3+ ENROLLED IN PRIVATE SCHOOLS BY ENROLLMENT						
BORN IN DIFF STATE	412	OR VERY WELL	14	166	NURSERY SCHOOL	12					
BORN ABROAD	35	SPEAK ENGLISH NOT WELL/NOT AT ALL	0	11	KIND/ELEM(1-8)	0					
FOREIGN BORN	200				HIGH SCHOOL(1-4)	2					
		VETERANS STATUS--CIVILIANS 16 AND OVER	MALE	FEMALE	COLLEGE	2					
PERSONS 5+ BY RESIDENCE IN 1975		VETERAN	507	4							
SAME HOUSE	1983	NONVETERAN	815	1521	PERSONS 16-19 BY ENROLLMENT AND L.F. AND H.S. GRAD						
DIFFERENT HOUSE		PERIOD OF SERVICE			ARMED FORCES	0					
SAME COUNTY	701	M.Y 1975 OR LATER	7		CIVILIAN						
DIFF COUNTY		VIETNAM ERA	83		ENROLLED IN SCHOOL	176					
SAME STATE	588	KOREAN CONFLICT	90		NOT ENROLLED						
DIFF STATE		WORLD WAR II	240		HS GRADUATE						
NORTHEAST	71	WORLD WAR I	10		EMPLOYED	7					
NORTHCENT	0	OTHER	75		UNEMPLOYED	1					
SOUTH	25				NOT IN LABOR FORCE	25					
WEST	9	PERSONS 3 AND OVER ENROLLED IN SCHOOL	NURSERY SCHOOL	ELEM (0-8)	NOT HS GRADUATE						
ABROAD	5			H.S. (1-4)	EMPLOYED	7					
				COLLEGE	UNEMPLOYED	7					
		TOTAL	14	500	NOT IN LABOR FORCE	17					
		WHITE	14	496							
IN SMSA IN 1980		BLACK	0	4							
SAME SMSA IN 1975		AM IND-ESK ALEUT	0	0							
CENTRAL CITY	0	ASIAN-PAC ISL	0	0							
SMSA REMAINDER	0	SP ORIG	0	14							
OUTSIDE THIS SMSA IN 1975											
DIFFERENT SMSA IN 1975		PERSONS 18+ BY YEARS OF SCHOOL COMPLETED									
NOT IN SMSA IN 1975	0										
NOT IN SMSA 1980		ELEMENTARY THRU HIGH SCHOOL, 1 TO 3 YEARS		1083							
IN SMSA IN 1975	508	HIGH SCHOOL 4 YEARS		905							
NOT IN SMSA IN 1975	2874	COLLEGE									
		1 TO 3 YEARS		378							
		4 YEARS		174							
		5 OR MORE YEARS		163							

PERSONS 16 AND OVER BY LABOR FORCE STATUS	TOTAL	WHITE	BLACK	AM IND-ESK-ALT	ASIAN-PAC ISL	SPAN ORIGIN
MALE						
LABOR FORCE	824	813	8	0	0	7
ARMED FORCES	0	0	0	0	0	0
CIV LAB FORCE						
EMPLOYED	740	729	8	0	0	7
UNEMPLOYED	84	84	0	0	0	0
NOT IN LAB FOR	498	486	12	0	0	11
FEMALE						
LABOR FORCE	545	541	3	0	0	8
ARMED FORCES	0	0	0	0	0	0
CIV LAB FORCE						
EMPLOYED	467	463	3	0	0	2
UNEMPLOYED	78	78	0	0	0	6
NOT IN LAB FOR	959	959	12	0	0	8

NONINSTITUTIONAL PERSONS 16 TO 64 BY WORK DISABILITY	
WITH A WORK DISABILITY	
IN LABOR FORCE	114
NOT IN LABOR FORCE	212
PREVENTED FROM WORKING	189
NOT PREVENTED FROM WORKING	23
NO WORK DISABILITY	1862

NONINSTITUTIONAL PERSONS 16 AND OVER BY PUBLIC TRANSPORTATION DISABILITY	16-64	65+
W/ PUBLIC TRANS DISABILITY	61	63
NO PUBLIC TRANS DISABILITY	2127	572

TOWN OF MIDDLETOWN: SAMPLE U.S. CENSUS 'A

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

EMPLOYED PERSONS 16+ BY OCCUPATION		FEMALES 16+ WITH OWN CHILDREN:		PERSONS 16+ BY LABOR FORCE STATUS			WORKERS 16+ BY MEANS OF TRANSPORTATION TO WORK	
MANAG AND PROF SPECIALTY		WITH OWN CHILDREN UNDER 6		IN LABOR FORCE			CAR, TRUCK OR VAN	
EXEC, ADMIN, MANAG	135	IN LABOR FORCE	39	WORKED IN 1979	MALE 1,018	FEMALE 756	DRIVE ALONE	962
PROFESSIONAL SPECIALTY	158	NOT IN LABOR FORCE	65	W/ UNEMPLOY	106	156	CARPOOL	234
TECH, SALES, ADMIN SUPPORT		WITH OWN CHILDREN 6-17		NO UNEMPLOY	738	468	PUBLIC TRANSPORTATION	16
TECHNICIANS&RELATED SUPPORT	53	IN LABOR FORCE	158	DID NOT WORK			W/TAXI ONLY	10
SALES	63	NOT IN LABOR FORCE	140	W/ UNEMPLOY	6	10	OTHER MEANS	4
ADMIN SUPPORT (INC CLERICAL)	166			NOT IN LAB FORCE	392	897	WORK AT HOME	85
SERVICE		WORKERS 16+ BY PLACE OF WORK						
PRIVATE HOUSEHOLD	0	STATE/COUNTY LEVEL		PERSONS 16+ WITH UNEMPLOYMENT IN 1979 BY RACE AND SPANISH ORIG			WORKERS 16+ BY CARPOOL STATUS	
PROTECTIVE SERVICE	7	WORK IN STATE OF RES			MALE	FEMALE	DRIVE ALONE	962
OTHER SERVICE	139	IN COUNTY OF RES	839	TOTAL	192	160	IN 2 PERSON CARPOOL	154
FARMING, FORESTRY, FISHING	56	OUTSIDE CTY OF RES	237	MEAN WEEKS UNEMP	15.1	14.4	IN 3 PERSON CARPOOL	32
PRECISION PROD, CRAFT, REPAIR	194	WORK OUTSIDE OF STATE	5	WHITE	187	160	IN 4 PERSON CARPOOL	32
OPER, FABRICATORS, LABORERS		NOT REPORTED	88	BLACK	5	0	IN 5+ PERSON CARPOOL	19
MACH OPER, ASSEMBLERS, INSP	114			AM IND-ESK-ALEUT	0	0	OCCUPIED HOUSING UNITS BY	
TRANS AND MATERIAL HANDLING	77	PLACE LEVEL		ASIAN-PAC ISL	0	0	NUMBER OF VEHICLES AVAILABLE	
HANDLERS, EQUIP CLEANERS, HELPERS, LABORERS	44	LIVING IN A PLACE		SPANISH ORIGIN	0	6	1	641
		WORK IN PLACE	0				2	367
EMPLOYED PERSONS 16+ BY INDUSTRY		WORK OUTSIDE PLACE	0				3 OR MORE	203
		NOT REPORTED	0	PERSONS 16+ WHO WORKED IN 1979 BY WEEKS WORKED AND USUAL HOURS				
AGRI, FOREST, FISH, MINING	59	NOT LIVING IN PLACE	1149		MALE	FEMALE	OCCUPIED HOUSING UNITS WITH NO VEHICLE AVAILABLE	
CONSTRUCTION	140	SMSA LEVEL		35+ HOURS/WEEK			TOTAL	215
MANUFACTURING		LIVING IN AN SMSA		50 TO 52 WEEKS	524	265	WHITE	199
NONDURABLE GOODS	65	WORK IN SAME SMSA		48 TO 49 WEEKS	51	20	BLACK	8
DURABLE GOODS	125	CENTRAL CITY	0	27 TO 35 WEEKS	69	29	AM IND-ESK-ALEUT	0
TRANSPORTATION	29	REMAINDER	0	1 TO 26 WEEKS	127	105	ASIAN-PAC ISLINDER	13
COMM, OTHER PUBLIC UTILITIES	36	WORK OUTSIDE SMSA	0				SPANISH ORIGIN	2
WHOLESALE	47	NOT REPORTED	0	1 TO 34 HOURS/WEEK				
RETAIL	148	NOT LIVING IN SMSA	1149	50 TO 52 WEEKS	25	70		
FINANCE, INS, REAL ESTATE	54			48 TO 49 WEEKS	4	6	PERSONS 16+ WITH UNEMPLOYMENT	
BUSINESS AND REPAIR SERVICE	41	MCD LEVEL		27 TO 39 WEEKS	15	13	IN 1979 BY WEEKS UNEMPLOYED	
PERS SERV, RECREATION SERV	126	WORK IN MCD OF RES	760	1 TO 26 WEEKS	45	75	1 TO 4 WEEKS	164
PROFESS AND RELATED SERVICE		WORK OUTSIDE MCD OF RESIDENCE	361				5 TO 14 WEEKS	330
HEALTH	110						15+ WEEKS	108
EDUCATION	161	NOT REPORTED	28	MEAN WEEKS WORKED	41.9	37.9		
OTHER	76							
PUBLIC ADMINISTRATION	25	WORKERS 16+ WHO DID NOT WORK AT HOME BY TRAVEL TIME		HOUSEHOLDS BY SIZE			PERSONS BY HOUSEHOLD RELATIONSHIP	
EMPLOYED PERSONS 16+ BY CLASS OF WORKER				1 PERSON	381		IN FAMILY HOUSEHOLD	
		LESS THAN 5 MINUTES	164	2 PERSONS	500		HOUSEHOLDER	1012
		5 TO 9 MINUTES	275	3 PERSONS	216		SPOUSE	753
PRIVATE WAGE AND SALARY	733	10 TO 14 MINUTES	168	4 PERSONS	179		OTHER RELATIVES	1132
FEDERAL GOVERNMENT	17	15 TO 19 MINUTES	64	5 PERSONS	88		NONRELATIVES	129
STATE GOVERNMENT	89	20 TO 29 MINUTES	140	6+ PERSONS	68		IN NON FAMILY HOUSEHOLD	
LOCAL GOVERNMENT	154	30 TO 44 MINUTES	59				MALE HOUSEHOLDER	197
SELF EMPLOYED WORKER	193	45 TO 59 MINUTES	49				FEMALE HOUSEHOLDER	335
UNPAID FAMILY WORKER	21	60 OR MORE MINUTES	85				NON RELAT,MED	43
		MEAN TRAVEL TIME (MIN)	18.3				IN GROUP QUARTERS	
							INMATE OF INSTITUTION	24
							OTHER	0

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

INCOME IN 1979	HHOLDS	FAMILIES	UNRELATED INDIVIDUALS 15+		FAMILIES AND NON FAMILY HOUSEHOLDS BY POVERTY STATUS IN 1979			FAMILIES WITH ONE OR MORE RELATED CHILDREN BY POVERTY STATUS IN 1979		
UNDER $2500	67	16							ABOVE POVERTY LEVEL	BELOW POVERTY LEVEL
$2500 TO $4999	216	82			INCOME BELOW	FAMILIES	NONFAM HHOLDERS	W/ RELATED CHILDREN	36	38
$5000 TO $7499	219	132	UNDER $1000	75	POVERTY LEVEL			UNDER 5 ONLY	38	8
$7500 TO $9999	144	100	$1000 TO $1999	19	15 TO 64	126	79	5 TO 17 ONLY	269	50
$10000 TO $12499	147	109	$2000 TO $2999	52	65 AND OVER	14	52			
$12500 TO $14999	123	124	$3000 TO $3999	106	INCOME 100 TO 124% OF POVERTY LEVEL					
$15000 TO $17499	102	91	$4000 TO $4999	45						
$17500 TO $19999	43	50	$5000 TO $5999	52	15 TO 64	37	12			
$20000 TO $22499	60	49	$6000 TO $6999	38	65 AND OVER	17	47			
$22500 TO $24999	79	64	$7000 TO $7999	22	INCOME 125% OF POV LEVEL AND ABOVE					
$25000 TO $27499	62	29	$8000 TO $8999	24						
$27500 TO $29999	25	25	$9000 TO $9999	13	15 TO 64	623	145			
$30000 TO $34999	31	29	$10000 TO $11999	19	65 AND OVER	197	87			
$35000 TO $39999	61	48	$12000 TO $14999	36						
$40000 TO $49999	25	25	$15000 TO $24999	27	POVERTY STATUS IN 1979					
$50000 TO $74999	18	19	$25000 TO $49999	38		ABOVE POVERTY LEVEL	BELOW POVERTY LEVEL			
$75000 OR MORE	13	6	$50000 OR MORE	7	PERSONS					
MEDIAN	11207	13569	MEDIAN	4767	UNDER 55	1890	543			
MEAN	15180	17035	MEAN	7846	55 TO 59	209	22			
					60 TO 64	183	28			
FAMILY INCOME IN 1979	WHITE	BLACK	AM IND-ESK-ALT	ASIAN-PAC ISL	65 AND OVER	551	84			
				SPAN ORIGIN	UNRELATED INDIVIDUALS					
UNDER $5000	87	5	0	0	15 TO 64	200	153			
$5000 TO $7499	132	0	0	0	65 AND OVER	166	54			
$7500 TO $9999	100	0	0	0	PERSONS BY RACE					
$10000 TO $14999	250	0	0	5	TOTAL	2833	677			
$15000 TO $19999	141	0	0	0	WHITE	2791	658			
$20000 TO $24999	110	3	0	0	BLACK	25	18			
$25000 TO $34999	83	0	0	0	AM IND-ESK-AL	0	0			
$35000 TO $49999	73	0	0	0	ASIAN-PAC ISL	0	0			
$50000 OR MORE	25	0	0	0	SPANISH ORIG	42	6			
MEAN	17093	10850	0	14505	13281					

FAMILIES BY FAMILY TYPE AND POVERTY STATUS IN 1979			HOUSEHOLDS WITH INCOME IN 1979 BY INCOME TYPE	HOUSEHOLDS	MEAN INCOME
INCOME ABOVE POVERTY LEVEL	TOTAL	FEMALE HHOLDER	EARNINGS	969	15753
WITH RELATED CHILDREN			WAGE OR SALARY	832	15035
UNDER 6 AND 6 TO 17	43	5	NONFARM SELF-EMPLOYMENT	215	8315
UNDER 6 ONLY	38	0	FARM SELF-EMPLOYMENT	45	4742
6 TO 17 ONLY	262	30	INTEREST,DIVID, OR NET RENT	595	3173
WITHOUT RELATED CHILDREN	531	29	SOCIAL SECURITY	589	4068
			PUBLIC ASSIST	182	2590
INCOME BELOW POVERTY LEVEL			OTHER	446	3919
WITH RELATED CHILDREN					
UNDER 6 AND 6 TO 17	36	12			
UNDER 6 ONLY	13	2			
6 TO 17 ONLY	47	14			
WITHOUT RELATED CHILDREN	42	9			

PER CAPITA INCOME IN 1979 BY INMATE STATUS	
TOTAL	6008
NONINSTITUTIONAL	6044
AGGREGATE INCOME IN 1979 OF PERS 15+ BY:	
INMATE STATUS	
TOTAL	21358895
NONINSTITUTIONAL	21343090
MEAN HOUSEHOLD INCOME IN 1979	
TOTAL	15066
OWNER	17414
RENTER	8140

OCCUPIED HOUSING UNITS WITH COMPLETE PLUMBING FACILITIES BY HEATING EQUIPMENT,YEAR BUILT,PERSONS/ROOM	
W/ CENTRAL HEATING SYSTEM	
1939 OR EARLIER	
UNDER 1.01 PERSONS	501
1.01+ PERSONS	17
1940 TO MARCH 1980	
UNDER 1.01 PERSONS	538
1.01+ PERSONS	12
NO CENTRAL HEATING SYSTEM	
1939 OR EARLIER	
UNDER 1.01 PERSONS	198
1.01+ PERSONS	0
1940 TO MARCH 1980	
UNDER 1.01 PERSONS	94
1.01+ PERSONS	14

PERSONS BY POVERTY STATUS IN 1979-- INCOME AS PERCENT OF THE POVERTY LVL	
BELOW 75 PERCENT	376
75 TO 124 PERCENT	537
125 TO 149 PERCENT	295
150 TO 199 PERCENT	621
ABOVE 199 PERCENT	1681

FAMILIES BY NO. OF WORKERS IN 1979	FAMILIES	MEAN INCOME
NO WORKERS	217	8419
1 WORKER	318	14022
2 OR MORE WORKERS	477	22914

TOWN OF MIDDLETOWN: SAMPLE U.S. CENSUS DATA

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

TOTAL HOUSING UNITS	2424	HOUSING UNITS-INC SEASONAL AND MIGRATORY, BY UNITS IN STRUCTURE	TOTAL	OCCUP	RENTER OCCUP	SEASON/ MIGRA	PERSONS IN OCCUPIED UNITS BY UNITS IN STRUCTURE	TOTAL	OWNER	RENTER
IN URBANIZED AREAS	0									
OTHER URBAN	0									
RURAL	2424	1, DETACHED	1530	994	163	296	1, DETACHED	2556	2164	392
UNWEIGHTED COUNT	574	1, ATTACHED	6	6	2	0	1, ATTACHED	18	16	2
100 PERCENT COUNT	2424	2	116	106	45	4	2	308	190	118
		3 AND 4	111	59	79	10	3 AND 4	192	46	144
YEAR ROUND UNITS BY STORIES IN STRUCTURE		5 OR MORE	55	48	24	35	5 OR MORE	100	67	33
1 TO 3	2044	MOBILE HOME/TRAILER	226	161	45	35	MOBILE HOME/TRAILER	389	316	73
4 TO 6	0									
7 TO 12	0	YEAR ROUND HOUSING UNITS						OCCUPIED HOUSING UNITS		
13 OR MORE	0		TOTAL	OCCUP	OWNER OCCUP	RENTER OCCUP	BY YEAR HHOLDER MOVED IN	TOTAL	OWNER	RENTER
		YEAR STRUCTURE BUILT					1979 TO MARCH 1980	222	82	140
UNITS IN 4+ STORY STRUCTURE		1979 TO MAR 1980	13	2	2	0	1975 TO 1978	347	212	135
WITH ELEVATOR	0	1975 TO 1978	162	86	86	0	1970 TO 1974	299	246	53
NO ELEVATOR	0	1970 TO 1974	341	164	129	35	1960 TO 1969	257	242	15
		1960 TO 1969	284	181	141	40	1950 TO 1959	139	133	6
BY HEATING EQUIPMENT		1950 TO 1959	196	140	107	33	1949 OR EARLIER	150	141	9
STEAM OR HOT WATER	442	1940 TO 1949	114	101	80	21				
CENTRAL WARM AIR	786	1939 OR EARLIER	934	740	511	229	BY RACE/SPAN ORIG HHOLDER	TOTAL	OWNER	RENTER
ELECTRIC HEAT PUMP	12						TOTAL	1414	1056	358
OTHER BUILT-IN ELEC	351	NUMBER OF BEDROOMS	TOTAL	OWNER OCCUP	RENTER OCCUP		WHITE	1383	1028	355
FLOOR,WALL,PIPELESS FURNACE	27	NONE	25	8	2	6	BLACK	15	15	0
ROOM HEATERS W/ FLUE	137	1	205	135	47	88	AM IND-ESK-ALEUT	0	0	0
ROOM HEATERS NO FLUE	7	2	667	444	295	149	ASIAN-PAC ISLANDER	16	13	3
FIREPLACES STOVES OR PORTABLE ROOM HEAT	268	3	637	456	372	84	OTHER RACE	0	0	0
NONE	11	4	275	204	180	24	SPANISH ORIGIN	15	11	4
		5 OR MORE	215	167	160	7				
BY KITCHEN FACILITIES							BY TELEPHONE IN UNIT	TOTAL	OWNER	RENTER
COMPLETE	2002	NUMBER OF BATHROOMS	TOTAL	OWNER OCCUP	RENTER OCCUP		WITH TELEPHONE	1298	1002	296
NOT COMPLETE	42	NONE OR ONLY HALF BATHROOM	87	44	33	11	NO TELEPHONE	116	54	62
		1 COMPLETE	1421	952	632	320				
BY AIR CONDITIONING		1 COMPLETE PLUS HALF BATH(S)	240	192	179	13	BY TELEPHONE FOR HOUSEHOLDERS 60+ BY AGE OF HOUSEHOLDER		60-64	65+
NONE	1944	2+ COMPLETE	296	226	212	14	WITH TELEPHONE		130	356
CENTRAL SYSTEM	18						NO TELEPHONE		16	18
1 ROOM UNIT	68	OCCUPIED HOUSING UNITS			BY HOUSE HEATING FUEL				BY WATER HEATING FUEL	
2+ ROOM UNITS	14				UTILITY GAS	8			UTILITY GAS	20
		BY COOKING FUEL			BOTTLED,TANK,LP GAS	164			BOTTLED,TANK,LP GAS	386
BY SEWAGE SYSTEM		UTILITY GAS	26		ELECTRICITY	164			ELECTRICITY	570
PUBLIC SEWER	619	BOTTLED,TANK,LP GAS	772		FUEL OIL,KEROSENE,ETC	678			FUEL OIL,KEROSENE,ETC	386
SEPTIC TANK OR CESSPOOL	1394	ELECTRICITY	570		COAL OR COKE	10			OTHER	48
OTHER MEANS	31	OTHER	46		WOOD	187			NO FUEL USED	10
		NO FUEL USED	0		OTHER FUEL	0				
BY WATER SOURCE					NO FUEL USED	3				
PUBLIC SYSTEM OR PRIVATE COMPANY	668	OCCUPIED UNITS W/ COMPLETE PLUMBING-				TOTAL	WHITE	BLACK	AM IND-ESK-ALEUT	ASIAN-PAC ISL	SPANISH ORIGIN
DRILLED WELL	1001	FOR EXCLUSIVE USE				1374	1343	15	0	15	15
DUG WELL	40	AND STRUCTURE BUILT BEFORE 1940				716	685	15	0	16	4
OTHER SOURCE	335	AND LACKING CENTRAL HEATING EQUIPMENT				43	43	0	0	0	0
						306	285	8	0	13	6

STATE OF NEW YORK COUNTY OF DELAWARE TOWN OF MIDDLETOWN

SPECIFIED RENTER OCCUPIED UNITS BY GROSS RENT

	UNDER $100	$100-$199	$200-$299	$300 OR MORE	NO CASH RENT
WHITE	0	0	0	0	0
BLACK	0	0	0	0	0
AM IND-ESK-ALEUT	0	0	0	0	0
ASIAN-PAC ISLANDER	0	0	0	0	0
SPANISH ORIGIN	0	0	0	0	0

SPECIFIED RENTER OCCUPIED UNITS BY HOUSEHOLD INCOME IN 1979 AND GROSS RENT AS PERCENTAGE OF INCOME

	UNDER $5000	$5000-$9999	$10000-$14999	$15000-$19999	$20000 OR MORE
UNDER 20 PERCENT	0	4	8	32	20
20 TO 24 PERCENT	0	12	14	1	0
25 TO 34 PERCENT	0	30	0	0	0
35 PERCENT OR MORE	80	64	0	0	0
NOT COMPUTED	28	5	15	3	2

SPECIFIED OWNER OCCUPIED NONCONDOMINIUM UNITS BY MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS

WITH A MORTGAGE	WHITE	BLACK	AM IND-ESK-ALT	ASIAN PAC-ISL	SPAN ORIGIN
UNDER $200	14	0	0	0	0
$200 TO $299	84	0	0	0	0
$300 TO $399	82	0	0	0	0
$400 TO $499	32	3	0	0	0
$500 OR MORE	19	4	0	0	0
NOT MORTGAGED	393	8	0	13	4

SPECIFIED RENTER OCCUPIED UNITS BY GROSS RENT

UNDER $60	0
$60 TO $79	0
$80 TO $99	2
$100 TO $119	3
$120 TO $149	15
$150 TO $169	60
$170 TO $199	67
$200 TO $249	63
$250 TO $299	37
$300 TO $349	7
$350 TO $399	5
$400 TO $499	4
$500 OR MORE	6
MEDIAN	196
MEAN	184
NO CASH RENT	44

SPECIFIED RENTER OCCUPIED UNITS PAYING CASH RENT AND VACANT-FOR-RENT

OCCUPIED	274
MEAN CONTRACT RENT	146
VACANT-FOR-RENT	24
MEAN RENT ASKED	136

SPECIFIED OWNER OCCUPIED NONCONDOMINIUM UNITS BY SELECTED MONTHLY OWNER COSTS

WITH A MORTGAGE		NOT MORTGAGED	
UNDER $100	0	UNDER $50	0
$100 TO $149	0	$50 TO 74	11
$150 TO $199	14	$75 TO $99	57
$200 TO $249	54	$100 TO $124	99
$250 TO $299	30	$125 TO $149	60
$300 TO $349	54	$150 TO $199	102
$350 TO $399	28	$200 TO $249	46
$400 TO $449	18	$250 OR MORE	31
$450 TO $499	17	MEDIAN COSTS	142
$500 TO $599	12		
$600 TO $749	11		
$750 OR MORE	0	MEAN VALUE OF ALL UNITS	34124
MEDIAN COSTS	319		

SPECIFIED RENTER OCCUPIED UNITS

PAY EXTRA FOR 1+ UTILITIES	270
NO EXTRA PAYMENT FOR UTILITIES	48

SPECIFIED OWNER OCCUPIED NONCONDOMINIUM UNITS BY YEAR HOUSEHOLDER MOVED INTO UNIT

W/ MORTGAGE	UNITS	MEAN COSTS
1975-MARCH 1980	86	341
1970-1974	76	352
1960-1969	59	322
1959 OR EARLIER	17	327
NOT MORTGAGED	414	157

NOTE: IN ORDER TO MAINTAIN CONFIDENTIALITY OF RESPONDENTS, THE CENSUS BUREAU SUPPRESSES TABULATIONS OF CHARACTERISTICS FOR SMALL GROUPS OF PEOPLE OR HOUSING UNITS. THESE CELLS WILL APPEAR AS BLANKS IN THIS REPORT. IT WILL BE NECESSARY TO CHECK THE SUM OF CHARACTERISTICS AGAINST THE TOTAL TO DETERMINE IF SUPPRESSION HAS OCCURRED OR IF THE CELL IS A VALID ZERO.

DATA IN THIS REPORT ARE ESTIMATES BASED UPON THE SAMPLE LONG FORM QUESTIONAIRES. THESE COUNTS MAY NOT AGREE WITH PREVIOUSLY PUBLISHED 100 PERCENT DATA.

(10/82-1)

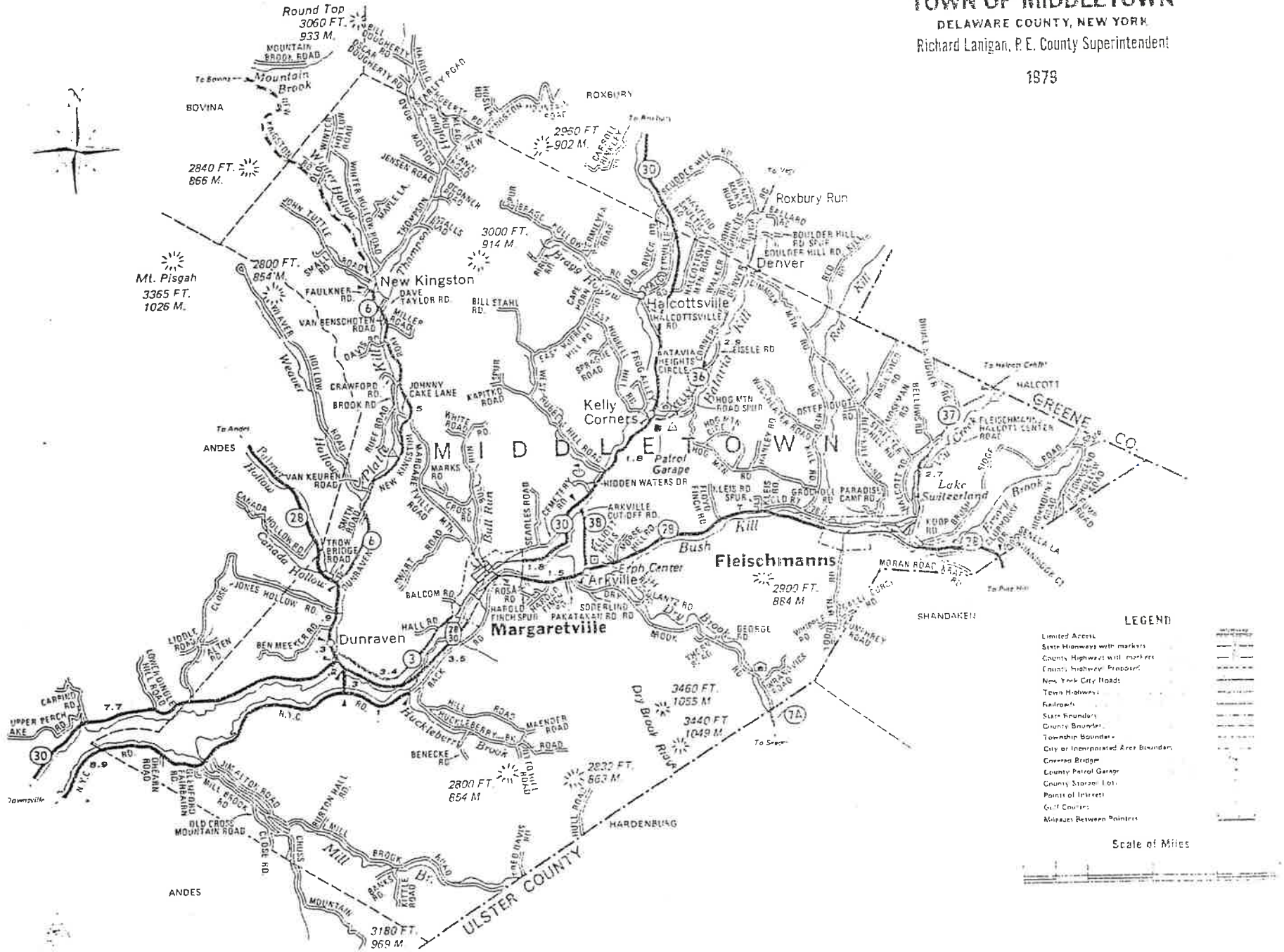
TOWN OF MIDDLETOWN: SAMPLE U.S. CENSUS DATA

TOWN OF MIDDLETOWN

DELAWARE COUNTY, NEW YORK

Richard Lanigan, P.E. County Superintendent

1979



4

SUBDIVISION REGULATIONS

TOWN OF MIDDLETOWN

DELAWARE COUNTY, NEW YORK

ADOPTED BY:
THE MIDDLETOWN TOWN PLANNING BOARD: OCTOBER 25, 1984

APPROVED BY:
THE MIDDLETOWN TOWN BOARD: DECEMBER 11, 1984

AMENDED BY:
THE MIDDLETOWN TOWN PLANNING BOARD: JUNE 8, 1989

APPROVED BY:
THE MIDDLETOWN TOWN BOARD: JULY 11, 1989

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TOWN OF MIDDLETOWN

SUBDIVISION REGULATION

ARTICLE 100. GENERAL PROVISIONS

101. AUTHORITY

By the authority of the resolution of the Town Board of the Town of Middletown, pursuant to the provisions of Article 16 of the Town Law of the State of New York, the Planning Board of the Town of Middletown is authorized and empowered to review and approve plats for the subdivision of land.

102. JURISDICTION

Land within the unincorporated portion of the Town of Middletown may be subdivided into lots, blocks, or sites, with or without roads or highways, only if approved by the Planning Board in accordance with the procedures and requirements as set forth in these Regulations, and only if the approved plat is duly filed in the office of the County Clerk of Delaware County, New York. Construction, excavation, filling, regrading, clearing of vegetation or other similar activities shall not begin within any area proposed or intended for subdivision until said subdivision shall have been approved, or conditionally approved, by the Planning Board.

103. POLICY

It is declared to be the policy of the Planning board to consider land subdivision as part of a plan for the orderly, efficient, and economical development of the Town. This means, among other things:

A) That land to be subdivided shall be of such character that it can be used safely for building purposes without danger to health or peril from fire, flood, or other menace, and without resulting in significant and/or irreparable damage to the ecology of the area in which it is located;

B) That proper provision shall be made for surface drainage, water supply, sewage and other needed improvements;

C) That all proposed lots shall be so laid out and of such size as to not cause any adverse effects, such as erosion, on neighboring properties;

D) That roads shall be of such width, grade and location as to accommodate the prospective traffic, to facilitate fire protection and to follow the natural contours of the land.

E) That in proper cases, and when required by the Planning Board, provisions shall be made for parks and playgrounds of suitable size, character and location for recreational purposes and to be shown on the subdivision plat.

104. BUILDING PERMITS

No building permit shall be issued for the erection of any building within a proposed subdivision until said subdivision has been duly approved by the Planning Board and filed in the office of the County Clerk. However, the Building Inspector may issue a single building permit for a single family residence based upon the entire tract of land where there is no other existing residence within the proposed subdivision and where the location of the proposed building is in accordance with an approved Preliminary Plat.

105. RESUBDIVISION

A resubdivision, as defined herein, is subject to the same procedures, rules and regulations applicable to an original subdivision.

106. CONDITIONS

Regulation of the subdivision of land and the attachment of reasonable conditions is an exercise of valid police power delegated by New York State to the Town. The subdivider or developer has the duty of compliance with reasonable conditions laid down by the Planning Board for design, dedication, improvement, and restrictive use of the land so as to conform to the physical and economical development of the Town and to the safety and general welfare of the future plat owners in the subdivision and the community at large.

107. WAIVERS AND MODIFICATIONS

A) Waivers

Where the Planning Board finds that, because of the special circumstances of a particular case, extraordinary hardship may result from strict compliance with these Regulations, the application of any of the requirements herein related to layout and platting of land for subdivision, provided, however, that any such waiver will not have the effect of nullifying the spirit and intent of these standards, the Comprehensive Plan, the Official Map, or any other regulations or ordinance, if such exists.

B) Design Innovations

When design concepts which are imaginative and beneficial to the public interest are proposed by the subdivider, the

Planning Board may modify the requirements of these Regulations and impose additional conditions as necessary to permit the accomplishments of such concepts. As authorized by resolution of the Town Board, the Planning Board may, simultaneously, with the approval of a plat, apply the provisions of Section 281 of the Town Law, when applicable.

C) Procedure

Applications for waivers or modifications shall be submitted by the subdivider at the time the Sketch Plan is submitted to the Planning Board. The Application shall state fully the grounds and all the facts relied upon by the Applicant.

108. AMENDMENTS

These Regulations may be amended by the Planning Board after public hearing on such amendments and subject to the approval of the Town Board. Any proposed preliminary subdivision plat which has not received conditional approval prior to the effective date of an amendment to these Regulations, or any conditionally approved preliminary subdivision plat where an application for Final Plat approval has not yet been received within six (6) months of the date of conditional approval, shall fully comply with any amendment to these Regulations.

109. ENFORCEMENT, VIOLATIONS, AND PENALTIES

A) General

1) It shall be the responsibility of the Planning Board to bring to the attention of the Town Attorney any violations or lack of compliance herewith.

2) No owner, or agent of the owner, of any parcel of land located in a proposed subdivision shall transfer or sell any such parcel before a plat of such subdivision has been approved by the Planning Board, in accordance with the provisions of these Regulations, and filed with the County Clerk.

3) The subdivision of any lot or any parcel of land, by the use of metes and bounds description for the purpose of sale, transfer, or lease with the intent of evading these Regulations, shall not be permitted. All such described subdivisions shall be subject to all of the requirements contained in these Regulations.

4) No building permit shall be issued for the construction of any building or structure located on a lot or plat subdivided or sold in violation of the provisions of these Regulations.

5) Lots may be advertised and contracted for sale only after Preliminary Plat approval has been granted by the Town Planning Board. No sale shall be finalized on any lot in the subdivision until Final Plat approval has been granted by the Town Planning Board.

B) Civil Enforcement

Appropriate actions and proceedings may be taken by law or in equity to prevent any violation of these Regulations, or prevent unlawful construction, to recover damages, to restrain, correct, or abate a violation, to prevent illegal occupancy of a building, structure or premises; and these remedies shall be in addition to the penalties described in a separate local law.

110. SEPARABILITY

Should any section or provision of the Regulations contained herein or as amended hereafter be declared by a court of competent jurisdiction to be invalid, such decision shall not affect the validity of the Regulation as a whole or any part thereof other than the part so declared to be invalid.

111. COURT REVIEW

Any person aggrieved by any decision of the Planning Board relative to a subdivision may have such decision reviewed by a special term of the Supreme Court in the manner provided by Article 78 of the Civil Practice Law and Rules, providing the proceeding is commenced within thirty (30) days after the filing of the decision in the office of the Planning Board, as all set forth in Section 282 of Town Law.

112. SUBDIVISIONS IN PROGRESS

This Regulation shall not apply to subdivisions already filed in the office of the County Clerk pursuant to Real Property Law 334 and where a substantial investment has already been made prior to the effective date of this Regulation. A substantial investment is the physical layout and preliminary construction work of new roads.

113. TITLE AND EFFECTIVE DATE

In order that land subdivisions may be made in accordance with the authority, jurisdiction, and policy as set forth above, these Regulations, which shall be known and cited as the "Town of Middletown Land Subdivision Regulations", have been adopted by the Planning Board on October 25, 1984 and approved by the Town Board on December 11, 1984. Amended by the Planning Board, after public hearing on July 8, 1989 and approved by the Town Board on July 11, 1989, to be effective August 1, 1989.

ARTICLE 200. DEFINITIONS

201. GENERAL TERMS

Except where specifically defined, all words used in these standards shall carry their customary meaning. Words used in the present tense shall include the future; words used in the singular shall include the plural, unless the context clearly indicates otherwise.

The work "shall" is always mandatory. The word "may" is permissive. "Building" or "structure" includes any part thereof. The word "person" includes an individual person, a firm, a corporation, a co-partnership, and any other agency of voluntary action.

202. KEY TERMS

For the purpose of these Regulations, certain words and terms shall have the following meaning:

APPLICANT - The owner of the land proposed to be subdivided or his duly appointed representative. Consent shall be required from the legal owner when a representative makes application.

BUILDING PERMIT - A permit issued by the Building Inspector which indicates the applicant has submitted an approved application and plan for building construction in compliance with the Town of Middletown requirements.

CONSTRUCTION DRAWINGS - The maps and/or drawings accompanying a subdivision plat and showing the specific location and design of improvements to be installed in the subdivision in accordance with the requirements of the Planning Board as a condition of the approval of the plat.

EASEMENT - Authorization by a property owner for the use of any designated part of his property by another, and for a specified purpose.

ENGINEER - A person licensed as a professional engineer by the State of New York or licensed in a state with a reciprocal agreement with New York State.

ENVIRONMENTAL ASSESSMENT FORM (EAF) - A form used by the Planning Board in the State Environmental Qualtiy Review process to assist in determining the environmental significance or nonsignificance of an action or project.

ENVIRONMENTAL IMPACT STATEMENT (EIS) - A written document required for each Type I and Unlisted Action which the Planning Board determines may have a significant effect on the environment.

ESCROW - A deposit of cash with the Town in lieu of an amount required and still in force on a performance or maintenance bond.

FINAL SUBDIVISION PLAT or FINAL PLAT - A drawing in final form, showing a proposed subdivision containing all information and detail required by law and these Regulations to be presented to the Planning Board for approval and which, if approved, shall be duly filed and recorded by the applicant in the office of the County Clerk.

LOT IMPROVEMENT - Any building, structure, place, work of art or other improvements to the land as may be required by the Planning Board, including clearing, final grading and drainage improvements that constitutes a physical betterment of real property. Certain lot improvements shall be properly bonded as provided in these Regulations.

LOT OR PARCEL - A tract, plot, or portion of a subdivision or other parcel of land intended, as a unit for the purpose, whether immediate or future, of sale, lease, donation or separate use.

MASTER/COMPREHENSIVE PLAN - A comprehensive plan prepared by the Planning Board pursuant to Section 272 (a) of the Town Law which indicates the general locations recommended for various functional classes of public works, places and structures and for general physical development for the Town and includes any unit or part of such plan separately prepared and any amendment to such plan or parts therein.

MODEL HOME - A dwelling unit used initially for display purposes which typifies the types of units that will be constructed in the subdivision.

OWNER - The person or persons actually holding title of a parcel or tract of land.

OFFICIAL MAP - A map established by the Town Board pursuant to Section 270 of the Town Law showing roads, highways, parks and drainage, both existing and proposed.

PERFORMANCE BOND - A bond as required by Section 277 of the Town Law to assure the full and satisfactory completion of all required subdivision improvements as specified in the Planning Board Resolution of Approval.

PLANNING BOARD - The Planning Board of the Town of Middletown, Delaware County, New York.

PLANNING BOARD ASSISTANT - A person appointed by the Planning Board and approved by the Town Board to assist the Planning Board with the administration of these Regulations. The person(s) will assist and instruct applicants with forms and procedures to ease administration. He may be directed by the Planning Board to review the application, including a field trip to the site and to make recommendations.

PRELIMINARY PLAT - A drawing or drawings clearly marked "Preliminary Plat" showing the salient features of a proposed subdivision, as specified in Article 600, Section 603 of these

Regulations, submitted to the Planning Board for approval prior to submission of the plat in final form and of sufficient detail to apprise the Planning Board of the layout of the proposed subdivision.

PUBLIC IMPROVEMENTS - Any drainage ditch, road, sidewalk, pedestrianway, tree, off-street parking, recreation area, lot improvement, or other facility for which the Town may ultimately assume the responsibilities for maintenance and operation, or which may affect an improvement for which Town responsibility is established. All such improvements shall be properly bonded.

RESUBDIVISION - A change in a map of an approved or recorded subdivision plat if such change affects any road layout on such map or any lot line or if it affects any map or plan legally recorded prior to the adoption of any regulations controlling subdivision. Any further subdivision of a previously defined Simple Subdivision shall be classified as a Major or Minor Subdivsion.

ROAD, COLLECTOR - A road which serves or is designed to serve as a trafficway for a neighborhood or as a feeder to a major road.

ROAD, DEAD-END or CUL-DE-SAC - A road or portion of a road with only one vehicular traffic outlet.

PRIVATE RIGHT-OF-WAY - A vehicular accessway which is not intended to be dedicated as a public way.

ROAD, PRIVATE - Any private roadway which was previously shown on a plat approved by the Planning Board and filed and recorded in the Office of the County Clerk or any private roadway which is built to Town Road Standards, but is not accepted as a Town roadway.

ROAD, PUBLIC - Any State, County or Town roadway.

ROAD, PAVEMENT - The wearing or exposed surface of the road right-of-way designed to be used by vehicular traffic.

ROAD PERIMETER - An existing road to which the parcel of land to be subdivided abuts on only one side.

ROAD REVIEW COMMITTEE - A committee appointed by the Town Supervisor to review plans and make periodic inspections during the construction phase of required improvement. The committee shall consist of one member of the Planning Board, one member of the Town Board and the Town Road Superintendent or his designee.

ROAD WIDTH - The width of the right-of-way between property lines measured at right angles to the centerline of the road at any given point.

SKETCH PLAN - A sketch of a proposed subdivision showing the information specified in Article 600, Section 601, of these Regulations to enable the subdivider to save time and expense in

reaching general agreement with the Planning Board as to the form of the layout and objectives of these Regulations.

STATE ENVIRONMENTAL QUALITY REVIEW ACT (SEQR) - It is a process to help government and the public protect and improve the environment. SEQR requires that environmental factors be considered along with social and economic considerations in government decisionmaking.

STREET - See ROAD

SUBDIVIDER - Any person, firm, corporation, partnership, or any legal entity who shall lay out any subdivision or part thereof as defined herein, either for himself or others.

SUBDIVISION - The division of any parcel of land into two (2) or more lots, blocks, or sites for any purpose with or without the creation of new roads or highways and includes resubdivision and planned unit developments.

SUBDIVISION, MAJOR - Any subdivision creating more than ten (10) lots on a public road or any subdivision of five (5) or more lots on a private road.

SUBDIVISION, MINOR - Any subdivison creating:

A) Four (4) to ten (10) lots on a public road;

B) Two (2) to four (4) lots on a private road meeting Town specifications;

C) Two (2) lots of twenty-five (25) acres or more on a private right-of-way.

SURVEYOR - A person licensed as a land surveyor by the State of New York.

TOWN CONSTRUCTION STANDARDS - The standards and specifications adopted by the Town Board for the construction of new roads and related improvements.

TYPE I ACTION - An action that is likely to have significant effect on the environment as listed in Part 617.12 of the SEQR Law.

UNLISTED ACTION - An action that may have a significant effect on the environment as explained in Part 617.2 of SEQR Law.

ARTICLE 300. APPLICATION PROCEDURE

301. GENERAL

Whenever any subdivision of land is proposed to be made, and before any contract for the sale of, or any offer to sell any lots in such subdivision or any part thereof is made, and before any permit for the erection of a structure in such proposed subdivision shall be granted, the subdivider or his duly authorized agent shall apply for and secure approval of such proposed subdivision in accordance with the following procedures.

302. INITIAL CONFERENCE

Before preparing a sketch plan, the applicant should meet with the Planning Board or its assistant to discuss the procedure for approval of a subdivision and the requirements as they may pertain, including general layout of lots, new roads, reservation of lands, road improvements, drainage, sewer, fire protection and other similar matters.

The applicant will also be advised of the necessary forms for Sketch Plan review and of the requirements for compliance with New York State Environmental Quality Review Act procedures.

303. SKETCH PLAN REVIEW

A) Submission of Sketch Plan

Any owner of land shall, prior to subdividing or resubdividing land, submit to the Secretary of the Planning Borad or its assistant, at least ten (10) days prior to the regular meeting of the Board, three copies of a Sketch Plan and a complete application for the proposed subdivision, which shall comply with the requirements of Article 600, Section 601, for the purposes of classification and preliminary review and discussion.

The subdivider, or his duly authorized agent, shall attend the meeting of the Planning Board to discuss the requirements of these Regulations for road improvements, drainage, sewerage, water supply, fire protection, flood protection and similar aspects, as well as the availability of existing services and other pertinent information.

B) Classification of Sketch Plan

At this time, the Planning Board shall classify the Sketch Plan as to whether it is a Minor or Major Subdivision as defined in these Regulations, provided all lots meet minimum standards in accordance with the Town Zoning Ordinance.

The Planning Board shall, as part of the subdivision review process, determine the applicability of the development limitations requirements for a particular subdivision

proposal. The Planning Board shall apply the development limitation requirements of minimum lot size and frontage to particular parcels when, and only when, two or more of the development limitations exist to any degree within the proposed parcel.

If the Sketch Plan is classified as a Minor Subdivision, the subdivider shall then comply with the procedure outlined in Article 300, Section(s) 304 and 307 of these Regulations. if it is classified as a Major Subdivision, the subdivider shall then comply with the procedures outlined in Article 300, Section(s) 305, 306, 307 and 308 and Article 400.

C) State Environmental Quality Review Act (SEQR) Requirements

The Planning Board shall also determine the applicability of SEQR. An Environmental Assessment Form (EAF), to be completed by the applicant, is required if the proposed subdivision is classified as Type I or Unlisted according to the SEQR Act. A completed EAF will assist the Planning Board in determining the environmental significance of the project.

D) Sketch Plan Review And Recommendations

The Planning Board, in studying the Sketch Plan, shall take into consideration the requirements of these standards and the best use of the land being subdivided. Particular attention will be given to the arrangement, location and width of roads, their relationship to the topography of the land, sewage disposal, drainage. lot sizes and arrangements, the further development of adjoining land, as yet unsubdivided, and the goals and objectives of the Town Comprehensive Plan and Zoning Ordinance as it may exist.

The Planning Board may transmit copies of the Sketch Plan to other interested officials or agencies of government for review and comment as may be necessary. Written comments, if any, from these officials and agencies shall be required within thirty (30) days of their receipt of Sketch Plan.

After reviewing the Sketch Plan and reports, as may be submitted, the Planning Board shall determine where the Sketch Plan meets the purposes of these Regulations and shall, as it deems necessary, make specific recommendations in writing to be incorporated by the applicant into the next submission to the Planning Board. Such recommendations shall be made within forty-five (45) days from the time the Sketch Plan was initially reviewed by the Planning Board.

304. APPROVAL OF MINOR SUBDIVISIONS

The Board may require, where it deems it necessary for protection of the public health, safety and welfare, that a Minor Subdivision comply with all or some of the requirements specified for Major Subdivisions.

A) Application and Fee

Within six (6) months after Planning Board classification of the Sketch Plan as a Minor Subdivision, the subdivider shall submit an application in duplicate for approval of a Minor Subdivision Plat. Failure to do so may require resubmission of the Sketch to the Planning Board for reclassification.

The Plat shall conform to the layout shown on the Sketch Plan plus any recommendations or conditions established by the Planning Board and to the requirements listed in Article 600, Section 602 of these Regulations. All applications for Plat approval for Minor Subdivisions shall be accompanied by a fee established by the Planning Board and on file in the Town Clerk's office.

Three (3) copies of the Minor Subdivision Plat shall be presented to the Secretary of the Planning Board at least ten (10) days prior to a regularly scheduled meeting of the Planning Board. The subdivider, or his duly authorized representative, shall attend the meeting of the Planning Board to discuss the Minor Subdivision Plat.

An Environmental Assessment Form (EAF), completed by the applicant, for the proposed subdivision shall, if required, be available for review at this meeting of the Planning Board. The statement should consider potential impacts of the development as anticipated by the developer.

The time of submission of the Minor Subdivision Plat shall be considered to be the date of the regular monthly meeting of the Planning Board, at least ten (10) days prior to which the application for Plat Approval, complete and accompanied by the required fee and all data required by Article 600, Section 602 of these Regulations, has been submitted to the Planning Board Secretary.

B) Referrals

When applicable, the Secretary of the Planning Board, upon receipt of a Minor Subdivision Plat, shall present a copy of said Plat to the Delaware County Planning Board for their review and report in accordance with the provisions of Section 239-n of Article 12-B of General Municipal Law.

C) Public Hearing

A public hearing shall be held by the Planning Board within forty-five (45) days from the time of submission of the Minor Subdivision Plat for approval. The hearing must be advertised at least once in a newspaper or general circulation in the town at least five (5) days prior to the hearing. The applicant shall notify by Certified Mail, at least five (5) days in advance, the owners of property abutting the proposed

subdivision and directly across any adjoining road and shall furnish the Planning Board with post office receipts as proof of notification. The Planning Board may notify other persons as it deems necessary.

D) Action On Minor Subdivision Plat

The Planning Board shall, within forty-five (45) days from the date of said Public hearing, act to conditionally approve with or without modifications, disapprove or approve such Minor Subdivision Plat and so indicate on the Plat. Failure to act within the stated time period, or a mutually agreed upon extension thereof, shall constitute approval of the Plat. The Planning Board resolution granting conditional approval, with or without modification of the Plat, shall also empower a duly authorized officer to sign the Plat, upon compliance with such conditions and requirements as may be stated in its resolution of conditional approval.

Within five (5) days of the resolution granting conditional approval, the Plat shall be certified by the Planning Board as conditionally approved. A copy of such certification shall be filed in the office of the Planning Board Secretary and a certified copy mailed to the subdivider. The copy mailed to the subdivider shall include a certified statement of such requirements which, when completed, will authorize the signing of the conditionally approved Plat.

Conditional approval of a Plat shall expire one hundred eighty (180) days after the date of the resolution granting such approval. Within such 180 day period, or any extension thereof granted by the Planning Board, the conditionally approved Minor Plat must be submitted for the Planning Board Signature of Final Approval. Upon receiving the signature of the offices of the County Clerk in accordance with the provisions of Article 300, Section 307, of these Regulations.

In the event of disapproval of a Minor Subdivision Plat, the Planning Board shall fully set forth the reasons for such disapproval in its resolution and formally notify the applicant, in writing, of the reason(s) for disapproval.

305. PRELIMINARY PLAT FOR MAJOR SUBDIVISION

A) Application And Fee

Within six months after Planning Board classification of the Sketch Plan as a Major Subdivision, the subdivider shall file an Application for Approval of a Preliminary Plat of the proposed subdivision. Such Preliminary Plat shall be clearly marked "Preliminary Plat" and shall be in accordance with Article 600, Section 603 of these Regulations and all zoning ordinance recommendations, except where a waiver may be specifically authorized by the Planning Board.

Four (4) copies of the Preliminary Plat shall be presented to the Secretary of the Planning Board at least ten (10) days prior to a regular meeting of the Planning Board. The Application for Approval of the Preliminary Plat shall be accompanied by a fee set by the Planning Board and on file in the Town Clerk's office.

The time of submission of the Preliminary Plat shall be considered to be the date of the regular meeting of the Planning Board, at least ten (10) days prior to which the Application for Conditional Approval of the Preliminary Plat, complete and accompanied by the required fee and all data required by Article 600, Section 503, of these Regulations, has been filed with the Secretary of the Planning Board.

An EAF, completed by the applicant, for the proposed subdivision shall be available for review at the meeting of the Planning Board. The statement should consider potential impacts of the development as anticipated by the developer.

B) Referrals

When applicable, the Planning Board shall, upon initial review, refer the Preliminary Plat to the Delaware County Planning Board for their review and recommendation as required by Section 239-n of Article 12-B of the General Municipal Law. In addition, the Planning Board shall refer the Preliminary Plat to other County or State agencies which have or may have jurisdiction of review or approval of the subdivision. If the subdivision meets any Type I threshold listed in Part 617.12 of the SEQR regulations, lead agency for the SEQR process shall be determined according to procedures outlined in Section 617.6 of the SEQR regulations.

C) Study of Preliminary Plat

The subdivider or his duly authorized representative shall attend the meeting of the Planning Board to discuss the Preliminary Plat.

The Planning Board shall study the practicality of the Preliminary Plat, taking into consideration the requirements of the community and the best use of the land being subdivided. Where uncertainty exists with respect to the boundaries or criteria of the development limitation overlays, the Middletown Town Planning Board shall determine the extent of the development limitations in question. Particular attention shall be given to the arrangement, location, width and design of roads and their relation to the topography, water supply, sewage disposal, surface drainage, lot sizes and arrangement, potential flood hazards, the future development of adjoining lands as yet unsubdivided, and the recommendations and requirements of the Master Plan, the Official Map, and zoning regulations, if such exist.

The Planning Board may schedule a field trip to the proposed subdivision site accompanied by the applicant or his agent. In order to facilitate field inspection and review of the site, temporary staking along the centerline of all proposed roads at fifty-foot (50') intervals and front lot corners may be required.

D) Public Hearing

Within forty-five (45) days after the time of submission of a Preliminary Plat, the Planning Board shall hold a Public Hearing on said Plat. The Hearing shall be advertised in a newspaper of general circulation in the town at least five (5) days before such hearing. This Public Hearing shall also be used to solicit comments on the Draft EIS under SEQR, if required. The applicant shall notify, by Certified Mail, at least five (5) days in advance, the owners of property abutting the proposed subdivision and directly across any adjoining road and shall furnish the Planning Board with Post Office receipts as proof of notification. The Planning Board may notify other persons as it deems necessary.

E) Action on Preliminary Plat

Within forty-five (45) days from the date of such Public Hearing, the Planning Board shall take action to approve, with or without modifications, or disapprove such Preliminary Plat and the grounds for any modification required or the grounds for disapproval shall be stated upon the records of the Planning Board. The time in which the Planning Board must take action on such Preliminary Plat may be extended by mutual consent of the subdivider and the Planning Board.

If the Planning Board disapproves the Preliminary Plat, it shall direct the Chairman to notify the applicant, in writing, of the specific reasons for disapproval.

A determination of no significant environmental impact (negative declaration) or a Draft EIS is required by the designated lead agency before the subdivision may be approved. The Planning Board shall notify other agencies who have authority to review the subdivision of this determination.

F) Approval of Preliminary Plat

When granting approval to a Preliminary Plat, the Planning Board shall state the conditions of such approval, if any, with respect to:

1) The specific changes which will be required in the Final Subdivision Plat;

2) The character and extent of the required improvements for which waivers may have been requested and which, in the

Planning Board's opinion, may be waived without jeopardy to the public health, safety, morals, and general welfare;

3) The amount of the improvement or the amount of all bonds therefore which will be required as a prerequisite to the approval of the Subdivision Plat.

Within five (5) days of conditional Preliminary Plat approval, the action of the Planning Board, plus any conditions attached thereto, shall be noted on, or attached to, three copies of the Preliminary Plat. One copy shall be returned to the subdivider, one retained by the Planning Board, and one forwarded to the Town Clerk.

Approval of a Preliminary Plat shall not constitute approval of the subdivision plat. Rather, it shall be deemed an expression of approval of the design submitted on the Preliminary Plat as a guide to the preparation of the Final Subdivision Plat. Prior to approval of the Final Subdivision Plat, the Planning Board may require additional changes as a result of further study or new information obtained.

5) Model Homes

For the purpose of allowing the early construction of model homes in a subdivision, the Planning Board, in its discretion, may permit a portion of a Major Subdivision, involving no more than three (3) lots, to be created in accordance with the procedures for Minor Subdivisions, provided said portion derives access from existing State, County or Town highway, and provided no future road or other improvement is anticipated where said lots are proposed. The subdivision Plat for the "Minor" portion shall be submitted to the Planning Board simultaneously with the Preliminary Plat for the entire Major Subdivision. After preliminary approval, the model may be constructed, subject to such additional requirements that the Planning Board may require.

306. FINAL PLAT FOR MAJOR SUBDIVISION

A) Application and Fee

The subdivider shall, within six (6) months after the approval of the Preliminary Plat, file with the Planning Board an application for approval of the Subdivision Plat in final form. The Application and accompanying data shall conform to the requirements of Article 600, Section 604, of these Regulations. If the Final Plat is not submitted within the said six (6) months, the Planning Board may refuse to approve the Final Plat and require resubmission of the Preliminary Plat.

The subdivider shall provide the Planning Board Secretary with two (2) copies of the Application, three copies of the Final Plat, the original and one copy of all offers of cession, convenants and agreements, and two prints of all construction

drawings, at least ten (10) days in advance of the regular Planning Board meeting at which the Plat is to be officially submitted. The Application For Approval of the Final Plat shall be accompanied by a fee set by the Planning Board and on file in the Town Clerk's office.

The time of submission of the Final Plat shall be considered to be the date of the regular meeting of the Planning Board at least ten (10) days prior to which the Application for Approval of the Subdivision Plat, complete and accompanied by the required fee and all data required by Article 600, Section 604, of these Regulations, has been filed with the Secretary of the Planning Board.

Evidence shall be supplied that any proposed water supply and sewage disposal facilities associated with the Subdivision Plat requiring approval by the Department of Environmental Conservation and/or the New York State Department of Health shall have received at least preliminary approval(s) of such facilities.

B) Public Hearing

A Public Hearing on the Final Plat may be held by the Planning Board if the Board deems that there are substantial changes from the approved Preliminary Plat. Such hearing shall be held within forty-five (45) days after the time of submission of the Final Plat for Approval and shall be advertised in the same manner as the previous public hearing for Preliminary Plat Approval. Adjacent property owners shall also be notified by the applicant by the process specified in Preliminary Plat Approval.

C) Action On Final Plat

The Planning board shall, within forty-five (45) days from the date of submission of the Final Subdivision Plat, if no hearing is required (or within forty-five days of second public hearing if required), approve, conditionally approve with or without modifications, or disapprove said Plat and so indicate on the Plat. This time period may be extended by mutual consent of the subdivider and Planning Board. Failure to act within the stated time period, or a mutually agreed upon extension thereof, shall constitute approval of the Plat.

A resolution of conditional approval shall also duly authorize and empower an officer of the Planning Board to sign the Plat for recording with the County Clerk. However, the Final Plat shall not be signed until the subdivider has complied with Article 400 of these Regulations. Conditional approval of a Final Plat shall expire one hundred eighty (180) days after the date of the resolution granting such approval, except that this time may be extended by the Planning Board for no more than two additional periods of ninety (90) days each.

If a Draft Environmental Impact Statement was required, the Planning Board's action on the Final Plat shall include either a negative declaration or the Final EIS and a statement of findings on the subdivision as required under Section 8-0109-8 of the SEQR Act of 1975, as amended.

Within five (5) days of the Planning Board resolution of conditional approval, the Final Subdivision Plat shall be certified by the Planning Board as conditionally approved. A copy of such certification shall be filed in the office of the Town Clerk and a copy mailed to the subdivider.

307. FINAL APPROVAL AND FILING

The Chairman or other duly authorized officer of the Planning Board shall endorse the Board's final approval on the Plat only after it is satisfied that all required conditions, modifications, and improvements have been met and/or completed in accordance with the Planning Board's resolution of approval of the Plat and construction plans, or alternatively that a bond on the required amount and surety has been filed and that all other required conditions of the resolution of approval, including the payment of all fees and the approval of the New York State Department of Health, have been complied with. The Planning Board endorsement shall be by signature and date in ink on the original of the Plat (which shall be returned to the applicant for filing) and on a print of the Plat which shall be retained by the Planning Board in its files.

The approved Plat may be filed with the Delaware County Clerk within sixty (60) days of the date of the Planning Board endorsement. Any Subdivision Plat not so filed, or recorded within sixty (60) days of the date which such Plat is approved, or considered approved by reasons of the failure of the Planning Board to act, shall become null and void, unless the particular circumstances of said applicant warrant the Planning Board to grant an extension which shall not exceed two additional periods of sixty (60) days.

No changes, erasures, modifications, or revisions shall be made on any Subdivision Plat after approval has been given by the Planning Board and endorsed in writing on the Plat, unless the said Plat is first resubmitted to the Planning Board and such Board approves any modifications. In the event that any such Subdivision Plat is recorded without complying with this requirement, the same shall be considered null and void, and the Board shall institute proceedings to have the Plat stricken from the records of the County Clerk.

308. STATUS OF ROADS, PARKS, AND EASEMENTS

A) Acceptance By Town

Acceptance of any offer of cession of roads or parks shall rest with Town Board. The approval by the Planning Board of Subdivision Plat shall not be deemed to constitute nor imply

the acceptance by the Town of any roads, parks, or other areas shown on said Plat, and the Planning Board shall require the addition of appropriate notes to this effect on the Plat.

B) Maintenance

In the event that no offer of cession to the public is made for the roads, parks and required easements shown on the Plat, there shall be submitted with the Final Application copies of agreements or other documents providing for and fixing responsibility for suitable maintenance of such facilities and statements of all rights which exist with respect to the use of such property(ies). The adequacy of such documents shall be subject to Planning Board approval, based upon recommendations of the Town Attorney.

ARTICLE 400. REQUIRED IMPROVEMENTS FOR MINOR OR MAJOR SUBDIVISIONS

401. GENERAL

A) After adoption of a resolution approving a Final Subdivision Plat and before the Plat is endorsed by the Planning Board, the applicant shall be required to complete, at his expense and without reimbursement by the Town or any special district, all road, sanitary, storm drainage, and other improvements, including lot improvements as shown on the approved Construction Plans or as otherwise specified in the resolution. The Planning Board may, in a special or perculiar circumstance of a particular case, modify or waive a requirement only by specific resolution.

B) ROAD CONSTRUCTION STANDARDS: MINOR AND MAJOR SUBDIVISIONS

1) Before grading is started, the entire right-of-way shall be cleared of all stumps, roots, brush and other objectional material. All ledge, large boulders and tree stumps shall be removed from the right-of-way.

2) Following road construction, the developer or contractor shall conduct a thorough clean-up of stumps and other debris from the entire right-of-way. If on-site disposal of the stumps and debris is proposed, the site shall be indicated on the Final Plat and be suitably covered with fill and topsoil, limed, fertilized and seeded.

3) Where the subdivision roads are to remain private roads, the following words shall appear on the recorded plat: "All roads in this subdivision shall remain private roads or private rights-of-way and be maintained by the developer or lot owners and shall not be accepted or maintained by the Town until the road is improved to meet Donovan standards for acceptance.

4) On Minor Subdivisions consisting of two to four lots on private roads, the developer or contractor shall provide a surface treatment acceptable to the Road Review Committee.

5) Private rights-of-way may follow along adjacent property lines and shall follow all natural drainage courses.

6) No building permits will be issued until the Road Review Committee has approved all road and/or released the financial guarantee secured.

7) When a Minor Subdivision is proposed consisting of: A) two lots of twenty-five (25) acres or more; or B) four to ten lots on a private road, then the following shall apply:

a) The minimum right-of-way width shall be fifty feet (50').
b) No minimum roadbed requirements are listed.
c) The angle of intersection with an existing road shall be maintained within ten degrees (10) of a right angle.
d) A reasonable grade shall exist within fifty feet (50') of intersections with existing roads subject to review by the Road Review Committee.
e) Clear visibility at all intersections shall be maintained as described in Article 500, Section 504, of these Regulations.
f) Adequate drainage is to be provided at intersections with existing roads acceptable to the Road Review Committee.
g) A map of the subdivision, suitable for filing in the Office of the Delaware County Clerk, as required by New York State Law, shall be drawn by a licensed surveyor.
h) Provisions shall be made for the proper installation of utilities. This means the establishment of utility easements or rights-of-way acceptable to the utility company having jurisdiction.

402. PERFORMANCE BOND AND COMPLETION OF IMPROVEMENTS

Before the Planning Board grants Final Approval of the Subdivision Plat, the Planning Board shall direct the developer to follow the procedure set forth in either subparagraph A) or subparagraph B) below:

A) In an amount set by the Planning Board from an estimate proposed by the Town Highway Superintendent or other duly designated officer, the subdivider shall either file with the Town Clerk a bond or financial guarantee satisfactory to the Planning Board covering the costs of the required improvements. Any such bond or financial guarantee shall comply with the

requirements of Section 277 of the Town Law and further shall be satisfactory to the Town Board and Town Attorney as to form, sufficiency, manner of execution and surety. A period of one year (or other such period as the Planning Board may determine appropriate, not to exceed three (3) years shall be set forth in the bond or financial guarantee within which required improvements must be completed.

- OR -

B) The subdivider shall complete all required improvements to the satisfaction of the Road Review Committee or other representative designated by the Town Board to fulfill such duties who shall file with the Planning Board a letter signifying the satisfactory completion of improvements required by the Board. For any required improvements not so completed and not approved, the subdivider shall file with the Town Clerk a bond, financial guarantee or certified check covering the costs of satisfactorily installing any improvements not approved by the Road Review Committee. Any such bond shall be satisfactory to the Planning Board as to form, sufficiency, manner of execution and surety.

C) Modification of Bond

1) Extension of Bond

The time period spedified for the completion of all required improvements, as set forth in the bond, may be extended only by resolution of the Planning Board upon request in writing by the applicant, setting forth in detail the amount of work which has been completed, reasons for failure to complete the remainder of the work within the specified period, the maximum estimated time required to complete the remainder of the work and the time period extension which is requested.

2) Reduction of Bond

An applicant may request in writing that the Planning Board authorize a reduction in the amount of the bond. Such request shall itemize the extent of required improvements remaining to be completed and the bond reduction requested. Upon approval of the Town Board, and after due notice and public hearing, the Planning Board may, if it determines that sufficient required improvements have been installed to warrant such action, reduce the face amount of the bond by an appropriate amount so that the new amount will cover the cost in full of all required improvements remaining to be completed, and any security deposited with the bond may be reduced proportionately.

403. MODIFICATION OF REQUIRED IMPROVEMENTS

If, at any time before or during the construction of the required improvements, it is demonstrated to the satisfaction of the Road Review Committee that unforseen conditions make it necessary or preferable to modify the location or design of such required improvements, the Road Review Committee shall, upon approval by the Planning Board, authorsize modifications provided these modifications are within the spirit and intent of the Planning Board's approval and are not tantamount to the waiver or substantial alteration of the function of any improvements required by the Planning Board. If such modification affects the scope of work covered by the bond, the Planning Board may required or allow appropoiate modification of such bond.

404. TEMPORARY IMPROVEMENTS

The applicant shall build or pay for all costs of temporary improvements required by the Planning Board. Prior to the construction of any temporary facility or improvement, the developer shall file with the Town Clerk a separate suitable bond for temporary facilities, which bond shall insure that the temporary facilities will be properly constructed, maintained and removed.

405. INSPECTION OF IMPROVEMENTS

A) At least five (5) days prior to commencing construction of required improvements, the subdivider shall pay to the Town Clerk the inspection fee required by the Planning Board and shall notify the Road Review Committee in writing of the time when he proposes to commence construction of such improvements. The Committee will then make periodic inspections to assure that all Town specifications and requirements shall be met during the construction of required improvements, and to assure the satisfactory completion of improvements, and utilities required by the Planning Board.

B) Final Inspection

A final inspection of all improvements will be made to determine whether the work is satisfactory and in agreement with the approved final plat and construction drawings. Upon a satisfactory final inspection report, action will be taken to release the performance bond covering such improvements and utilities (if a bond was filed). The Road Review Committee shall also notify the Planning Board that all work has been completed to its satisfaction.

C) Inspection Fee

An inspection fee, as may be promulgated from time to time, and on file with the Town Clerk, shall be paid to the Town prior to the time that Planning Board signs the Final Plat. No Building Permits nor Certificates of Occupancy shall be issued until all inspection fees (if required) are paid.

406. PROPER INSTALLATION OF IMPROVEMENTS

If the Road Review Committee finds, upon inspection, that, either the required improvements have not been completed in accordance with the plans and specification filed by the subdivider, or that the required improvements have not been completed within the period specified in the Planning Board resolution of approval or the expiration date of the performance bond (if one exists), such approval shall be deemed to have expired, unless upon request of the applicant, the period has been extended by resolution of the Planning Board.

If a bond has been filed, and if no application for the extension of such period has been made by the applicant, the Town Board may declare said bond to be in default. The Town Board shall then notify the subdivider and, if necessary, the bonding company and take all necessary steps to preserve the Town's rights under the bond. No plat shall be approved by the Planning Board as long as the subdivider is in default on a previously approved Plat.

407. ESCROW DEPOSITS FOR LOT IMPROVEMENTS

A) Acceptance

Whenever, or by reason of the season of the year, any lot improvements required by these Regulations cannot be performed, the Road Review Committee may, nevertheless, permit the issuance of a Certificate of Occupancy, provided there is no danger to health, safety or general welfare, upon accepting a cash escrow deposit, in an amount to be determined by the Committee, for the cost of said improvements. The performance bond covering such lot improvements shall remain in full force and effect.

B) Procedures

All required improvements for which escrow monies have been accepted by the Town at the time of issuance of a Certificate of Occupancy shall be installed by the developer within a period of nine (9) months from the date of deposit and issuance of the Certificate of Occupancy. In the event that the improvements have not been properly installed at the end of the time period, the Road Review Committee shall give two (2) weeks written notice to the developer requiring him to install same; and, in the event the same are not installed properly in the discretion of the Road Review Committee, the Committee may request the Middletown Town Board to authorize the Town of Middletown to proceed to contract out the work for the sum not to exceed the amount of the escrow deposit. At the time of issuance of the Certificate of Occupancy for which escrow monies are being deposited with the Town, the applicant shall obtain and file with the Town, prior to obtaining the Certificate of Occupancy, a notorized statement from the purchaser or purchasers of the premises authorizing the Town of Middletown to install the improvements at the end of the

nine (9)-month period, in the event the same have not been duly installed by the developer.

408. CERTIFICATE OF OCCUPANCY

A Certificate of Occupancy shall not be issued for a structure within a subdivision where the improvements are guaranteed by a performance bond unless it is determined by the Planning Board that the following conditions have been complied with.

A) Status of Road Improvements

The improvement of the road or roads giving access to the structure has progressed to a stage deemed adequate by the Planning Board to render safe all-weather vehicular access for both routine and emergency purposes.

B) Maintenance Agreements

Written agreements have been filed providing for the maintenance of the bonded road or road in such all-weather passable condition, including snow removal and sanding, during the period between the issuance of the Certificate of Occupancy and the acceptance of the fully completed road by the Town Board. If the road is not to be offered for dedication to the Town, maintenance agreements shall have been required in accordance with Section 308, Part B, Maintenance of these Regulations.

ARTICLE 500. GENERAL IMPROVEMENTS AND DESIGN STANDARDS

The Planning Board, in considering an application for the subdivision of land, shall be guided by, but shall not be bound by the following considerations and standards, upon which the Planning Board shall be the determining agent. In general, these standards shall be deemed to be the minimum requirements, for the convenience, health, safety and welfare of the town and shall be waived by the Planning Board only under circumstances set forth in Article 100, Section 107 herein.

501. GENERAL CONSIDERATIONS

A) Conformity To Official Map, Master Plan and Zoning Ordinance.

Subdivision shall conform to the Official Map of the town and shall be in harmony with the Master Plan and Zoning Ordinance as they may exist.

B) Plats Straddling Municipal Boundaries

Whenever access to the subdivision is required across land in another municipality, the Planning Board may request assurance from the Town Attorney that access is legally established and from the Road Review Committee that the access road is adequatley improved, or that a performance bond has been duly

executed and is sufficient in amount to assure the construction of the access road. In general, lot lines should be laid out so as not to cross municipal boundaries.

C) Monuments And Lot Corner Markers

Permanent monuments meeting specifications approved by the Road Review Committee as to size, type, and installation shall be set of such block corners, angle points, points of curves in roads and other points as the Planning Board may require, and their location shall be shown on the subdivision Plat.

D) Character of Land

Land to be subdivided shall be of such character that it can be used safely for building purposes without danger to health or peril from fire, flood or other menace. Land shall conform to minimum lot size and dimensions in accordance with the Town of Middletown Zoning Ordinance.

E) Reservations and Easements

All reservations and easements shall be clearly indicated on the Final Subdivision Plat, along with appropriate notations indicating the rights which exist with respect to each such reservation and/or easement title, if vested in interests other than the developer, shall be clearly indicated on all reservations for park and playground purposes.

F) Subdivision Name

The proposed name of the subdivision shall not duplicate, or too closely approximate phonetically, the name of any other subdivision in the area covered by these Regulations.

G) Intended Use of Land

The intended use of the properties shall be in conformance with the Town of Middletown Zoning Ordinance and the district regulations.

If the intended use is not in compliance with the Town Zoning Ordinance, then the applicant shall apply for the proper variance or use permit prior to subdivision approval.

502. LOT IMPROVEMENTS

A) Lots To Be Buildable

The lot size, width, depth, shape and arrangement shall be such that there will be no foreseeable difficulty for reasons of topography or other natural conditions in securing building permits to build on all lots in compliance with these Regulations, the New York State Health Department, Town Law 280(a), the Uniform Building and Fire Code, the City of New York, and a Town Zoning Ordinance as it may exist.

B) Side Lines

Side lines of lots shall generally be at right angles to straight road lines and radial to curved road lines, unless a variance from this rule will give a better road or lot arrangement.

C) Corner Lots

In general, corner lots should be larger than interior lots to provide for proper building setback from each road and to provide a desireable building site.

D) Driveways

Driveway grades within 15' of the road right-of-way shall not incline more than ten percent (10%) from the road and culverts must comply with the requirements of the Planning Board and the Superintendent of Highways. Driveway access shall also conform with the standards of the Town, County and State Highway Departments when necessary.

E) Access From Private Roads

The area proposed to be subdivided and all proposed lots shall have frontage on and direct access to a public road or private road which conforms to Town Law and construction specifications as prescribed in this Regulation. Such required improvements to a private road shall be a condition of subdivision approval.

F) Debris and Waste

No cut trees, timber, debris, junk, rubbish or other waste materials of any kind shall be buried within any proposed right-of-way. Such material shall be disposed of in a manner approved by the Planning Board.

G) Soil Preservation And Final Grading

Land to be subdivided shall be designed in reasonable conformity to existing topography in order to minimize grading, cut and fill, to retain the natural contours, to limit storm water runoff, and to conserve the natural vegetative cover and soil. No trees, top soil or excavated material shall be removed from its natural position except where necessary to the improvement of lots and the construction of roads and related facilities in accordance with the approved plan. Topsoil shall be restored to its original depth and properly seeded and fertilized in those disturbed areas not occupied by buildings or structures.

H) Performance Bond To Include Lot Improvement

The performance bond shall include an amount to guarantee completion of all requirements contained in Article 400 of these Regulations including, but not limited to, soil preservation, final grading, lot drainage, lawn-grass, seeding, removal of debris and waste, and all other lot improvements required by the Planning Board.

503. ROAD LAYOUT

A) Location, Width, and Construction

Roads shall be of sufficient width, suitably located and adequately constructed to conform with the applicable Town Highway Construction Specifications, accommodate the prospective traffic and to afford satisfactory access to police, fire fighting, snow removal and other road maintenance equipment. The arrangement of roads shall be such as to cause no undue hardship to adjoining properties and shall be coordinated so as to compose a convenient system.

B) Arrangement

The arrangement of roads in the subdivision shall provide for the continuation of major roads of adjoining subdivisions, and for proper projection of major roads into adjoining properties which are not yet subdivided, in order to make possible necessary fire protection, movement of traffic and the construction or extension, presently or when later required, of needed utilities and public services, such as sewers, water and drainage facilities. Where, in the opinion of the Planning Board, topographic and other conditions make such continuance undesirable or impractical, the above conditions may be modified.

C) Minor Roads

Minor roads shall be laid out that their use by through traffic will be discouraged.

D) Special Treatment Along Major Roads

When a subdivision abuts or contains an existing or proposed major road, the Board may require marginal access roads, reverse frontage with screen planting contained in a non-access reservation along the rear property line, deep lots with rear service alleys, or such other treatment as may be necessary for adequate protection of residential properties and to afford separation of through and local traffic.

E) Dead End Roads

The Planning Board may require, where needed or desireable along a dead-end road, reservation of a twenty foot (20') wide easement to the subdivision boundary to provide for the continuation of pedestrian traffic, utilities, and/or drainage

facilities to the next road. The entrance at a dead-end road shall bear a "No Outlet" sign.

F) Intersections With Collector Or Major Road

Minor or secondary road openings into such roads shall, in general, be at least five hundred feet (500') apart.

G) Road Jogs

Road jogs with center line offsets of less than one hundred twenty-five feet (125') shall be avoided.

H) Angle of Intersection

In general, all roads shall join each other so that for a distance of at least one hundred feet (100') the road is approximately at right angles to the road it joins. No road shall intersect with another at an angle of less than eighty degrees (80).

I) Relation to Topography

The road plan of a proposed subdivision shall bear a logical relationship to the topography of the property, and all roads shall be arranged so as to obtain as many of the building sites as possible at or above the grade of the roads. Grades of roads shall conform as closely as possible to the original topography.

J) Road Names

All road names shown on the Preliminary Plat and Final Plat shall be approved by the Planning Board. Proposed road names shall be substantially different in sound and spelling from present names in the town so as not to cause confusion. A road which is a continuation of an existing road shall bear the same name.

504. ROAD DESIGN

A) Conformity To Town Standards

In order to provide for roads of suitable location, width and improvement to accommodate prospective traffic and afford satisfactory access to police, emergency vehicles, fire fighting, snow removal, sanitation and road maintenance equipment and school buses, the following design standards, contained within these Regulations and those standards adopted by the Town and included here by reference, are hereby required. All roadway and related construction, whether to be offered for dedication or not, shall be the responsibility of the subdivider unless otherwise indicated, and shall be in accord with these standards and other relevant road standards developed by the Town of Middletown.

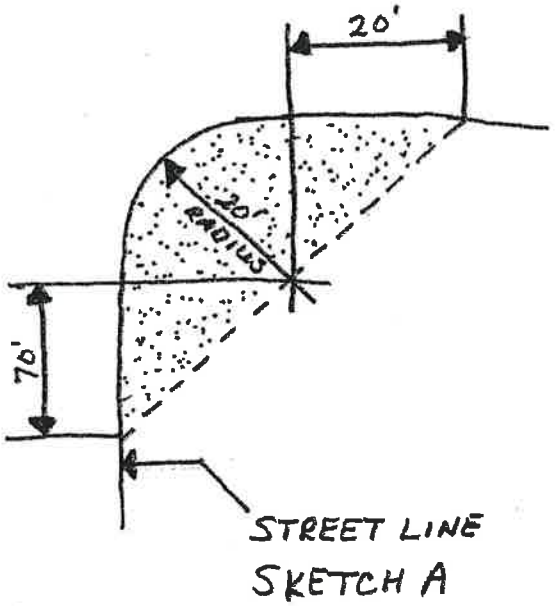
B) Other Improvements As Deemed Appropriate

The Planning Board may require the following improvements: sidewalks, gutters, road lighting, road signs, school bus pickup areas, water mains, sanitary sewers, storm drains, fire hydrants and other utilities.

C) Changes in Grade

All changes in grade shall be connected by verticle curves of such length and radius as meet with the approval of the Town Highway Superintendent so that clear visibility shall be provided for safe distance. A combination of steep grades and curves shall be avoided.

D) Visibility Of Intersections
In order to provide visibility for traffic safety, that portion of any corner lot (whether at an intersection entirely within the subdivision or of a new road with an existing road), which is shown shaded on Sketch A, shall be cleared of all growth (except isolated trees) and obstructions above the level three feet (3') higher than the center line of the road. If directed, ground shall be excavated to achieve visibility. An easement for the enforcement of this provision shall be granted to the owner of the road and notation to this effect made on the Final Plat.



SKETCH A

E) Watercourses

Where a watercourse separates a proposed road from abutting property, provision shall be made for access to all lots by means of culverts or other structures of design approved by the Town Highway Superintendent.

Where a subdivision is traversed by a watercourse, drainage-way, channel or stream, there shall be provided a storm water easement or drainage right-of-way as required by the Town Highway Superintendent, and in no case less than twenty feet (20') in width.

F) Road Signs

Road signs, of the type approved by the Town Highway Superintendent, including highway warning and directional signs, shall be provided by the subdivider and placed at all locations, within the road right-of-way and in locations approved by the Planning Board and Highway Superintendent.

G) Road Lighting Standards

Where required by the Planning Board, road lighting of a design and location approved by the appropriate utility company and the Planning Board shall be provided and installed by the subdivider.

H) Slope Easements

Where steep slopes beyond the road right-of-way may require maintenance, an easement may be required for such purposes.

I) Service Roads Or Loading Space in Commercial Development

Rear service roads of not less than twenty feet (20') in width, or in lieu thereof, adequate off-road loading space, suitably surfaced, shall be provided in connection with lots designed for commercial use.

J) Free Flow Of Vehicular Traffic Abutting Commercial Developments

In front of areas designed for commercial use, or where commercial use is contemplated, the road width shall be increased by such amount on each side as may be deemed necessary by the Planning Board to assure the free flow of traffic without interference by parked or parking vehicles, and to provide adequate and safe parking space for such commercial or business district.

K) Road Dedications and Reservations

1) New Perimeter Roads

Road systems in new subdivisions shall be laid out so as to eliminate or avoid new perimeter half-roads. Where an existing half-road is adjacent to a new subdivision, the other half of the road shall be improved and dedicated by the subdivider. The Planning Board may authorize a new perimeter road where the subdivider improves and dedicates the entire required road right-of-way width within his own subdivision.

2) Widening and Realignment of Existing Roads

Where a subdivision borders on an existing road which is narrower than the recommended right-of-way width as specified for such roads in these Regulations, or where a subdivision borders an existing road planned for widening or realignment in such a way as to require the use of some land in the subdivision, the Planning Board may require the subdivision plat to show such areas which shall be marked "Reserved for Road Alignment (or Widening) Purposes". Land reserved for such purposes may not be counted in satisfying yard or lot area requirements.

505. DRAINAGE IMPROVEMENTS

The Planning Board may require that the subdivider make adequate provision for storm or flood water runoff channels or basins. The storm water drainage system shall be separate and independent of any sanitary sewer system.

A) Removal Of Spring and Surface Water

The subdivider may be required by the Planning Board to carry away by pipe or open ditch any spring or surface water that may exist either previous to, or as a result, of, the subdivision. Such drainage facilities shall be located in the road right-of-way where feasible, or in perpetual unobstructed easements of appropriate width, and shall be constructed in accordance with the town construction standards and specifications.

B) Accommodation of Upstream Drainage Areas

In a subdivision, a culvert or other drainage facility shall, in each case, be large enough to accommodate potential runoff from its entire upstream drainage area, whether inside or outside the subdivision. The Planning Board and Town Highway Superintendent shall approve the design and size of the facility based on anticipated runoff from a "fifty year" storm under conditions of maximum potential development within the water shed. The applicant shall be responsible for submitting such computations to the Planning Board in sufficient detail

to make possible the ready determination of the adequacy of the proposed drainage installations. Concentrated drainage from lots onto the road right-of-way shall not be permitted.

C) Effect of Downstream Drainage Area

The Planning Board may also require a study of the effects of the subdivision on existing downstream drainage facilities outside the area of the subdivision. Where it is anticipated that the additional runoff incident to the development of the subdivision will overload an existing downstream drainage facility during a fifty-year storm, the Planning Board shall notify the owner of such downstream facility and the Town Board of such potential condition. In such case the Planning Board shall withhold approval of the subdivision until provsion has been made for the correction of said potential condition.

D) Wetlands

Areas shown on DEC maps as official freshwater wetlands shall be regulated according to the provisions contained in Article 24 of the NYS Environmental Conservation Law, including Subsequent amendments, which is adopted herein by reference.

E) Flood Plain Areas

Flood plain areas shall be those defined on the Official H.U.D. Flood Hazard Maps. These flood areas shall be preserved from any and all destruction or damage resulting from clearing, grading or dumping of earth, waste material or stumps, except at the discretion of the Planning Board.

F) Drainage Easements

Where topography or other conditions are such as to make impractical the inclusion of drainage facilities within road right-of-way, perpetual unobstructed easements shall be provided for such across properties outside the road lines and with satisfactory access to the road.

506. WATER FACILITIES

A) Wells and Central Water Systems

If developer is planning for wells and central water systems, he must conform to Part 75 of New York State Department of Health Regulations and other applicable regulations governing community water systems.

B) Water Mains and Fire Hydrants

Where required by the Planning Board, the subdivider shall install water mains and fire hydrants of the type and in a

manner prescribed by the regulations of the appropriate water or fire district or other municipal agency having jurisdiction.

507. COMMUNITY SEWAGE FACILITY

If the applicant is proposing to install a community sewage system, then he shall install such sanitary sewer facilities in a manner prescribed by the Town of Middletown, any instituted sewer district and in accordance with the regulations of the New York State Health Department and New York City Board of Water Supply.

508. SIDEWALKS OR WALKWAYS

A) General

The Planning Board may require sidewalks or walkways as it deems necessary to provide for the safety of pedestrians. The construction of a walkway or sidewalk shall be of suitable materials approved by the Planning Board. Concrete, flag stone or gravel may be considered.

B) Easements For Pedestrian Access

The Planning Board may require, in order to facilitate pedestrian access from roads to schools, parks, public areas, and roads to neighboring areas, the reservation of perpetual unobstructed easements for such purposes.

509. UTILITY IMPROVEMENTS

A) General

In order to insure greater safety and improved appearance, all utility lines and related equipment for providing electric power and communication services shall, whenever required by law, be installed underground in the manner prescribed by the regulations of the utility company having jurisdiction. Underground utilities shall be located outside of the traveled way of roads but, except in unusual circumstances, within the road right-of-way.

B) Easements

Where topography or other conditions are such as to make impractical the inclusion of utilities within road rights-of-way, perpetual unobstructed easement shall be provided for such utilities across properties outside the road lines and with satisfactory access to road.

ARTICLE 600. DOCUMENTS TO BE SUBMITTED

601. SKETCH PLAN

The Sketch Plan initially submitted to the Planning Board shall be based on tax map information or some other similarly accurate base map at a scale (preferably not less than four hundred feet (400') to the inch) to enable the entire tract to be shown on one sheet. The Sketch Plan shall be submitted showing the following information:

A) A location map to indicate the relationship of the proposed subdivision to existing community facilities which will serve or influence the layout, such as existing road patterns, schools, parks and other public lands, local villages and hamlets, and special districts, including school, fire, agricultural, etc.

B) All existing structures, burial grounds, railroad rights-of-way, existing property lines, wooded areas, streams or watercourses, flood hazard areas, wetlands, quarries or excavations, bedrock outcrops and other significant physical features within the area to be subdivided and within two hundred feet (200') thereof. Topographic conditions shall be indicated at contour intervals of not more than twenty feet (20'). U.S.G.S. maps are suitable.

C) The name of the owner, the name of the professional person(s) responsible for the subdivision design, and the names of all adjoining property owners as disclosed by the most recent municipal tax records within five hundred feet (500') of any perimeter boundary of the subdivision.

D) The proposed subdivision name, the tax map sheet, block and lot numbers, scales, north arrow and acreage involved.

E) All the utilities currently available, including any existing easements, and all roads which are either proposed, mapped, or built.

F) The proposed pattern and approximate dimensions and area of lots, road layout, recreation area, systems of drainage, sewerage and water supply within the subdivision area.

G) All existing restrictions on the use of land, including easements, covenants, or zoning districts.

H) Where private roads are proposed, the plat shall show the minimum right-of-way and other design standards for simple subdivisions. Also a note to the effect that this is not a town road shall be placed on the map.

I) Verification of approvals of any variance request of special use permit applications previously granted.

602. MINOR SUBDIVISION PLAT

In addition to the information required by Section 601, the following shall be submitted for Minor Subdivisions only:

A) A copy of such covenants or deed restrictions as are proposed to cover all or part of the tract.

B) An actual field survey of the boundary lines of the tract, giving complete description data by bearings and distances, made and certified to be a licensed land surveyor. The corners of the tract shall also be located on the ground and marked by monuments as approved by the Town Planning Board or its assistant and shall be referenced and shown on the Plat.

C) All lots shown on the plat shall be able to provide for individual on-site sanitation and water supply facilities and shall be shown designed to meet the minimum specifications of any applicable State, County, Town or New York City agencies having jurisdiction.

D) The proposed subdivision name, the name of the town and county in which it is located, the date, north point, map scale, name and address of property owner and subdivider and the names of the adjoining property owners.

E) The Plat shall conform with the filing requirements of the Delaware County Clerk's office.

603. MAJOR SUBDIVISION PRELIMINARY PLAT

The Preliminary Plat shall be submitted at a scale of one inch (1") equals one hundred feet (100'), or another scale approved by the Planning Board, whichever most clearly illustrates the subdividers proposal. The Preliminary Plat shall be clearly marked "Preliminary Plat" and shall include:

A) Proposed subdivision name, name of town and county in which it is located, name and address of property owner, subdivider, engineer or surveyor preparing the plan, including license number seal, date, true north point and scale.

B) The name of all subdivisions immediately adjacent, if any, and the names and addresses of the owners of records of all property adjacent to the subdivisions and within five hundred feet (500') of any perimeter boundary.

C) The location of any zoning district lines, special districts, including school, fire and agricultural, or municipal boundary lines affecting the subdivision.

D) Offers of cession of all land to be offered for dedication for roads, highways, easements, parks or other public facilities.

E) The location of all existing structures and pertinent features, including railroads, water bodies, watercourses, wetlands, flood hazard areas, stonewalls, rock outcrops, wooded areas, and any other significant existing features that may influence the design of the proposed subdivision area plus accurate topography at a vertical contour interval of not less than twenty feet (20'). The topographic data shall be determined by field survey unless the Planning Board specifically waives this requirement and/or permits the substitution of topographic information obtained from other sources determined satisfactory for the particular case.

F) Location of existing sewers, water mains, culverts and drains serving the property, with pipe sites, grades, direction of flow and existing easements.

G) The width, location and names of any roads or public ways or places shown on the Official Map or in the Master Plan, if such exists, within the area to be subdivided including existing easements and rights-of-way; and the right-of-way width, location, grades, proposed easements and road profiles of all roads or public ways proposed by the developer, contours with intervals of five feet (5') or less as required by the Planning Board, including elevations on existing roads.

H) Approximate location and size of all proposed water lines, valves, fire hydrants, and sewer lines or alternative means of water supply or sewage disposal and treatment, including sites for on-site systems as provided in the Public Health Law. Profiles of all proposed water and sewer mains. If septic systems are proposed, the results of soil bearing and soil percolation tests shall accompany the Preliminary Plat. Where on-site water supply systems are proposed, the quality and quantity of water available shall be indicated.

I) Storm drainage plan indicating the approximate location and size of proposed lines, their profiles and connection to existing lines or alternative means of disposal, including existing and proposed drainage easements. Temporary measures to control erosion during construction phase shall also be shown.

J) Construction plans, profiles, cross-sections and other drawings as required to show the proposed location and types of all improvements required by Article 500 and the Planning Board.

K) Preliminary designs of any bridges or culverts which may be required.

L) The proposed lot lines with approximate dimensions and area of each lot and the total acreage of the subdivision. An actual field survey of the boundary lines of the tract, giving complete descriptive data by bearings and distances made and certified to be a licensed land surveyor. Corners of the

tract shall be located on the ground and marked by monuments as approved by the Planning Board or its assistant and shall be referenced and shown on the Plat.

M) A copy of any covenants or deed restrictions that are intended to cover any lot in all or part of the tract.

N) If the Preliminary Plat submitted for approval covers only a part of the subdivider's entire holding in the area, then a map shall be prepared, at a scale of not less than one inch equals four hundred feet (1"=400'), showing the entire tract as it relates to the parcel included on the Preliminary Plat.

O) A site location sketch, at a maximum scale of one inch equals two thousand feet (1"=2000'), showing the general situation of the applicant's property with respect to surrounding properties and roads, including all utility lines.

604. MAJOR SUBDIVISION FINAL PLAT

The Final Plat, to be approved by the Planning Board and filed in the Office of the County Clerk, shall be drawn at the same scale as the Preliminary Plat. When more than one (1) sheet is required, an additional index map on the same size sheet shall be prepared and included for filing showing to scale the entire subdivision with lot and block lines clearly legible. The Final Plat submission shall show:

A) Proposed subdivision name or identifying title, the name of the Town and County in which it is located, the name and address of the owner of record and of the subdivider (if other than owner), the name, certification and seal of the registered engineer or licensed land surveyor who prepared the plat, the names of the owners of record of adjoining properties and of properties directly across the road.

B) Road lines, pedestrian ways, lots, reservations, easements and areas to be dedicated to public use.

C) The location and dimensions of all boundary lines of the proposed subdivision and all existing and proposed road lines, lot lines, easements and rights-of-way, with sufficient data to readily determine the location, bearing and length of all such lines and to reproduce such lines upon the ground. The Plat shall show the boundaries of the property, location, graphic scale and true north point.

D) All offers of cession and all covenants governing the maintenance of unceded open space shall bear the certificate of approval of the Town Attorney as to their form and legal sufficiency.

E) Notations explaining any drainage, sight, slope, road widening, park area or other reservations or easements, as may be

required by the Planning Board, including any self-imposed restrictions or covenants.

F) Lots and blocks within a subdivision shall be numbered and lettered in accordance with the prevailing Town practice.

G) Permanent reference monuments and lot corner markers shall be shown and their location referenced on the Final Plat.

H) A site location map, at a scale no greater than one inch equals two thousand feet (1"=2000'), showing the location of the applicant's property with respect to surrounding land and roads.

I) Construction drawings including plans, profiles, and typical cross-sections, as required, showing the proposed location, size, grade and type of roads, sidewalks, road lighting standards, curbs, water mains, sanitary sewers, storm drains, pavement and sub-base. manholes, catchbasins, and other improvements as required by the Planning Board or proposed by the subdivider.

J) The following notes shall be placed upon the Final Plat:

1) No Building Permit shall be issued to any property owner within this subdivision other than to the owner or applicant unless all improvements are completed and approved in accordance with the Planning Board's resolution of approval of this Plat.

2) Sanding, snowplowing and other similar maintenance of highways within this subdivision shall be the responsibility of the developer until such time as the Town accepts the roads.

K) Endorsement of Approval by the New York State Department of Health with regard to sewage disposal and water supply systems. No modification may be made after Department of Health certification.

L) Statement from the appropriate town officials certifying that required improvements have been satisfactorily installed or that an acceptable bond for such installation has been filed with the Town Clerk.

M) Notation for endorsement by Planning Board Chairman as follows:

"Approved by Resolution of the Middletown Town Planning Board"

_____

(Chairman) (Date)

PROPOSED AMENDMENTS TO MIDDLETOWN SUBDIVISION REGULATION

Addition - Page 3, 109 A) 5) Lots may be advertised and contracted for sale only after Preliminary Approval has been granted by the Town Planning Board. No sale shall be finalized on any lot in the subdivision until Final Plat approval has been granted by the Town Planning Board.

Addition - Page 7, Definition: Private Right-of-Way - A vehicular accessway which is not intended to be dedicated as a public way.

Deletion - Page 7, Definition: Road Existing - An existing State, County or Town road, or other private road shown on a plat approved by the Planning Board or shown on a plat duly filed and recorded in the Office of the County Clerk prior to the effective date of these Regulations.

Deletion - Page 7, Definition: Road, Major - A road which serves or is designed to serve heavy flows of traffic and which is used primarily as a route for traffic between communities and/or other heavy traffic generating areas.

Deletion - Page 7, Definition: Road, Minor - A road intended to serve primarily as an access to abutting properties.

Deletion - Page 7, Definition: Road, Private Right-of-Way - A new road intended to provide access to no more than five (5) lots that have been classified as a simple subdivision.

Addition - Page 7, Definition: Road, Private - Any private roadway which was previously shown on a plat approved by the Planning Board and filed and recorded in the Office of the County Clerk or any private roadway which is built to town road standards, but is not accepted as a town roadway.

Addition - Page 7, Definition: Road, Public - Any state, county or town roadway.

Revision - Page 8, Definition: Subdivision, Major - Any subdivision creating more than ten (10) lots on a public road or any subdivision of five (5) or more lots on a private road.

Revision - Page 8, Definition: Subdivision, Minor - Any subdivision creating: a) four (4) to ten (10) lots on a public road; b) Two (2) to four (4) lots on a private road meeting town design standards; c) two (2) lots of twenty-five (25) acres or more on a private right-of-way.

Deletion - Page 8, Definition: Subdivision, Simple - The subdivision of any parcel of land into no more than five (5) lots.

Addition - Page 19, 401 B) Road Construction Standards: Minor and Major Subdivisions

1) Before grading is started, the entire right-of-way shall be cleared of all stumps, roots, brush and other objectionable material. All ledge, large boulders and tree stumps shall be removed from the right-of-way.
2) Following road construction, the developer or contractor shall conduct a thorough clean-up of stumps and other debris from the entire right-of-way. If on-site disposal of the stumps and debris is proposed, the site shall be indicated on the Final Plat and be suitably covered with fill and top-soil, limed, fertilized and seeded.

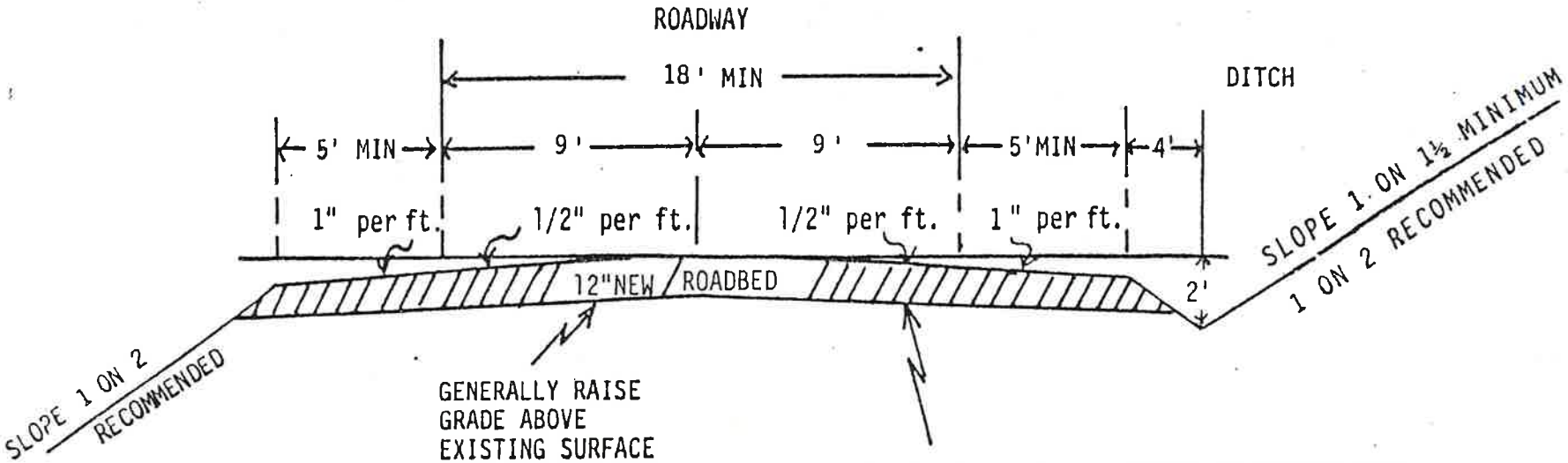
CHART A

GENERAL ROAD IMPROVEMENTS

The following design standards apply according to road classification.

DESCRIPTION	MINOR SUBDIVISION Two lots; each 25 acres or more	MINOR SUBDIVISION Two to four lots on private roads	MAJOR SUBDIVISION Five lots or more not on public road
Minimum ROW Width	50'	50'	50'
Minimum Pavement	12' of cleared access	18' of cleared access	18'
Maximum Grade	N/A	12%	10% - grades up to 12%
Minimum Grade	N/A	1%	1%
Minimum Shoulder Width	N/A	3'	5'
Minimum Ditch Width	where possible, water drainage shall meet natural drainage course(s)	4' per ditch where possible from shoulder to opposite or back side of ditch	4' per ditch where possible from shoulder to opposite or back side of ditch
Slope Grade (cut and fill)	N/A	N/A	1 on 2
Crown Slope	N/A	N/A	1/2"/foot or more
Shoulder Slope	N/A	N/A	1"/foot or more
Turnaround diameter on dead-end road	N/A	N/A	90' surface width minimum; 120' right-of-way minimum
Minimum centerline radius of curve	N/A	200'	200'
Minimum radius at intersection	N/A	N/A	20' right-of-way, 30' surface
Minimum tangent length	N/A	N/A	100'
Minimum sight distance	N/A	N/A	150' along road, 75' across corner at intersection
Minimum length of vertical curve	N/A	N/A	L = 50A L = Length of vertical curve in feet A = Algebraic difference in grades
[illegible]	N/A	N/A	1 at 4

RECOMMENDED TYPICAL SECTION FOR ROADS



4" SCREENED GRAVEL PASSING 2" SCREEN OVER
8" OF ACCEPTABLE COARSE BANK RUN GRAVEL
WITH NO LARGER THAN 6" STONE
SURFACE TO BE STABILIZED BY SURFACE TREATMENT

DRAINAGE

1. USE CULVERTS AS REQUIRED BY ROAD REVIEW COMMITTEE
2. USE 13" x 22" PIPE ARCHES AS EQUIVALENT 18" DIA.
3. PLACE ONE GUIDE POST AT EACH END.
4. RUN CULVERTS DIAGONALLY (45°MIN.) ON HILLS
5. CONSTRUCT DRY STONE MASONRY HEADWALLS INSTALLING "L" SHAPED HEADWALLS WHERE APPROPRIATE.

GENERAL NOTES

1. 50' MIN. R.O.W.-OR 5' BEYOND OR TOE OF SLOPE. ANY EXISTING STONE WALLS PARALLEL TO THE ROAD SHOULD BE INCLUDED IN THE DEDICATED RIGHT-OF-WAY.

2. REMOVE BRUSH FOR SIGHT DISTANCE AND SEED AND MULCH ALL DISTURBED AREAS.

CHART B (1)

CHART B

TOWN OF MIDDLETOWN

ADDITIONAL DESIGN STANDARDS FOR NEW ROADS IN MAJOR SUBDIVISIONS

NEW ROAD BED

Compacted 12" minimum using 8" of coarse bank run gravel with no larger than 6" stone and top 4" to be crushed or screened gravel which will pass through a 2" screen or equivalent.

All roadways are to be stabilized with salt or calcium, including shoulders.

1) Calcium chloride - Minimum 11 ton/mile
2) Sodium chloride - Minimum 18-20 ton/mile
3) Liquid calcium "

The following materials are not acceptable for final grade or sub-grade: top soil, clay, mud, plain dirt, trees, brush, or stumps. If sub-grade is of poor material, more gravel may be required.

Optional - A hard surface road may be constructed by the developer. It requires a minimum double surface treatment of no less than 1/2 gallon per square yard of bituminous material as recommended by Town Highway Superintendent. First course no less than No. 1 stone, second course No. 1A.

SIDE SLOPES

Remove brush for sight distance and seed and mulch all disturbed areas. Top soil need not be replaced on road slopes.

SHOULDERS

Shoulders shall be gravel rather than dirt to permit drainage from road bed.

BRIDGES

Where a bridge is necessary, it is to be 24' wide, carry a maximum legal New York State load, accommodate the water flow of a 50-year storm, and any wood used in construction shall be pressure treated. Bridge plans shall be prepared by a New York State licensed engineer and shall be submitted to the Town Highway Superintendent for approval in consultation with the County Highway Department prior to the start of construction.

DRIVEWAYS

At ditch centerline, driveways shall be at least 3" below lowest point of road shoulder. All driveways shall have a landing area of at least 20' in length as measured from the centerline of the highway ditch.

APPLICATIONS FOR TOWN TAKEOVER

All applications must conform to Sections 170 and 171 of the Town Highway Law. There may be additional requirements by the Town Board before dedication is considered.

December 11, 1984

TOWN OF M. .LETOWN

Design Standards For New Roads In Major Subdivisions

MINIMUM RIGHT-OF-WAY

50 feet

MINIMUM PAVEMENT WIDTH

18 feet

MINIMUM SHOULDER WIDTH

5 feet

MINIMUM DITCH WIDTH

4 feet per ditch, from shoulder to opposite or back side of ditch

SLOPE GRADE (CUT AND FILL)

1 on 2

CROWN SLOPE

1/2 inch/foot or more

SHOULDER SLOPE

1 inch/foot or more

MAXIMUM GRADE

10% - Grades up to 12% may be allowed for short, straight runs, but will not be permitted within 60' of intersections.

MINIMUM GRADE

1%

TURNAROUND DIAMETER ON DEAD END STREET

90 feet pavement minimum
120 feet right-of-way minimum

MINIMUM CENTERLINE RADIUS OF CURVE

200 feet

MINIMUM RADIUS AT INTERSECTION

20 feet right-of-way
30 feet pavement

MINIMUM TANGENT LENGTH

100 feet

MINIMUM SIGHT DISTANCE

150 feet along street
75 feet across corner at intersection

MINIMUM LENGTH OF VERTICAL CURVE

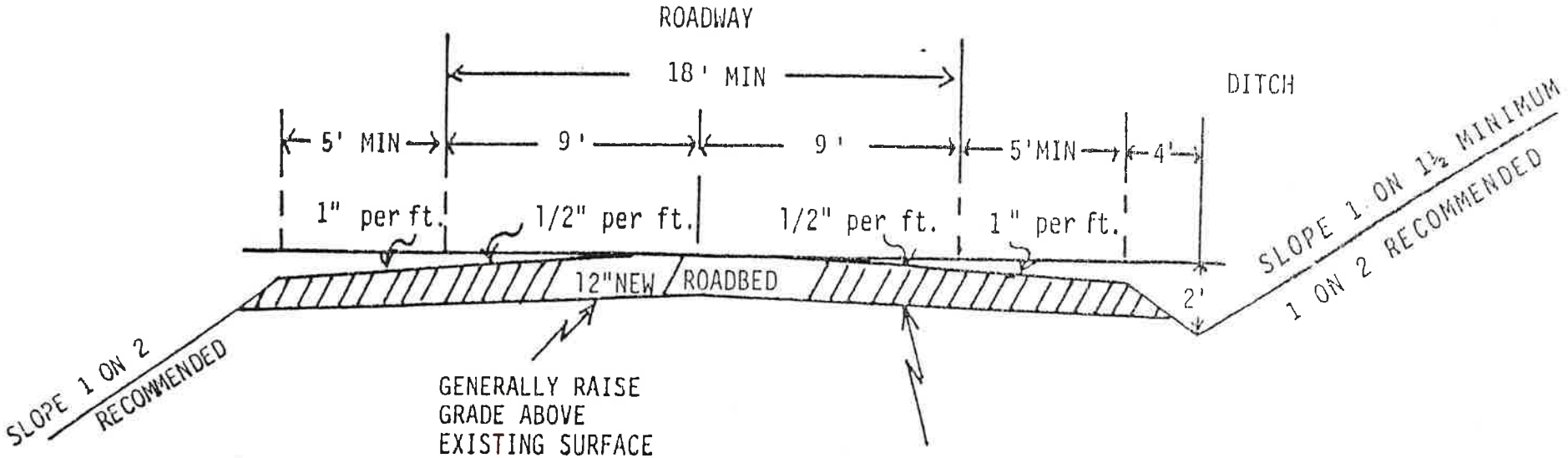
L = 50 A.

L = Length of vertical curve in feet
A = Algebraic difference in grades

SIDEWALKS (IF REQUIRED)

1 at 4 feet

RECOMMENDED TYPICAL SECTION FOR ROADS



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CWT
Ex. 3

DELAWARE COUNTY
BOARD OF SUPERVISORS

Senator Charles D. Cook County Office Building
111 Main Street
Delhi, New York 13753

Telephone: 607- 746-2603
Fax: 607- 746-7012

James E. Eisel, Sr., Chairman
Christa M. Schafer, Clerk

February 26, 2004

Richard R. Wissler
Administrative Law Judge
New York State Department of Environmental Conservation
625 Broadway
Albany, New York

Dear Judge Wissler:

I am writing in response to the comments offered by Assistant Attorney General James Tierney at the public hearing in Middletown at the Margaretville Central School on January 14, 2004. As Chairman of the Board of Supervisors for Delaware County, I am troubled by the content of the comments offered by Mr. Tierney at the hearing and that the comments were being offered in his capacity as an Assistant Attorney General/ Watershed Inspector General.

In my comments at the hearing and in the comments offered by Delaware County's attorney Kevin Young at the hearing, we provided DEC with the demographics of Delaware County. I will not repeat those comments here other than to stress that Delaware County is one of the most rural counties in New York State and has one of the lowest per capita income statewide. In order for our communities to survive we need projects like Crossroads to replace the manufacturing plants, hotels and farms that are closing.

The theme of Mr. Tierney's comments were that this project is too big, that it should be in a hamlet, that mountain top development (even in compliance with the Watershed Regulations) should be discouraged and that it could lead to secondary development which should also be discouraged. As a signatory to the MOA, Delaware County understood that assuming the state and city regulations could be met, the decisions regarding appropriateness of the size of the project, where it should be located and whether secondary development should be encouraged is a local decision – not a New York State decision and, in particular, not a decision to made by the New State Attorney General. Mr. Tierney's position as a Assistant Attorney General and Watershed Inspector General was created as a result of and pursuant to Section 152 of the MOA which states as follows: "[allocate] up to one hundred and ten thousand dollars ($110,000) to the New York State Department of Law for the establishment of the Watershed Inspector General's Office to provide for the enforcement of law and regulations pertaining to the use, operation, and protection of the Watershed." The parties to the MOA consented and provided for the establishment of the position of Watershed Inspector General within the Attorney General Office for an amount not to exceed $110,000 to ensure that the terms and conditions of the MOA and the state environmental regulations were enforced within the Watershed. Neither the parties to the MOA nor the Executive Order that created the position delegated to an Assistant Attorney General a policy position or decision making authority. Rather such roles were specifically and very deliberately delegated to the extent applicable to the Partnership Council which was intended to represent all of the stake holders.

The purpose of the MOA was to establish balance between the need to protect the water supply while, at the same time, allowing the individuals that lived in the Watershed within the confines of the Watershed Regulations to make their own decisions regarding how their communities evolve and mature. The Watershed Regulations were comprehensive effort to protect the water supply from the impacts of irresponsible development. The Watershed Regulations were not intended to be the floor (the starting point) from which additional requirements can be proposed and required until the project is no longer able to get financing.

The New York State Department of Law (and in particular, Mr. Tierney) does not have responsibility to ensure that the citizens of Delaware County have jobs, have food and housing, have an adequate road system, have police protection, fire protection, health services and the basic infrastructure necessary for a decent quality of life. These responsibilities are, in part, with the local town, village and county government official which are elected by the citizens of this county and are accountable to such citizens. An Assistant Attorney General living in Albany making 7 times the per capita income of the average Delaware County resident, Mr. Tierney does not speak for and has no right to speak for the citizens of Delaware County. As an attorney for the State of New York, he is not an independent contractor hired to promote his own agenda or vision for Delaware County; he was retained to enforce the law of the State of New York and to represent the state agencies (such as the DEC) when they are sued in court for their decisions. As the attorney for the DEC hired to represent that agency in court to defend its decisions, the Assistant Attorney General should not appear as an independent party to a permit proceeding before that agency in opposition or in support of a particular project. As the attorney for the DEC, the Attorney General Office is supposed to zealously represent the DEC in order to protect the validity of DEC's decisions. By appearing as a party with its own agenda in a permit proceeding before that agency, Assistant Attorney General creates a conflict between it and its client.

Under the MOA, the local communities are to have responsibility within the confines of the state and city regulations to make land use decisions. In making such decisions, the local municipality is responsible to review the project in the context of whether it will be good for the community and consistent with the community character. While it is easy to say no to a project; any decision should be made in a manner that is consistent and in accordance with the overall best interest of the community.

Thank you for the opportunity to submit these additional comments. By a copy of this letter, I am also writing to the New York State Attorney General Elliot Spitzer inquiring regarding his opinion on the legality and appropriateness of the actions of Mr. Tierney.

Very truly yours,

James E. Eisel, Sr., Chairman
Delaware County Board of Supervisors

cc: Governor George Pataki
New York State Attorney Eliot Spitzer
Senator John J. Bonacic
Senator Joseph L. Bruno
Erin M. Crotty, DEC Commissioner
Alexander Ciesluk, Jr.

Encs.

(Hap Roell)

phone company to the insurance company to some of the representatives of our township, we know we need this project.

So please think carefully now that you have your piece of the pie. Shouldn't other people also share in these beautiful Catskill Mountains? Thank you.

ALJ WISSLER: Hap Roell. After Hap Roell, we'll hear from Jim Tierney.

MR. ROELL: Hi. I live in Fleischmanns. Ask ourselves why we live here. Isn't it the beauty, serenity and non-congestion? Why should a developer be able to change our quality of life so drastically with a project of this magnitude? Just say no.

ALJ WISSLER: Jim Tierney. After Mr. Tierney, we'll hear from Antoinette Cotelle.

MR. JIM TIERNEY: Thank you, Judge Wissler, and good afternoon. My name is Jim Tierney. I serve as the Watershed Inspector General, a position that is a joint appointment of the Governor and the Attorney General that was created pursuant to the 1997 New York City Watershed Memorandum of Agreement. I'm also an

(Jim Tierney)

Assistant Attorney General.

Like many persons who are here today, I'm still in the process of reviewing the massive Draft Environmental Impact Statement on the Crossroads Ventures hotel, golf resort and housing complex, and I'll be submitting my formal comments later. I'm here today to briefly raise a few concerns and to listen carefully to the comments of ours.

As many here know, the New York City Watershed provides drinking water for about half the residents of our state. That is over 9 million people each day. The cities of New Paltz, Newburgh drink this water, as does 15 percent of the people in Putnam County, and 85 percent of the people in Westchester County, in addition to all the residents of New York City.

For the vast majority of the people who drink this water, it is unfiltered, meaning that the only thing that happens to the water from reservoir to tap is that it gets doused with chlorine to kill the microbes. That's it. That's all. So this water supply, though

(Jim Tierney)

generally of very high quality, is also very fragile, because once pollutants are in the water, there is no means to remove them. And, of course, people then consume the pollutants.

One thing that is not well-known is just how small the New York watershed is. While providing water for over half the state, the entire watershed on both sides of the river only comprises 4.2 percent of the land area of the state. In fact, the entire East of Hudson watershed, the usual source of 90 percent of the drinking water, constitutes only 3.4 percent of the state, an area that is roughly the size equivalent to the size of Delaware County. And the proposed development is, of course, within the Catskill Park.

The Crossroads Ventures projects is proposed for a small and unusually sensitive area of the state where environmental and public health interests should, in my view, be the predominant interest when evaluating development under the State Environmental Quality Review Act.

Of course, sustainable economic vitality

(Jim Tierney)

for the Catskills, its farms, its forestry, its hamlets, its main streets is also a critical component of the bargain reached in the watershed Memorandum of Agreement.

My main concern here today is that this large-scale mountaintop and mountainside development will combine with other developments and development pressure to degrade the Catskill portion of the New York City Watershed. The polluted runoff from these developments may well combine in a relatively short time. We've seen it happen elsewhere, to place at serious risk all of our efforts to maintain high quality drinking water and avoid the need to build a multi-billion-dollar water filtration plant.

The Catskill system, it's not the entire watershed. It's the Ashokan and Schoharie Reservoirs, whose basins are mostly in Greene and Ulster County. On average, the Catskill system provides 40 percent of the drinking water. The vast majority of the Crossroads Ventures project is located in the Ashokan Reservoir basin. People may not realize it,

(Jim Tierney)

but fairly low levels of development can degrade water quality quickly.

Many scientific studies now report that when impervious surfaces, parking lots, roads, rooftops and the like, exceed 8 to 10 percent of a watershed, then water quality becomes impaired due to polluted runoff and all that comes with polluted runoff in a normal watershed. However, the Catskill system of the New York City Watershed is not normal. It has steep slopes, significantly erodible clay soils, flashy streams and unstable streams. It is far more sensitive to development than most areas.

EPA, for example, has estimated that construction activity discharge -- that an area, one acre subject to construction activity discharges 1,000 to 2,000 times the sediments in a rainstorm as one acre of forest. One acre of pavement generates approximately 15 times the runoff as one acre of forest. So when you build things, you often send massive amounts of sediments and the numerous associated pollutants into the water well above natural

(Jim Tierney)

conditions. You also release higher quantities of water during storms that often blows apart streams, releasing even more sediment.

And so my concerns are based on the -- and they're not finalized yet, but on the size of this project relative to other developments around here, the amount of soil disturbance and forest clear-cutting and root cutting. You're not just taking down the trees, you're ripping out the roots and grading and moving the soils around that can cause particularly serious erosion and sediment problems. The site soils here have very little percolation. The water doesn't go in, at least with these soils. So that when you clear, grate and compact these soils with heavy equipment, it discharges water, storm water in much the same way as impervious surfaces.

Also, it's interesting that this project is located in the area of New York State that experiences the most severe rainfalls. You can literally draw a circle around Belleayre Mountain, and that's where you get the most intense rainfall historically in New York

(Jim Tierney)

State. And the project sponsor has requested that they be able to disturb 50 acres at one time, which is ten times that allowed under DEC's normal regulations. These are issues with respect to wetlands.

There's issues with respect to alternatives and what appears to be a strong resistance by the project sponsor to look at smaller, lower impact alternatives. Almost along the lines of two golf courses, two resorts and associated buildings, or nothing because it's claimed need-based on economic viability.

I'm also concerned about wastewater treatment plants being located to support mountaintop and mountainside development. We want vital, well-developed businesses in our hamlets, but once we have wastewater treatment plants around the countryside, then that removes the limit on the ability to have a limit on mountaintop development, mountainside development, mountaintop condos.

Now, the Schoharie Reservoir in this Catskill system, the other piece, besides the

(Jim Tierney)

Ashokan Reservoir, is already impaired. It's already impaired and formally listed on DEC's 303(d) list of impaired water bodies due to high levels of sediment. The reservoir often looks like reddish chocolate milk. This is because clay particles that permeate the Schoharie and Ashokan Reservoir basins can stay suspended frequently for six to nine months. Once they're in the water and they're floating in the water, they don't settle out very quickly.

The Esopus Creek, many people love it, fish it, enjoy it. The main tributary to the Ashokan Reservoir is already formally listed as impaired by State DEC due to sediment.

The planned expansion of the Belleayre Ski Center is under the upcoming unit management plan, involves 22,000 acres within the Catskill Forest Preserve and within the Ashokan Reservoir basin. There is a proposal that I know of for six additional miles of new ski trails, of new clearances for ski trails just as that one resort.

There's a precedent that would be set for

(Jim Tierney)

other large-scale mountaintop development throughout the watershed as opposed to development and hotels within the hamlets. Three casinos are proposed for southern Ulster and Sullivan County. Casinos would be tremendously growth-inducing, and those casinos were passed and approved under state law with no requirement for review under the State Environmental Quality Review Act.

The significant development pressure is coming to Ulster and Greene Counties. Rockland County to the south is paved. Orange County is in the process of being paved. Southern Ulster County is heavily paved. The flash of development could come here very quickly and impact that Catskill system.

And one other thing that I find interesting is that the Cornell study that between 1982 and 1997, the population of New York State, of upstate New York grew only 2.6 percent. Yet, the amount of developed area grew by over 30 percent. We're expanding for some reason, even if we stay the same. And in a fragile watershed, that's a real problem.

(Jim Tierney)

So in conclusion, this project, the secondary growth associated with a project injecting hundreds of millions of dollars into the economy, the precedents it can set for sprawl development and mountaintop development rather than hamlet development all place at serious risk the long-term viability of the Catskill portion of the New York City Watershed, and with it, the water quality in the entire New York City drinking water system.

I'm glad, and I thank you for allowing me to present these comments here today. I'm not from Catskill but I went to high school in the watershed area down in Dutchess and Putnam County. And I can appreciate the balance that's necessary to make this whole effort work. Thank you for your time.

ALJ WISSLER: Antoinette Cotelle. After Ms. Cotelle, we'll here from Rocci Aguirre.

MS. ANTOINETTE COTELLE: Hi. My name is Antoinette Cotelle and I've lived up here full time since '97. And first off, this business of people getting jobs and all this stuff, I

CWT 4

Proposed Phase II Phosphorus TMDL Calculations for Pepacton Reservoir

March 1999

Prepared by: Dr. Kimberlee Kane
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Table 3.5. Wastewater Treatment Plant Phosphorus Loads and Wasteload Allocations for Pepacton Reservoir.

Plant Name	SPDES Permit Number	SPDES Flow (mgd)	Phosphorus Effluent Limit (mg l^{-1})	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)	WLA (kg)
Camp Nubar (Seasonal)	23787	0.0125	1.0	11	11	11	3	17
Camp Tai Chi (Seasonal)	104957	0.0075	1.0	5	0	0	1	10
Margaretville STP	26531	0.4000	0.5	476	450	257	547	277
Regis Hotel (Seasonal)	100382	0.0096	1.0	7	6	5	3	13
Roxbury Run Village	99562	0.1000	0.5	27	56	28	44	69
Basin Total				526	523	301	598	388

SPDES = State Pollution Discharge and Elimination System; WLA = Wasteload Allocation

the facility can discharge under its permit. Seasonal facilities are treated according to the limits given in their SPDES permit, so if year-round flow is allowed, then the WLA assumes year-round flow.

There are five WWTPs in the Pepacton basin (Table 3.5). Three facilities are seasonal, Camp Nubar, Camp Tai Chi and the Regis Hotel. There is one large WWTP owned by NYC in Margaretville. Interannual patterns in the flow mirror the interannual pattern of rainfall. A year with high runoff, such as 1996, results in higher flows into and out of the plants. The annual WWTP phosphorus load exceeded the basin WLA each year except for 1993.

Table 5.1. TMDL Calculation for Pepacton Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	59375	79167
MOS (10% of TMDL; SE = 0.4)	5938	7917
Available Load (TMDL - MOS)(kg yr^{-1})	53437	71250
WLA (kg yr^{-1})	388	388
LA (kg yr^{-1})	53049	70862
Current load (kg yr^{-1})	37327	37327
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	210	210
Remaining reduction (kg yr^{-1})	0	0

5.2 Basin Results

The TMDL calculations for Pepacton Reservoir using both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}) are given in Table 5.1. The current and critical phosphorus loads for each of the five years in the analysis are given in Table 3.4. The MOS for Pepacton Reservoir is 10% due to a low amount of variability in the annual phosphorus concentrations. Between 1992 and 1996 the annual geometric mean phosphorus concentrations ranged from 8.2 to 10.5 µg l^{-1}. Subtracting the MOS from the TMDL results in an available load which is apportioned between point and nonpoint sources. The WLA for the individual WWTPs are given in Table 3.5; the basin WLA is 388 kg yr^{-1}. The load remaining for nonpoint sources depends on the guidance value utilized.

The current phosphorus load is below the available phosphorus load, so load reductions are not required. A comparison of the basin WLA (388 kg yr^{-1}) and the total point source load for 1996 (598 kg yr^{-1}) indicates that a load reduction of 210 kg yr^{-1} may be expected from the WWTP upgrades. However, 1996 was an unusual year and the previous year the WWTPs were below the basin WLA. The principal phosphorus source in the Pepacton watershed is forest land use.

5

CWT 5

Proposed Phase II Phosphorus TMDL Calculations for Ashokan Reservoir

March 1999

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Table 3.9. Wastewater Treatment Plant Phosphorus Loads and Wasteload Allocations for Ashokan Reservoir.

Plant Name	SPDES Permit Number	SPDES Flow (mgd)	Phosphorus Effluent Limit ($\mu g\ l^{-1}$)	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)	WLA (kg)
Belleayre Mountain Ski Center (#001)	34169	0.0150	1.0	5	6	4	7	21
Belleayre Mountain Ski Center (#002)	34169	0.0140	1.0	2	3	2	2	19
Camp Timber Lake	240664	0.0340	1.0	54	22	11	20	47
Onteora Jr-Sr High School	99856	0.0270	1.0	36	41	33	29	37
Pine Hill STP	26557	0.5000	0.2	193	148	74	117	139
Mountainside Restaurant	251241	0.0030	1.0	0	0	0	5	4
Basin Total				290	220	124	180	268

SPDES = State Pollution Discharge and Elimination System; WLA = Wasteload Allocation

There are five WWTPs in the Ashokan basin (Table 3.9). One facility, a summer camp, is seasonally operated. The largest facility is the Pine Hill Sewage Treatment Plant which has a maximum permitted flow of 500,000 gpd. All facilities are currently operating below their maximum flow. Interannual patterns in the flow mirror the interannual pattern of rainfall. A year with high runoff, such as 1996, results in higher flows into and out of the plants. The annual WWTP phosphorus loads to Ashokan Reservoir decreased from 1993 to 1995, but experienced an increase in 1996 due to high flows. Part of the apparent decrease in the phosphorus load may be attributable to improved flow data used in the phosphorus load calculations in more recent years. All the facilities, with the exception of Mountainside Restaurant, are below their individual WLAs. This results in the basin as a whole being 296 kg yr^{-1} below the basin WLA.

Table 5.1. TMDL Calculation for Ashokan-West Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	45399	60532
MOS (10% of TMDL; SE = 1.0)	4540	6053
Available Load (TMDL - MOS)(kg yr^{-1})	40859	54479
WLA (kg yr^{-1})	264	264
LA (kg yr^{-1})	40595	54215
Current load (kg yr^{-1})	32833	32833
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	0	0
Remaining reduction (kg yr^{-1})	0	0

note: excludes 1996, see text for further information.

Table 5.2. TMDL Calculation for Ashokan-East Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	19542	26056
MOS (10% of TMDL; SE = 0.9)	1954	2606
Available Load (TMDL - MOS)(kg yr^{-1})	17588	23450
WLA (kg yr^{-1})	4	4
LA (kg yr^{-1})	17584	23446
Current load (kg yr^{-1})	16484	16484
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	1	1
Remaining reduction (kg yr^{-1})	0	0

5.2 Basin Results

West Basin Results

The TMDL calculations for Ashokan Reservoir, West Basin are given in Table 5.1 using both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}). The TMDL is based on the annual data from 1992 - 1995 only. The 100-year flood in the early part of 1996 delivered a tremendous phosphorus load to Schoharie Reservoir, greatly increasing the annual phosphorus concentration. Since this was clearly an unusual event, it is inappropriate to use the data from 1996 in a predictive, regulatory tool such as the TMDL. The current and critical phosphorus loads for each of the five years in the analysis are given in Table

6

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Watershed Communities 6 8-26-04

NEW YORK CITY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

GUIDANCE
for
PHOSPHORUS OFFSET
PILOT PROGRAMS

March 1997

Prepared by: Bureau of Water Supply Quality and Protection
Engineering and Operations Division, Project Management Group

PHOSPHORUS OFFSET PILOT PROGRAMS

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I. INTRODUCTION TO PILOT PHOSPHORUS OFFSET PROGRAMS

The "Rules and Regulations for the Protection from Contamination, Degradation, and Polluti of the New York City Water Supply and its Sources" (Regulations) regulate wastewater treatme plant (WWTP) discharges within the watershed of the City's drinking water supply system. T Regulations prohibit construction of new, and expansions of existing, WWTPs with surfa discharges in phosphorus restricted basins. However, under the five-year pilot program describ in Sections 18-82 and 18-83 of the Regulations, construction of up to three new surface dischargi WWTPs in phosphorus restricted basins in the Croton System in Putnam County and up to three ne or expanded surface discharging WWTPs in phosphorus restricted basins in the West of Hudsc (WOH) watershed would be allowed provided the following condition is met. Every 1 kilogram (k of additional phosphorus loading from the WWTP and accompanying nonpoint sources (over pr development conditions) must be "offset" by a reduction of at least 3 kg of phosphorus loading. the pilot program successfully achieves water quality and regulatory goals it will serve as the bas for establishing a permanent offset program, pursuant to Section 18-84 of the Regulations. Th guidance document discusses the regulatory requirements, policies, and procedures applicable to th pilot phosphorus offset program, and provides guidance for WWTP sponsors seeking to participat in the program.

In a similar program described in Section 18-61(d) of the Regulations, expansion of existin WWTPs with surface discharges in phosphorus restricted basins may be allowed under a variance subsurface discharge is impossible. Specific requirements of the variance provision are not discusse here. Refer instead to the New York City Department of Environmental Protection's "Guidance fo Preparing a Variance Application for a WWTP Expansion Involving Phosphorus Offset Plans."

II. REGULATORY REQUIREMENTS OF THE PHOSPHORUS OFFSET PROGRAM

A. General Requirements

Sections 18-82 and 18-83 of the Regulations set forth the terms of the phosphorus offset pilo programs under which WWTPs with surface discharges in phosphorus restricted basins may b constructed or expanded. Section 18-16 defines what reductions in phosphorus loadin constitute an offset. The phosphorus offset pilot program applies only in reservoir basins whic are phosphorus restricted only. Proposed new or expanded WWTPs with surface discharges ir phosphorus restricted reservoir basins that are also coliform restricted or that are within the 60- day travel time are not eligible to participate in the pilot offset program.

B. Eligibility Requirements for WWTPs Located in Putnam County

Section 18-82 of the Regulations requires the New York City Department of Environmental Protection (Department) upon request of Putnam County to prepare, or assist in preparing, a Comprehensive Croton System Water Quality Protection Plan (Croton Plan) for Putnam County. The county's participation in preparation and implementation of the Croton Plan is voluntary. Proposed new WWTPs with surface discharges in phosphorus restricted basins located in Putnam County are eligible to participate in the pilot offset program only if Putnam County has committed in writing to participate in the development of the Croton Plan. In addition, the County or municipality in which the WWTP is located must agree to the plant's inclusion in the pilot program.

Under the pilot offset program, up to three new surface discharging WWTPs with a total aggregate capacity of up to 150,000 gallons per day, as measured by the plants' State Pollutant Discharge Elimination System (SPDES) permit flow limitations, may be built in the drainage basins of phosphorus restricted reservoirs in the Croton System in Putnam County (the total of three plants is all-inclusive, not per basin). Expansions of existing plants with surface discharges are not eligible for the pilot program in Putnam County, but may be permitted pursuant to the variance provision of Section 18-61(d)(2) of the Regulations.

The phosphorus offset pilot program requires that every kilogram of projected increase in the phosphorus loading from the new WWTP and accompanying nonpoint source runoff from the WWTP site, including the development site(s) to be served, must be "offset" by a reduction of at least 3 kg of phosphorus loading from existing sources within the reservoir basin where the new WWTP is to be located. The conditions under which a phosphorus reduction qualifies as an offset are identified in Section II.D.1., Definition of Terms, Offsets.

The Croton system in Putnam County consists of the drainage basins of Bog Brook, Croton Falls, Diverting, Muscoot, Amawalk, East Branch, and Middle Branch Reservoirs, and Lake Gleneida, Lake Gilead, and Kirk Lake. The basins of the Muscoot Reservoir and Lake Gleneida, and parts of the Amawalk and Croton Falls Reservoirs are within the 60-day travel time. The Department annually determines which basins are phosphorus or coliform restricted. To learn the status of a particular basin and its eligibility for inclusion in the Pilot Offset Program, call 914-742-2034.

C. Eligibility Requirements for WWTPs Located West of Hudson

Section 18-83 of the Regulations provides for a similar phosphorus offset pilot program in phosphorus restricted basins in the WOH watershed. Under the WOH pilot program, up to three WWTPs with surface discharges, with a total aggregate capacity of up to 100,000 gallons per day as measured by the plants' SPDES permit flow limitations, may be built or expanded in phosphorus restricted basins. At the time this document was prepared, the Cannonsville Reservoir basin was the only phosphorus restricted basin in the WOH watershed. Part of the Cannonsville Reservoir basin is within the 60 day travel time.

The phosphorus offset pilot program requires that every kilogram of projected increase in the phosphorus load resulting from the construction of new WWTPs, or expansion of existing plants, and accompanying nonpoint source runoff from the WWTP site, must be "offset" by a reduction of at least 3 kilograms of phosphorus loading from existing sources within the basin in which the new or expanded WWTP is located. The conditions under which a phosphorus reduction qualifies as an offset are identified in Section II.D.1., Definition of Terms, Offsets.

WWTPs may only be built in a WOH county which has prepared, or is the process of preparing, in partnership with the Department and local governments, a comprehensive strategy which will identify economic resources, water quality problems, potential remedies for such problems, and potential strategies and recommendations for economic development initiatives that would be protective of water quality.

D: Definitions of Terms

1. Offsets

Only certain reductions in phosphorus discharges qualify as offsets. Pursuant to Section 18-16(a)(69) of the Regulations, an offset is defined as a reduction in the discharge of phosphorus into a drainage basin which is *surplus*, *quantifiable*, *permanent* and *enforceable* as defined below.

a. Surplus-

Surplus is defined as that part of the reduction in phosphorus which is not otherwise required by federal, state, or local law, including the Regulations, or pursuant to the terms of any judgement, decree, or order of any court, administrative tribunal or government agency, or pursuant to any watershed protection program funded by the Department, except as provided in subparagraphs 18-83(a)(3) and (a)(4) of the Regulations.

A surplus is considered a "credit" that can be applied toward the 3:1 offset requirement. The difference between (1) a reduction that is surplus and (2) a reduction that is not surplus and results from federal, state or local requirements, and therefore cannot be counted as a credit, is illustrated by reductions achieved through a Stormwater Pollution Prevention Plan (SPPP). Under the New York State General Permit for Stormwater Discharges from Construction Activities (General Permit) and Section 18-39 of the Watershed Regulations, an SPPP must be developed to reduce to the greatest extent possible, post-development increases in phosphorus exported from a site to pre-development levels. Reductions in post-development phosphorus loading achieved through an SPPP to satisfy the requirements of the General Permit and the Regulations will not qualify, and thus, cannot be credited as an offset. However, if the SPPP is enhanced so that post-development phosphorus loads are reduced to below pre-development loads, the incremental difference may be credited as an offset. Similarly, phosphorus reductions achieved through the Department's WWTP upgrade programs will not constitute offsets as the programs is required and/or funded by the City.

There is one exception to the rule that phosphorus reductions achieved under programs funded by the Department do not qualify as surplus. In WOH watersheds, applicants may use as an offset any phosphorus reduction funded by the City under the Catskill Fund for the Future or the Stormwater Retrofit Program, two programs being administered by the Catskill Watershed Corporation. These exceptions apply to both new and expansions of WOH WWTPs, and do not apply in the Croton System. Information about the Catskill Fund for the Future or the Stormwater Retrofit Program may be obtained from the Catskill Watershed Corporation, P.O. Box 569, Margaretville, New York.

b. Quantifiable-

An offset is quantifiable if a reasonable basis exists for calculating and verifying the amount of reduction in phosphorus. Models may be used to estimate the post-development increases in phosphorus exported from a site and reductions in phosphorus expected to be achieved through offsets. Methods for calculating phosphorus exported from a site are described in Section IV and Appendix A of this document. The effectiveness of the offset mechanisms implemented, however, must be verified through routine monitoring (except where the offset is achieved by the closure or elimination of the source). Refer to Section V.F., Quality Assurance and Quality Control Plan, for the Department's verification requirements.

c. Permanent-

An offset is permanent if the reduction in phosphorus is ongoing and of unlimited duration, as opposed to a temporary reduction. Mechanisms to achieve phosphorus reductions must be adequately maintained to ensure their permanence. An inspection and maintenance plan must be included in the offset plan and approved by the Department to ensure that all offset measures are adequately maintained for the duration of the discharge.

d. Enforceable -

An offset is enforceable if the actions and performance standards proposed by the applicant leading to the reduction in phosphorus loadings are incorporated into a legally valid and binding agreement which may be enforced by the City in a court of competent jurisdiction. At a minimum, the actions and performance standards proposed by the applicant must be incorporated into the applicant's New York State Department of Environmental Conservation (NYSDEC) SPDES permit and into conditions of the Department's approval of the WWTP.

2. Phosphorus Restricted Basin

The regulations define a phosphorus restricted basin as the drainage basin of a reservoir or controlled lake in which the phosphorus load to the reservoir or controlled lake results in the phosphorus water quality values established by the NYSDEC and set forth in its Technical Operational Guidance Series 1.1.1, Ambient Water Quality and Guidance Values, being exceeded as determined by the Department pursuant to its annual review conducted under Section 18-48(c) of Subchapter D of the Regulations.

3. Pre-Development

A site's pre-development condition refers to the existing state, configuration and use(s) of a parcel of land at the time the WWTP construction or expansion proposal is submitted to the Department. Copies of any current SPDES permit and, if applicable, the previous SPDES permit(s) for any facilities on the proposed site, must be included with an application for a new or expanded WWTP expansion to document pre-development phosphorus loads from an existing WWTP. The existing physical characteristics of the land and all of the land uses and cover types within the WWTP and contributing development sites' bounds shall be the basis for calculating pre-development nonpoint source phosphorus loads. Contributing development sites include those sites which will contribute wastewater flows to the WWTP being constructed or expanded because these are subject to offset requirements.

4. Post-Development

A site's post-developed condition refers to the proposed state, configuration and use(s) of a parcel of land following completion of construction. All proposed uses of the WWTP site and contributing development sites shall be considered in the calculation of post-development phosphorus loads.

III. ACHIEVING PHOSPHORUS OFFSETS: MECHANISMS AND TECHNIQUES

Phosphorus offset mechanisms can be implemented in the reservoir drainage basin receiving the proposed WWTP surface discharge or in a hydrologically-connected, phosphorus-restricted basin that is directly up-stream from the WWTP discharge. However, the methods used to determine reduction requirements and verify reductions are different if offsets are achieved in a hydrologically-connected basin. Refer to Appendix A for methods. In both cases, the required phosphorus reductions must be realized in the reservoir basin receiving the WWTP discharge.

Mechanisms to offset increases in phosphorus loading from new or expanded WWTPs and nonpoint sources may assume a variety of forms. Examples of these mechanisms, which may be used alone or in combination, include Stormwater Best Management Practices (BMPs), Land Reclamation, WWTP Retrofits, Diversion of WWTP Flows, Wetland Restoration, Actual WWTP Flow Reduction in Conjunction with Reductions in SPDES Permitted Flow, Facility Closure/Consolidation, and Conversion of Surface Discharges to Subsurface Discharges. Any other individual mechanism or combination of acceptable measures can be used to achieve the required offset. In each case the mechanism(s) must be reasonably demonstrated to be feasible in terms of site conditions and pollutant removal efficiencies, and the minimum requirements outlined in Section V., Other Offset Program Requirements, must be substantially implemented prior to the WWTP being placed in operation.

The following are provided as examples of phosphorus offset mechanisms that may be viable. The list is not all-inclusive and the Department will consider all reasonable proposals.

A. Stormwater BMP Retrofits

Stormwater best management practices (BMPs) may be effective in reducing phosphorus loads from existing sites and infrastructure, if properly sited, designed, constructed, and maintained.

Plans that include the use of BMPs and other proposed mechanisms must demonstrate that site characteristics, including soils, topography, depth to bedrock and water, and drainage area restrictions, are capable of supporting each of the proposed BMPs. *Appendix D of the New York State General Permit for Stormwater Discharges from Construction Activities* will serve as the basis for determining the suitability of a site's characteristics.

B. Land Reclamation

Reductions in phosphorus may be accomplished by altering a parcel of land to a condition which generates a lower phosphorus load than it does in its existing condition, and maintaining the land in its altered condition. To qualify for an offset, an applicant must have the title to the parcel of land to be altered, or secure a permanent easement that allows for the restoration and restriction of development, and develop a plan to modify the land use to generate a lower phosphorus export rate. For example, a parcel occupied in whole or part by an impervious surface may be reclaimed by removing the impervious portions and replacing them with a vegetated landscape that exports less phosphorus.

C. WWTP Retrofits

Offsets may be derived by reducing phosphorus discharges from other existing WWTPs. To be

eligible, an applicant must demonstrate that a reduction is technically feasible and is not otherwise required, demonstrate to the satisfaction of the Department that the proposed modification will permanently accomplish the offset, and enter into a binding agreement with the WWTP owner to incorporate the reduction.

Pursuant to the Watershed MOA, the City will fund upgrades for all existing WWTPs in the watershed to meet the standards set forth in the Regulations, including phosphorus removal. Phosphorus reductions attributable to City-funded upgrades are not surplus and therefore do not qualify as offsets for purposes of this program. Phosphorus reductions at existing plants, below the level which the City-funded upgrades will achieve, may qualify as offsets and may be implemented prior to the City-funded upgrades. Such reductions, however, must achieve lower phosphorus levels than the technology proposed to be implemented by the City.

D. Diversions of WWTP Flows

Offsets may be accomplished by diverting effluent from other existing WWTPs located within the basin where the WWTP is proposed to be built or expanded, to points outside of the City's water supply watershed. Phosphorus reductions gained through the diversion of a WWTP discharge from one basin to another within the water supply watershed will not qualify as offset. Further, any phosphorus reduction resulting from a diversion project funded by the Department shall not qualify as an offset.

E. Wetland Restoration

Offsets may be accomplished by restoring degraded wetlands. To qualify for an offset, applicants must have the title to the parcel of land containing the wetland to be restored, or have secured a permanent easement allowing for the restoration and protection of the wetland in perpetuity.

Plans, designs and specifications for restoring and maintaining the wetland's function must be approved by regulatory agencies with jurisdiction, and by the Department. Calculations estimating the phosphorus reduction capabilities of the restored wetland must be included with application submissions.

F. Actual WWTP Flow Reduction in Conjunction with Reductions in SPDES Permitted Flow

The New York State Department of Environmental Conservation SPDES permitting program governs discharges to surface and ground waters from WWTPs and other facilities. SPDES permits establish flow limits that are based on a facility's design capacity.

To qualify as an offset, applicants must reasonably demonstrate to NYSDEC and the Department that phosphorus reductions will be achieved by actual flow reductions that are permanent and enforceable. Further, the applicant must request that the NYSDEC revise its SPDES permitted flow limit, following which the NYSDEC must initiate the revision process which is then subject to public review. In the event that NYSDEC permits a reduction in flow and revises the SPDES permit, the incremental reduction in phosphorus gained through the lower flow will qualify as an offset. In the event that NYSDEC does not revise the SPDES permitted flow, the flow and consequent phosphorus reduction cannot qualify as an offset. Flow reductions may be accomplished through installation of water conservation and recycling equipment. Reductions in SPDES flow limits that do not involve

actual flow reductions do not qualify as offsets.

G. Facility Closure/Consolidation

Existing WWTPs and other similar facilities discharging to surface waters in phosphorus restricted basins may contribute a significant portion of a reservoir's phosphorus load. Eliminating such sources may qualify for an offset if the WWTP or facility is permanently de-commissioned. In the event the facility is replaced with a similar facility within the same watershed, only the net reduction in phosphorus discharged, the difference between the old and the new discharge, may be considered the offset.

For purposes of this program, a permanent de-commissioning means that the facility will be closed in perpetuity and will never reopen, operate, or function in its original capacity. To qualify for an offset, the applicant must adequately demonstrate that the facility will be permanently closed. Further, applicants must demonstrate that all closed facilities will not be replaced in the watershed by the same or a related corporate owner with equivalent facilities with the same or similar discharge in the same or greater amount.

H. Subsurface Sewage Treatment Systems

Properly functioning subsurface sewage disposal systems do not contribute a measurable amount of phosphorus to surface waters. Accordingly, septic systems do not provide an opportunity for offsets.

The Department notes that improperly functioning septic systems which do contribute measurable amounts of phosphorus are subject to enforcement proceedings by the Department and County Departments of Health (DOH), and in some cases NYSDEC. As such, reductions of phosphorus from these systems brought about by repair or replacement are not considered surplus and, thus, do not qualify as offsets.

I. Conversion of WWTP Surface Discharges to a Subsurface Discharges

It may be possible to eliminate all or a portion of a surface discharge from an existing WWTP by rerouting the plant's effluent to a subsurface absorption field. The phosphorus reduction resulting from diversion to a subsurface discharge qualifies as an offset, provided all necessary regulatory approvals are received.

IV. PHOSPHORUS LOAD/OFFSET REQUIREMENT CALCULATIONS

The amount of phosphorus discharged by a new or expanded WWTP (point source load) and the nonpoint source loads from the site on which the WWTP is located and development sites contributing wastewater flows to the plant are used to determine the offset requirement. Appendix A describes one of many methods for determining and comparing point and nonpoint source phosphorus loadings from the WWTP site and contributing development sites before and after development, calculating the amount of phosphorus which must be offset through phosphorus reduction measures, determining phosphorus loads before and after offset mechanisms are implemented, and verifying that the proposed offsets will achieve the required phosphorus reduction. The six-step process is as follows:

Step 1: Determine the increase in the annual phosphorus load to be discharged from the proposed new or expanding WWTP.

Step 2: Determine the pre-development and post-development phosphorus loads from nonpoint sources, and net change in nonpoint loading from the undeveloped WWTP site and the sites that will be contributing to the WWTP's flow volume (hereinafter referred to as the "contributing development site").

Step 3: Determine the increase in the amount of phosphorus exported from the entire WWTP and contributing development sites after the WWTP is constructed or expanded.

a. If the nonpoint phosphorus loading will increase following completion of the WWTP and development of contributing sites, add the net increase calculated in Step 2 to the WWTP loading. This is the total phosphorus load that will need to be offset on a 3:1 basis.

b. If the nonpoint phosphorus loading will decrease following completion of the WWTP and development of contributing sites, only the load from the WWTP discharge must be offset on a 3:1 basis. The post-development nonpoint source reduction may be used as an offset.

Step 4: Determine the offset requirement based on the above estimate of phosphorus exports.

Steps 5: Calculate the phosphorus reductions to be achieved through the offset mechanisms. Confirm through calculations that the proposed offset mechanisms will achieve the required phosphorus reduction and are quantifiable, permanent and enforceable. The calculations must consider load attenuation during transport between reservoir basins if offset mechanisms are implemented in hydrologically-connected basins.

V. OTHER OFFSET PROGRAM REQUIREMENTS

A. Application Procedures

1. Conceptual Proposals

A conceptual proposal must be submitted with a completed application (Appendix B) for participation in the pilot offset program to the Department for review within 90 days of the effective date of the Regulations. Following the Department's selection of conceptual proposals, a complete application for review and approval of a phosphorus offset plan must be submitted to the Department. Applications will be reviewed in the order in which they are received.

The Department will employ the following process to evaluate pilot offset program proposals. First, all applications will be screened to ensure that each includes the information specified in Appendix B. Each application must also demonstrate necessity: that is, the applicant must show that naturally occurring constraints within the project area prevent subsurface discharge and that the site in not located within a sewer district with the capacity to accept additional sewage. Applications that do not meet the eligibility requirements will be eliminated from consideration. Applicants whose proposals meet all eligibility requirements will be notified and given an

opportunity to meet with the Department to discuss specific elements of the proposal and respond to the Department's questions and comments.

2. Application Requirements for Offset Plans

The Department's review and approval of applications for Phosphorus Offset Plans is based upon the requirements and procedures set forth in the Regulations, including Application Procedures and Requirements (18-23), Watershed Planning in the Croton System (18-82) and Watershed Planning West of Hudson (18-83).

Offset program applications must provide sufficient information in the form of a narrative, maps, details and specifications to substantiate the anticipated phosphorus loads and to demonstrate that the required phosphorus offset will be achieved for the duration of the discharge. Refer to Appendix C for an application for approval of a Phosphorus Offset Plan. Applications must also include inspection and maintenance protocols, plans, any necessary agreements, a quality assurance and quality control plan, and a contingency plan, meeting the criteria set forth in Sections V.B., V.C., and V.D. of this document.

Section 18-82(g)(1) of the Regulations, Watershed Planning in the Croton System, conditions participation in the offset pilot program on the applicant demonstrating that the County or municipality in which the WWTP will be or is located agrees to the plant's inclusion in the pilot program. Applicants are responsible for obtaining the necessary county or municipal approvals.

The Regulations do not require counties or municipalities in WOH watersheds to agree to a WWTP's inclusion in the offset program. Instead, the WOH county, in partnership with the municipality in which the WWTP is located, and the Department must have prepared or be in the process of preparing a Comprehensive Strategy pursuant to Section 18-83 of the Regulations to be eligible to participate in the offset program. Applicants must demonstrate that they have prepared or are in the process of preparing a Comprehensive Strategy.

3. Application Requirements for WWTPs and Stormwater Pollution Plans

The Department's review and approval of applications relating to wastewater treatment plants is based on the requirements and procedures set forth in the Regulations, including Section 18-36. Refer to the Department's "Applicant's Guide to Wastewater Treatment Plant Approvals" for information regarding the application for approval of the WWTP itself.

Any wastewater treatment plant constructed or expanded pursuant to the pilot program must be designed and operated to meet a total phosphorus effluent limit of 0.2 mg/l.

The Department also has the authority to review and approve Stormwater Pollution Prevention Plans (SPPPs) for projects meeting certain thresholds. For further information on SPPPs, refer to the "Applicant's Guide to Stormwater Pollution Prevention Plans and Crossing, Piping or Diversion Permit."

B. Maintenance

An Inspection and Maintenance Plan must be submitted to the Department for review and

approval as a component of each phosphorus offset plan. The Inspection and Maintenance Plan must address specific maintenance and management requirements for each of the offset mechanisms included in the offset plan, and must include inspection schedules, maintenance needs and responsibilities, data recording forms, and maintenance cost estimates. The plan must also specify the funding source and the party(s) to be held legally responsible for inspection and maintenance throughout the life of the project. Additionally, the applicant must acquire, or secure agreements with the owners of, the sites on which offset mechanisms are proposed. If the sites are not owned by the applicant, the applicant must provide the Department with an agreement guaranteeing that the applicant will have permanent access to each offset site for implementing, monitoring and maintaining the offset mechanisms. Refer to Department's Applicant's Guide to Stormwater Pollution Prevention Plans and Crossing, and Watercourse Piping and Diversion Permits for acceptable inspection and maintenance standards. Quarterly reports, summarizing the results of inspection and maintenance program, must be submitted to DEP.

C. Quality Assurance and Quality Control Plan

The applicant is responsible for designing a site-specific monitoring program to verify and document the actual phosphorus loads from the WWTP and contributing development sites and from each offset mechanism. Modeling estimates, by themselves, are not sufficient to demonstrate that offsets are achieved. Therefore, a Quality Assurance and Quality Control (QA/QC) Plan, which sets forth strategies for implementing the offset measures and for verifying that phosphorus offset requirements are met, must accompany each application for the phosphorus offset program. The QA/QC plan must:

- document the ability of the Offset Plan to meet the phosphorus offset requirements for the duration of the discharge, using model estimates of BMP efficiencies;
- provide a statistical basis for verifying the offset (statistical level of confidence);
- identify the parties responsible for implementing the monitoring and QA/QC programs; and
- propose criteria for determining when the Contingency Plan will be implemented.

The monitoring plan must be site-specific, and will reflect the type(s) of offset mechanisms employed. The monitoring requirements, to provide statistical assurance that the offset is achieved, differ significantly between point and nonpoint sources of phosphorus. Point sources typically have less variable phosphorus loads and are easier to monitor. The nonpoint source phosphorus loads however are more difficult to monitor due to their diffuse nature and the fact that the majority of the load is delivered during storm events. The monitoring plan should take these issues into account, and must include, at a minimum:

- locations of proposed sample sites;
- monitoring parameters (must include flow and concentrations of total phosphorus);
- storm event monitoring;
- frequency, duration, and type of sampling (e.g., grab sample every two weeks, storm event monitoring);
- proposed laboratory for sample analysis, including lab qualifications; and
- an analysis of sources of uncertainty in the verification program and steps that will be taken to reduce and evaluate uncertainty.

D. Contingency Plan

A Phosphorus Offset Contingency Plan must accompany each application for participation in the Phosphorus Offset Pilot Program. The Contingency Plan will set forth a strategy for assuring that a 3:1 phosphorus reduction is achieved in the event the monitoring program determines that the implemented offset mechanisms are unsuccessful in meeting the offset requirement. The Contingency Plan must include plans for immediate implementation of viable alternatives, enhancements, modifications or repairs of approved offset mechanisms. The plan must also address the expected longevity of the proposed offset mechanisms and the strategies which will be employed to ensure the offsets are achieved for the duration of the WWTP discharge.

E. NYSDEC SPDES Permit Requirements

The owner a of WWTP participating in the pilot program must apply in writing to the NYSDEC for a new or revised SPDES permit for the WWTP that incorporates, as special conditions, those measures necessary to: (1) achieve offsets through point or nonpoint source reductions, including any easements, or contracts for access to the offset site or to ensure the performance of the owner of such site; (2) maintain any best management practices critical to the attainment of the offset; (3) monitor the offset for compliance with the requirements of the SPDES permit; and (4) achieve contingency reductions of phosphorus in the event that the proposed and permitted measures do not achieve the required phosphorus offset. A WWTP will only be eligible to participate in the pilot offset program if the NYSDEC issues a SPDES permit for the WWTP that reflects the applicant's offset plan.

F. Quarterly Reporting Requirements

Quarterly reports containing the following information must be submitted to the Department, throughout the useful life of the WWTP:

- records and results of the inspection and maintenance program
- sampling data and results of analyses

G. Timing of Offset Implementation and WWTP Plant Operation

Several conditions of the phosphorus offset program must be met before the WWTP will be allowed to operate. These include the following:

- The proposed Phosphorus Offset Plan must be reviewed and approved by the Department along with each supporting document-the contingency, quality assurance and quality control, and inspection and maintenance plans.
- The applicant must have a valid SPDES permit reflecting the Phosphorus Offset Plan.
- The applicant must secure ownership of the land necessary to implement, construct or install offset mechanisms, or enter into a binding agreement permanently granting permission to implement, construct or install, and maintain offset mechanisms to achieve load reductions for as long as the WWTP discharge continues.
- Construction of offset mechanisms must be complete except where the offset mechanisms are on the same site as the WWTP and cannot be implemented until the WWTP is completed.

H. Availability of State financing as part of the Watershed MOA

The State will make up to $100,000 available for each participant in the Croton or West of Hudson pilot programs to design, implement, and maintain phosphorus offsets which have been approved by the Department. For information about the availability of such funds and the State's application process, contact the New York State Department of Economic Development.

VI. REFERENCES

Herson-Jones, L., Kumble, P., and T. Schueler. 1993. 10% Rule Compliance: Urban Stormwater Quality Guidance for the Maryland Chesapeake Bay Critical Area in Intensely Developed Areas. Plan Reviewer's Guide, Applicant's Guide and Technical Guide. Metropolitan Washington Council of Governments.

Schueler, T. R. 1995. Urban Watershed Management: Design of Urban Best Management Practices. Center for Watershed Protection.

Schueler, T. R., Kumble, P.A., and M.A. Heraty. 1992. A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone. Metropolitan Washington Council of Governments. 127 pages.

Schueler, T. R. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices. Metropolitan Washington Council of Governments. 275 pages.

US EPA. 1996. Draft Framework for Watershed-Based Trading. EPA/800/R/96/001

US EPA. 1993. Urban Runoff Pollution, Prevention and Control Planning Handbook. EPA/625/R-93/004. 175 pages.

US EPA. 1991. Watershed Monitoring and Reporting for Section 319 National Monitoring Program Projects. EPA Office of Water. 65 pages.

APPENDIX A:
PHOSPHORUS LOAD AND OFFSET CALCULATIONS

This appendix sets forth the calculations required to determine pre- and post-development point and nonpoint source phosphorus loadings from the WWTP site and the sites that will be contributing to the WWTP's flow volume (hereinafter referred to as the "contributing development sites"). These calculations form the basis for determining the amount of phosphorus that must be offset through phosphorus offset mechanisms.

The method used to calculate nonpoint source phosphorus loading is based on relationships between land use/cover and the concentrations of pollutants found in urban runoff (Schueler 1987). Refer to Steps 2a and 2b for a discussion on the theory and limitations of the method.

- Step 1 quantifies the increase in the annual phosphorus load to be discharged from the new or expanded WWTP.
- Step 2 quantifies the point and nonpoint sources loads exported from the site. Step 2a quantifies the pre- and post-development nonpoint source phosphorus loads generated from the WWTP site and contributing development sites. Step 2b quantifies the change in nonpoint source phosphorus loads exported from the WWTP site and contributing development sites.
- Step 3 quantifies the total increase in the amount of phosphorus exported from the WWTP and contributing development sites after the proposed WWTP is constructed or expanded.
- Step 4 quantifies the offset requirement based on the estimate of phosphorus exported from the WWTP and contributing development sites following construction or expansion of the WWTP and completion of contributing development sites.
- Step 5 outlines the procedures for calculating and verifying that the phosphorus reductions to be achieved through the offset mechanisms. If offsets are located in hydrologically-connected basins, the calculations must factor in load attenuation during transport between reservoir basins.

Step 1. Calculate the Post-Development Point Source Phosphorus Load: (based on NYSDEC wasteload methodology)

The amount of phosphorus to be discharged from the proposed new or expanded WWTP is termed the "post-development" point source phosphorus load. It is based on the maximum permitted flow and the permitted phosphorus effluent limit.

For new WWTPs, calculate the post-development point source phosphorus load to be discharged from the proposed new WWTP as follows:

$$L_{pt\text{-}post} = \text{(maximum permitted flow)(effluent standard)}$$

For WWTP expansions, calculate the increase in surplus post-development phosphorus load to be discharged from the proposed expansion:

$L_{pt\text{-}post}$ = [(post-expansion maximum permitted flow) – (pre-expansion maximum permitted flow)](post-expansion effluent standard)

For example, a WWTP with a 30,000 gallon per day flow and a one milligram per liter (mg/l) phosphorus effluent limit is proposing an expansion to an 80,000 gallon per day maximum permitted flow. The effluent limit for the expanded discharge is 0.2 mg/l. The net increase in the post-development surplus phosphorus load ($L_{pt\text{-}post}$), including the conversion to pounds per year (lbs/yr) is calculated as follows:

(0.08 - 0.03 million gal/day) (365 days/year) (0.2 mg/l) (10.15 l•lbs/million gal•mg) = 37.05 lb/yr

to convert from mg•million gal/l•yr to lbs/yr, multiply by = 10.15 l•lbs/million gal•mg

$$\frac{3.79 \times 10^{6} \text{ liters}}{\text{million gallons}} \times \frac{2.679 \times 10^{-6} \text{ lbs}}{\text{mg}} = 10.15 \text{ l•lbs/million gal•mg}$$

This calculation assumes that the facility operates year round. For seasonal facilities, substitute the number of days the facility is permitted to operate, as specified in its SPDES permit, for 365.

Generally, the effluent standard will be the phosphorus effluent limit required by the Department's watershed regulations or the SPDES permit. Under the offset program, the Department will consider proposals to reduce phosphorus discharges beyond those required by federal, state and the Department regulations. If the technology is deemed acceptable and the reductions are incorporated into the SPDES permit or another appropriate enforceable document, the reductions will lower the post-development point source phosphorus loading from the WWTP.

Step 2. Calculate Nonpoint Source Phosphorus Load Exported From a Site:

The nonpoint source phosphorus load generated under existing or pre-development conditions, and under proposed or post-development conditions must be quantified to estimate the incremental change in the amount nonpoint source phosphorus to be exported from the proposed new or expanded WWTP site, from contributing development sites and from proposed offset mechanisms. The methodology described below as an example for calculating nonpoint source phosphorus loads exported from a site is the "Simple Method," (Schueler, 1987) and has been adapted from *10% Rule Compliance: Urban Stormwater Quality Guidance for the Maryland Chesapeake Bay Critical Area in Intensely Developed Areas* (May 1993). Refer to the *Technical Guide, Applicant's Guide,* and *Plan Reviewer's Guide*, attachments to that document, for a detailed description of the 10% Rule and sample calculations. The Simple Method is only one of many methodologies for calculating nonpoint pollutant loads from development activities. Use of this particular methodology for comparing pre- and post-development phosphorus loads is not required and, in fact, as noted in Appendix G, may not be appropriate for many sites, including golf courses and mixed-use sites. Applicants may use alternate methods to calculate phosphorus loads including the P8 Urban Catchment Model and the U.S. Environmental Protection Agency's Stormwater Management Model (SWMM). In all cases, applicants should identify the methodology, describe the calculations and the assumptions on which the computations are based, provide the runoff coefficients used in the calculations, justify the accuracy of the chosen methodology and obtain the Department approval for its use.

Step 2a. Calculate the nonpoint source phosphorus loading ($L_{nps\text{-}pre}$ and $L_{nps\text{-}post}$) as follows:

1. Identify sub-basins within the proposed site under pre- and post-development conditions. The smallest sub-basin delineated must be used when calculating phosphorus loads. The post-development sub-basin boundaries may be different from the pre-development sub-basin boundaries. Refer to Appendix G for land uses requiring slightly modified methodology.

2. Assign development categories and runoff coefficients (R_v) to each sub-basin of the development site using National Urban Runoff Program (NURP) data (see Appendix E and "Results of the Nationwide Urban Runoff Program" USEPA, 1993). Other phosphorus export coefficients may be substituted if acceptable local monitoring data are available.

3. Using the following formulas, calculate the pre- and post-development pollutant loading from each sub-basin.

$$L_{nps\text{-}pre}\ (lbs/yr) = [(P)(P_j)(R_{v\text{-}pre})/12](C_{pre})(A)(2.72)$$

$$L_{nps\text{-}post}\ (lbs/yr) = [(P)(P_j)(R_{v\text{-}post})/12](C_{post})(A)(2.72)$$

$L_{nps\text{-}pre}$ = average annual load of phosphorus exported from the site before development (lbs/year)
$L_{nps\text{-}post}$ = average annual load of phosphorus exported from the site after development (lbs/year)
P = average rainfall (inches/year) - refer to Appendix D for rainfall data
P_j = fraction of rainfall events that produce runoff
$R_{v\text{-}pre}$ = runoff coefficient for pre-development conditions
$R_{v\text{-}post}$ = runoff coefficient for post-development conditions
C_{pre} = pre-development flow-weighted mean of [P] in urban runoff (mg/l) (values in Appendix E)
C_{post} = post-development flow-weighted mean of [P] in urban runoff (mg/l) (values in Appendix E)
A = area of sub-basin (acres)
12 = unit conversion factor (from inches to feet)
2.72 = unit conversion factor (from ft•mg•acre/l•yr to lbs/yr)

Step 2b. Calculate the incremental change in post-development nonpoint source loads (L_{nps}) by subtracting the sum of the pre-development nonpoint source load from the sum of the post-development nonpoint source load as follows:

$$L_{nps} = \sum (L_{nps\text{-}post})_{\text{sub-basin } 1\ldots n} - \sum (L_{nps\text{-}pre})_{\text{sub-basin } 1\ldots m}$$

n = number of sub-basins post-development; m = number of sub-basins pre-development

For WWTP site and contributing development site calculations where the post-development nonpoint source phosphorus load is greater than the pre-development load, the increment will be added to the point source load increment and the entire load must be offset. Where the post-development nonpoint sources phosphorus load is less than the pre-development load, the nonpoint source load from the site is not increased and, thus, the load reduction may be used as an offset. In that situation, only the WWTP point source load must be offset.

Step 3. Calculate the Post-Development Phosphorus Load From the WWTP and Contributing Development Sites.

The post-development phosphorus loading from all point and nonpoint sources (P_{post}) must be calculated to determine the phosphorus load to be offset. The post-development load of phosphorus exported from a WWTP site and contributing development sites is calculated as follows:

$$P_{post} = L_{pt\text{-}post} + L_{nps}$$

P_{post} = estimated increase in post-development phosphorus load from a site (lbs/yr)
$L_{pt\text{-}post}$ = estimated post-development total phosphorus load from new or incremental load from expanded point sources (lbs/yr)
L_{nps} = estimated net post-development phosphorus load from nonpoint sources if > 0 (lbs/yr) If $L_{nps} < 0$, substitute 0 for L_{nps}.

Step 4. Calculate the Phosphorus Offset Requirement

Under the terms of the Phosphorus Offset Pilot Program, participating WWTPs in phosphorus restricted basins must offset each kilogram increase in phosphorus discharged from the WWTP and nonpoint sources with a 3 kilogram decrease in phosphorus loading to the same watershed basin.

The phosphorus load reduction (offset) requirement (P_{offset}) for the pilot program is then calculated as:

$$P_{offset} = (3)(P_{post})$$

When offset mechanisms are employed in a hydrologically-connected upstream basin, the formula used to calculate the offset requirement (P_{offset}) must be modified to account for additional uncertainties. Phosphorus retention by the reservoirs significantly effects phosphorus attenuation in an upstream watershed and the subsequent discharge to the downstream basin.

The following examples clarify this concept. First, assume that basin A is currently receiving a phosphorus load of 1000 kg/yr. Through phosphorus reduction measures, the load is decreased by 200 kg/yr to 800 kg/yr. If basin A has a phosphorus retention of 10 percent, then the loading from basin A to the hydrologically connected downstream basin, A^1, would originally have been 900 kg/yr. After the reduction measures are implemented, the phosphorus loading from A to A^1 be 720 kg/yr.

In contrast, assume that basin B also initially receives a phosphorus load of 1000 kg/yr and through phosphorus reductions, this loading is decreased to 800 kg/yr. If basin B has a phosphorus retention rate of 50 percent, then the loading from basin B to the hydrologically connected downstream basin, B^1, would originally have been 500 kg/yr. After the reduction measures, the loading from B to B^1 would be 400 kg/yr.

Offset measures that are sited in an upstream basin must account for the attenuation of the phosphorus downstream. An applicant proposing an offset measure in an upstream basin must demonstrate to the Department's satisfaction that the required offset will be met downstream. That is, the amount of phosphorus to be reduced by an upstream offset mechanism must be sufficient to

ensure that the reduction in the reservoir receiving the new or expanded WWTP discharge meets the 3:1 offset requirements. As indicated in the examples above, the Department expects that the attenuation of phosphorus will vary among reservoirs.

Step 5a. Estimate the Phosphorus Reductions to be Achieved by the Proposed Offsets

Phosphorus loads exported from the offset site(s) must be calculated for site conditions before and after the offset is implemented. The formulas given below for calculating nonpoint load reductions achieved by offset mechanisms refer to the Simple Method, by way of example. As noted, other methods can, and may have to be used to quantify pre-offset and post-offset nonpoint source phosphorus loads.

1. Point Source Discharges

Phosphorus reductions from point sources can be achieved in several ways. First, a point source may be eliminated entirely, and not replaced by a similar facility in the watershed (see Section III.G. above). The phosphorus reduction associated with such a facility closure is equal to the point source phosphorus loading from the eliminated facility, less any increased phosphorus loading from the site of the eliminated facility if land use/cover conditions are altered at the site.

Second, the phosphorus loading from an existing point source may be reduced, in which case, pre- and post-offset treatment phosphorus loads will be calculated using the point source discharge formula used in Step 1 of the WWTP calculations as follows:

$L_{post\text{-}offset}$ = [(post-offset maximum permitted flow) - (pre-offset maximum permitted flow)] (post-offset effluent standard)(conversion factor to lbs/yr)

This calculation assumes that the facility operates year round. For seasonal facilities, substitute the number of days the facility is permitted to operate, under its SPDES permit, for 365, as explained in Step 1 of the WWTP calculations.

Finally, phosphorus reduction from a point source discharge may be accomplished by the diversion of effluent from an existing facility to a point outside the watershed. The offset credit for such a measure is based on the total point-source phosphorus diverted less the nonpoint phosphorus discharges from any new development along the sewer line that may reasonably be anticipated.

2. Nonpoint Source Discharges

The following are provided as examples of phosphorus offset mechanisms and the methods used to calculate their phosphorus removal rate. Applicants may propose any feasible offset mechanism and use any reliable method to predict their removal rate.

A. Stormwater BMP Retrofits

The incremental nonpoint source load reduction realized through the use of BMPs will be determined in a three step process.

Part 1. Calculate the nonpoint source phosphorus loads before each BMP is implemented (pre-development) for the drainage area served by the BMP.

Part 2. Calculate the post-development phosphorus load ($L_{nps\text{-}pre}$) exported from the BMP site using the pre-development phosphorus load and the phosphorus removal rate for each BMP specified in Appendix F.

Post-BMP Load = (pre-development nonpoint source load) (BMP removal rate)

$$L_{BMP} = \sum(L_{nps\text{-}pre})\,(RR)$$

BMP Type	Removal Rate* (RR)	x	($L_{nps\text{-}pre}$)	=	Post-BMP Load (L_{BMP})
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____
_____	_____	x	_____	=	_____

Part 3. Calculate the net change in phosphorus load exported from the BMP site served by the BMP ($L_{post\text{-}offset}$). Use the following formula:

$$L_{post\text{-}offset} = L_{BMP} - P_{nps\text{-}pre}$$

Part 4. When several BMPs are installed in series, it cannot be assumed that the sum of individual efficiencies is equal to the actual phosphorus load reduction achieved by the combination of mechanisms. The cumulative effectiveness of a series of offset mechanisms can best be assessed using a combination of water quality sampling and an analysis of the estimated effectiveness of the mechanisms' phosphorus reduction ability.

The recommended formula to calculate reductions from BMPs installed in series, from the *Plan Reviewer's Guide for 10% Compliance, Urban Stormwater Quality Guidance for the Maryland Chesapeake Bay Critical Area*, page 8 (May 1993), is:

Total Load Removed by BMP Series =
$L_{nps\text{-}pre}$-[$L_{nps\text{-}pre}$ (1-BMP efficiency$_1$)(1-BMP efficiency$_2$)... (1-BMP efficiency$_{last}$)]

B. Land Reclamation and Wetland Restoration

Reductions in phosphorus loads will be determined by subtracting the load generated by the land in its restored form (L_{rest}) from the phosphorus load generated in its current form (L_{pre}) as calculated with formulas described in Step 2a of this

Appendix as follows:

$L_{post\text{-}offset}$ = Post Offset Restored Land Loading = $L_{pre} - L_{red}$

Land reclamation BMPs must be evaluated by individual drainage units.

Step 5b: Verify Offset Mechanisms Will Achieve Required Phosphorus Reductions

Calculate the sum of the phosphorus loads exported from each offset mechanism and compare it to the offset requirement (P_{offset}) to verify that the offset requirement will be achieved.

$$P_{offset} = \sum (L_{post\text{-}offset})_{offset\ 1} + (L_{post\text{-}offset})_{offset\ 2} \cdots \sum (L_{post\text{-}offset})_{offset\ n}$$

For cases in which the offset mechanisms are implemented in hydrologically-connected basins, attenuation during transport between reservoirs must be factored into the calculation.

APPENDIX B

NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION APPLICATION FOR PARTICIPATION IN THE PILOT PHOSPHORUS OFFSET PROGRAM

Project Name: _____

Applicant/Owner:	Design Professional:
Name: _____	Name: _____
Address: _____	Address: _____
Phone: _____	Phone: _____

_____

County Receiving Stream or Reservoir

Proposed WWTP Location and Design Capacity: _____

Check Applicable Provision of New York City Regulations Under Which Approval is Being Sought

___ Section 18-82 - Watershed Planning in Croton System Watersheds

___ Section 18-83 - Watershed Planning in West of Hudson Watersheds

Include the following information and descriptions in sufficient detail to allow the Department to determine the feasibility of implementing and technical merit of the Offset Plan:

General Project Description and Eligibility Requirements

1. A description of the project(s) that the WWTP or the WWTP expansion will serve.

2. A description of the capacity requirements, treatment capabilities and conceptual design of the WWTP.

3. A description of how the project meets the eligibility requirements of the offset program including, but not limited to the following:
   a. Naturally occurring constraints within the project area preclude subsurface discharge and the site is not located within a sewer district with the capacity to accept additional sewage.
   b. Proposed offsets are surplus, quantifiable, permanent and enforceable.
   c. The necessary municipal/county commitments are in place.
      i. For WWTPs located in Putnam County, the municipality or the County in which the WWTP is located must indicate that they agree to the WWTP's participation in the pilot program.
      ii. For WWTPs located in Putnam County, the municipality in which the WWTP is located and the County must commit in writing to participate in the development of the Croton Plan.
      iii. For WWTPs located WOH, the County must have prepared or be in the process of preparing a Comprehensive Strategy in partnership with the Department and local governments.

4. An inventory of regulatory approvals necessary for the project and a description of how that project complies with the requirements.

Technical Elements

1. A conceptual description of the offset plan. Identify the additional phosphorus loading from the proposed WWTP and contributing development/project site(s), method(s) used to predict pre- and post-development phosphorus loading, the types and locations of offset mechanisms to be employed, and the method(s) used to determine the effectiveness of the offset mechanisms.

2. A conceptual description of the inspection and maintenance plan.

3. A conceptual description of the monitoring plan and quality assurance plan that contains a defensible basis for documenting attainment of offset goals.

4. A conceptual description of the Contingency Plan including:
   a. a description of the measures to remove additional phosphorus in the event the offset mechanisms fail and
   b. engineering, design, redundancy safety factors and other actions to be taken to minimize failure and maximize success of implementation of the plan.

5. Other impacts, including
   a. a discussion of the water quality risks associated with failure of the offset plan and
   b. a discussion of the water quality benefits associated with implementation of the plan.

Implementation

1. A clear description of the steps required to implement the offset program, including identifying all design, construction, land acquisition or other requirements.

2. A planning level schedule of how the different components of the plan will be implemented, including interactions among tasks.

3. Demonstrate that adequate financing for the entire project, including offset mechanisms and any land acquisition associated with the offset mechanism, is available.

_____ _____

Signature Date

APPENDIX C
NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION
APPLICATION FOR APPROVAL OF A PHOSPHORUS OFFSET PLAN

Date Initiated: _____

Project Name: _____

Applicant/Owner:
Name: _____
Address: _____
Phone: _____

Design Professional:
Name: _____
Address: _____
Phone: _____

_____
County Receiving Stream or Reservoir

Proposed WWTP Location and Design Capacity: _____
Basins in Which Offsets Are Proposed: _____
_____

Check Applicable Provision of New York City Regulations Under Which Approval is Being Sought
___ Section 18-82 - Watershed Planning in Croton System Watersheds (3:1 Offset Pilot Programs)
___ Section 18-83 - Watershed Planning in West of Hudson Watersheds (3:1 Offset Pilot Programs)

PHOSPHORUS OFFSET PLAN

Provide sufficient information in narrative and map form to document anticipated phosphorus loads and to demonstrate that the required phosphorus offset will be achieved for the life of the new WWTP discharge. The narrative and plans must include the following:

I. Background Information/WWTP and Offset Site Descriptions

The following information must be included with the background materials:

- a description of the project that the WWTP or WWTP expansion will serve;
- a description of how the project meets the eligibility requirements (e.g., demonstrate that the municipalities have indicated their agreement to make the necessary commitments); and
- a description of how offset plan fulfill the surplus, quantifiable, permanent and enforceable requirements described in the Regulations.
- information required under Section 18-23 of the Regulations
  - a copy of any Environmental Assessment Form, or any Draft Environmental Impact Statement, or determination of nonsignificance by the lead agency;
  - a list of related approvals the applicant knows to be required for the project as a whole, and a statement of the status of those approvals at the time of filing the application with the Department; and
  - a statement describing any enforcement action against the applicant (or any principal affiliate of the applicant) for any alleged violations of law related to the WWTP or

Offset Plan in the five years preceding the application.

II. Project Description

The application must include a narrative describing the following:

- WWTP proposal, including all information required under Section 18-36 of the Regulations;
- Offset proposal:
  - descriptions of each offset mechanism proposed (i.e., stormwater BMP retrofits, land reclamation, WWTP retrofits, or diversions of WWTP flows);
  - ability of offset mechanisms to achieve reduction/individual and cumulative reductions expected from phosphorus reduction measures (include reduction calculation(s) for BMPs installed in series);
  - methods employed to ensure that phosphorus reductions are permanent and that measures will be replaced or rebuilt as necessary; and
- costs, financing and land acquisition/easements arrangements; and
- a description of how the project complies with local requirements concerning stormwater management, erosion and sediment control, and wetland and natural resource protection.
- An inventory of formal agreements, municipal ordinances, or other legal documents required for project implementation.

III. Maps

The application must include the following:

1. Location map(s).
2. Plans for the WWTP site and the site of each proposed offset mechanisms showing the following:
   - existing and proposed topography (maximum scale of 1" = 50' and 2 foot contours);
   - wetlands, streams and watercourses on and adjacent to WWTP and offset mechanism sites;
   - drainage areas and acreage; and
   - existing land use at and surrounding site(s) of measures.
3. Site development plan (with WWTP).
4. Plans, maps, details and specifications for each proposed phosphorus offset mechanism.
5. Stormwater Pollution Prevention Plans that address the WWTP, associated development/project(s) and offset mechanisms.

IV. Phosphorus Load Calculations

The application must also describe the method and include the calculations employed to estimate the phosphorus load from the proposed project site, the offset requirement, and the reductions to be achieved by the proposed offset mechanisms as described in Appendix A of *The Guidance for Phosphorus Offset Pilot Programs.*

V. Supplemental/Supporting Documentation

Attach the required Offset Plan Supplements:

Operation and Maintenance Plan
Operation and Maintenance Agreements with Owners of Offset Sites
Quality Assurance and Quality Control Plan
Contingency Plan

Is any part of the proposed project eligible for state financing?

☐ yes ☐ no Amount Available: $_____

_____ _____

(Signature) (Date)

NOTE: Refer to the New York City Department of Environmental Protection "Guidance for Phosphorus Offset Pilot Programs," "The Applicant's Guide to Subsurface Sewage Treatment Systems," "Applicants Guide to WWTPs and Sewerage Systems," "Applicant's Guide to Stormwater Pollution Prevention Plans and Crossing, Piping or Diversion Permits," "Applicant's Guide to Individual Residential Stormwater Permits," and Sections 18-61, 18-82, and 18-83 of "The Rules and Regulations for the Protection from Contamination, Degradation, and Pollution of the New York City Water Supply and its Sources" for additional information.

APPENDIX D
RAINFALL TABLE

(Adapted from the "New York State Guidelines for Urban Erosion and Sediment Control," Amendment NY-1, November 7, 1990, Page 2-14.4.)

Rainfall For Each Frequency

	1 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	Average Annual Rainfall
Delaware County	2.5	2.9	4.0	4.5	5.0	5.5	7.9	45.0
Dutchess County	2.8	3.5	4.5	5.0	6.0	7.0	8.0	40.2
Greene County	3.0	3.0	4.5	5.0	6.0	7.0	8.0	42.4
Putnam County	2.7	3.5	4.5	5.0	6.0	7.0	7.5	45.0
Schoharie County	2.4	2.8	3.7	4.5	4.9	5.5	7.0	37.3
Sullivan County	3.0	3.5	4.5	5.0	6.0	7.0	8.0	48.2
Ulster County	3.5	4.0	5.0	6.0	6.5	7.0	8.0	50.4
Westchester County	2.8	3.5	4.5	5.0	6.0	7.0	7.5	49.5

APPENDIX E
POLLUTANT LOADING COEFFICIENTS mg/l
(C Values For Use With Simple Method)

POLLUTANT	NEW SUBURBAN NURP SITES (Wash., DC)	OLDER URBAN AREAS (Baltimore)	CENTRAL BUSINESS DISTRICT (Wash., DC)	NATIONAL NURP STUDY AVERAGE	HARDWOOD FOREST (Northern Virginia)	NATIONAL URBAN HIGHWAY RUNOFF)
PHOSPHORUS						
Total	0.26	1.08	--	0.46	0.15	--
Ortho	0.12	0.26	1.01	--	0.02	--
Soluble	0.16	--	--	0.16	0.04	0.59
Organic	0.10	0.82	--	0.13	0.11	--
NITROGEN						
Total	2.00	13.6	2.17	3.31	0.78	--
Nitrate	0.48	8.9	0.84	0.96	0.17	--
Ammonia	0.26	1.1	--	--	0.07	--
Organic	1.25	--	--	--	0.54	--
TKN	1.51	7.2	1.49	2.35	0.61	2.72
COD	35.6	163.0	--	90.8	>40.0	124.0
BOD (5-day)	5.1	--	36.0	11.9	--	--
METALS						
Zinc	0.037	0.397	0.250	0.176	--	0.380
Lead	0.018	0.389	0.370	0.180	--	0.550
Copper	--	0.105	--	0.047	--	--

FROM: "Controlling Urban Runoff: A practical manual for Planning and Designing Urban BPMs". Schueler, 1987

APPENDIX F
BMP POLLUTANT REMOVAL EFFICIENCIES

Source: Schueler, 1995.

BMP/Design	Total Phosphorus Removal	BMP Removal Rate (for Step 5 of Appendix A)
Extended Detention Pond		
Design 1	20 to 40 %	0.2
Design 2	40 to 60 %	0.4
Design 3	60 to 80 %	0.6
Wet Pond		
Design 4	40 to 60 %	0.4
Design 5	40 to 60 %	0.4
Design 6	60 to 80 %	0.6
Infiltration Trench		
Design 7	40 to 60 %	0.4
Design 8	40 to 60 %	0.4
Design 9	60 to 80 %	0.6
Infiltration Basin		
Design 7	40 to 60 %	0.4
Design 8	40 to 60 %	0.4
Design 9	60 to 80 %	0.6
Porous Pavement		
Design 7	60 to 80 %	0.6
Design 8	60 to 80 %	0.6
Design 9	60 to 80 %	0.6
Water Quality Inlet		
Design 10	insufficient information	0
Filter Strip		

Design 11	0.to 20 %	0.05
Design 12	40 to 60 %	0.4
Grassed Swale		
Design 13	0 to 20 %	0.05
Design 14	20 to 40 %	0.2

* Insufficient Information

Design 1: First-flush runoff volume detained for 6-12 hours.
Design 2: Runoff volume produced by 1.0 inch, detained 24 hours.
Design 3: As in Design 2, but with shallow marsh in bottom stage.
Design 4: Permanent pool equal to 0.5 inch storage per impervious acre.
Design 5: Permanent pool equal to 2.5 (V_r); where V_r = mean storm runoff.
Design 6: Permanent pool equal to 4.0 (V_r); approximately 2 weeks retention.
Design 7: Facility exfiltrates first-flush; 0.5 inch runoff per impervious acre.
Design 8: Facility exfiltrates one inch runoff volume per impervious acre.
Design 9: Facility exfiltrates all runoff, up to the 2 year design storm.
Design 10: 400 cubic feet wet storage per impervious acre.
Design 11: 20 foot wide turf strip.
Design 12: 100 foot wide forested strip, with level spreader.
Design 13: High slope swales, with no check dams.
Design 14: Low gradient swales with check dams.

APPENDIX G
SPECIAL CIRCUMSTANCES: GOLF COURSES, LAWNS AND SIMILARLY LANDSCAPED FEATURES

Problem: The Simple Method does not accurately reflect impacts of highly maintained turf on water quality: These sites typically contain little impervious surface area.

Strategy: Require additional practices or management measures to reduce impacts.

1) Use alternative loading factor of 0.5 pounds/acre/year (Grizzard, reference in *10% Rule Compliance: Technical Guide*);

2) Maintain natural vegetation along streams, wetlands, and public water supplies wherever possible. Consider the use of low growing plant materials or meadows alone stream corridors;

3) Request submission of a certified Integrated Pest Management program for maintenance;

4) Require submittal of a pesticide risk assessment;

5) Provide a list of recommended fungicides, insecticides, herbicides (low toxicity).

6) Establish fertilizer use limits (4-5 lbs/P/1000 square feet);

7) Where possible, design sand traps to also function as a sand filter BMP. In addition, design water features as stormwater management ponds or stormwater wetlands.

8) Minimize direct discharge of under-drains to streams and water bodies. Require diversions, where feasible, to a stormwater facility.

5-8-98.

THE CITY OF NEW YORK DEPARTMENT OF ENVIRONMENTAL PROTECTION
JOEL A. MIELE, SR., P.E. Commissioner

(914) 338-3604
(914) 338-4589

WIL
Dep

Bureau of Water Supply,
Quality and Protection

DETERMINATION

Pursuant to the authority granted under:
Section 1100 of the Public Health Law; and
Section 18-03 of 15 RCNY

The New York City Department of Environmental Protection makes the following determination with respect to the application described below for participation in the Putnam County phosphorus offset pilot program authorized by section 18-82(g) of the Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources ("the Watershed Regulations"):

Name of Project:	Kent Manor
Location:	Nichols Street, Kent, NY
Applicant:	Lexington Realty and Development Corporation
Address:	3010 Westchester Avenue Purchase, New York 10577 (914) 694-8300
Drainage Basin:	Croton Falls Reservoir

General Description of Project:

The applicant proposes to construct a 303 unit condominium development on a 113 acre site in the Town of Kent. The land area on which the condominiums would be constructed is in the drainage basin of the Croton Falls Reservoir. The proposed wastewater treatment plant ("WWTP"), for which a State Pollutant Discharge Elimination System ("SPDES") permit has already been issued, would discharge into Michael's Brook, which flows southerly into Palmer Lake and ultimately into the Croton Falls Reservoir.

Phosphorus Discharge from Point Sources. The applicant proposes to discharge 81,600 gallons/day from the WWTP. The applicant also proposes to seek a 0.10 mg/l effluent standard in the SPDES permit for phosphorus discharge from the WWTP, which will result in a point source discharge of 29.64 lbs of phosphorus per year. If the applicant cannot convince NYSDEC to modify the SPDES permit to a 0.10 mg/l phosphorus effluent standard, the 0.20 mg/l phosphorus standard required under section 18-82(g)(5) of the Watershed Regulations will

apply, and the point source discharge will be 59.28 lbs of phosphorus per year.

Phosphorus Discharge from Nonpoint Sources The proposed development would increase the discharge of phosphorus from nonpoint sources (stormwater runoff) from 26.30 lb/year before construction to 51.45 lbs/year after construction. As required by section 18-39(b) of the Watershed Regulations, the applicant has prepared a conceptual Stormwater Pollution Prevention Plan which proposes to reduce the 51.45 lb/year of phosphorus after construction to 11.12 lbs/year, or 15.18 lbs/year less than the preconstruction stormwater phosphorus discharge. This 15.18 lbs/year reduction may be applied as a credit to the required phosphorus offset.

Required Phosphorus Offset. The required offset is determined by adding the phosphorus discharged from the WWTP (29.64 lbs/year) and the increase in phosphorus discharged from nonpoint sources (0.00 lbs/year) and multiplying the sum by three. The required offset is 88.92 lbs/year.

General Description of Proposed Conceptual Offset Plan:

Offset. The applicant proposes both on- and off-site mechanisms to meet the offset requirement. On-site, the applicant proposes a 15.18 lbs/year reduction over preconstruction levels in phosphorus discharged in stormwater runoff through an enhanced Stormwater Pollution Prevention Plan. In addition, the applicant proposes to treat the discharge from the WWTP through a series of wet ponds that will remove an additional 23.24 lbs/year of phosphorus. These on-site proposed reductions total 38.42 lbs/year, leaving 50.50 lbs/year of phosphorus to be offset through off-site mechanisms

To achieve this remaining 50.50 lbs/year offset requirement, the applicant proposes to treat stormwater runoff from a shopping center in the Croton Falls Reservoir drainage basin in the Town of Carmel by installing a manufactured stormwater retrofit structure at the outfall from the shopping center's existing drainage system. The shopping center, which has approximately 10 acres of impervious surface, discharges an estimated 110 lbs/year of phosphorus into Michael's Brook. The applicant proposes to use the retrofit device (CSF Stormwater Treatment System) to reduce the phosphorus discharged in the stormwater runoff from the shopping center by 57%, or 62.15 lbs/year. The reduction would exceed the required offset of 50.50 lbs/year by a margin of 11.65 lbs/year. The applicant has provided the Department with a letter from the owners of the shopping center indicating that they will grant the applicant permission to install and maintain the retrofit structure.

Contingency Plan. The applicant proposes a contingency plan which consists of 1) restoring a non-functional stormwater management basin at the shopping center; 2) installing an additional stormwater retrofit structure at the stormwater outfall from the shopping center; and 3) installing an additional retrofit structure in the watercourse before it enters a pipe that conveys in under the shopping center. According to the applicant's conceptual offset plan, these measures together could reduce phosphorus discharges by an additional 117.84 lbs/year.

Monitoring the Offset. The applicant proposes a conceptual plan to monitor the effectiveness of the on-site stormwater controls and the stormwater retrofit structure at the shopping center. Monitoring will include automatic sampling devices to measure rainfall and phosphorous discharges into and out of each offset mechanism. The Department will be provided with quarterly reports and annual summaries.

DETERMINATION

(X) Conceptual Plan Approved ( ) Conceptual Plan Disapproved

Reasons Supporting Approval:

The Watershed Regulations authorize a pilot program for construction of up to 3 new surface discharging WWTPs with a total new discharge of no more than 150,000 gallons per day in phosphorus restricted basins in the Croton water supply system in Putnam County. For a WWTP to be eligible for inclusion in the program, each kilogram of phosphorus discharged from the new WWTP and each kilogram increase over pre-construction conditions in phosphorus discharged in stormwater runoff from the development must be offset by the removal of 3 kilograms of phosphorus from the same reservoir drainage basin. The offsets must be surplus, permanent, enforceable, and quantifiable, as those terms are defined in the watershed regulations.

The conceptual application for Kent Manor satisfies all the criteria for inclusion in the phosphorus offset pilot program and the Department has concluded that Kent Manor's inclusion in the program will further the goals of the pilot program and is consistent with the Department's watershed protection program. The offset is surplus because no law, regulation, permit, or other enforceable standard requires that effluent discharged from a WWTP be treated after discharge through a series of wet ponds to remove additional phosphorus or that the amount of phosphorus discharged in stormwater runoff be reduced to below pre-construction levels. In addition, no law, regulation, permit, or other enforceable standard requires that stormwater runoff from the already constructed shopping center be treated before discharge into Michael's Brook. As proposed, the offset is permanent because it can continue for so long as the offset mechanisms are maintained. After construction of the WWTP and offset mechanisms are complete, if a homeowners' association assumes responsibility for the WWTP, the applicant must also require the homeowners' association to maintain the offset mechanisms. The offset is enforceable because it will be included as a condition in any approval of the WWTP issued by the Department. In addition, NYSDEC has committed to including the on-and offsite offsets in the SPDES permit for the WWTP. The Department will also require that the applicants' ability to implement the off-site offset be set forth in a binding agreement, enforceable by the Department, between the applicant or a successor homeowners' association and the owner of the shopping center. The offset is quantifiable and will be monitored by the applicant.

Conditions of Approval

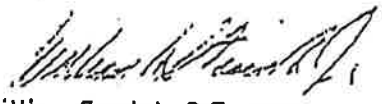
The purpose of this pilot program is to enable the Department to determine if it is feasible to implement a permanent phosphorus offset program to reduce phosphorus loading to the City's reservoirs while easing the Watershed Regulations' restrictions on new surface discharging WWTPs in phosphorus restricted reservoir basins. The Department would be best able to assess the success of the pilot program and the feasibility of a permanent program if the pilot program included different types of offset mechanism and similar offset mechanisms operated by different operators under differing conditions. Because the Watershed Regulations allow up to three new WWTPs to participate in the pilot program but restrict their total combined discharge to 150,000 gallons/day, the purposes of the pilot program would be best served if no

single participating WWTP used more than half of the available discharge gallonage. Accordingly, this approval is for 70,000 gallons/day.

This approval is for the conceptual offset application only. The applicant must prepare and submit approvable complete plans for the WWTP and the offset mechanisms, including detailed quality assurance, monitoring, and contingency plans. The applicant's participation in the phosphorus offset pilot program is contingent on obtaining the Department's approval of such plans.

The applicant has not yet submitted a letter from the Town of Kent or Putnam County demonstrating that the Town or County agrees to the WWTP's inclusion in the pilot program, as required by section 18-82(g)(1) of the Watershed Regulations. This approval is contingent on the applicant submitting the required letter.

Determination made by:



Date: May 8, 1998

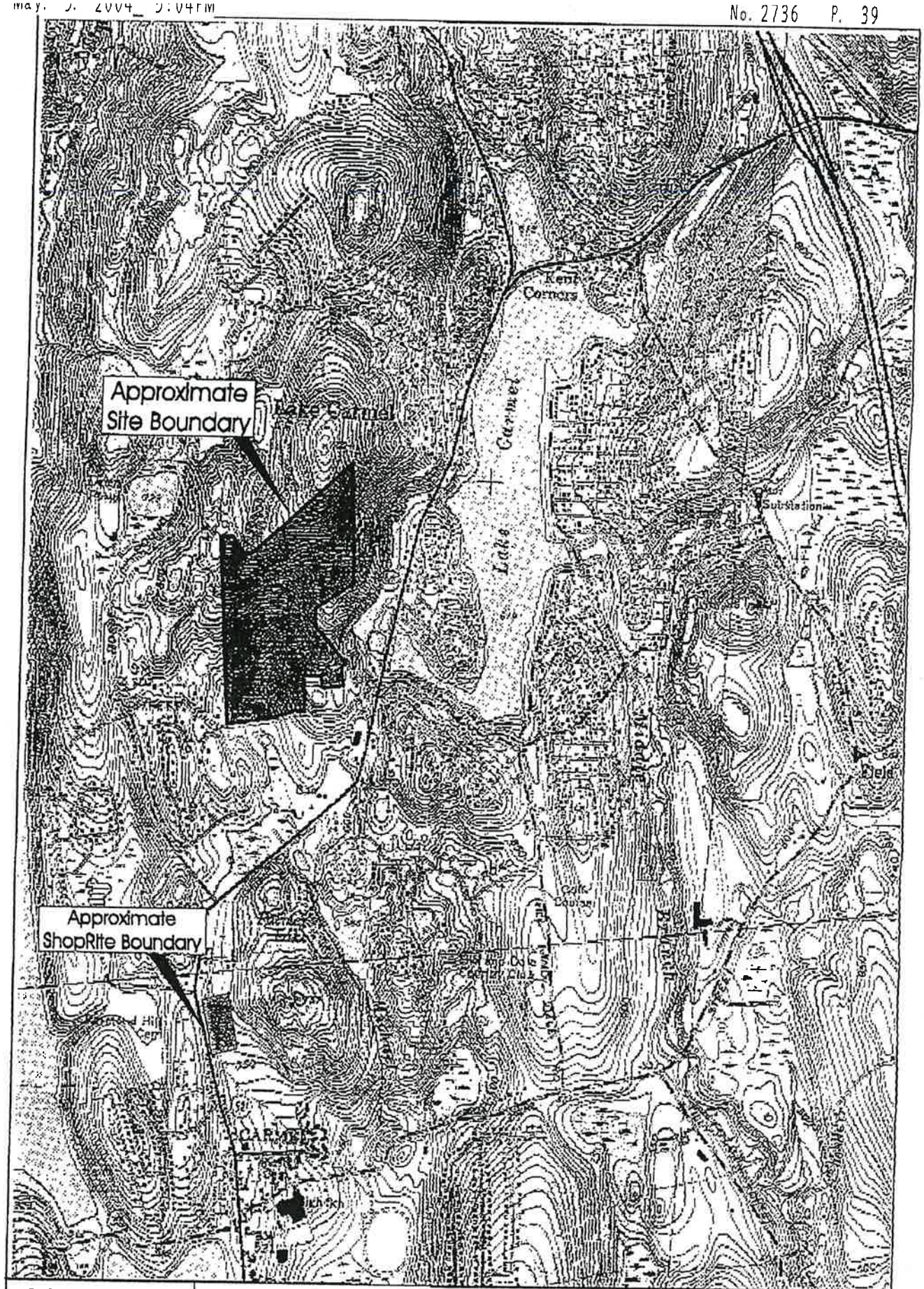
William Stasiuk, P.E., Ph.D.
Deputy Commissioner
Bureau of Water Supply, Quality and Protection
New York City Department of
Environmental Protection

B. TECHNICAL ELEMENTS

1.0 Conceptual Description of Offset Plan

The Kent Manor phosphorus offset concept plan includes two key elements. The first element is a reduction in the phosphorus discharge limit of the SPDES permit from 0.2 mg/L to 0.1 mg/L. We have discussed the limit reduction with Ken Markussen of the New York State Department of Environmental Conservation (NYSDEC), in which Mr. Markussen has stated that reducing the limit will be considered, pending approval of engineering plans. A letter from the NYSDEC is included as Attachment D. Additionally, we have incorporated a series of BMPs into the site plan such that the post-development non-point source load is less than the pre-development non-point source load. The WWTP will also discharge to the series of BMPs, thereby reducing the phosphorus load associated with the WWTP. The incremental difference between the pre and post-development non-point source load, and the reduction in the WWTP load by the BMPs on-site are applied as an offset.

The second element is the off-site offset of phosphorus loading. We propose to manage stormwater runoff from the ShopRite shopping center located just south of the Kent Manor site on Route 52 (see Figure 3). The shopping center site is approximately 10 acres in size and 100 percent impervious. The shopping center site also receives stormwater runoff from a contributing area of approximately 15.4 acres. The land within the contributing area consist of portions of Route 52, a cemetery and undeveloped forest. The contributing area and shopping center site are part of the headwaters of a stream that feeds Michael's Brook, which ultimately discharges into the Croton Falls Reservoir. The Kent Manor project also drains to Michael's Brook and ultimately the Croton Falls Reservoir. We have met with the owner of the shopping center site, HRE properties, and they have issued a letter granting us permission to manage their stormwater quality. The letter from HRE properties is presented in Attachment E. Site photos are presented in Attachment F.



MALCOLM PIRNIE	Kent Manor Development Offset Site Location Map	Figure 3

As shown on Figure 3, the area to the north of the shopping center forms a stream, which is diverted beneath the shopping center parking lot by an approximate four-foot diameter culvert. The area contributing to the stream consists of 60 acres of mixed land uses. The culvert discharges into a channel that feeds a wetland area at the southwest corner of the shopping center. Stormwater runoff from the shopping center site and the contributing area is conveyed to an approximate 18-inch diameter outfall which discharges to a small depression located at the southeast end of the shopping center. In the small depression is an approximate two-foot diameter, three-foot high metal overflow riser pipe. Water flowing into the riser pipe discharges into a wetland area via an approximately 12-inch pipe located ± 40 feet south of the shopping center.

The small depression area appears to have been a detention pond. Currently, it does not function as such, as evidenced by siltation, the lack of high water marks, significant vegetative growth, and mature trees growing in the area. Additionally, the riser pipe is perforated at the base, thereby allowing stormwater from the shopping center to flow directly into the 12-inch diameter outfall pipe with little to no detention, and hence, little to no phosphorus removal.

Our proposed phosphorus offset concept plan consists of the installation of stormwater treatment system at the outfall point described above. The proposed treatment system is called a CSF stormwater treatment system. The CSF utilizes a specially processed leaf compost filter media to filter and treat non-point source pollutants. Both field and laboratory tests demonstrate that the CSF removes approximately 57 percent of phosphorus as well as sediments, oil and grease and heavy metals. The CSF system is relatively small in size (similar to a box culvert) and is an efficient solution to solving "in-line" stormwater quality management. Technical information on the CSF system is in Attachment G. The following are the calculations to determine the required phosphorus offset for the Kent Manor project.

Phosphorus Loading Calculations

The phosphorous load associated with the proposed Kent Manor Project was developed by calculating both the pre-development non-point source load (the phosphorous contribution from both previously developed and undeveloped lands on the project site) and the post development load (including undeveloped lands, newly developed lands, and the load associated with the proposed wastewater treatment plant). The post development non-point source load includes credits from on-site stormwater management structures that will be constructed such that the post-development non-point source load is less than the pre-development non-point source load. The net change between the pre and post development non-point source loads was then applied as an offset credit. The WWTP load was multiplied by three to determine the required offset. The actual WWTP load was then routed through the on-site stormwater management features (i.e. three wet ponds) to reduce the phosphorus load leaving the site from the WWTP. That reduction was then applied as an offset credit.

The calculations used to determine the pre and post-development loadings as well as the stormwater control credits are presented on the following pages.

Pre-development Loading

Pre-development non-point source loadings were calculated using the simple method for Non Point Source Pollutant Loadings for the disturbed and undisturbed portions of the site under existing conditions as described in the DEP Guidance for Phosphorus Offset Pilot Programs::

Pre-development - Undisturbed Areas

$$L_{nps\text{-}pre\text{-}und}\ (lbs./yr.) = [(P)(P_j)(R_{v\text{-}pre})/12](C_{pre})(A)(2.72)$$

Where:

$L_{nps\text{-}pre\text{-}und}$ = Pre-development Non Point Source Loading in pounds per year

P	=	Average rainfall (inches/year)
P_j	=	Fraction of rainfall events that produce runoff
$R_{v\text{-}pre\text{-}und}$	=	Runoff coefficient for pre development conditions
$C_{pre\text{-}und}$	=	Pre-development flow weighted mean of Phosphorus in urban runoff (mg/l)
A	=	area of sub-basin
12	=	unit of conversion (inches to feet)
2.72	=	unit of conversion (ft*mg*acre/l*yr to lbs/yr.)

The following values were used to calculate the pre-development loading:

P	=	45 inches per year
P_j	=	9 (value recommended in "Reducing the Impacts of Storm-water". NYSDEC 1992)
$R_{v\text{-}pre\text{-}und}$	=	.1 (Assumes 5% watershed imperviousness (see footnote)
$C_{pre\text{-}und}$	=	.15 (Hardwood Forest)
A	=	79 Acres
$L_{nps\text{-}pre\text{-}und}$	=	**10.88 lbs/yr**

Pre-development - Disturbed Portions of Site

$L_{nps\text{-}pre\text{-}dist}$ (lbs./yr.) = $[(P)(P_j)(R_{v\text{-}pre})/12](C_{prc})(A)(2.72)$

Where:

$L_{nps\text{-}pre\text{-}dist}$	=	Pre-development Non Point Source Loading in pounds per year for disturbed portions of the site
P	=	Average rainfall (inches/year)
P_j	=	Fraction of rainfall events that produce runoff
$R_{v\text{-}pre\text{-}dist}$	=	Runoff coefficient for pre development conditions

$C_{pre-dist}$	=	Pre-development flow weighted mean of Phosphorus in urban runoff (mg/l)
A	=	area of sub-basin
12	=	unit of conversion (inches to feet)
2.72	=	unit of conversion (ft*mg*acre/l*yr to lbs/yr.)

The following values were used to calculate the pre-development loading:

P	=	45 inches per year
P_j	=	.9 (value recommended in "Reducing the Impacts of Storm-water". NYSDEC, 1992)
$R_{v-pre-dist}$	=	0.19 (Assumes 15% watershed imperviousness. *Field Verify*)
$C_{pre-dist}$	=	0.26 (new suburban development)
A	=	34 Acres

$L_{nps-pre-dist}$ = **15.42 lbs/yr**

TOTAL PRE-DEVELOPMENT NON-POINT SOURCE LOADING = 26.30 LBS/YR.

Post-Development Area Loading

WWTP Loading

$L_{pt-WWTP}$ = Maximum Permitted Flow * Effluent Standard

$L_{pt-WWTP}$ = .08 mgd * 365 days per Year * 0.1 mg/l * 10.15 Conversion Factor

$L_{pt-WWTP}$ = 29.64 lbs per year

Post-Development Non-Point Disturbed Areas

Post-development non-point source loadins were calculated using the simple method as described in the DEP Guidance document.

$L_{nps\text{-}devel\text{-}dist}$ (lbs./yr.) = $[(P)(P_j)(R_{v\text{-}post\text{-}devel\text{-}dist})/12](C_{post\ devel\text{-}dist})(A)(2.72)$

Where:

$L_{nps\text{-}devel\text{-}dist}$	=	Non point source loading in pounds per year from developed area of the site.
P	=	Average rainfall (inches/year)
P_j	=	Fraction of rainfall events that produce runoff
$R_{v\text{-}post\ devel\text{-}dist}$	=	Runoff coefficient for developed areas of site.
$C_{post\ devel\text{-}dist}$	=	flow weighted mean of Phosphorus in urban runoff (mg/l) from developed portion of the site
A	=	area of sub-basin
12	=	unit of conversion (inches to feet)
2.72	=	unit of conversion (ft*mg*acre/l*yr to lbs/yr.)

The following values were used to calculate the post-developed loading:

P	=	45 inches per year
P_j	=	.9 (value recommended in "Reducing the Impacts of Storm-water". NYSDEC, 1992)
$R_{v\text{-}post\text{-}devel\text{-}dist}$	=	.5 (Assumes 50% watershed imperviousness taken from "Reducing the Impacts of Storm-water". NYSDEC, 1992)
$C_{post\text{-}devel\text{-}dist}$	=	.26 (new suburban development)
A	=	34 Acres

$L_{nps\text{-}post\ devel\text{-}dist}$ = **40.57 lbs/yr**

Post-development Non-Point - Undisturbed Area Loading

$L_{nps\text{-}devel\text{-}und}$ (lbs./yr.) = $[(P)(P_j)(R_{v\text{-}post\text{-}devel\text{-}und})/12](C_{post\ devel\text{-}und})(A)(2.72)$

Where:

$L_{nps\text{-}devel\text{-}und}$	=	Non point source loading in pounds per year from undeveloped area of the site.
P	=	Average rainfall (inches/year)
P_j =		Fraction of rainfall events that produce runoff
$R_{v\text{-}post\ devel\text{-}dist}$	=	Runoff coefficient for undeveloped areas of site.
$C_{post\ devel\text{-}dist}$	=	flow weighted mean of Phosphorus in urban runoff (mg/l) from undeveloped portion of the site
A	=	area of sub-basin
12	=	unit of conversion (inches to feet)
2.72	=	unit of conversion (ft*mg*acre/l*yr to lbs/yr.)

The following values were used to calculate the post-developed loading:

P =		45 inches per year
P_j =		.9 (value recommended in "Reducing the Impacts of Storm-water". NYSDEC, 1992)
$R_{v\text{-}post\text{-}devel\text{-}dist}$	=	.1 (Assumes 5% watershed imperviousness taken from "Reducing the Impacts of Storm-water. NYSDEC, 1992)
$C_{post\text{-}devel\text{-}dist}$	=	.15 (Hardwood Forest)
A	=	79 Acres
$L_{nps\text{-}post\ undevel\text{-}dist}$	=	**10.88 lbs/yr**

TOTAL POST DEVELOPMENT LOADING

Post Development Non-Point = 51.45 lbs./yr.

WWTP = 29.64 lbs./yr

Calculation of Required Offset

The following is a summary of the phosphorus loading calculations:

1. Pre-Development, Non-Point Source Load = 26.30 lbs/yr.
2. Post-Development, Non-Point Source Load = 51.45 lbs/yr.
3. WWTP Source Load = 29.64 lbs./yr.

As required by the NYSDEC (General Permit No. GP-93-06), a Stormwater Pollution Prevention Plan (SWPPP) is necessary for the Kent Manor project. The Best Management Practices (BMPs) proposed to mitigate stormwater pollutants consists of a series of three wet ponds. Each wet pond has a BMP Removal Rate of 40 percent. All stormwater from the site will be conveyed to the wet ponds. Therefore, for the purposes of the SWPPP, the resultant Post-Development, Non-Point Source Load would be as follows:

Post-Development, Non-Point Source Load =	51.45 lbs/yr.
40% Reduction from Wet Pond #1	-20.57 lbs/yr.
Load Leaving Wet Pond #1	30.88 lbs/yr.
40% Reduction from Wet Pond #2	-12.36 lbs/yr.
Load Leaving Wet Pond #2	18.53 lbs/yr.
40% Reduction from Wet Pond #3	-7.41 lbs/yr.
Final Post-Development, Non-Point Source Load	11.12 lbs/yr.

Because the Post-Development, Non-Point Source Load is less than the Pre-Development, Non-Point Source load, an offset credit of 15.18 lbs/yr can be realized (Pre-Development - Post-Development).

The WWTP load of 29.64 lbs/yr. will also be discharged through the stormwater BMPs. The resultant phosphorus load will be as follows:

WWTP Load	=	29.64 lbs/yr.
40% Reduction from Wet Pond #1		-11.86 lbs/yr.
Load Leaving Wet Pond #1		17.78 lbs/yr.
40% Reduction from Wet Pond #2		-7.11 lbs/yr.
Load Leaving Wet Pond #2		10.67 lbs/yr.
40% Reduction from Wet Pond #3		-4.27 lbs/yr.
Final WWTP Load		6.4 lbs/yr.

The difference between the WWTP load (29.64 lbs/yr) and the BMP reduced load (6.4 lbs/yr) can be realized as an offset credit. The WWTP credit equates to 23.24 lbs/yr. The total offset credit (Post-Development Non-Point and WWTP) due to the on-site stormwater BMPs equates to 38.42 lbs/yr. (15.18 + 29.64).

The required offset from the WWTP equates to 88.92 lbs/yr. (29.64 lbs/yr. x 3). Applying the BMP credit of 38.42 lbs/yr., the final phosphorus offset required for the Kent Manor project is 50.50 lbs/yr.

Proposed Offset Mechanism Calculations

As previously discussed, the proposed off-site location for the removal of phosphorus required by the offset program is the ShopRite shopping center on Route 52 in Carmel, New York. The shopping center site is 100 percent impervious and encompasses 10 acres. Additionally, the stormwater collection of the shopping center receives surface water runoff from portions of Route 52 (approximately 800 linear feet), a cemetery (approximately 3.7 acres) and undeveloped forest (approximately 11 acres). The calculated phosphorus load from the shopping center and contributing area is as follows:

Using the simple method:

$$L = [(P)(Pj)(Rv)/12](C)(A)(2.72)$$

where: L = Storm pollutant export (in pounds)

P = Rainfall Depth (inches)

Pj = Factor that corrects P for storms that produce no runoff

Rv = Runoff Coefficient

C = Flow-weighted mean concentration of the pollutant in urban runoff

A = Area

12 and 2.72 = Conversion factors

ShopRite Shopping Center and Route 52

$L = [(45)(0.9)(0.94)/12](1.08)(10.7)(2.72)$

L = 99.72 lbs/yr.

Cemetery

$L = [(45)(0.9)(0.5)/12](0.46)(3.7)(2.72)$

L = 7.81 lbs/yr.

Forest

$L = [(45)(0.9)(0.10)/12](0.15)(11)(2.72)$

L = 1.5 lbs/yr.

Therefore, the total calculated load from the shopping center stormwater collection system equates to 109.03 lbs/yr.

By installing the CSF Stormwater Treatment System in-line at the discharge point of the shopping center stormwater system, a reduction of 57 percent in phosphorus loading will be realized (see Attachment G for technical information on the CSF system). A 57 percent reduction in the shopping center load equates to a removal of 62.15 lbs/yr. The proposed removal of 62.15 lbs/yr. is in excess of the required offset of 50.50 lbs/yr. and therefore, the proposed offset is more than adequate to meet the requirements of the pilot program.

2.0 Conceptual Description of Inspection and Maintenance Plan

The inspection and maintenance of the WWTP will be subject to the applicable regulations under the NYSDEC SPDES permit program. Under the SPDES program, regular inspections of the WWTP by a licensed operator is required. Overall, the proposed WWTP requires little maintenance when compared to conventional systems (see Attachment A for general description).

The inspection and maintenance of the proposed offset BMPs will be important to the continuing success of reducing phosphorus loads. We propose to conduct quarterly inspections of all BMP features used in the offset program. This information will be submitted quarterly to the DEP along with the water quality monitoring data (see Section B.3 for details on the monitoring plan). It is anticipated that the Inspection and Maintenance Plan will include inspection of the following elements:

Off-Site CSF Treatment System

-Sediment build-up

-Structural integrity

-Integrity of connections

-Erosion around control structure

-Erosion around outfall

-Replacement of filter media

7

CWT #7

KEITH S. PORTER

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Mission Statement of the New York State Water Resources Institute

The NYS Water Resources Institute (WRI) addresses water resource problems by engaging research, educational and outreach resources of the New York State academic community. As specified by federal and state laws establishing NYS WRI, its complementary objectives are to:

1. Foster applied and basic research, education, training, and outreach concerning water resource and associated environmental issues to create and disseminate knowledge and technical assistance, and thereby;
2. Assist governmental agencies, communities, businesses and other public and private constituencies, in identifying, research, educational and informational needs to address their water resource and associated environmental issues.

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1986 - present.....Director: Water Resources Institute, Center for the Environment, Cornell University, Ithaca, NY

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1975 - 1978.....Groundwater Program Director: Cooperative Extension Association of Suffolk County, Cornell University, Ithaca, NY

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1968 - 1974.....Higher Scientific Officer: Water Pollution Research Laboratory, Stevenage, Department of the Environment, United Kingdom

1966 - 1968.....Instructor (Mathematics): Abbs Cross Technical High School, Hornchurch, Essex, United Kingdom

1964 - 1966.....Economics Analyst: Management Information Division, Prudential Insurance Company of America, Western Home Office, Los Angeles, CA

PROFESSIONAL ACTIVITIES

2003 – Present .....Extension Leader for Department of Earth and Atmospheric Sciences
2000 – Present .....Cornell Nutrient Management Program Work Team
1999 - 2002.....NYS Soil & Water Conservation Committee
1999 – Present .....Delaware County Phosphorus Study Committee

1997 - 1998.....NYS Pesticide-Fertilizer Technical Working Group
1996 - 2002.....NYS Agricultural Environmental Management Steering Committee
1996 - 1998.....Cornell Environmental Outreach Council
1995 – Present .....Upper Susquehanna Coalition
1994 - 1996.....Founder Member: Watershed Forest Ad Hoc Task Force
1992 - 2001 .....Advisory member of the New York City Watershed Agricultural Council
1992 - 1994.....Chair, Policy Dialogue Committee for the New York City Watershed
1991 – 1993 .....Facilitator, Coalition of Watershed Towns
1994 - Present.....Steering Committee for NYS Nonpoint Source Coordinating Committee
1991 – Present .....New York State Non-Point Source Coordinating Committee
1990 – 1992 .....Founder Member, Ad Hoc Taskforce on Agriculture in the NYC Watershed
1989 - 1990.....Chair, Cornell Statewide Water Resources Program Committee
1988 - Present.....Chairman of the Expert Review Panel: New York City Water Demand Study
1986 - Present.....Cornell Principal Delegate: University Council on Water Resources
1986 - Present ....Member: National Association of Water Institute Directors
1986 - 1991.....NYS Safe Drinking Water Advisory Committee
1985 - Present ....Cornell representative Water Management Advisory Committee NYSDEC
1985 - 1993.....Member of the USEPA Scientific Advisory Panel Subcommittee: National Pesticide Survey of Drinking Water Wells
1983 - 1986.....National TEMIK Advisory Committee, Union Carbide Company
1980 - 1983.....Founder Member: Long Island Aldicarb Steering Committee
1971 - 1972.....Member of U.K. River Trent Modeling Task Group

PROFESSIONAL ORGANIZATIONS

- Royal Agricultural Society of England
- Environmental Law Institute

EDUCATION

Diploma.....Essex Institute of Agriculture, United Kingdom: 1958
Certificate.....Royal Horticultural Society, United Kingdom 1957
B.A. .....Mathematics: University of California: Santa Barbara 1964
LLM.....DeMontfort University, School of Law, Leicester, United Kingdom 1998

RECENT AWARDS

- Water Resources Achievement award: New York State Department of Environmental Conservation, 2003
- The Addleshaw Booth & Company Postgraduate Environmental Law Prize. 1998
- Community and Rural Development Institute Innovator Award. 1997. Awarded to WRI and its partners in the Whole Farm Planning Program, New York City Watershed

PUBLICATIONS & REPORTS

Keith S. Porter, *Neighbors vs. Farmers: Damaging conflict or friendly coexistence?* Northeast DairyBusiness, June 2003.

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SPONSORED PROJECTS OBTAINED THROUGH THE WATER RESOURCES INSTITUTE: 1990 - PRESENT

Date	Project Title	Total Amount
1990-91	Assessing Nonpoint Sources in Schuyler County	$18,924
1990-92	Soil & Water Pollution Prevention through Nonpoint Source Management	$300,000
1990-91	FY90-91 Groundwater Research	$252,500
1990-91	Canadaigua Lake Watershed Project	$40,000
1990-93	East Sidney Lake	$1,485,000
1990-92	IPA for Water Suppliers' Record-keeping and Reporting Software	$18,949
1990-91	Research Workshop: Potential Groundwater Contamination as a Basis for Determining Development Density	$2,600
1990-91	Skaneateles Lake Water Management	$12,949
1991-92	NYS Water Resources Institute Program+B52 FY91-92 - Dept. of Interior	$77,120
1991-96	NYS Water Resources Institute (State Legislation)	$489,123
1991-96	Water Demand and Supply Management Emphasizing the Delaware/ Lower Hudson Substate Region	$850,000
1991-94	Walkill-Roundout Watershed	$1,690,000
1991-92	Underground Injection Control	$65,000
1991-93	Lake Champlain Basin Project - CAMEP	$4,166
1992-92	NYS Water Resources Institute Program FY92-93 - Dept. of Interior	$96,000

1993-94	Whole Farm Planning Pilot Project Phase - NYS Watershed	$1,018,557
1993	New York City Watershed Public Participation	$45,000
1993-94	NYS Water Resources Insititute FY93-94 (State Legislation)	$100,000
1993-94	FY93 Water Quality Program Pilot - Water Resources Newsletter	$3,200
1993-94	Nonpoint Source Pollution Directory	$7,000
1993-95	New York City Harbor Report	$30,000
1993-96	Transport Pathways and Fate of Cryptosporidium parvum oocysts from Infected Dairy Wastes	$175,800
1994-97	Whole Farm Planning Phase II	$3,405,000
1995-99	Walkill Rondout Water Quality Demonstration Program	$15,923
1996-97	NYS Water Resources Institute Program FY96 - Dept. of Interior	$60,000
1996-97	Support to Watershed Agricultural Program - Marketing Strategy "Information/Outreach Center, Whole Farm Planning Guide"	$60,562
1996-97	Support to Chair of the Watershed Agricultural Council	$30,457
1996-97	Watershed Facilitation and Report on NYC's Drinking Water Quality	$195,411
1996	New York City Watershed Forestry Program	$29,217
1996-97	Catskill Forest Preserve Public Use and Information Plan	$25,000
1997	NYS Water Resources Program FY97 - Dept. of Interior	$97,096
1997-98	"Watershed Facilitation and Chair, Watershed Agricultural Council"	$73,536
1997-98	Applicability of Computer Models to Determine Fate of Selected Pesticides in the Canajoharie Creek Watershed	$90,963
1997-98	Water Resources Strategy for Genesee County	$10,000
1997-01	NYS DEC Vehicle	$67,516
1998	NYS Water Resources Program FY98 - Dept. of Interior	$197,565
1998-99	Developing a Statewide Strategy for Local Involvement in Source Water Assessment	$30,000
1998-99	Delaware County Comprehensive Strategy for Phosphorus Reductions: New York City Watersheds	$54,450
1998-00	Delaware County Phosphorus Management	$50,000
1999	Demonstration and Monitoring Project for Reducing Phosphorus in the Cannonsville Reservoir Basin	$150,000
1999-01	Hudson River Estuary Management Program	$338,291
1999	Initial Pesticide Use and User Behavior Estimates for East of Hudson New York City Watersheds	$75,000
1999-00	NYS Water Resources Institute Program FY99 - Dept. of Interior	$68,178
1999	Pesticide Management Informational Brochures	$8,504
1999-01	Delaware County Water Quality Monitoring and Modeling	$78,902
2000	Educational Program for Water Quality Monitoring and Pesticides	$50,870
2000-01	NYS Water Resources Institute Program FY00 - Dept. of Interior	$68,178
2000-01	NYS Water Education for Teachers (WET)	$97,429
2000-02	"Delaware County Action Plan, SDWA 2000"	$375,000
2001	NYS Water Education for Teachers (WET)	$34,198
2001-02	NYS Water Resources Institute Program FY01 - Dept. of Interior and DEC	$143,784
2001-03	Delaware County Action Plan, SDWA 2001	$351,841
2000-03	NIWR FY 2000 USGS National Competitive Grants Program	$216,999
2001-02	R Farm Modeling and Monitoring Study	$166,000
2001-02	Pesticide Management Education and Training Materials	$7,000
2001-02	NYS Water Education for Teachers (WET)	$163,498
2001-02	Lake Ontario/St. Lawrence Water Level Study	$198,000
2001-04	NIWR FY 2001 USGS National Competitive Grants Program	$84,294
2001-03	Hudson River Estuary Management Program	$350,890
2002-03	Upstate NYS Pesticide Sampling	$146,271
2002-04	AEM Integrated Pathogen and Nutrient Management	$100,000
	Total Sponsored Projects: 1990-Present	**$14,547,711**

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CWT #8

Delaware County Comprehensive Strategy for Phosphorus Reductions

Prepared for the

Delaware County
Board of Supervisors

Fall 1999

NYS Water Resources Institute
Delaware County Department of Planning & Economic Development

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Chapter 1.
Introduction

A. The Water Quality and Economic Challenge

Economic development in Delaware County depends upon the ability to build or expand surface discharging wastewater treatment plants. Under the New York City Watershed Memorandum of Agreement (MOA), the Cannonsville Reservoir is designated "phosphorus-restricted", thereby prohibiting the building and expansion of surface discharging wastewater treatment plants in the Reservoir Basin. Potentially, Delaware County can limit these constraints by participating in a NYCDEP Pilot Phosphorus Offset Program (as specified in section 18-83 of the Watershed Regulations) or by applying for case-by-case variances also involving "offsets." This Comprehensive Strategy Report is prepared in part as a condition of the Phosphorus Offset Program, and specifically addresses the challenge of overcoming the phosphorus restrictions. When the MOA was signed by the Watershed Partners, the requirements were still in their formative stage. They were neither fully understood nor worked out. It is very important to recognize that Delaware County, the Catskill Watershed Corporation, and the Watershed Agricultural Council, have all only this year become aware of the critical importance of managing phosphorus in the Cannonsville Reservoir Basin.

Requirements and opportunities for phosphorus management remain to be worked out. It is now clear, however, there is a need to reduce phosphorus loading from point and nonpoint sources in a way that quantitatively can be confirmed as meeting the restrictions. This program can only be achieved through management at the local level. Local support and responsibility are therefore essential. Delaware County is not affluent. Accordingly, the Delaware County Action Plan (the final section of this document) recognizes and seeks to meet the economic interests of businesses, farmers, communities and residents, so they are enabled to cooperate in satisfying water quality objectives. Such comprehensive point and non-point source management to restore and protect a reservoir has not been attempted on this scale to this degree anywhere before. It is a novel challenge that will serve as an important example elsewhere in New York State and nationally.

B. The Comprehensive Strategy and the Action Plan

The Delaware County Comprehensive Strategy process produced two documents, bound together in this volume. The more important one is the Delaware County Action Plan (DCAP). DCAP presents an agenda of management options to be formulated and performed at the local level in the County. Given the Phosphorus Restriction in the Cannonsville Reservoir Basin, DCAP emphasizes phosphorus management. However, DCAP is a County plan with potential value for the other parts of the New York City Watershed and elsewhere. Although phosphorus is a main focus, DCAP also addresses

all major sources of contamination.

The second document, presented as Chapters 1-9 of this report, presents the technical and informational foundation upon which DCAP has been developed and may be advanced.

C. This Report

Chapter 2 provides an overview of federal, state, and local laws, regulations, and agreements that authorize and constrain various governments' authority to manage phosphorus.

Chapter 3 summarizes scientific and regulatory information about phosphorus loading from the West Branch Delaware River Basin and behavior within the Cannonsville Reservoir. Developments after this report's underlying work was completed have continued the trend of increasing scientific understanding about the reservoir and maturation of the State/City/Federal phosphorus regulation process. Readers should consult NYS DEC and NYC DEP about developments after mid-1999, particularly Phase II of the Total Maximum Daily Loads (TMDL) process and mathematical modeling of the Cannonsville Reservoir's chemistry, physics, and biology.

Chapter 4 takes stock of all wastewater treatment plants in the watershed. It also provides a synopsis of treatment technologies for phosphorus removal.

Chapter 5 summarizes phosphorus aspects of onsite wastewater disposal systems, including a status assessment and a review of available Best Management Practices (BMPs).

Chapter 6 covers developed-area stormwater. There were essentially no local data about this subject previously organized. A formal inventory and an inventory of management options was deferred, and included in the work agenda of DCAP.

Chapter 7 provides an in-depth review of phosphorus status and planned BMP implementation for farms that participate in the Watershed Agricultural Program (WAP). This work was done in conjunction with WAP, especially the Manure Infrastructure Committee of the Watershed Agricultural Council (WAC).

Chapter 8 reviews forest land phosphorus aspects including recognized BMPs.

Chapter 9 looks toward a possible phosphorus management program for Delaware County within the context of the MOA, focusing on administrative and outreach aspects.

The Delaware County Action Plan, following Chapter 9, sets out policy, technical, and organizational steps toward a phosphorus management program. It is separated from

Chapters 1-9 to allow the Action Plan to be changed later as the County's agenda evolves rapidly. Background material like that contained in Chapters 1-9 represents a snapshot in time as of early 1999 and will continue to be useful as a historical reference. Readers should always inquire about a later version of the Action Plan in case it has been updated.

Chapter 2.
Legal and Administrative Framework for Phosphorus

A. Purpose and Context

From the federal Clean Water Act to the New York City Watershed Memorandum of Agreement (MOA), there is a complex array of statutes and regulations governing phosphorus management in the Cannonsville Reservoir basin. Each successive layer of legislation introduces new terms and concepts, the end result of which is an intricate and often confusing legal framework. This section attempts to elucidate the relevant legal obligations existing in the Cannonsville Reservoir basin.

Synopsis:

The federal Clean Water Act (CWA) was enacted in the mid-70s, with a national goal of reducing pollution to the point where every water body would be safe for both fishing and swimming. Rather than stipulating precise standards, the CWA created a framework consisting of Water Quality Standards, NPDES permits, and TMDLs to guide the states towards this national goal.

The federal Safe Drinking Water Act of 1974 (SDWA) was passed to protect drinking water across the nation; subsequent amendments to the SDWA include the Surface Water Treatment Rule (SWTR). The SWTR required all surface drinking water sources to be filtered, unless the EPA has determined that the requisite watershed conditions have been met.

In order to ensure that New York City could continue to meet these SDWA watershed conditions, NYC, NYS, the EPA, local governments and environmental organizations entered into the New York City Watershed Memorandum of Agreement (MOA). Although this is largely in response to the SDWA's requirements, the MOA contains much of the same structure and language as the CWA (such as the use of TMDLs).

B. The Clean Water Act: A National Framework

The suite of legislation known collectively as the Clean Water Act—from the 1972 Federal Water Pollution Control Act to its 1977 and 1987 amendments—was a response to the growing national concern for the dwindling quality of America's waterways. The CWA set a national goal for all waters to be "fishable and swimmable" and provided a national framework consisting of Water Quality Standards, NPDES permits, and TMDLs.

1. Water Quality Standards

The chief mechanism of the CWA is the Water Quality Standard (WQS), which consists of the following three components:

1. ***Designated Uses:*** a description of the desired uses of a particular water body, such as recreation or fishing;

2. ***Numeric Water Quality Criteria***: the in-stream conditions necessary to protect the designated use, i.e., physical or chemical characteristics like temperature, minimum concentration of dissolved oxygen, and the maximum concentrations of toxic pollutant; and

3. ***Narrative Water Quality Criteria***: a general statement that prohibits pollutants at objectionable levels, such as the narrative criteria of "no toxics in toxic amounts."

After the CWA was originally enacted, each state was to develop a WQS for each water body, and then submit them to the EPA for approval. In the event that the state did not meet the specific timeframe, or that the standards were inconsistent with the Clean Water Act, the EPA was required to prepare and publish their own WQSs for the state.

At least every three years, the Governor or state water pollution control agency must hold public hearings for the purposes of reviewing, modifying, or adopting State standards. Again, all proposed revisions must be submitted to the EPA for approval.

In order to assess proposed WQSs and to provide the States with technical assistance, the EPA issues a variety of guidelines based upon the latest scientific research. Guideline topics include:

- The effects of pollutant presence on the health and welfare of fish, wildlife, beach, recreation, etc.

- The concentration and dispersal of pollutants through biological, physical, and chemical processes.

- The effects of pollutants on biological community diversity, productivity and stability.

- Effluent limitations.

- Reduction attainable through best practicable control technology available for point sources.

- Identifying the nature of non-point source pollutants.

- Pollutant discharge elimination procedures.

2. The National Pollutant Discharge Elimination System (NPDES)

The Clean Water Act also establishes the National Pollutant Discharge Elimination System (NPDES), which requires all discharges from any point source into waters of the United States to obtain an NPDES permit. NPDES permits contain discharge limits, as well as monitoring and reporting requirements.

Discharge limits are based upon:

a. local Water Quality Standards: discharges may not contain pollutant or other characteristics in a level which would cause the receiving water body to fail its WQS; and

b. national "technology-based standards", which describe discharge limits by the discharge type, regardless of the local situation.

"In short, water quality-based standards are designed to protect specific water bodies, and technology-based standards are designed to assure a minimum level of control for a particular class of discharge, no matter where that discharge takes place." (http://www.epa.gov/reg5oh2o/npdestek/npdnpdb1.htm)

By now most states, including New York, have taken over the NPDES program, to facilitate administration and pursue state objectives. The New York program, renamed SPDES (for State Pollutant Discharge Elimination System), is discussed in greater depth in section B of this chapter.

3. The Total Maximum Daily Load (TMDL) Process

Generally speaking, a TMDL is the maximum amount of a particular pollutant that a water body can absorb without the water body failing to meet a related water quality standard.

For example, increasing the amount of phosphorus entering a lake increases algal growth. At low phosphorus levels, increased algal growth can be handled by increased consumption by native fish populations. However, excessive phosphorus levels can increase algal growth beyond the capacity of native fish, leading to the eutrophication of that lake. The TMDL thus represents a theoretical threshold point, above which the amount of the pollutant being added cannot be assimilated by the water body without causing pollution.

It should also be noted that "TMDL" is a bit of a misnomer. Although the "D" stands for "Daily", since monitoring the daily load of a particular pollutant is highly impractical, TMDLs are often based on a seasonal or annual basis. Still, the essential idea remains: a TMDL is the maximum amount of pollutant that can be added on a regular basis without causing pollution.

To supplement the Water Quality Standard mechanism, Section 303(d) of the CWA establishes the TMDL process. Each state must develop a list of all water bodies whose Water Quality Standard is not being satisfied by the normal national and state controls, i.e. the local water quality and national technology-based discharge limitation aspects of the NPDES program. That list must then be prioritized, and a TMDL for every offending pollutant must be developed for each of the water bodies. Next, the state must submit both the list and the TMDLs to the EPA; if a TMDL is rejected, the EPA must generate a new one in its place.

Unlike the two types of Water Quality Criteria within a WQS, which designate the maximum level of pollutants that can be safely *within* the water body, TMDLs designate the maximum amount of pollutant that can be safely *added* to the water body. TMDLs are developed using local scientific data, with the aid of computer models and GIS. Also, TMDLs consider seasonal variations background pollution levels and non-point sources, plus a margin for safety.

Although a TMDL may require pollution controls, the TMDL legislation does not provide any special TMDL enforcement plan. Thus, existing federal, state or local programs must be utilized. For example, the NPDES program can be used to further reduce point source discharges in tandem with a state initiative to reduce the effects of non-point sources.

Recently the EPA has been considering revising the current TMDL program, and a TMDL federal advisory committee studying the issue for the past two years. Several key points have yet to be resolved.

First, a major concern in the TMDL program is how to account for the pollution contribution of non-point sources. While the NPDES program can be used for point sources, at present, no national mechanism exists to incorporate non-point sources into the TMDL equation. The advisory committed has recommended a system whereby states establish "reasonable assurances" that efforts are being made to reduce non-point source pollutant loadings. While these "reasonable assurances" would not be enforceable or required, without them credit would not be given for reductions in targeted pollutants, and point sources would get punished. EPA has yet to decide on the proposed "reasonable assurance" policy.

Also, EPA officials are unsure whether "threatened" waters should be considered for inclusion on state TMDL lists. Threatened waters do not fall under the Clean Water Act's definition of impaired, but are waters that may be classified as "impaired" within a

few years because of urban growth, forest harvesting, etc.

Finally, EPA is trying to resolve the question of whether TMDLs should be set to address pollutants or pollution. Pollutants are defined as solid waste, chemicals, garbage, etc.— things that can cause waters to be impaired. Pollution, however, is broader and refers to human-caused alterations in the chemical, physical, biological, and radiological integrity of water. At the moment, EPA is leaning towards listing and tracking pollution as a problem, but requiring TMDLs only for pollutants.

C. The Clean Water Act: New York State's Response

1. Water Quality Standards

As per the Clean Water Act, New York State has developed a regulatory process for implementing Water Quality Standards, overseen by the Department of Environmental Conservation (DEC). New York groups its waters into various classes, based upon the following criteria: size, depth, flow, and temperature; the character of the bordering district; the uses made of the waters; and the extent of pollution/contamination. Next, the State assigns Water Quality Standards to each classification, based upon the factors:

- Extent that floating solids could be permitted in the water.
- Extent that suspended solids, colloids, or a combination of solids with other substances suspended in water, could be permitted.
- Organisms of the coliform group of from human/animal origin should meet various usage standards (i.e., drinking water sources must comply with New York State Department of Health regulations).
- Extent of oxygen demand which could be permitted in the receiving waters.
- Other physical, chemical, or biological properties necessary to obtain objectives.

Water Quality Standards can be Narrative or Numerical. For example, the WQS for phosphorus is "None in amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages"; the WQS for ammonia is <2.0 mg/L. (6 NYCRR Parts 701 and 703)

New York State has also outlined the powers and duties of the DEC regarding Water Quality Standards. The DEC Commissioner is authorized to do the following:

a. Hold public hearings (which even includes compelling the attendance of witnesses);

b. Modify orders about sewage discharge;

c. Send non-compliers to court;

d. Issue or deny permits;

e. Continue permits already issued;

f. Revoke or modify permits;

g. Conduct investigations; and

h. Perform further acts as necessary to carry out the provisions of the Water Quality Standard laws.

The DEC as an agency should:

a. Encourage voluntary cooperation with these measures;

b. Encourage the formulation of pollution prevention plans;

c. Cooperate with appropriate agencies;

d. Help conduct studies and research;

e. Prepare a comprehensive plan for pollution abatement/prevention; and

f. Develop a public education and promotion program.

WQS can be modified only after a public hearing has been held. Public hearing notices must be published at least twice in a relevant newspaper at least 30 days before the date of the hearing, and these notices must be mailed to each municipal corporation affected by the standards at least 30 days before the hearing.

Guidance Values - For many pollutants that do not have a Water Quality Standard based on Numerical Criteria—such as phosphorus—the DEC determines a "Guidance Value". Both Water Quality Standards and Guidance Values are determined by scientific procedures described in 6 NYCRR Part 702. The difference between the two is that Guidance Values do not go through the same regulatory process as a WQS (i.e., the same level of public participation), and thus are not applicable to Clean Water Act legislation. Guidance Values are listed in the New York State Department of Environmental Conservation Technical and Operational Guidance Series (TOGS) 1.1.1. As we shall see, Guidance Values are given a significant role in the MOA.

2. The State Pollutant Discharge Elimination System (SPDES)

As mentioned before, the EPA has allowed New York State to take over the in-state NPDES program, renamed SPDES. The SPDES permit law ensures that New York has adequate authority to regulate pollutant discharges into compliance with the Clean Water Act. Since wastewater treatment plants in Delaware County that discharge phosphorus are subject to the SPDES law, an understanding of the terms and conditions surrounding SPDES permits is essential. A SPDES permit can be issued:

a. When the DEC finds that the proposed discharge will not violate the local WQS; or

b. When the receiving water body is unclassified and the DEC finds that the discharge will not be injurious to public health and enjoyment.

Either way, SPDES permits must contain effluent limitations as required by the Clean Water Act and as set by the DEC.

a. Discharge Restrictions

The following discharges are prohibited and thus cannot receive SPDES permits:

- Discharge of any radiological, chemical, or biological warfare agent or high level radioactive waste;
- Any discharge which would substantially impair anchorage or navigation; and
- Any discharge to which the federal government has objections.

Moreover, the DEC formulated guidelines in 1991 creating discharge restriction categories for both surface and ground waters. These discharge restriction categories may be assigned to:

1) Waters of particular public health concern, which include:
   - Waters within a 60-day water time-of-travel of unfiltered public water supply intake points;
   - Public water supply watersheds with reservoirs experiencing accelerated eutrophication;
   - Groundwaters requiring such protection as specified in watershed rules and regulations or wellhead protection programs; and

- Marine waters certified by the Department for taking of shellfish.

1) Significant recreational or ecological waters where the quality of the water is critical, such as:

- Wild and scenic rivers;
- Critical aquatic habitat for fishes, amphibians, or aquatic invertebrates listed as endangered, threatened or of special concern;
- State park waters;
- State and Federal wildlife management area waters;
- Groundwaters and surface waters tributary to and within freshwater wetlands designated class I;
- Classified waters within intertidal marsh and coastal fresh marsh tidal wetlands;
- Waters protected under the State Constitution; and
- Pristine, minimally impacted waters with a diversity of naturally reproducing aquatic species.
- Other sensitive waters where the Department has determined that existing standards are not adequate to maintain water quality, for example:
- Recreational waters where accelerated eutrophication threatens current and future use of the waters;
- Waters where the physical accumulation or bioaccumulation of contaminants produces water use impairments;
- Small trout spawning streams; and
- Waters with little assimilative capacity due to natural background conditions or human activities.

b. Stormwater

Fewer limitations exist when a discharge involves stormwater. In fact, prior to October 1, 1992, discharges composed entirely of stormwater were acceptable and did not

even need SPDES permits. The follow exceptions were noted:

1) Discharges associated with industrial activities directly related to manufacturing, processing, or raw material storage areas at an industrial plant;

2) Discharges from a municipal separate storm water system serving a population of 100,000 or more; and

3) Discharges which the Commissioner determines to be in violation of water quality standards or to be contributing significantly to pollution.

Recently, the EPA has proposed that the national storm water regulations be expanded to cover smaller municipalities and construction sites. Since the SPDES system gives New York State the authority to implement national regulations (NPDES), the State will no doubt be affected by these more stringent storm water policies.

Remaining exceptions to the SPDES permit law include small sewage dischargers and electric generating facilities. A permit is not required for a system which is designed to discharge *only* sewage effluent to groundwater, so long as the discharge consists of a flow of less than one thousand gallons per day. Concerning such sewage discharges, a county, city, town, or village may still adopt and enforce additional regulations, and water quality standards must still be met. In the case of a major electric generating facility or a major steam electric generating facility, the certificate that is required under articles ten and eight respectively of the public service law can substitute for a SPDES permit.

SPDES permit-holders are subject to certain conditions:

- A new application must be submitted if new or increased discharges occur;

- Discharge of a non-authorized pollutant or discharge of a pollutant in excess constitutes a permit violation, as does misrepresentation of the discharge amount;

- The permit holder is further responsible for filing Discharge Monitoring Reports, which should demonstrate compliance with SPDES permit requirements and can be reviewed by the public;

- To ensure that compliance is in fact occurring, the Department is authorized to enter the premises of the effluent source location; there, Department officials can copy records, inspect monitoring equipment, and sample discharges;

- The permit holder must post signs at all discharge points (except for where the discharge is exclusively storm water runoff). The Department can waive the sign requirement, however, if the sign cannot be reasonably maintained, if the nature of the discharge is temporary, or for a variety of other practical reasons; and

- Finally, the discharger may be subject to both compliance schedules and reasonable fees to compensate the DEC for expenses).

All SPDES permits must undergo periodic review by the DEC. If they are issued in lieu of NPDES (National Pollutant Discharge Elimination System) permits, SPDES permits are valid for a fixed term not to exceed five years; otherwise, they are valid for a fixed term not to exceed ten years. The Department must review a permit at least once every five years to check for conformance with new federal treatment technology, new state water quality classifications, and updated water quality standards. The Department also has to develop a priority ranking for permits for full technical review. During this review process, interested parties are invited to send in written requests for permit modification, suspension, or revocation if new information is discovered.

3. The NY State Total Maximum Daily Load (TMDL) Process

As mentioned above, section 303(d) of the Clean Water Act requires each state to develop a priority water body listing for TMDL (Total Maximum Daily Load) development. The New York State DEC oversees the state's TMDL process, and has targeted the following waters as priorities for TMDL development over the next two years:

- New York Harbor;
- Long Island Sound;
- New York City Water Supply Watershed;
- Onondaga Lake; and
- Lake Champlain.

This prioritization does not necessarily mean that TMDLs will be completed for each of the above waters during the next two years; this listing simply means that priority effort will be given to developing solutions to water quality problems in these areas. As shown above, the DEC has targeted the New York City Watershed as a TMDL priority.

The process for developing TMDL lists in New York State utilizes the DEC's Division of Water Comprehensive Assessment Strategy, which integrates numerous Division programs and activities to monitor and assess water quality throughout New York. Specifically, the TMDL list is mostly drawn from the Priority Water bodies List (PWL), an inventory of state water bodies having known or suspected water quality problems or issues.

Every year the Comprehensive Assessment Strategy begins a three-year study on

roughly 20 percent of the state; thus, the Strategy is constantly examining 60 percent of New York.

- Year One of a study consists of reviewing the existing PWL as well as water quality screening. The PWL incorporates data from Division of Water programs and other DEC agencies, and receives public input from groups like the County Water Quality Coordinating Committees.

- Year Two consists of intensive chemical monitoring. This monitoring centers on the RIBS (Rotating Intensive Basin Studies) Sampling Program, which includes chemical analyses of contaminants in water, bottom sediment and whole organisms. Monitoring programs from other agencies also contribute.

- Year Three involves evaluation/assessment and a PWL update. DEC examines the results from the two-year effort, and solicits input from water quality professionals as well as the public.

The PWL is then narrowed down to create the TMDL list. The order in which TMDLs will be developed for each water body is determined by the following factors:

1. Uses impaired;

2. Extent and severity of the impairment; and

3. Resources available.

Additionally, highest priority is given to water bodies that present a threat to human health or important aquatic species.

For the 1998 listing, the 27 constituent PWL water body segments of the New York City Watershed have been designated as a priority, with Phosphorus being noted as the pollutant of concern in nearly all 27 segments.

Critics of the DEC's TMDL development program question the level of public participation, proposing that the DEC fully include the public in the 303(d) listing process by holding public meetings and hearings. In response, the DEC points out that much public input already goes into the Comprehensive Assessment Strategy and the PWL; since these are the precursors of the state TMDL list, it would be inefficient to hold another round of public participation. However, public participation is mandated by the Clean Water Act and by New York State law; thus, the question of whether the State's TMDL program allows for enough public input is very important, and public input opportunities during all stages of the TMDL process should be assessed.

D. The Safe Drinking Water Act

The increasing number of giardiasis outbreaks nationwide led to the 1986 Surface Water Treatment Rule (SWTR) amendment of the federal Safe Drinking Water Act. The SWTR requires all surface drinking water sources be filtered, except when the EPA has determined that the following conditions have been met:

1) The source is of high quality and adequately protected;

2) Certain levels of turbidity and fecal coliform are not exceeded;

3) Adequate disinfection is provided; and

4) No outbreaks of waterborne disease have occurred.

The following summarizes SWTR criteria for filtration avoidances:

Source water criteria

- Fecal coliforms $\leq$ 20 CFU/100 mL and total coliforms $\leq$ 100 CFU/100 mL in at least 90 percent of the samples taken within any six month period.

- Turbidity $\leq$ 5 ntu.

Site-specific criteria

- Disinfection and chlorine contact time requirements for Giardia and virus inactivation.

- Watershed control requirements:

  - Identification of watershed characteristics and activities that could harm source water quality;

  - Monitoring these activities; and

  - Demonstration through ownership or written agreements with landowners within the watershed that the water purveyor can control all human activities that may have an adverse impact on the microbiological quality of the source water.

- Absence of waterborne disease outbreaks.

- Compliance with the total trihalomethane maximum contaminant level of 0.10 mg/L.

EPA retained the responsibility of determining whether avoidances can be granted. In the summer of 1992, EPA created an advisory panel to assist them in making this determination for the Catskill-Delaware reservoir system. The panel eventually decided that the Catskill-Delaware supply met water quality criteria marginally, but that the supply did not meet watershed control requirements. The panel further concluded that the City would probably not be able to meet water quality requirements of a forthcoming enhanced SWTR, which would most likely include measures to control Cryptosporidium.

Specifically, the EPA panel was concerned about the Catskill-Delaware supply for the following reasons:

- In the Kensico Reservoir watershed, much of the local population was served by septic systems at the time, and fecal coliform counts had been high in the past;
- During the summer months, the NYC Watershed population increases by about 150,000;
- About 35 treatment plants discharge wastewater effluent, and some of these plants have failed to meet permit requirements in the past;
- The number of dairy farms and cattle in the watershed were potential sources of *Cryptosporidium*; and
- Finally, the Coalition of Watershed Towns had vigorously opposed watershed protection regulations, and watershed land acquisitions had not proceeded as promised.

The panel's conclusion in 1992 was that both watershed protection and filtration are necessary for New York City's water supply. Even when water is filtered, source water degradation increases the risk from disinfection byproduct precursors (DBPs) and pathogens. Thus, the panel believes that watershed protection and filtration must go hand in hand.

NYC DEP issued a response to the EPA panel's report in December 1993. DEP stressed that the Catskill-Delaware system had an excellent long-term record in meeting quality criteria for pathogens and turbidity, that a comprehensive watershed protection program had been launched, and that the specific pathogen concern about Kensico Reservoir had already been resolved through a waterfowl control program. DEP presently notes that many factors the EPA panel considered in its 1992 work have changed in succeeding years.

EPA has granted NYC a series of temporary filtration avoidances, the most recent of which extends through 2002. These latest avoidances have been granted in large part because of the New York City Watershed MOA's emphasis on watershed management.

Still, regarding the Agreement, EPA's panel members expressed concern that local watershed communities would not cooperate in land use management. In light of this concern, it is even more important that local input be incorporated into any decision-making processes about the Catskill-Delaware system.

E. The New York City Watershed Memorandum of Agreement

The New York City Watershed Memorandum of Agreement (MOA) is a landmark arrangement between New York City, New York State, the EPA, local municipalities and environmental organizations, signed January 21, 1997. The goal of the MOA is for NYC to remain eligible for SWTR filtration avoidance through watershed management, without endangering the economic welfare of Watershed communities.

The MOA is a complex legal document, which creates both contractual and regulatory obligations for the various parties. The first two sections below deal with the two components of the MOA particularly relevant to phosphorus regulation within the Cannonsville Reservoir Basin: the Watershed Rules and Regulations, which describe the "phosphorus-restricted basins" program; and the phosphorus TMDL process for NYC reservoirs. The last section discusses the costs of various MOA programs to New York City.

1. Watershed Rules and Regulations

According to Section 1100 of NYS Public Health Law, the NYS Department of Health (DOH) "may make rules and regulations for the protection of any or all public supplies of potable waters and water supplies of the state". Furthermore, the New York City commissioner of environmental protection "may make [similar] rules and regulations subject to the approval of the department [DOH] for the protection from contamination" of NYC's water supply. The statute goes on to outline both NY State's and NY City's roles in inspecting watersheds as well as identifying and punishing regulation violators.

Under the authority noted above, Attachment "W" of the MOA contains proposed Watershed Rules and Regulations for the NYC watershed that were subsequently approved by the DOH commissioner shortly after the MOA was signed. Referred to as Watershed Regulations in the MOA, they describe how the standard of quality for water bodies within the watershed shall be determined, list which watershed activities are subject to regulation and outline the requirements for obtaining pollution permits.

a. Standards of quality

The Watershed Regulations state that "the water in all reservoirs...shall meet the

following standards of quality":

(1) New York State's Clean Water Act "Water Quality Standards" (As listed in NYCRR Parts 701 and 703)

(2) New York State "Guidance Values" (As listed in the DEC Technical and Operational Guidance Series (TOGS) 1.1.1.)

Additionally, the DEP must annually perform a review of all reservoirs to determine whether they meet or fail these standards of quality as defined above.

Note that the Watershed Regulations will often refer to the standards defined in parts (1) and (2) as "water quality standards". This can be confusing since part (1) itself, 6 NYCRR Parts 701 and 703, comprise the State's Clean Water Act "Water Quality Standards". "Guidance Values" and "Water Quality Standards" have distinct roles in the federal and state Clean Water Act regulatory framework, even though the Watershed Regulations give them equal footing. Thus to avoid confusion, in this document "standards of quality" will refer to the MOA's requirements; "Water Quality Standards" refer to the Clean Water Act requirements defined in 6 NYCRR Parts 701 & 703; and "Guidance Values" are New York State tools found in TOGS 1.1.1.

Importantly, the Watershed Regulations defines a phosphorus-restricted basin as "the drainage basin of a reservoir... in which the phosphorus load to the reservoir... results in the phosphorus water quality values [set forth in the DEC's TOGS 1.1.1] being exceeded as determined by the [DEP] pursuant to its annual review." (Subchapter A, subsection 18-16, paragraph 78.) Thus, because the DEP has determined that the Cannonsville Reservoir is above the Guidance Value of 20 ug/L, the Cannonsville Reservoir Basin is a phosphorus-restricted basin.

b. Regulations

The Watershed Regulations regulate various activities within the Watershed; furthermore, these regulations can change when a particular basin, such as the Cannonsville Reservoir basin, is classified as phosphorus-restricted. The following sections detail the extent of Watershed Regulations within the Cannonsville Reservoir basin.

Wastewater Treatment Plants

DEC will revise SPDES permits for all existing WWTPs to reflect the phosphorus limits in the Watershed Regulations.

In order to create or expand a surface discharge wastewater treatment plant (WWTP) within a phosphorus restricted basin such as Cannonsville's, the MOA provides

for a phosphorus pilot offset program managed by the DEP. Its purpose is to evaluate the effectiveness of phosphorus offsets as a potential basis for allowing new wastewater treatment plants or expanding existing plants in phosphorus restricted basins. The pilot program was initiated on the effective date of the MOA, and is limited to a five-year time span with an option to extend. During the course of the pilot program, DEP may approve new WWTPs or expansion of existing plants provided that conditions including the following are met:

1. The County must be preparing a Comprehensive Strategy identifying resources, problems, remedies, etc.;

2. Applicant must demonstrate that the new or expanded plant is consistent with the Comprehensive Strategy;

3. Applicant must demonstrate that every 1 kg of projected phosphorus increase (including the accompanying non-point source runoff) will be offset by a 3 kg decrease elsewhere in the basin;

4. DEP must review and approve all proposals for plants before they can be accepted;

5. No more than three new plants or expansions with surface discharge are allowed in phosphorus restricted basins, and their total capacity shall not exceed 100,000 gallons per day (gpd) aggregate surface discharge; and

6. Any wastewater treatment plant shall meet the total phosphorus effluent limit of 0.2 mg/l.

These and other specifications for a pilot offset program are within section 18-83 of the Watershed Regulations. DEP has also published a later guidance document.

A key component to this pilot program is the 1 kg to 3 kg trading ratio. A strategy will need to be developed in Delaware County for accomplishing this component. Applicants are permitted to use as an offset any phosphorus reduction funded by the Catskill Fund for the Future or achieved from stormwater pollution prevention measures under the Stormwater Retrofit Program. Other reductions funded through MOA programs do not qualify.

The Watershed Regulations also describe what will happen upon completion of the pilot program. When the pilot program is completed in five years, DEP will need to make determinations. They may determine that phosphorus offsets have been achieved, and a permanent phosphorus offset program should be established. In the West of Hudson, in such a permanent program, applicants may still be able to use offsets from the Catskill Fund for the Future or from measures funded by the Stormwater Retrofit Program provided the 1:3 kg phosphorus ratio is kept. However, the DEP may instead

determine there is insufficient data to evaluate the success of the pilot, and the pilot may be extended for another five years. Finally, DEP may determine that the pilot program has not been successful, in which event the program would conclude after five years.

If a permanent offset program is established, its conditions should be appropriate based on the results of the pilot program or other Watershed studies.

Stormwater

All basins in the Watershed must establish stormwater pollution prevention plans for certain activities. If the basin is phosphorus restricted, these plans must include an analysis of phosphorus runoff before and after the land disturbance activity; furthermore, the plans must also include measures to capture and treat the two-year, twenty-four-hour storm runoff from the disturbed area created by the activity.

The following list of activities requires stormwater pollution prevention plans in the West of Hudson region:

- Plans for the development or sale of land that will result in disturbance of five or more acres of total land area;
- Construction of a subdivision;
- Construction of a new industrial, municipal, commercial or multi-family residential project that will create an impervious surface totaling over 40,000 square feet;
- A land clearing or grading project of two or more acres, any portion of which is located either within 100 feet of a watercourse or wetland, within 300 feet of a reservoir, reservoir stem, or controlled lake, or on a slope exceeding 15 percent;
- Construction of a new solid waste management facility or modification of an existing one that is within 300 feet of a watercourse or wetland or within 500 feet of a reservoir, reservoir stem, or controlled lake;
- Construction of a gas station;
- Construction of an impervious surface for a new road;
- Construction of an impervious surface within a village, hamlet, village extension, or area zoned for commercial or industrial uses; and
- Up to a 25 percent expansion of an existing impervious surface at an existing commercial or industrial facility within 100 feet of a watercourse or wetland.

Stormwater Pollution Prevention plans for these activities must be prepared and implemented according to the requirements of Part III of the DEC General Permit No. GP-93-06. In phosphorus restricted basins (such as Cannonsville), plans must include the necessary phosphorus components.

In terms of administration, the City has established Stormwater Project Review Committees in order to assist DEP in the implementation of the prevention plans. Towns and Villages may designate one representative each to the committee, within fifteen days of the MOA's effective date. This Committee can make recommendations to DEP concerning applications for the above-listed activities, but DEP makes the final decision on approval.

Onsite Wastewater Systems

The MOA's provisions for onsite wastewater systems do not deal directly with the fact that Cannonsville is phosphorus restricted. However, the MOA's program for improving these systems should aid in the effort to reduce phosphorus on a basin-wide scale. Old and/or failing septic systems can cause phosphorus leakage, and the MOA's Septic System Rehabilitation and Replacement Program will fund many repairs.

The Watershed Regulations call for stricter design, operation, treatment, and maintenance of all "subsurface sewage treatment systems." The following is a list of necessary conditions for a given system:

- All systems shall prevent the exposure of sewage to the surface or the discharge of sewage to groundwater;
- Mound systems, intermittent sand filters, and evapotranspiration/absorption systems are prohibited;
- An additional area of at least 100 percent of the primary absorption field area shall be set aside as a reserve absorption field area;
- Building fields under pavement or other impervious surfaces is prohibited, as is building pavement or other impervious surfaces over fields after installation;
- At least one percolation test and one deep hole test must be performed in each field area, and DEP must be informed and given the option of observing these tests;
- Proposed sites with soil percolation rates faster than three minutes per inch or slower than sixty minutes per inch shall not be approved; and
- When possible, gravity flow systems shall be used for subsurface sewage treatment systems; use of pumping, mechanical dosing, or other mechanical

devices shall require a pump chamber, equipped with an alarm to indicate malfunction; and systems must have a backup storage tank or pump capable of holding one to two day's flow, depending on system size.

Additionally, the DEP provides for programs to improve septic systems on both a community and an individual basis. Though DEP is providing funding to the West of Hudson for implementation of these programs (see, "City's Costs due to MOA Obligations"), County Health Departments can request to oversee the process. According to the MOA, if any County in the Watershed has or establishes a Health Department with an NYS Department of Health (DOH) certified program (or contracts with an existing local Health Department for such a program), the local Health Department may apply for delegation of DEP's authority. The local Health Department will then be responsible for reviewing and approving new subsurface sewage treatment systems in that County. If there is disagreement between a local Health Department and DEP about a particular subsurface sewage treatment system, either DOH or DEC shall act as a mediator; if the mediator cannot resolve the issue within 15 days, both the local Health Department and DEP shall retain their independent review and authority. Thus, counties in the Watershed have perhaps a greater chance for authority in the case of onsite wastewater systems than in either wastewater treatment plants or stormwater controls.

2. MOA and the Total Maximum Daily Load Process

The MOA also describes how the Federal Clean Water Act section 303(d) TMDLs are to be developed for the New York City Watershed Water Supply. The DEP and DEC "will jointly develop Total Maximum Daily Loads ("TMDLs"), wasteload allocation ("WLAs") and load allocations ("LAs") for phosphorus in each of the reservoirs in the Catskill, Delaware, and Croton Systems. The USEPA will provide technical support in the development of TMDLs and review and approve submitted TMDLs ... The New York State guidance value [from TOGS 1.1.1] will be used for TMDL development" (Article VI, paragraph 162).

There are two specific Guidance Value issues.

1) Since there is neither a national nor a state quantitative Water Quality Standard for phosphorus, the parties agreed to use the state's quantitative Guidance Value for TMDL development. However, because the current phosphorus Guidance Value of 20 µg/L is based upon aesthetic and recreational criteria, the EPA's TMDL Phase I decision letter required the DEC to reevaluate the appropriateness of the 20 µg/L Guidance Value for a public drinking water supply. In March of 1999, the DEP issued a report proposing a Guidance Value of 15 µg/L for the NYC Watershed reservoirs that are "capable of receiving surface runoff, and are located just prior to initial disinfection." After extensive research, the DEP feels that 15 µg/L is a more appropriate phosphorus level for the protection of drinking water sources, and as such should be used for the Phase II TMDL report. Cannonsville

may be excluded from the 15 µg/L figure since it is not "located just prior to initial disinfection." However, DEP did evaluate both 15 and 20 µg/L figures in their Phase II TMDL report for Cannonsville.

2) Also, the TMDL process set forth in the MOA does not supercede section 303 (d) of the Clean Water Act. Rather, it describes the parties' understanding of how that process will be completed. Parties to the MOA agree not to challenge the TMDL process, provided it follows the description provided in the MOA. However, an outside organization, the Natural Resources Defense Council, has filed suit against the EPA, DEC and DEP for using the Guidance Value as the basis of TMDL development. They assert that because the Clean Water Act specifically calls for Water Quality Standards to be used in TMDL development, the use of any other value—such as a Guidance Value—is a violation of federal law. The case is still pending.

The MOA describes a loose schedule for TMDL development and refinement. At the time of the MOA's signing, the DEP had already developed "Phase I" TMDL reports, using the Reckhow method. Upon reviewing the Phase I TMDL reports, the DEC would submit them to the EPA for approval. Once approved, the DEP and DEC had a limited amount of time to evaluate and identify management practices for controlling nonpoint phosphorus sources. Furthermore, for every reservoir that exceeded its Phase I TMDL:

1) NYSDEC will propose permit modifications for surface water permits to implement the effluent limits for phosphorus specified in the Watershed Regulations;

2) Proposed surface discharge WWTP permits shall require a total phosphorus effluent limit of 0.2 mg/l. Also, for new surface discharges, it is required that every one (1) kilogram of projected increase of phosphorus load be offset by a reduction of three (3) kilograms; for expanding an existing surface discharge, every one (1) kilogram of increased phosphorus load be offset by a reduction of two (2) kilograms. If the DEC determines that inadequately treated sewage is being discharged to the water supply, and the only remedy is a new or expanded WWTP, no offsets shall be required; and

3) Proposed sub-surface discharge WWTP permits shall meet the following limits:

SPDES Permitted Total Flow (gal/day)	Total Phosphorus Limit (mg/L)
≤ 50,000	1.0
>50,000 and< 500,000	0.5
≥ 500,000	0.2

According to the MOA, Phase II TMDLs for the West of Hudson reservoirs will utilize a "generalized watershed loading function" model (GWLF, see chapter 3); the

Phase II TMDLs are scheduled for submission to the EPA in September 1999.

If a reservoir is found to be violating its Phase II TMDLs, the same stipulations listed above for violating the Phase I TMDLs will apply.

After Phase II, the DEC and DEP will continue to monitor and regularly assess the phosphorus load allocations for each reservoir basin, adjusting when necessary.

"The [DEC's] development of TMDLs for phosphorus shall not affect the City's agreement to pay the incremental costs, including operation and maintenance costs, to upgrade existing WWTPs to comply with the phosphorus control requirements of the Watershed Regulations as [agreed to previously in the MOA]." (MOA, para. 162, (j))

3. New York City Funded MOA Programs

a. Wastewater Treatment Plants

New York City is committed to paying for regulatory upgrades to existing public and private wastewater treatment plants in the West of Hudson Watershed, including those for reducing phosphorus to the required level. Furthermore, the City will pay the costs of phosphorus controls at new or expanding public wastewater treatment plants when those controls are required by the Watershed Regulations and not by federal or State requirements.

It is important to note the City is not responsible for paying for controls at new private wastewater treatment plants or expansions to private wastewater treatment plants.

One question arises here concerning the obligations of New York State. Under the SPDES permit program, the State requires that wastewater treatment plants meet certain regulations. However, the City will only pay for "regulatory upgrades" to wastewater treatment plants required *solely* by its Watershed Regulations, not by federal or state law. Thus, the regulations under the MOA must be different or more stringent than the normal regulations under SPDES permits. A look at the MOA's requirements reveals that this is probably the case. The phosphorus requirements under the Watershed Regulations are most likely beyond what the State would normally mandate. For example, if the SPDES permitted total flow of a plant equals or exceeds 50,000 gallons/day, only 1 mg/l of this flow may be phosphorus. Furthermore, the City will only allow plants with SPDES permits to continue to operate if the treated effluent is also subject to sand filtration, disinfection, phosphorus removal, and microfiltration; these kinds of treatment measures are generally not required under SPDES, so the City must assume responsibility for funding them.

b. Stormwater

New York City is further committed to provide funding for the stormwater pollution prevention plans. The City will provide $31,700,000 of "New Stormwater Funds" for a program to design, construct, implement, and maintain new stormwater measures pursuant to the required stormwater pollution prevention plans, though the program itself will be administered by the Catskill Watershed Corporation (CWC). This program will cover only those plans that are required by the Watershed Regulations and *not otherwise required* by State and/or federal law. However, for purposes of the New Stormwater Funds, any action required by a TMDL developed by DEC solely for phosphorus control shall not constitute a requirement of State and/or federal law. Thus, the CWC will apply the New Stormwater Funds to the additional phosphorus components for plans instituted in phosphorus restricted basins.

Other funding involving stormwater includes Stormwater Retrofits to address existing runoff. The City shall make available $7,625,000 for a Stormwater Retrofit Program to design, permit, construct, implement, and maintain stormwater best management practices, again administered by the CWC.

A separate program administered by the DEP is the Future Stormwater Controls. Paid for by the City Program, this provides unlimited funding to mitigate certain costs of stormwater measures required by the Watershed Regulations but not by any other federal or state standard. Eligibility for this program is limited to single-family homes, small business and low-income housing projects in certain areas.

c. Onsite Wastewater Systems

Significant funding is to be provided by New York City for onsite wastewater system upgrades; the City will give $75,000,000 in "New Infrastructure Funds" to the West of Hudson for the New Sewage Treatment Infrastructure Program. Specifically, the MOA identifies a list of 22 communities, prioritized on the basis of water quality needs. It is expected that the top seven priority communities will use New Infrastructure Funds for developing WWTPs to resolve their wastewater needs. Beyond these top seven priority communities, any remaining New Infrastructure Funds are to be used to construct and install community septic systems, or to create and fund septic districts at the remaining communities.

Furthermore, the City will give $13,600,000 for "Septic Program Funds" for single or two family residences in the West of Hudson. The Septic Program Funds are to be used to rehabilitate septic systems that are failing or are reasonably likely to fail, to upgrade/replace substandard underground sewage treatment systems, and to inspect and pump out septic systems so as to determine whether rehabilitation or replacement is appropriate.

Notably, neither the New Infrastructure Funds nor the Septic Program Funds are named as usable options for discharging offsets in the context of the phosphorus pilot program. The only two MOA-sponsored programs that are explicitly stated as usable in such a context are the Catskill Fund for the Future and the Stormwater Retrofits Program. Consequently, while the onsite wastewater system funding may be useful for lowering overall levels of phosphorus in Delaware County, it does not seem to help with the phosphorus pilot program restrictions.

F. General Municipal and County Authority

Towns located within Delaware County have set up their own regulations regarding land use planning and the environment. These regulations are meant to work in conjunction with existing state and federal law. A brief look at these town laws shows that Delaware County has already assumed a certain level of responsibility for its own environmental health and safety. Existing municipal and county authority should be taken into consideration when working on phosphorus issues.

For example, the town of Franklin has various subdivision regulations which take the environment into consideration. The Planning Board of the Town of Franklin is authorized and empowered to review and approve plats for the subdivision of land; for such subdivisions, the Planning Board requires that proper provision be made for surface drainage, water supply, sewage, and other needed improvements. If there are violations or a lack of compliance, the Board can bring its findings to the Town Attorney. Furthermore, the Planning Board is authorized to determine the applicability of SEQR (State Environmental Quality Review Act). If a subdivision is classified as Type I or Unlisted under SEQR, the applicant must complete an Environmental Assessment Form. Finally, Article 510 of Franklin's subdivision regulations notes various environmental considerations for applicants. According to Article 510, natural features of an area must be preserved, which includes preserving all worthwhile trees and shrubs on the site as well as disturbing the soil as little as possible. Land subject to serious or regular flooding shall not be subdivided in such a way that would aggravate the flood hazard. In terms of sediment control, the applicant can expose only the smallest practical area of land at any one time during the development, and he/she must install sediment basins to remove sediment from runoff waters. These are only a sample of the provisions that Franklin's subdivision regulations make for environmental protection.

In addition, Franklin's zoning ordinances consider environmental impacts. Two of the central purposes of the zoning ordinance are to protect the open and natural character of the land and to promote the health, safety, and general welfare of the public. No land use or structure can be established nor land developed until a permit has been issued by the Zoning Enforcement Officer. Where relevant, applications must show evidence that application for a Sewage Disposal Permit from New York City DEP has been made. No building permit shall be issued for any proposed building or land use which, in the judgement of the Zoning Enforcement Officer, would require an

environmental assessment in accordance with the State Environmental Quality Review Act of 1975 and any County or Town regulations enacted pursuant thereto; such an application shall be referred to the appropriate land agency for a determination as to whether an environmental impact assessment will be required. Thus, the zoning ordinances in Franklin mandate a certain amount of environmental protection.

Table 2.1 is a sample of land use planning laws in Delaware County. Only selected towns are shown. The table is intended to give a general idea of the degree of responsibility that county authorities have assumed in this sphere.

Table 2.1. Status of Land Use Planning and Regulations in Delaware County (November 1993) – Selected Towns

	Andes	Bovina	Delhi	Franklin	Hamden	Hancock	Roxbury	Walton
Comprehensive Plan	XXX		XXX	XXX		***	XXX	XXX
Subdivision Regulations	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Subdivision Enforcement Local Law								XXX
Road Take-Over Policy	XXX	XXX	XXX	XXX				
All Subdivisions Subject to Review	XXX	XXX	XXX				XXX	
Soil Profile Analysis	XXX	***	XXX	XXX	XXX		***	
Sanitary Code				XXX				
Dump Control Local Laws		XXX	XXX	XXX				
Mobile Home Regulations	XXX	XXX	XXX	XXX	XXX			XXX
Site Plan Review	XXX	XXX	XXX	XXX				XXX
Zoning Regulations	XXX	XXX	XXX	XXX				XXX
Critical Environmental Area							XXX	
Local Historic District								
Well Head Protection				XXX			XXX	

XXX = *Adopted*

*** = *Item is proposed but not adopted, except "Soil Profile Analysis" where it means soils information is required, but model soil profile analysis amendment has not been adopted but is used as a "policy"*

Chapter 3.
Phosphorus and Water Quality in the Cannonsville Watershed System

A. Purpose and Context

The phosphorus restrictions in the Cannonsville Reservoir Basin impelled by the New York City Watershed Memorandum of Agreement (MOA) are critical to Delaware County's economy. While the Watershed Regulations create several baseline restrictions for new or expanding businesses in the Basin, more restrictions take effect if the amount of phosphorus, either within *or* being added to the Reservoir, exceeds certain limits. Chapter 2 describes the legal framework behind the various water quality criteria and regulations pertaining to the Cannonsville Reservoir Basin; this chapter deals primarily with the scientific basis of water quality criteria and estimates of current water quality conditions.

B. Water Quality Criteria for Phosphorus

1. Legal Basis for Criteria (Review from Chapter 2)

The comprehensive New York City Watershed Memorandum of Agreement (MOA) incorporates various elements of federal and state laws, and should be considered the primary source of rules and guidelines for water quality in the Cannonsville Reservoir Basin. In general, the MOA mandates that the "water in all reservoirs...shall meet" both NYS Water Quality Standards and NYS Guidance Values (Attachment "W", Watershed Regulations; Section 18-48). Water Quality Standards are created pursuant to the federal Clean Water Act, and establish narrative and/or numerical standards. Guidance Values, on the other hand, are primarily a state tool that establish numerical standards for pollutants that only have a narrative Water Quality Standard, based on recreational and aesthetic uses.

For example, the Water Quality Standard for phosphorus is purely narrative: "None in amounts that will result in growth of algae, weeds and slimes that will impair the waters for their best usages". On the other hand, the Guidance Value for phosphorus is listed at 20 µg/L. The Watershed Regulations specifically refer to the Guidance Value as the basis for determining if a basin has status as "phosphorus restricted" (Watershed Regulations, Section 18-16).

Furthermore, article VI, paragraph 162 of the MOA states that the "New York State guidance value for phosphorus will be used for TMDL development [for each of the reservoirs of the Catskill and Delaware, and Croton Systems]." Thus, in preparing TMDLs the target so far has been the phosphorus Guidance Value of 20 µg/L.

However, as the following section explains further, it is important to note that the phosphorus Guidance Value is based upon aesthetic and recreational uses; a lower Guidance Value for drinking water sources may be adopted soon.

2. Scientific Basis for Criteria

High phosphorus levels can lead to the eutrophication of a lake or reservoir. Eutrophication is the term defined as the increased growth of algae and aquatic plants to nuisance levels due to elevated nutrient enrichment. Water quality concerns associated with eutrophication include: disagreeable odors, tastes and colors; low dissolved oxygen levels; elevated metals concentrations; disinfection by-products (e.g. THMs); and overall aquatic habitat degradation.

The New York State phosphorus Guidance Value of 20 µg/L is based upon aesthetic and recreational criteria associated with the above eutrophication effects. According to a New York State fact sheet on the phosphorus guidance value, the value was derived using a series of surveys completed by lake users statewide: descriptions of perceived water quality conditions at local lakes were compared to their actual phosphorus levels (NYSDEC, 1993). In short, the results indicated that a phosphorus level of 20 µg/L would reduce lake conditions to a "moderate nuisance level" at most 10% of the time. (Moderate nuisance levels conditions were defined as "those conditions where more than 50% of the lake users [saw] definite algae greenness and at least slight impact of use.")

Thus, it is apparent that the 20 µg/L Guidance Value should not be considered a "threshold" value, which when exceeded has some specific effect. Instead, it is a point on a continuous scale, where statistically speaking lakes or reservoirs with a 20 µg/L phosphorus level will create a "moderate nuisance level" only 10% of the time.

Furthermore, the Guidance Value addresses only aesthetic and recreational concerns, rather than specific drinking water safety concerns. Water supply concerns about eutrophication revolve around the concomitant algal biomass, which is organic material. When water is chlorinated, the chlorine will react with the organic material to form disinfection byproducts (e.g. trihalomethanes), which are toxic in excessive amounts. Thus guidance values based upon aesthetics and recreational concerns may not be sufficiently low to minimize formation of these DBPs.

However, because 20 µg/L is the legal Guidance Value referred to in the MOA, it was used as the target for the Phase I TMDL report. Accordingly, in its TMDL Phase I decision letter the EPA required the DEC to reevaluate the appropriateness of the 20 µg/L Guidance Value for public water supplies.

In March of 1999, the DEP issued a report proposing a Guidance Value of 15

µg/L for certain of the NYC Watershed reservoirs, and a Cannonsville report incorporating both the 20 and 15 values. After extensive research, the DEP has made the case that 15 µg/L is a more appropriate phosphorus level for the protection of drinking water sources.

C. What Does it Mean to be Phosphorus Restricted?

As stated above, the current phosphorus Guidance Value is 20 µg/L, and under MOA terms any reservoir found to exceed this value is considered "phosphorus-restricted". To determine whether or not the phosphorus concentration for a given year exceeds the guidance value, the DEP calculates a five-year running average of the annual geometric mean phosphorus concentrations. For example, to determine the status of the reservoir in 1995, the values from 1991, 1992, 1993, 1994, and 1995 are averaged together. To account for interannual variability, the standard error of the mean is added to the mean. Furthermore, phosphorus concentrations for a single year are determined from samples taken between May and October, the primary months of algae growth.

This value of the phosphorus concentration is then compared to the Guidance Value. In order to be declared a phosphorus-restricted basin, the running average phosphorus concentration must exceed the guidance value for two consecutive years. Figure 3.1 shows the values of the geometric mean phosphorus concentration for the Cannonsville Reservoir from 1991 to 1996.

For 1995 and 1996, the phosphorus concentrations utilized to determine the status of the Cannonsville Reservoir were 23.4 µg/L and 21.1 µg/L respectively, both of which are above the current Guidance Value of 20 µg/L. Accordingly, the Cannonsville Reservoir has been designated a phosphorus-restricted basin. In order to remove this label from the basin, the running average phosphorus concentration must be below the guidance value for two consecutive years.

However, because the phosphorus-restricted status is based upon this five-year average, reducing the phosphorus concentration in the reservoir below the guidance value for one year will not necessarily bring the running average below the guidance value for that year. In fact, the Cannonsville Reservoir was below 20 µg/L for three of the six years shown in Figure 3.1. Consequently, it may take several years before the effects of any phosphorus management strategies in the basin will remove the Cannonsville Reservoir's phosphorus-restricted status.

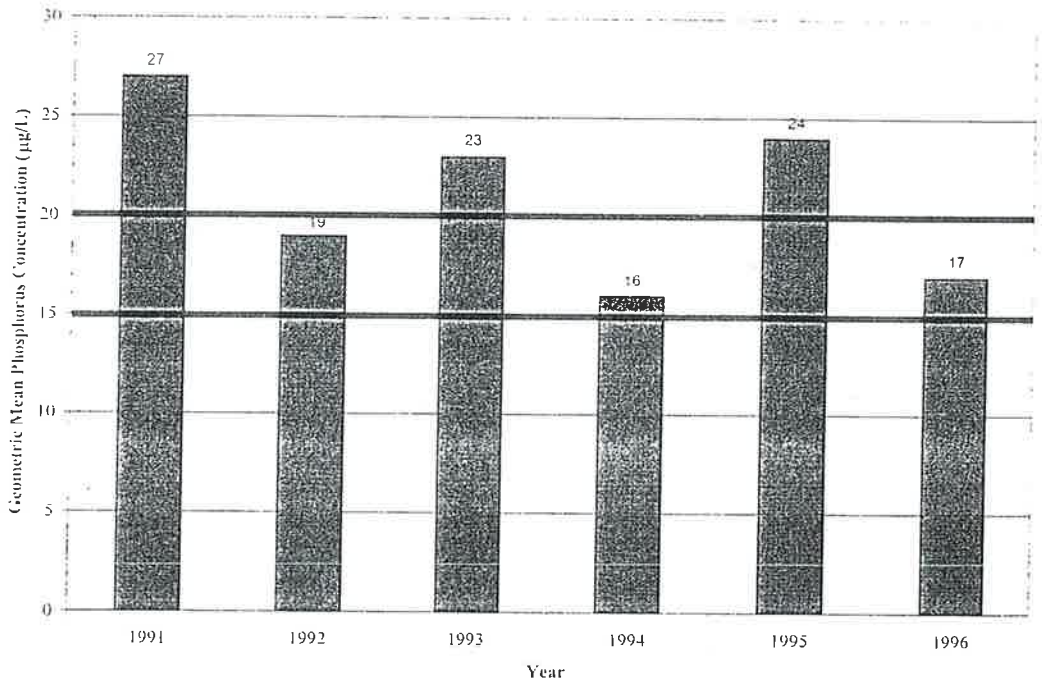

Figure 3.1 Geometric Mean Phosphorus Concentration Data for the Cannonsville Reservoir. Source: NYC DEP, July 1997

Incidentally, exceeding the phosphorus guidance value is not the only way to invoke certain regulations within the reservoir. If it is determined that the amount of phosphorus being *added* to the reservoir (its phosphorus "load") is above a specified limit, certain regulations take effect as well. According to the MOA, the DEC and DEP jointly determine the appropriate amount of phosphorus that can be added to each reservoir in the NYC Watershed, including the Cannonsville. The official term is the *Total Maximum Daily Load* (TMDL), though the name is a bit of a misnomer since the DEP actually calculates and applies annual loads (TMALs). In any event, if a reservoir is found to exceed its "TMDL", certain regulations take effect, most notably restrictions on expanding wastewater treatment facilities (see Chapter 2 section E.2, "The MOA and the TMDL Process"). Thus, even if the reservoir's phosphorus concentration were below the Guidance Value, if the amount of phosphorus being added to the reservoir exceeds its TMDL, the expansion of wastewater treatment capacities in the basin would be limited. To clarify, though a basin whose reservoir exceeds its TMDL is liable to certain regulations, it is not a "phosphorus-restricted basin." Under MOA parlance a "phosphorus-restricted basin" is strictly one having a reservoir that exceeds its Guidance Value expressed as a concentration. Although both programs are addressing phosphorus, TMDLs are a State program (Clean Water Act) and Phosphorus Restricted Basins are a City program (Watershed Regulations). The topic of phosphorus loads is explored further in the following sections.

D. Assessment of Existing and Prospective Phosphorus Loads

The phosphorus "load" is the weight of phosphorus added to a given water body in a specified time. Accurately estimating the phosphorus load to the Cannonsville Reservoir is necessary for establishing a phosphorus management strategy for phosphorus reduction. Additionally, the relative contributions of various sources of phosphorus must be determined so that Delaware County can allocate their resources for reducing the phosphorus load most wisely. Estimation of both the total load and the loads from various sources has gone through several stages and is still being refined by the NYC DEP, a process described in the following section.

1. Estimating the Phosphorus Load to the Cannonsville Reservoir

a. Vollenweider Model

DEP and many others use an equation credited to Richard Vollenweider to translate a phosphorus concentration into an annual loading. Basically, Vollenweider's equation represents the theoretical relationship between phosphorus concentration, the lake's shape, the water replacement rate, and the annual phosphorus loading. Specifically, the water replacement rate and the lake's shape affect the settling of particulate phosphorus to the lake floor, as well as the flushing of phosphorus from the system. Furthermore, the lake's shape also affects the "areal dilution" of phosphorus — Vollenweider found a strong correlation between eutrophication and the total loading divided by the lake surface area. Vollenweider's equation requires only three lake-specific variables to be known—phosphorus concentration, lake shape and water replacement rate—in order to determine the annual phosphorus load. There is one empirical parameter that Vollenweider estimated by statistical fitting -- a settling coefficient representing a net permanent loss of phosphorus into lake sediment. The way that Vollenweider and later researchers estimated this parameter implicitly adjusts for any phosphorus release from sediment such as may happen via agitation of the bottom or anoxic conditions.

Vollenweider and other researchers following his lead relied on databases of in-lake phosphorus concentrations and input phosphorus loadings that pre-date the most recent sampling methodology for stream loadings (e.g. Longabucco and Rafferty, 1998). State-of-the-art stream sampling is much better able to take into account the fact that a disproportionately high fraction of annual dissolved and particulate loadings are carried by the highest stream flows. Earlier sampling designs, such as fixed-frequency grab sampling at intervals of a week or longer, significantly underestimate annual loadings. In particular, sampling tactics that cover higher flows poorly miss much of the annual load of particulates. Since large lakes act as mixers, the effect of transient changes in input loading is averaged out to some extent. The consequence of this is that the Vollenweider approach's empirical parameter -- a settling coefficient -- is based on fitting an equation relating in-lake concentrations that have some likelihood of representing average

conditions, to input loadings that are likely to be underestimates. The practical significance of this is that input loadings based on state-of-the-art stream sampling are not compatible with the empirical settling coefficients in most published Vollenweider-method work. If one can assume that the DEP's in-lake sampling and the DEC's West Branch Delaware River sampling are both well-representative of growing season and annual averages, respectively, then a Vollenweider settling coefficient representing much more rapid settling than that used in DEP's Phase I work would be needed for the Cannonsville Reservoir.

b. Phase I Load Estimates

The Phase I Load Estimates mandated by the MOA consists of two components: the estimated phosphorus load and the theoretical "critical" load (or TMDL) for a particular reservoir. For both components the New York City Department of Environmental Protection (DEP) used the Vollenweider equation.

The phosphorus loads entering the Cannonsville Reservoir were determined by entering the annual mean phosphorus concentration calculated from monitoring data (see Section C, above) into the Vollenweider equation. For 1990-1994 the average load was calculated to be 15,792 kg/yr.

The critical load (commonly referred to as a TMDL) is the maximum amount of phosphorus that can be loaded into a lake or reservoir without resulting in a phosphorus concentration higher than a given number. For the Phase I TMDL that threshold value was the NY State Guidance Value 20 µg/L. Using the Vollenweider equation, the DEP determined that the phosphorus TMDL for Cannonsville Reservoir to be 16,642 kg/yr. A margin of safety, 10 % of the TMDL, is subtracted from the TMDL to create the "allowable" load of 14,978 kg/yr. Thus, since the estimated 1990-1994 phosphorus load of 15,792 kg/yr exceeded the allowable load of 14,978 kg/yr, the Cannonsville Reservoir violated its TMDL, triggering the wastewater treatment plant restrictions described above.

While the phosphorus load estimates from the Vollenweider equation were used to determine the Reservoir's compliance with the MOA, the DEP used the Reckhow Land Use Model to estimate phosphorus sub-loads from specified land uses. Such estimates would enable managers to focus on the land use types contributing the most phosphorus. Under the Reckhow Land Use Model each type of land use has a coefficient that determines its contribution to the total phosphorus load. Then, the load for each land use is determined by multiplying the area of that type of land use in the watershed by its coefficient. The total load is calculated by summing loads from all land uses in the watershed. Using this method, the total phosphorus load was determined to be 30,045 kg/yr broken down into general categories as shown in Table 3.1.

The Reckhow Land Use Model is a highly simplified technique. Since it only depends upon land use area, the total load will remain the same every year if the land use

areas remain the same. Furthermore, this equation does not account for the largest controlling factor in how much non-point source phosphorus enters the reservoir: the amount of precipitation and the consequent runoff events.

Table 3.1. Loading Profile Based on Reckhow Land Use Model	
Source	**Total P Load (kg/yr)**
WWTPs	8,004
Urban	482
Septic	1,298
Forest	3,479
Grass/shrub	8,180
Bare Soil	10
Corn/Alfalfa	6,958
Water	1,634
Source: NYC DEP, 1996. (Phase I Cannonsville Phosphorus TMDL report)	

Phase II addresses weaknesses in both the Vollenweider equation and the Reckhow Land Use Model in order to form more accurate estimates of the phosphorus load.

c. Phase II Load Estimates

The Phase II load estimates were calculated in a series of steps that utilized NYS DEC's sampling data for Beerston, the General Watershed Loading Function model (GWLF), and an adjusted Vollenweider equation. GWLF is a model that predicts a phosphorus load from a given land use (similar to the Reckhow Land Use Model), using meteorological, soil, and other data about the watershed. The total load to the reservoir can be determined by summing the loads from each land use type. GWLF has the distinct advantage of accounting for changes in precipitation and consequent runoff from month to month and year to year. GWLF was also specifically designed for this region of New York.

Calculation of the Phase II load estimate followed these basic steps:

1. For 1993 to 1996, overall estimates from the GWLF model were compared to the Beerston sampling data (see section 2, below).

2. GWLF coefficients derived from fitting the GWLF to the Beerston data were used to extrapolate the GWLF model to the whole watershed.

3. A total load from the GWLF model was calculated from the loads from each type of land use.

4. The Vollenweider equation was fitted to the annual geometric mean phosphorus concentration for each year and the total load from the GWLF model for each year by introduction of an f_s term. This term is intended to represent the fraction of phosphorus that enters the reservoir and which immediately settles to the bottom. This fraction therefore is assumed not to contribute to the phosphorus concentration.

5. The critical and current phosphorus load for each year was determined by utilizing an average f_s term (calculated using the data from 1992 – 1996) for each year in conjunction with the guidance value phosphorus concentrations and the annual geometric mean phosphorus concentration, respectively.

6. The Phase II TMDL was determined by averaging the critical load for 1992 – 1996. This resulted in a TMDL of 40,237 kg/yr or 53,659 kg/yr, using a guidance value of 15 µg/L or 20 µg/L respectively. After the introduction of a 12.5% margin of safety, the available load for the reservoir was determined to be 35,207 kg/yr or 46,944 kg/yr, for guidance values of 15 µg/L or 20 µg/L respectively.

7. The current load in the reservoir that was used to determine if the TMDL is being exceeded was calculated by taking an average of the current loads from 1992 – 1996. The current load was estimated to be 52,368 kg/yr.

This different method of calculating critical loads in Phase II has consequences for Delaware County. Phase II allows for more phosphorus to enter the reservoir with the assumption that much of it immediately sinks to the bottom. On the other hand, current load is now based upon the DEP-adapted Vollenweider equation that results in a larger load corresponding to a given concentration. In Phase I there was a discrepancy between the loads estimated by the Vollenweider and Reckhow methods. Consequently it was difficult to see how a reduction in phosphorus might affect lake concentration. In Phase II, the total loads based upon the adjusted Vollenweider equation (using the f_s term) and loads calculated with GWLF match more closely. This gives some confidence that GWLF results can help in attributing loads to different land uses and setting priorities for load reductions.

2. Actual Phosphorus Load to the Cannonsville Reservoir

Since the 1970s, efforts have been made to measure the actual load of phosphorus entering the Cannonsville. From these various sampling efforts, estimates of the phosphorus loads have ranged in value from 26,700 kg/yr to 117,000 kg/yr (Longabucco and Rafferty, 1998).

Unlike point source pollution (for example, wastewater treatment plant effluents or industrial effluents), non-point source pollution does not come from a particular

location. Rather, non-point source pollution is a function of the amount of runoff that occurs. Excessive runoff occurs primarily after a storm event or during snowmelts. When the water runs across the land, it can acquire various pollutants, including phosphorus. Without redeposition on land, the runoff eventually will deposit these pollutants into a water body. Generally, the more runoff that occurs, the more pollutant is transferred from the land to the water. Consequently, a large portion of the non-point source pollution that enters the reservoir occurs primarily during randomly scattered extreme events of varying duration. Thus, in order to best estimate the actual load of phosphorus to the reservoir, it is imperative that the frequency of sampling be greater during storm events in order to catch concentration peaks.

Accordingly, recent sampling efforts by Longabucco and Rafferty use event based sampling in order to more accurately determine the phosphorus load to the reservoir. The method used was a refined version of that used by Brown and Rafferty between 1980 and 1982. Samples were taken at Beerston, a site on the West Branch Delaware River (WDBR) approximately 0.8 km upstream of the Cannonsville Reservoir. A flow gauge at Walton, approximately 8 km upstream of Beerston was utilized for flow data; flows are adjusted upward to reflect the 6% greater watershed area between Walton and Beerston. The frequency of sampling at Beerston was directly proportional to river height (the increase in river height being an indicator of increased runoff). Using the concentration data from Beerston and the flow data from Walton, a phosphorus load from the WDBR can be determined. These data represent the load from approximately 80% of the Cannonsville watershed. If the contribution from point sources is subtracted, the remaining contribution from non-point loads can be extended to estimate the phosphorus contribution from the remaining 20% of the watershed. The extrapolated phosphorus load for the whole watershed calculated using this method is shown below in Table 3.2 (PP = particulate phosphorus, TSP = total suspended phosphorus, PS = point source, NPS = non-point source).

Table 3.2 Estimates of P Loads (kg/yr) to Cannonsville Reservoir in the 1990s as extrapolated from measurements at Beerston.

	PP			TSP			TP		
Year*	PS	NPS	Total	PS	NPS	Total	PS	NPS	Total
1992	4,900	16,500	21,400	9,200	12,250	21,450	14,100	28,750	42,850
1993	1,600	41,625	43,225	4,500	22,750	27,250	6,100	64,375	70,475
1994	1,000	20,750	21,750	3,700	15,000	18,700	4,700	35,750	40,450
1995	800	9,250	10,050	3,000	8,250	11,250	3,800	17,500	21,300
1996	600	143,750	144,350	2,800	26,000	28,800	3,400	169,750	173,150
1997	600**	53,540	54,140	2,800**	20,260	23,060	3,400**	73,800	77,200
1998	600**	40,500	41,100	2,800**	17,400	20,200	3,400**	57,900	61,300

*based on water year, October - September (e.g. 1992 = 10/91 - 9/92)
** Estimate carried over from 1996; NPS loads are derived by difference and are thus affected by the estimation of the PS amount.
Source: NYS DEC, Patricia Longabucco, personal communication.

Because of the rigorous sampling efforts, these values of the phosphorus load to the reservoir are considered the most accurate. The total loads estimated from the Phase II analysis can be compared to these values (Figure 3.2).

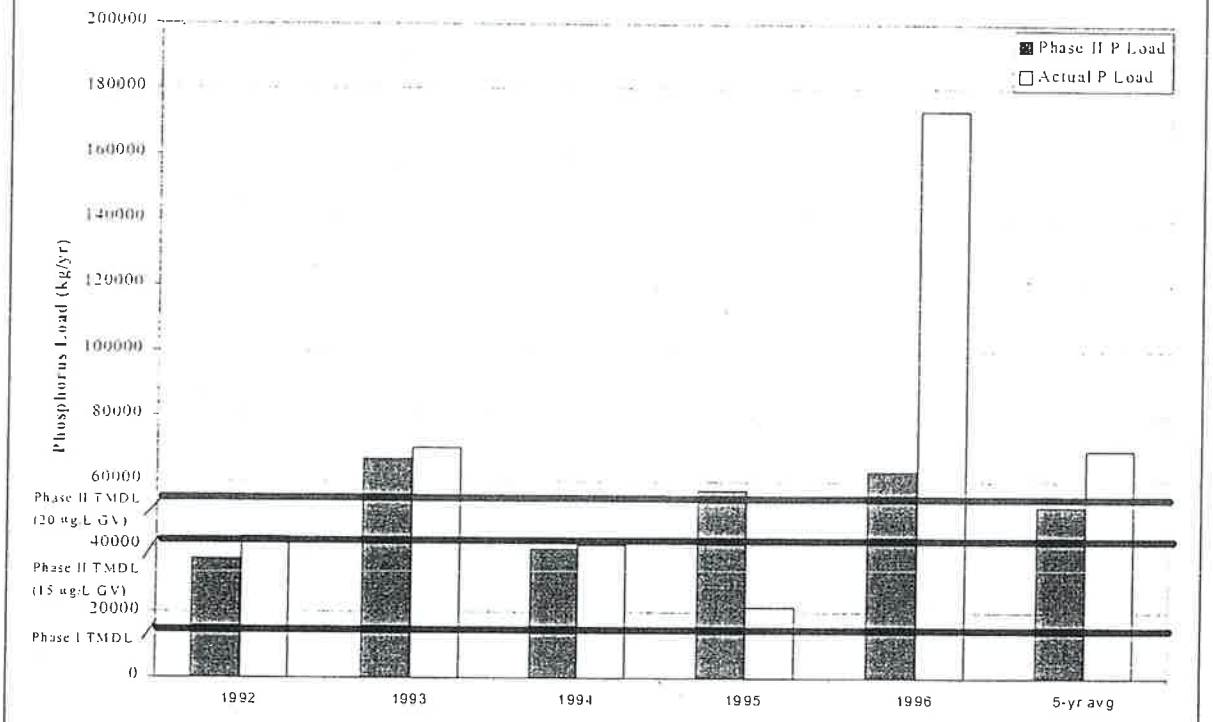

Figure 3.2. Comparison of Phase II estimated phosphorus loads and the actual load as measured at Beerston. *Source: Proposed Phase II Phosphorus Calculations for Cannonsville Reservoir and Table IV.2*

The percentage differences between these numbers and the geometric mean phosphorus concentrations associated with them can be found in Table 3.3.

Table 3.3. Comparison of Phase II Estimated Total P Loads and Loads Extrapolated from Beerston Monitoring

	1992	1993	1994	1995	1996	5-yr avg
Adjusted Vollenweider P Load (kg/yr)	35,943	66,809	39,103	56,984	63,001	52,368
P Load extrapolated from Beerston (kg/yr	42,850	70,475	40,450	21,300	173,150	69,591
Percentage Difference (extrapolated Beerston vs adjusted Vollenweider)	16.1 %	5.2 %	3.33 %	168 %	63.6 %	24.7 %
Geometric Mean P Concentration (µg/L)	19	23	16	24	17	21

Sources: NYC DEP, 1999 (Proposed Phase II Phosphorus TMDL Calculations for Cannonsville Reservoir); and Table 3.2

The two load estimates are quite close for some years (e.g. 1993 and 1994), but when extreme years are encountered (e.g. 1995 (a drought year) and 1996 (a wet year)), there are major discrepancies between the adjusted Vollenweider and extrapolated monitoring loads. The WBDR discharge in 1995 was the third lowest in the 46-year record, while the discharge in 1996 was the second highest on the record, causing the storm event to exceed the 100-year flood. The discrepancies are primarily due to errors in

the adjusted Vollenweider model. (DEP believes that the model does, however, meet the performance requirements as set forth in the Phase II TMDL Methodology.) Even though the current load utilized in the TMDL evaluation is a 5 year average to account for interannual variability, if the average from 1992 – 1996 of the extrapolated Beerston load is taken, a current load of 69,591 kg/yr results, a difference of 17,223 kg/yr. This difference hints that there remains an uncomfortably large uncertainty in how much phosphorus reduction must be achieved before the Cannonsville Reservoir basin is actually below the TMDL.

3. Summary

Table 3.4 summarizes the succession of policies and estimates for Cannonsville Reservoir phosphorus loading. As watershed sampling becomes more sophisticated the loading estimates increase, especially from nonpoint sources. While this report was in preparation in 1998 through early 1999, there was a period when the official New York State TMDL (from NYC's Phase I) was 16,642 kg/yr and the credibly estimated total loading was 52,368 kg/yr. At face value this large difference made it seem impossible to achieve the necessary loading reductions. This was one example of how the regulatory process has lagged rapidly increasing scientific understanding in this watershed. This undermined the credibility of the TMDL process to Delaware County.

The Phase II TMDL proposals from New York City were released after most of this comprehensive strategy's background work was completed. If those are accepted by New York State, there will be much greater compatibility between the magnitudes of official TMDLs and estimated total loadings.

Table 3.4. Summary of Previous TMDL and Estimated Annual Total Phosphorus Loads from various sources

Basis	TMDL (kg/yr)	Allowable Load (kg/yr)	Estimated Phosphorus Load (kg/yr)
Phase I - Vollenweider method	16,642	14,972 (TMDL less 10%)	15,792 - Used to determine MOA Compliance
Phase I - Reckhow Land Use Model	-	-	30,045 - Sum of load from each landuse type, used to facilitate phosphorus management
Phase II – GWLF/Beerston Data	40,237 (15 µg/L) or 53,659 (20 µg/L)	35,207 or 46,944 (TMDL less 12.5%)	52,368 - 5 year average, from 1992-1996

4. Phase III

A third phase of TMDL calculations is not required at the moment, but may be a part of the Phase II approval. Improved models or a change in the water quality standards or guidance values may also lead to Phase III TMDL calculations.

DEP staff express confidence that major scientific improvements are being made in two areas. First, DEP's Cannonsville Reservoir Model provides a much more detailed sense of the relationship among phosphorus loading and algal concentrations, going well beyond the Vollenweider model in incorporating scientific understanding about lake chemistry, physics, and biology. New management tactics may emerge from the more detailed insight this type of modeling can inspire. Second, the DEP hopes to use a probabilistic approach to represent loadings to the reservoir, instead of working with multi-year averages. This is particularly important in nonpoint source management where substantial loading fluctuation must be allowed for.

E. Phosphorus Restrictions and Delaware County

In order for Delaware County to have the phosphorus restrictions that have been imposed upon it removed, two things must happen. First, the 5-yr geometric mean phosphorus concentration running average (plus the standard error) for the Cannonsville Reservoir must be below the guidance value for two consecutive years. This will lift the phosphorus-restricted designation. Second, the 5-yr running average total phosphorus load entering the reservoir must be below the established allowable load (the TMDL minus the 12.5% margin of safety).

Measures to reduce phosphorus loadings from the reservoir basin will help Delaware County reach both of these goals, although one might be more readily attainable than the other. For instance, because the DEP currently uses estimated loads rather than actual loads in determining the current load in the reservoir, the implementation of a BMP or another practice (such as removing manure from the watershed) might have an immediate effect in the calculation of the current load, but it might take several years for the reservoir concentration to actually show the effect of the practice.

The primary effect of the Cannonsville Reservoir Basin being phosphorus-restricted and exceeding the TMDL for phosphorus is the restrictions that are placed on new or expanded surface wastewater discharges. Under the MOA, communities or businesses in any reservoir basin determined to be phosphorus-restricted that want to introduce a new or expanded wastewater discharge must either follow the strict regulations of the Pilot Phosphorus Offset Program or meet the requirements for a Variance from the Watershed Regulations. Within its many requirements, the Pilot Phosphorus Offset Program mandates that there must be 3 kg/yr of phosphorus reductions to offset every 1 kg/yr of phosphorus to be added by the new discharge. This can be

accomplished by introduction of non-point source controls or reductions in the phosphorus load from other WWTPs (beyond that which will be achieved after all the WWTPs are upgraded). However, the Offset Program also limits phosphorus-restricted basins to three new plants or expansions of existing plants, and the total increase in capacity of these cannot exceed 100,000 gpd. A Variance has numerous requirements as well, including a 2:1 phosphorus offset, and each case must be approved by the DEP. In addition, under the TMDL program, no new surface discharges (or expansions) will be approved until the Cannonsville basin no longer exceeds the allowable load. This limitation on new and expanded surface discharges affects Delaware County's economy because any new industry that would like to establish itself in the Cannonsville Basin must deal with several restrictions if they are to have any wastewater discharge at all (either their own separate discharge or the addition of their wastewater to that of one of the municipal plants in the county). Also, they must pay to implement reductions in the existing phosphorus load as mandated by the Watershed Regulations. This could be a major deterrent to industries looking to establish themselves in the area unless otherwise provided for in the Delaware County Comprehensive strategy.

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Chapter 4.
Wastewater Treatment Plants

A. Inventory and Map

NYC DEP provided a GIS coverage of sewage treatment plants that included all but two of the WWTPs in the Cannonsville Reservoir Basin (see Figure 4.1). DEP's data set covered plants that treated strictly sewage. A Dairyvest facility near Delhi has a permit to discharge non-contact cooling water in addition to wastewater, and a Kraft facility in Walton discharges solely non-contact cooling water. (Kraft's process wastewater is treated at the Village of Walton WWTP.)

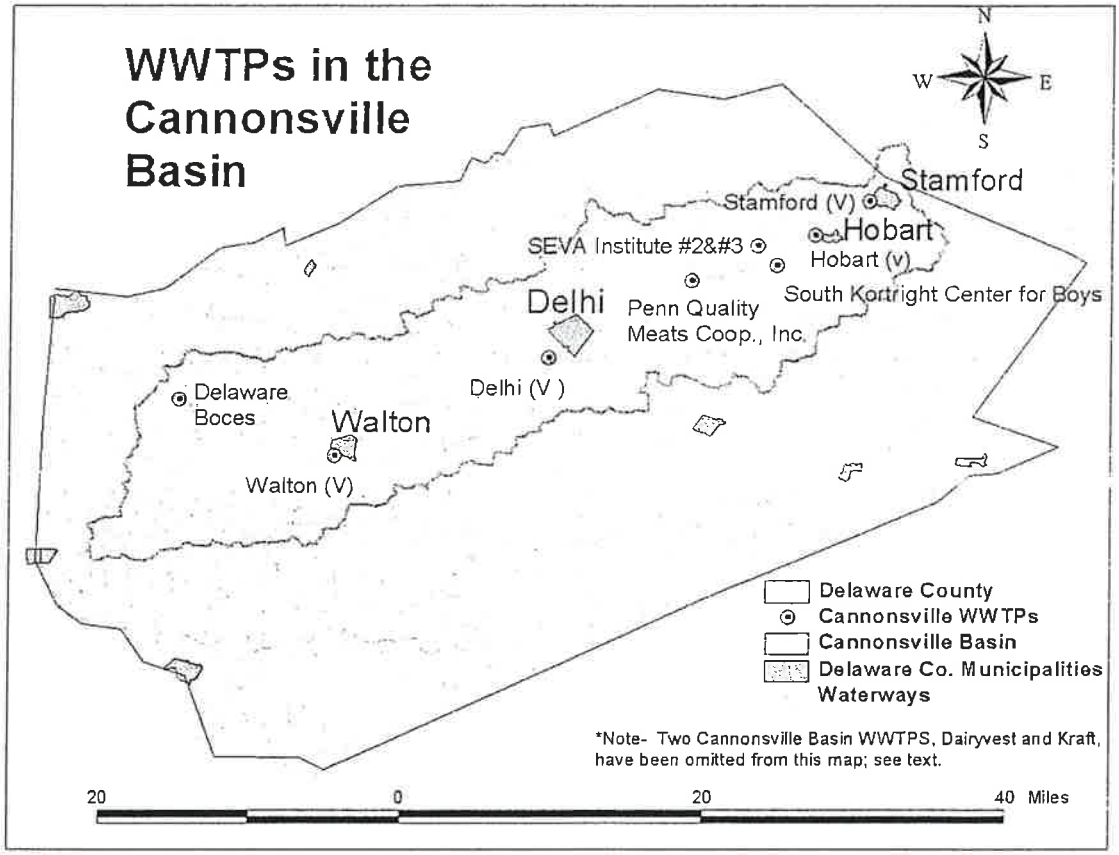

Figure 4.1. WWTPs in the Cannonsville Basin.

B. Estimated Phosphorus Loadings

Four municipal WWTPs serve Delhi, Hobart, Stamford, and Walton respectively. Non-municipal facilities include the Allen Residential Center (South Kortright Center for

Boys), Dairyvest #001 and #002, Delaware BOCES, Kraft Cooling Water, Penn Quality Meats, and SEVA Institute #002 and #003. Table 4.1 summarizes DEP's estimates as of early 1999 for WWTP phosphorus loading.

Table 4.1. NYC DEP estimates of annual total phosphorus loads from WWTPs				
Plant Name	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)
Delhi	1,604	1,484	1,376	1,270
Hobart	216	232	195	202
Stamford	544	587	182	551
Walton	2,476	3,175	3,192	5,175
Allen Residential Center	93	83	64	78
Dairyvest #001 and #002	0*	0*	0*	0*
Delaware BOCES	1	1	1	1
Kraft	3,058	3,058	1,296	124
Penn Quality Meats	8	6	4	9
SEVA Institute #002	0	0	0	0
SEVA Institute #003	0	0	0	0
Total:	8,000	8,625	6,310	7,410
* #001 discharge is by land application, and #002 is cooling water, thus zero loading to surface water is assumed Source: NYC DEP, March 1999. DEP also has monthly data.				

NYS DEC has different estimates of the point source phosphorus load in the Cannonsville basin. The estimates from the DEP and the DEC are compared in Table 4.2.

Table 4.2. Comparison of estimates of WWTP phosphorus load in the Cannonsville basin				
Source	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)
DEP	8,000	8,625	6,310	7,410
DEC	6,100	4,700	3,800	3,400
Sources: Table 4.1 and NYS DEC (pers. comm.)				

As shown above, there is a significant discrepancy in the current estimated phosphorus loading. DEP notes that they provide DEC with data for all WWTPs except Walton's, and that the difference must be due to differences in Walton data. Different effluent sampling methodologies are employed by the two agencies, and sampling timings are different.

The implementation of a phosphorus reduction strategy requires reasonably accurate estimates of WWTP phosphorus loading for two reasons. First, accurate estimates are needed so that after WWTP upgrades are implemented, there can be an accurate estimation of the phosphorus reduction due to this measure. Once all the WWTPs in the watershed are in compliance with the regulations, the estimated load from the WWTPs will be approximately 1,060 kg/yr. Using the DEP's estimates, that is a reduction of approximately 6,350 kg/yr, enough to bring the load below the allowable

load for a 20 µg/L guidance value. But if the actual WWTP load is closer to the DEC estimates, then there is really only a reduction of approximately 2,340 kg/yr, which is not sufficient to bring the load the reservoir to an acceptable level. Second, the non-point source phosphorus load is estimated by subtracting the point source load from the total load. If the point source load estimate is inaccurate, so will the non-point source load estimate. Misattribution of loadings between point sources and nonpoint sources as two aggregates is more important than misattribution within either of these categories, since there is a significant difference in how these two categories are managed legally and technically.

To help corroborate and forecast loading estimates for WWTPs, the following information may be obtained for each treatment facility:

1. The population served by the facility (including all contributors such as industry, etc.) as well as a history of the demographics of the area served;

2. The amount of influent (if any) that is storm water;

3. The quantity and the quality of the flows into the facility (including the amount of industrial waste;

4. The components of the treatment system and when they were constructed (a history of the facility);

5. Any likely future upgrades to the system, especially pertaining to phosphorus removal;

6. The quantity and the quality of the wastewater effluent from the facility;

7. The quantity and quality of the sludge output from the facility; and

8. Sludge disposal arrangements.

Table 4.3 summarizes flow and calculated loading information for each facility. The following sections discuss technological and operational details of the plants.

Table 4.3. WWTP SPDES Permit Flow Limits, Actual Flows, and Phosphorus Concentration Limits				
Facility	SPDES Flow Limit [gpd]	Flow average (typical range) [gpd]	MOA Total P effluent limit [mg/L]	Comment
Delhi Village WWTP	515,000	420,000 (300-450,000)	0.2	Pending capacity increase to 815,000 gpd
Hobart Village WWTP	160,000	43,000 (30-90,000)	0.5	
Stamford Village WWTP	500,000	410,000 (300-400,000, peak 1-2 mgd)	0.2	
Walton Village WWTP	1,170,000	1.6 mgd (1.1-2.0 mgd)	0.2	
Allen Residential Center	20,000	11,000 (1-20,000)	1.0	
Dairyvest #001 (process water)	200,000	124,000 (90-170,000)	no discharge to surface water; land disposal	Scheduled to be routed to Delhi Village WWTP
Dairyvest #002 (cooling water)	720,000	555,000 (420-650,000)	0.2	
Delaware BOCES	2,500	1,000	1.0	
Kraft Cooling Water	1,080,000	590,000	0.2	
Penn Quality Meats	19,000	inactive		
SEVA Institute #002	6,600	negligible	1.0	
SEVA Institute #003	1,200	negligible	1.0	
Sources: Delaware Engineering, P.C.; SPDES Discharge Monitoring Reports; NYC DEP, March 1999.				

Delhi Village WWTP

The influent to the Delhi WWTP is 98 percent domestic sewage (Delaware Engineering, P.C., pers. comm.). The Village sewer system is designed to collect only wastewater, not storm water. But storm water does infiltrate the system, sometimes in large quantities. The influent total phosphorus concentration is 15 mg/L. (Delaware Engineering, pers. comm)

The Delhi WWTP was built in 1970 and originally included primary settling, a trickling filter, and secondary clarification. In 1990, the plant was upgraded to include an additional clarifier and a chemical feed system prior to the secondary clarifier. Since 1995, mechanical components of the primary settling tanks have been replaced. The plant currently has no specialized equipment to remove phosphorus. The plant will be upgraded to include treatment for phosphorus and virus removal during the NYC Watershed upgrade. There is also potential for upgrading to an activated sludge system if the Dairyvest waste stream is incorporated. (Delaware Engineering, pers. comm.) Sludge processing at the plant is accomplished with a belt filter press. Pumps send sludge to the

belt filter press about once per week. Liquid from the press is sent back to the head of the plant. The final sludge (approximately 20% solids) is disposed of in the Delaware County Landfill. (DEP Wastewater Treatment Facility Compliance Inspection Report and Year End Summary Report (WTFCIR & YESR), October 1997)

The SPDES permit for the Delhi facility currently has no limits for phosphorus and does not require monitoring of phosphorus. Thus there is no phosphorus data from the plant itself. The DEP took 23 grab samples between 1/97 and 2/98. The arithmetic mean of the total phosphorus concentration of these samples is 3.25 mg/L. Using this value and the average flow rate, the annual total phosphorus loading would be roughly 1890 kg/yr. According to the Watershed Regulations, the plant must achieve a total phosphorus concentration of 0.2 mg/L (corresponding to an annual load of 120 kg/yr if the average flow is used or 140 kg/yr if the permitted maximum flow is used), although the engineers believe that the actual effluent phosphorus concentration may be reduced to < 0.05 mg/L, which would reduce the load to <30 kg/yr or <40 kg/yr for the average flow or permitted maximum flow, respectively.

Hobart Village WWTP

Flow to the Hobart WWTP consists of both domestic and commercial/industrial components. In 1991, it was estimated that the facility served 696 people. Projected population served for 2010 is 1,160. In 1991 the commercial/industrial flow into the plant was estimated to be 7,500 gpd. Projected commercial/industrial flow for 2010 is 12,500 gpd (Lamont, Van de Valk Engineers Wastewater Facilities Report, 1991). The influent total phosphorus concentration is approximately 6.8 mg/L (average from 1995-1998 DMR).

The original WWTP was constructed in 1975. A new plant was constructed and began operation in 1993. Hobart's WWTP consists of a bar screen, comminutor, equalization tank, two aeration tanks, two secondary clarifers, and chemical chlorination and dechlorination. The sludge effluent is contained in two holding tanks and then proceeds to a filter press. From the filter press, the sludge may go to composting or to a landfill. (DEP Wastewater Treatment Facility Compliance Inspection Report (WTFCIR) April 1997)

Hobart's wastewater effluent has a phosphorus concentration of 3.1 mg/L (average from 1995-1998 DMR). Using this value and the average flow rate, the annual phosphorus load would be roughly 180 kg/yr. According to the Watershed Regulations, the plant must achieve a total phosphorus concentration of 0.5 mg/L, which will reduce the load to 30 kg/yr based on the average flow or 110 kg/yr based on the permitted maximum flow.

Stamford Village WWTP

The influent to the Stamford WWTP is primarily domestic. The sewer system is designed to collect only wastewater, not storm water. But storm water does infiltrate the system, sometimes in large quantities.

The plant consists of screening, grit removal, a comminutor (which generally isn't used), aeration tanks, secondary clarification, chlorination, and lagoons to which high flows are bypassed for treatment, which generally occurs once the flow exceeds 750,000 gpd. Sludge disposal is on uncovered drying beds that are operational only on a seasonal basis. In cold or wet weather, the sludge is hauled to another treatment plant for belt pressing and land disposal (Delaware Engineering, pers. comm.).

According to the DMR from 11/97 to 10/98, the current average effluent phosphorus concentration is 1.08 mg/L. Using this value and the average flow rate, the annual phosphorus load should be roughly 610 kg/yr. Under the Watershed Regulations, the plant must achieve a total phosphorus concentration of 0.2 mg/L (corresponding to an annual load of 110 kg/yr if the average flow is used or 140 kg/yr if the permit flow is used), although the engineers believe that the actual effluent phosphorus concentration may be reduced to <0.02 mg/L, which would reduce the load to <10 kg/yr.

Walton Village WWTP

The influent to the Walton WWTP is only 30 to 40% domestic sewage, with the rest coming from process water from Kraft Foods (Delaware Engineering, pers. comm.). There is a contract between Kraft and the Walton WWTP regarding Kraft's contribution to the WWTP, but any phosphorus effluent from Kraft is encompassed under the Walton WWTP effluent. According to the DMR from 1/95 to 9/98, the average influent phosphorus concentration is 11.2 mg/L.

The influent to the plant goes through a preliminary treatment consisting of an equalization tank followed by a bar screen. It then goes to a grit chamber. The influent is then pumped to a pretreatment chamber where the pH and chlorine residual can be adjusted. Also, this tank is kept in such a state as to select for phosphorus removing bacteria. Next, the influent flows to aeration tanks. After leaving the aeration tanks, the wastewater is injected with a phosphorus-precipitating agent. Next, it enters secondary clarifiers where the activated sludge settles out. The sludge is then thickened and sent to a belt filter press and then brought to the county landfill. The wastewater is disinfected and then released to the West Branch Delaware River. (DEP WTFCIR & YESR October 1997)

According to the DMRs from 1/95 to 9/98, the current average effluent phosphorus concentration is 0.78 mg/L, but this value varies between 0.2 mg/L and 3

mg/L depending on the waste stream from Kraft (DEP, pers. comm.). Using this average value and the average flow rate, the annual phosphorus load should be roughly 1,720 kg/yr. According to Watershed Regulations, the plant must achieve a total phosphorus concentration of 0.2 mg/L (corresponding to an annual load of 440 kg/yr if the average flow is used or 320 kg/yr if the permitted maximum flow is used), although the engineers believe that the effluent phosphorus concentration may be reduced to <0.05 mg/L, which would reduce the load to <110 kg/yr or <80 kg/yr for the average or permitted maximum flow, respectively.

Allen Residential Center (South Kortright Center for Boys)

The treatment process consists of a comminutor or bar screen, followed by an aeration tank, then a secondary clarifier. From the clarifier, the sludge that settles out is sent to a sludge holding tank. The wastewater from the clarifier is then chlorinated and released to the West Branch Delaware River. (WTFCIR & YESR October 1997)

Currently, the average phosphorus concentration in the effluent is 3.09 mg/L (average from DEP WTFCIR). Using this value and the average flow rate, the annual phosphorus load should be roughly 50 kg/yr. According to Watershed Regulations, the plant must achieve a total phosphorus concentration of 1.0 mg/L, which will reduce the load to 20 kg/yr based on the average flow or 30 kg/yr based on the SPDES permit's flow limit.

Dairyvest #001

The influent to the Dairyvest #001 WWTP is process water comprised mainly of dairy and high protein wastes, with approximately 50,000 gpd coming from the DMV Nutritionals facility and the rest coming from the Ultra Dairy facility (DEP WTFCIR & YESR October 1997).

The plant consists of grit removal, aerated lagoons, and a secondary clarifier (DEP WTFCIR & YESR October 1997).

The effluent of the plant has a phosphorus concentration of approximately 19.9 mg/L (PAR). The effluent is discharged onto the ground surface via spray irrigation and thus is considered a subsurface discharge and is not considered when calculating phosphorus loads to surface water.

During 2000, this wastewater has been scheduled to be diverted to the Delhi Village WWTP, which would eliminate the on-site land application.

Dairyvest #002

This water is non-contact cooling water and thus is not expected to make a major contribution to the phosphorus loading in the Cannonsville Reservoir. The facility is subject to the Watershed Regulations and, consequently, it must achieve an effluent phosphorus concentration of no more than 0.2 mg/L.

Delaware BOCES

The treatment process consists of a septic tank, sand filter beds, and then chlorination. Sludge from the septic tank is disposed of at a NYSDEC sludge disposal facility (DEP WTFCIR April 1997).

The average effluent total phosphorus concentration is approximately 1.86 mg/L. (average from WTFCIR & YESR October 1997) Using this value and the average flow rate, the annual phosphorus load should be under 3 kg/yr. According to Watershed Regulations, the plant must achieve a total phosphorus concentration of 1 mg/L. The phosphorus load will continue to be inconsequential.

Kraft Cooling Water

The Walton Village WWTP treats Kraft's process wastewater; see above. This water is non-contact cooling water and thus is not expected to make a major contribution to the phosphorus loading in the Cannonsville Reservoir. Previously, Kraft was thought to be adding a phosphorus-containing substance to the cooling water to prevent corrosion. This would account for high calculated phosphorus loads seen before Kraft eliminated the use of this particular material. This facility is subject to the Watershed Regulations and must achieve a total phosphorus concentration no higher than 0.2 mg/L.

Penn Quality Meats

Penn Quality Meats shut down in 1997. The SPDES permit has been maintained for the use of any potential future owners. Currently there is no phosphorus loading from this WWTP. No estimation of the future phosphorus loading can be made until the future of the plant is known.

SEVA Institute #002 and #003

The SEVA Institute WWTPs serve seasonal facilities using a simple treatment processes that includes a septic tank and sand filters. This facility's two outfalls produce

practically no flow to streams. These facilities contribute essentially no phosphorus load to the Cannonsville Reservoir. Subject to the Watershed Regulations, they must achieve an effluent total phosphorus concentration no higher than 1 mg/L.

Upgrade Plans

Specific upgrade plans for each of the facilitites will not be known until engineering contracts are finalized and design plans submitted. General phosphorus removal techniques employed consist of: the addition of aluminum, iron salts, and/or anionic polymers to aid in coagulation and flocculation of phosphorus particles; sand filtration and/or microfiltration to remove phosphorus particles; and biological phosphorus removal via the modification of activated sludge processes by the addition of an anoxic zone to allow the preferential growth of phosphorus-consuming bacteria. There is also the possibility for some of the smaller flow facilities to change to a subsurface sewage treatment facility (septic tank, leachfield).

C. Relevant Technologies and Best Management Practices

Because thorough information regarding the current processes and upgrades in the WWTP is not known yet, this section is just a discussion of the current technologies available for phosphorus removal, without any specific recommendations regarding the Cannonsville basin.

Phosphorus in WWTP influent is comprised of dissolved and suspended phosphates. The purpose of phosphorus removal processes is to convert the dissolved phosphates into suspended phosphates so that they can be removed as part of the sludge of the treatment facility (Henze *et. al.*, 1997, p 311).

Standard treatment processes can remove some influent phosphorus. In primary sedimentation, suspended phosphorus will settle out of the water. In secondary biological treatment, the bacteria involved will consume dissolved phosphorus. The amount of phosphorus consumed depends upon the amount and type of bacteria present, as well as their phosphorus requirements. Of the total amount of phosphorus, approximately 2 mg/L can be removed from municipal sewage of average organic content by these typical wastewater treatment processes (Jenkins and Hermanowicz, 1991).

When these typical wastewater treatment processes do not remove a sufficient amount of phosphorus, a variety of supplemental chemical and biological processes may be used to enhance phosphorus removal. Chemical methods usually involve the addition of chemicals that will cause the dissolved phosphorus to precipitate so that it can be removed via the sludge of the facility. Biological methods generally involve growing bacteria that consume more phosphorus than those already present in secondary biological

treatment.

1. Chemical Phosphorus Removal

Chemical precipitation of phosphorus occurs in four stages: precipitation, coagulation, flocculation, and separation. The precipitation phase typically consists of the addition of a chemical that causes the dissolved phosphorus to be converted into solids called colloids. Commonly used precipitants are salts of ferric iron, ferrous iron, aluminum, and calcium. In the coagulation phase, these colloids agglomerate to form larger particles called primary particles. The purpose of the flocculation phase is to combine these primary particles into larger particles called flocs, which can then settle out and be disposed of as part of the sludge. Flocculation occurs in chambers, which gently mix the water, causing the primary particles to collide and aggregate. The last phase, separation, is where the phosphorus compounds precipitated during the first phase finally settle out of the wastewater. (Henze *et. al.*, 1997, p314)

The processes for phosphorus removal can occur in several places during the course of wastewater treatment. There are after-treatment processes that can be utilized as well. Preprecipitation, simultaneous precipitation, and post precipitation are the most commonly used processes. After-treatment processes include contact filtration, ponds, and infiltration ponds.

Preprecipitation involves the addition of the precipitant to the raw wastewater. The phosphorus particles settle out in the primary settling tank and are then removed with the primary sludge (Jenkins and Hermanowicz,, 1991). One concern with preprecipitation is that it can lead to an increase in sludge and thus a need for more sludge handling (Henze *et. al.*, 1997).

The most common process is simultaneous precipitation. Simultaneous precipitation involves the addition of precipitant so that the phosphorus particles are removed with the secondary biological sludge. A few problems can arise with simultaneous precipitation. If an iron salt is used and if the biological treatment process is overloaded with organic matter, then anaerobic conditions may occur. When this happens, ferric iron may be reduced to ferrous iron, and there will be a subsequent release of phosphorus back into the wastewater. This problem can be remedied by blowing air into the activated sludge system. But this action has the consequence of creating additional turbulence which may cause flocs to break apart, reducing the efficiency of phosphorus removal. Care must be taken to add oxygen to the water with as little turbulence as possible. (Jenkins and Hermanowicz, 1991)

Post precipitation involves a tertiary treatment process in which precipitant is added after primary and secondary treatment. The resulting phosphorus particles are then removed via a clarifier or a filter. One issue with post precipitation is that it produces a

voluminous chemical sludge that is difficult to dewater. (Henze *et. al.*, 1997)

Contact filtration is a useful process when very low phosphorus effluent concentrations must be obtained. A contact filter is a rapid filter (a combined plastics/sand filter for best efficiency) where precipitant is added to the influent. The dissolved phosphorus precipitates into particles that get caught in the filter. Small particles that did not settle out previously are also often caught in the filter (Henze *et. al.*, 1997).

Ponds can also be utilized for phosphorus removal. They can be used as either the primary precipitation area or as a polishing process to remove phosphorus that managed to escape the other phosphorus removal processes. In some cases, an algal pond will form. The algae will also remove dissolved phosphorus from the water, but the algae must be removed from the effluent. A chemical sludge is deposited on the pond bottom and must be removed at large time intervals (Henze *et. al.*, 1997).

Infiltration plants utilize the phosphorus binding properties of soils to remove phosphorus from the water. As the water passes through soil on its way to the groundwater, the phosphorus is removed. Most of the organic matter in the effluent must be removed for this process to be successful. The infiltration plant must have dry period to prevent clogging of the upper soil layers (Henze *et. al.*, 1997).

2. Biological Phosphorus Removal

Bacteria can consume large amounts of phosphate. Phosphate is removed from the bacteria's environment during aerobic conditions. The bacteria use phosphates as an energy reserve that is utilized during anaerobic conditions. *Acinetobacter* are the best known bacteria that can carry out this process. Several conditions should exist in the plant for the successful cultivation of these types of bacteria. First there must be alternating periods of aerobic and anaerobic conditions. This condition is conducive to the growth of phosphorus removing bacteria, thus a larger portion of the bacteria present will be these bacteria. Also, during the anaerobic period, nitrate must not be present. The phosphorus removal process requires the presence of easily degradable organic matter. The denitrification process utilizes this organic matter present in the wastewater, thus reducing the amount available for the phosphorus removal process. By increasing the population of these phosphorus accumulating bacteria in the plant, more phosphorus can be removed. There are six commonly used biological phosphorus removal processes, two that only remove phosphorus, and four that remove phosphorus and nitrogen. The two phosphorus removal only processes are called the anaerobic/oxic (A/O) process and the Phostrip process. The four phosphorus/nitrogen removal processes are called the anaerobic/anoxic/aerobic (A^2/O) process, the Modified Bardenpho process, the University of Capetown (UCT) process, and the VIP process. (Henze *et. al.*, 1997)

During the A/O process, the influent to the process is mixed with recycled activated sludge (RAS) from the process. The mixed solution enters an anaerobic zone where the selection of phosphorus removing bacteria occurs. It then passes to an aerobic zone where phosphorus removal occurs. The solution is then sent to a clarifier where the sludge settles out. Some of this sludge becomes the RAS and some is removed as waste. The sludge removed as waste is the point of actual phosphorus removal from the system (Daigger and Polson, 1991).

The Phostrip process utilizes both biological and chemical means for phosphorus removal. The main process is similar to that of an activated sludge process. The influent enters an aerobic zone where the phosphorus removal occurs and then proceeds to a secondary clarifier. The RAS from the clarifier is then sent though a sidestream process. Part of the RAS is immediately recycled back to the aerobic zone but the other part is sent to an anaerobic stripper tank. During these anaerobic conditions, phosphorus removal bacteria release all their phosphorus by continuous "washing" of the sludge. The stripped sludge is recycled back to the aerobic tank, where the process begins again. Lime is then added to the phosphorus that was washed out of the sludge causing the phosphorus to be removed via chemical precipitation. Phosphorus is also removed in the waste activated sludge that comes out of the clarifier immediately following the aerobic zone. The Phostrip process can achieve phosphorus concentrations less than 1 mg/L in the effluent (Daigger and Polson, 1991).

The A^2/O process is applicable to situations requiring only nitrification or nitrification/denitrification. The A^2/O process adds an anoxic zone between the anaerobic and aerobic zones in the A/O process. This results in denitrification, reducing the nitrate concentration in the RAS, thus improving the efficiency of phosphorus removal. The phosphorus is removed from the system via the waste sludge (Daigger and Polson, 1991).

The Modified Bardenpho Process includes a succession of five zones (anaerobic, anoxic, aerobic, anoxic, aerobic) succeeded by a clarifier. The anaerobic zone allows for the selection of phosphorus removing bacteria. The process is similar to that of the A^2/O process with the exception of an additional aerobic zone before the clarifier. In terms of phosphorus removal, this zone helps prevent the formation of anaerobic conditions in the clarifier which would result in the release of phosphorus into the effluent. The Modified Bardenpho process can achieve phosphorus concentrations less than 3 mg/L (Daigger and Polson, 1991).

The UCT process involves three basic zones (anaerobic, anoxic, aerobic). To reduce the nitrate in the anaerobic zone and thus increase the efficiency of phosphorus removal, the RAS is recycled to the anoxic zone instead of the anaerobic zone. The anoxic zone is operated to maintain low nitrate concentration, so that the recycle stream from the anoxic zone to the anaerobic zone does not contain very much nitrate.

Otherwise, the UCT process functions similarly to the other nitrogen/phosphorus removal systems (NYC DEP, 1999).

There are several methods for biological and chemical phosphorus removal that can be utilized depending on the given situation. A combination of chemical and physical methods can be used to enhance even further phosphorus removal.

D. Conclusions

The current load to the Cannonsville Reservoir is estimated by the DEP to be 52,370 kg/yr. For the 20 μg/L guidance value, the allowable load is 46,940 kg/yr. Thus in order for the load to the reservoir to be acceptable for this guidance value, there must be a reduction in the load equal to 5,420 kg/yr. To be conservative, the DEP estimates that the phosphorus load from each WWTP after the upgrades will be equal to the phosphorus load allowed based upon the SPDES permit flow and the SPDES permit phosphorus concentration. This total load is 1,060 kg/yr. The DEP assumes that the load reduction can be met for this guidance value solely through reductions in WWTP phosphorus loads. This is why accurately determining the current WWTP load is essential.

The total load to the reservoir based upon the rough estimates calculated using average flows and phosphorus concentrations is approximately 4,440 kg/yr. The most current estimates from the DEP and the DEC are 7,410 kg/yr and 3,400 kg/yr, respectively. This rough calculation shows that the DEP approximations may be overestimating the contribution of WWTPs to the phosphorus load. Although the WWTP load comprises only about 10% of the total load, an inaccurate WWTP load estimate can have significant consequences. If the DEP estimates are accurate, then reducing the phosphorus load below the allowable level is only a matter of upgrading the WWTPs, which would reduce the load by 6,340 kg/yr. But if the DEP estimates are too large, the situation changes. First, if the actual load is below 5,420 kg/yr, it is not possible to meet the allowable load solely by upgrading WWTPs, even if it is assumed that the load can be reduced even further than 1,060 kg/yr by various technologies. Second, effective non-point source management becomes essential.

Accurate estimates of WWTP loadings are necessary for Delaware County to begin to take the necessary measures to reduce the phosphorus load to the Cannonsville Reservoir. Only by a more complete sampling survey of the effluent streams of the WWTPs can accurate information regarding their contribution to the load be gained. In addition, information regarding long term trends in flow rates and effluent phosphorus concentrations should be observed to determine whether or not the load can be expected to increase or decrease in the future. This can be valuable information for determining to extent of non-point source management needed to keep the county economically healthy by keeping the phosphorus load below the allowable load.

References

Note: Additional references covering individual WWTPs are embedded in the chapter text.

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Chapter 5.
Onsite Wastewater Disposal Systems

A. Inventory of Failing Systems (Noted by DEP's NOVs)

Each of the four regional offices of the DEP Protection Program keeps track of which systems have received a Notice of Violation (NOV) or Notice of Failure (NOF), and when those systems have been satisfactorily remediated. As of March 1, 1999 the number of systems in the Cannonsville Basin identified as "failing" was 185.

The MOA establishes a program in which the Catskill Watershed Corporation (CWC) can fund owners of single or two family residences to repair or replace failed septic systems. In order to facilitate their role in this process, the DEP West of Hudson Community Planning office combined the four Protection Program databases with an existing GIS coverage of tax-map parcel centroids. However, the accuracy of the map below (Figure 5.1) is constrained by three factors:

1. Human error in recording the original Protection program data prevented about 15 percent of the systems receiving an NOV or NOF from being associated with their proper tax-map parcel.

2. Since the data are associated with tax-map parcel centroids, the locations in Figure 5.1 are not exact.

3. There is a time lag between when data from the Protection Program database can be assimilated into the GIS database, so the map is inevitably outdated.

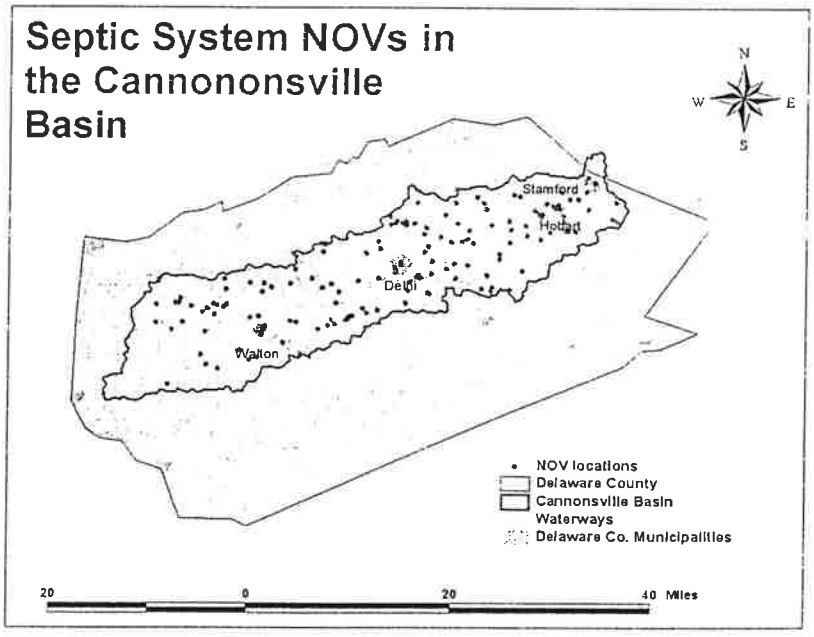

Figure 5.1. Septic System NOVs in the Cannonsville Basin

B. Estimated Phosphorus Loading

The GIS coverage mentioned above contains most known failed septic systems in the basin, but certainly not every failing septic system in the basin. Since the NOV program is largely voluntary, many owners have not reported their failing septic system; some may not want to go through the hassle of repairs (even though they would be reimbursed), while others may not realize they have a problem in the first place. To address this issue (among others), the Catskill Watershed Commission formed a Technical Working Group in 1998. The Group found that it could not determine accurately the number of failing systems; however, upon reviewing soil maps and design practices, they estimated that over 50% of septic systems in the WOH Watershed are "substandard and thus more likely to fail."

To estimate the number of septic systems in the Cannonsville Basin using GIS, two GIS coverages were utilized:

1) A GIS map of houses in the basin obtained from the DEP (Figure 5.2). Since it was originally generated by digitizing a DOT map of the basin, with all solid polygons being considered "houses", there are likely to be a number of non-houses mistakenly included on this coverage.

2) A GIS map of sewer district boundaries also obtained from the DEP.

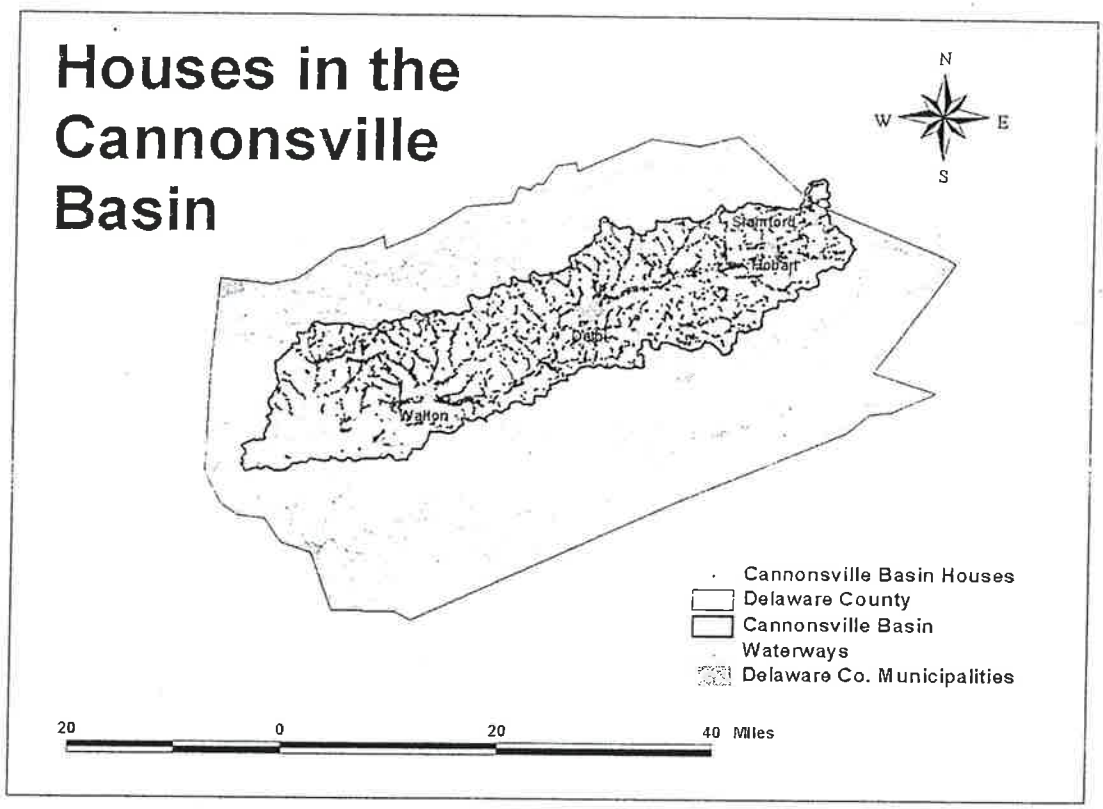

Figure 5.2. Houses in the Cannonsville Basin

Assuming that all houses outside of the sewer districts have septic tank systems, there are 4,660 septic systems in the basin. However, this may be high, due to the number of non-houses likely included in the first GIS coverage.

If over 50% of all septic systems are "substandard and more likely to fail", there are potentially over 2,300 failing septic systems in the Cannonsville Basin. In septic tank systems, waste is first held in the septic tank, and then distributed into adjacent "biomats"; a failing system is one where waste escapes the local biomat system and enters the larger ecosystem. Estimates on the amount of effluent that leaves the septic tank portion of the system vary, from 180 liters per capita per day (Canter and Knox, 1985) to 280 liters per capita per day (Novotny and Chesters, 1981). Furthermore, the estimates of phosphorus concentration in that effluent vary as well, from 11 mg/L to 31 mg/L (Novotny and Chesters, 1981), though Canter and Knox place the "typical" phosphorus concentration at 15 mg/L.

Assuming the low estimate of 180 L effluent per person per day, a household of four would produce 720 L/day. Multiplying this amount by 15 mg total phosphorus/L gives a daily total P load of 10.8 g/day. Multiplying this amount by 2,300 failing systems and 365 days/yr gives a total yearly P load of 9,100 kg. Using 280 L/day of flow results in 14,100 kg/yr.

While these numbers estimate the amount of phosphorus being released by failing septic systems, that is not to say all of the phosphorus would end up in the Cannonsville Reservoir; a certain percentage is undoubtedly retained by the soils.

C. Relevant Best Management Practices

Relevant practices in phosphorus reductions for Delaware County, which target rural settings, are:

- Septic tanks and standard absorption fields;
- Aerobic systems and standard absorption fields;
- Recirculating sand filters;
- Constructed wetlands; and
- Rotating biological contractors.

Important in the use of septic tanks and aerobic systems is the periodic inspection and pumping of the tanks and also the transport of treated materials to a Publicly Owned Treatment Works (POTW). Following are descriptions of each.

1. Septic tanks and standard absorption fields

Septic tanks are large (normally 1000-1750 gallons), subterranean, watertight chambers that contain inlet and outlet filters that prevent the discharge of solids. The tanks are connected to a distribution box that diverts flow to two or more perforated pipes positioned in gravel trenches within natural, undisturbed soil. Gravel trenches are standard absorption fields. Septic tanks provide 24-36 hours of detention time in which sewage bacteria decompose solids in the tank. Heavier solids accumulate at the bottom of the tank in the form of sludge; grease and lighter solids float to the top of the tank as scum. The liquid in the tank filters through the distribution box and then to the perforated pipes in the trenches. Crushed rock or gravel in the trenches further purifies the liquid as do bacteria and oxygen in the soil. Following filtration through the trenches and the soil, the liquid percolates to the groundwater. Sludge and scum that accumulated in the tank are pumped out periodically — at least once every three years, or as dictated by local authorities.

Septic tanks and absorption fields are the most common on-site systems because they are the least expensive and require minimal maintenance.

2. Aerobic systems and standard absorption fields

An aerobic system is comprised of a partitioned watertight compartment with a pump and air compressor. An alternate device that will inject air into the sewage in the first compartment may replace the air compressor. Air and wastewater mix in the partitioned tank and aerobic bacteria grow which digest sewage and liquefy most solids. Following the watertight compartment is a settling chamber or filtering device that connects to buried gravel trenches or a gravel bed via a distribution box. After passing through the absorption fields, the remaining liquid percolates through the soil to the groundwater. Aerobic systems are used in areas where insufficient unsaturated soil exists above the groundwater table.

Higher quality effluent is produced by this system. However, the construction costs are considerably higher than that of a septic system. Also, frequent inspection and maintenance are required. Other disadvantages include the possible need of pretreatment and the requirement of electricity.

3. Recirculating sand filters

Modified intermittent sand filters can be used in conjunction with septic tanks. (Note that the current Watershed Regulations prohibit the use of intermittent sand filters.) Initially, raw sewage is pretreated in the septic tank through settling of sludge and surfacing of scum. Effluent from the septic tank is discharged to the sand filter or recirculation tank. In the recirculation tank, sand filter effluent combines with septic tank effluent and is recirculated through the sand filter. The sand filter effluent may recirculate to the septic tank, combine with septic effluent in the recirculation tank (500 gallons), or may discharge to an absorption field.

This recirculation process can remove a greater percentage of phosphorus than conventional systems and is ideal for sites having inadequate depth to groundwater. Maintenance of the sand filter is a disadvantage as it includes semiannual raking of the sand filter to prevent the formation of a dense biomat, the removal of weeds and debris. Also, replacement of the sand media is necessary when raking reduces filter depth by four or more inches. Total phosphorus removal for this system is 70-90 percent.

4. Constructed wetlands

Constructed wetlands are used in conjunction with septic or aerobic tanks and are a component of a complete wastewater treatment system. They are used specifically in areas where standard absorption filters may adversely affect the surface and groundwater without enhanced treatment. An aquatic plant/microbial filter constructed in the gravel bed or gravel trenches of standard absorption filters characterizes constructed wetlands. They provide further filtration of wastewater through the addition of an additional process in the filtration system.

One notable disadvantage is that this process does not yield as much filtration during the winter due to the weather-dependent nature of the aquatic plants and microorganisms. There are also large land area requirements.

DEP notes that constructed wetlands may not be approvable as septic system components in the watershed.

5. Rotating biological contactors

This system is more innovative than the others for onsite wastewater treatment. It is a type of aerobic wastewater treatment system that includes a primary clarifier with extended confinement times and a sludge detention capacity for a minimum of 200 days. Biological support media, the discs in the rotating biological contactors, cause a circulating movement within the wastewater instigating an elevated interaction between the oxygen and the pollutants. This module is electrically operated. The aerobic bacteria within the wastewater propagate and synthesize the pollutants into by-products that can be discharged to an absorption field. High dissolved oxygen is returned to the primary clarifier by a constant attenuation device to draw down the applied disc load. Since some pollutants will slough, the flow will enter a secondary settlement tank that will capture the sloughed biomass.

This system is appropriate for areas with a high water table. A disadvantage is that only ninety percent of this system can be underground.

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Chapter 6.
Stormwater

A. Municipal Systems

There was no systematic information available from NYC DEP, NYS DEC, or Delaware County sources about municipal stormwater collection systems. The Villages of Delhi, Walton, and Stamford, at least, do have separate storm sewers that could be inventoried and assessed later when resources become available.

Data useful to make locally-specific estimates of phosphorus loading from storm sewers or urban overland runoff include catchment boundaries of storm sewers, land use maps of the catchments, soil maps, impervious surface estimates, and estimates of unit-area phosphorus loadings or concentrations (NYS DEC, 1992).

B. Stormwater Outlets from Major Institutional, Commercial and Industrial Establishments

There was no systematic information available from NYC DEP, NYS DEC, or Delaware County sources about site stormwater collection systems. Larger sites could be inventoried and assessed later when resources become available.

Data useful to make site-specific stormwater loading estimates from nonresidential sites again include basic catchment, soil, and land cover properties. A difference from municipal system stormwater assessment is that individual nonresidential properties are likely to vary widely in their runoff quality based on specific aspects of the site, where municipal systems reflect a larger and more heterogeneous mixture of land uses in which there will be an averaging effect. National data may still be useful to establish an order of magnitude (e.g. National Urban Runoff Program data summarized in part in NYS DEC, 1992), but it may be necessary to collect site-specific runoff quality information for important nonresidential sites.

C. Impervious Surfaces of 20,000 sq. ft. or more of Industrial or Commercial Property where Stormwater BMPs are not in Place

There were no digital data available on this subject, according to NYC DEP staff. The DEP does have estimates of impervious surfaces derived from a classification of Thematic Mapper satellite imagery with a 30-meter cell resolution. DEP estimated a total impervious surface of 692.2 hectares in the Cannonsville basin. With a 30-meter cell size (about 10,000 square feet), satellite imagery is not useful to identify impervious areas near to the 20,000 square foot threshold. Due to the way that the satellite sensors detect and

report spectral data as averages per cell, or due to classification algorithms that process the spectral data, there may be pervious surfaces within cells classified as impervious and there may be impervious surfaces within cells classified as pervious.

One way to identify impervious surfaces of 20,000 square feet or more would be:

a) Identify the industrial and commercial property where BMPs are not in place.

b) Use tax maps to determine which sites are large enough to hold an impervious surface > 20,000 square feet.

c) Obtain low-aerial photography of these sites.

d) Ground-truth the aerial photographs for accuracy, if necessary.

e) Identify the locations from the aerial photographs and enter into a GIS system.

For larger areas, there may be some potential to use NYS DEC's color-infrared aerial orthophotos, which have a 1-meter digital cell size. Photos covering all of Delaware County are scheduled to be available during year 2000.

Without area size and location data, estimates of phosphorus loading cannot be made for large impervious surfaces as a class. Most Cannonsville basin instances of large impervious surfaces would fall under the commercial/industrial/institutional classification if they are outside of a village or within a municipal storm sewer service area if they are within a village.

References

NYS Department of Environmental Conservation. 1992. Reducing the Impacts of Stormwater Runoff from New Development. Albany, NY. 178 p.

Chapter 7.
Agricultural Lands

A. Introduction to Agricultural Phosphorus

This chapter emphasizes phosphorus because of the phosphorus restrictions in the Cannonsville Reservoir watershed. It is recognized that the Watershed Agricultural Council (WAC) has given priority to pathogens in accord with EPA's Filtration Avoidance determinations. Pathogen management will remain a priority.

In the mid to late 1990s, farms in the Cannonsville watershed occupied about 19.9 percent of the basin's land area, 23,506 hectares. A majority of the 321 farms in the watershed are dairy farms. There are also other types of livestock farms and a few horticultural operations.

Dairy farms dominate the farm phosphorus economy in the watershed. As part of high-intensity milk production, a dairy farm processes large amounts of phosphorus each year, in the form of crops, animals, feed, animal manure, and commercial fertilizer. Some portion of the phosphorus that is handled, or that is carried over in the farm's soil from previous years (including that naturally present), will inevitably escape to watercourses. The farm's operation, structures, and terrain determine how much above the minimum will escape.

Basin-scale phosphorus assessments published by DEP attribute a high proportion of non-point source phosphorus in the basin to farmland, because of its large land area and the number of farm animals. As a rough indication of the potential size of the phosphorus load due to only the cattle themselves, a simple calculation can be done. In 1992 there were approximately 39,000 cattle (with about eleven times as many dairy cattle as beef cattle) in Delaware County (see Table 7.1). A conservative estimate of the number of cattle in the watershed can be made by assuming those cattle are evenly distributed around the County; consequently one-third, or 13,000, of them would be in the Cannonsville basin. The average amount of phosphorus they produce each year in their manure is ~13 kg P/yr/animal for beef cows and ~25 kg P/yr/animal for dairy cows (Novotny and Chesters 1981). Combining these numbers yields an estimate that the cattle produce over 300,000 kg P/yr that has the potential to run off into watercourses.

Figure 7.1 shows the ways that dairy farms handle phosphorus. The watershed agricultural program classifies several routes by which phosphorus can escape from a dairy farm in water:

Diffuse sources:

- Overland runoff from fields;
- Diffuse soil erosion from fields;

Concentrated sources:

- Concentrated soil erosion, such as from streambanks and steep access roads;
- Leakage from waste containment, fertilizer storage, and feed storage;
- Washaway of manure deposited in concentrated animal areas such as barnyards and barns;
- Discharge of wastewater.

(Note: for regulatory purposes most emissions from farms have been considered "nonpoint" sources. Recent rules treat larger "confined animal feeding operations" (CAFOs) as point sources. Most of the farms in the Cannonsville watershed fall below the regulatory size thresholds.)

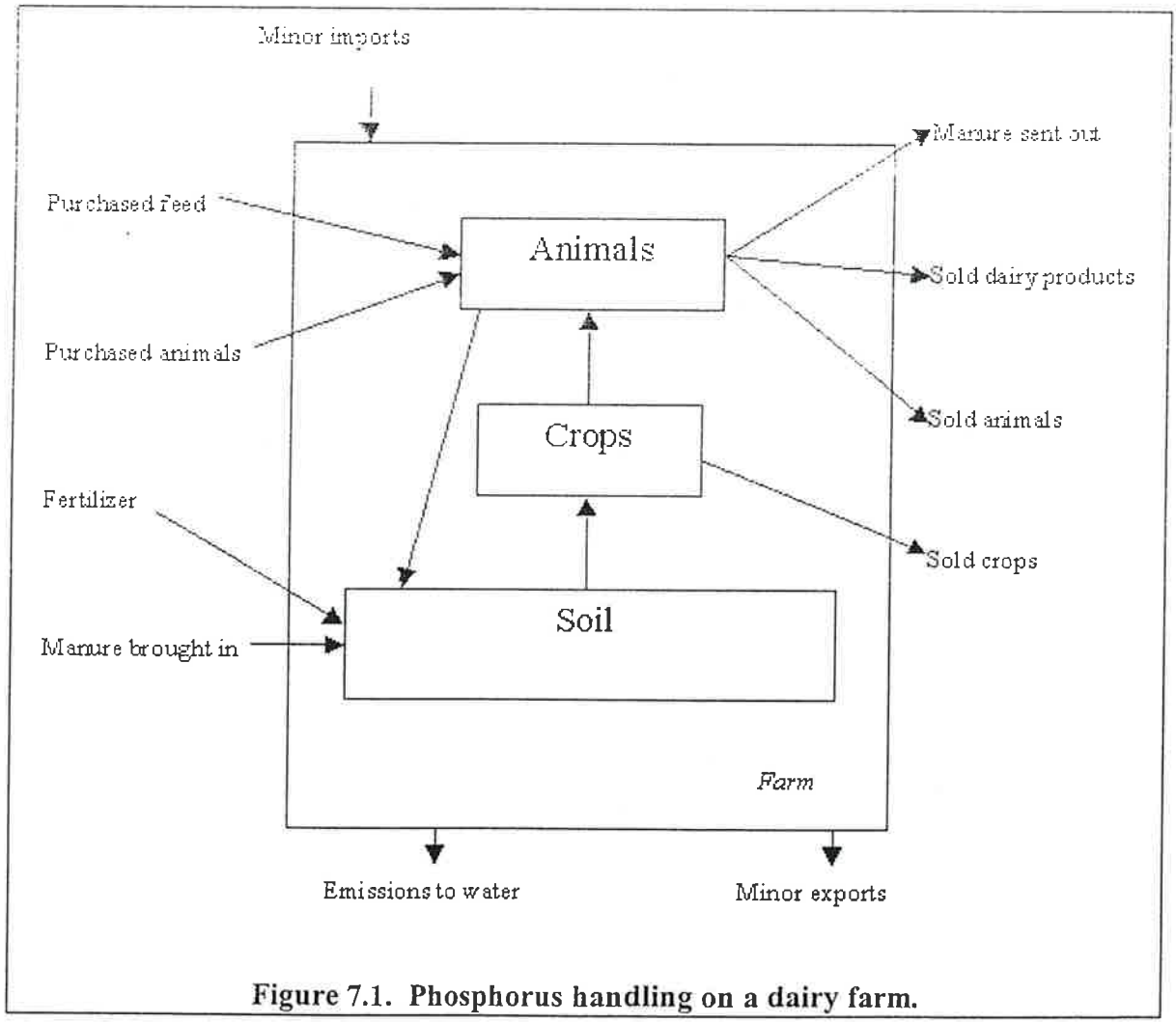

Figure 7.1. Phosphorus handling on a dairy farm.

B. Total Acreage and Location of Farms

Farm locations were obtained from NYC DEP based on data collected by USDA-NRCS (Figure 7.2). Other than the location, data about individual farms are generally confidential.

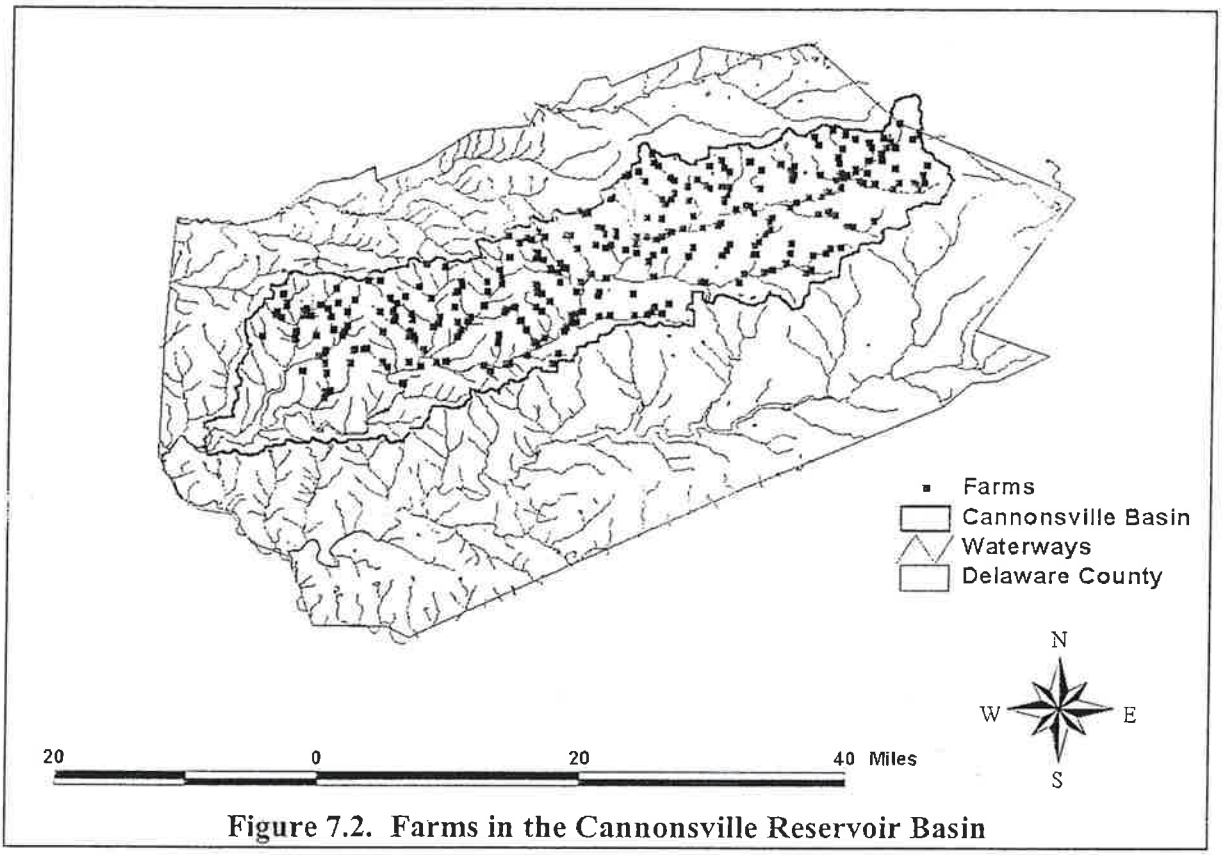

Figure 7.2. Farms in the Cannonsville Reservoir Basin

Subsequent sections review available data about phosphorus emission sources on farms. Unless otherwise attributed, data in this section are derived from records of the Watershed Agricultural Program for the New York City Watersheds.

Farms are uniformly distributed throughout the Cannonsville basin, as Figure 7.2 showed. To indicate the cropping mix, 115 cooperating farms in the Watershed Agricultural Program had about 21,000 acres devoted to crop production (Figure 7.3). Besides actively cropped land, many farms contain considerable woodland, and each farm will contain some land in a farmstead with a residence, barns, and paved areas. The woodland part of farm property is considered in the forestry sections of this report.

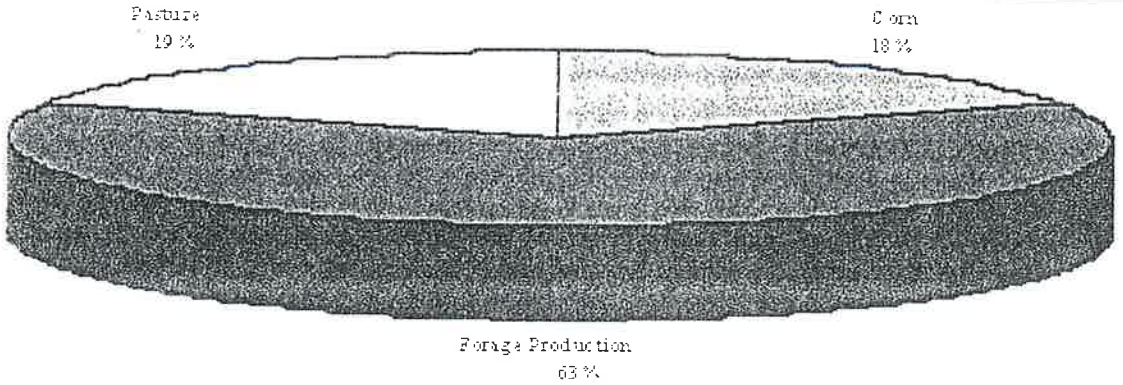

Figure 7.3. Composition of cropped acreage on 115 farms cooperating with the Watershed Agricultural Program.

Source: Watershed Agricultural Program soil sampling records as of November 1998

Farmed acreage and the count of farms have been falling in Delaware County, of which the Cannonsville basin makes up approximately 30 % of the land area. This trend can be seen in Table 7.1. The trend has continued into the late 1990's.

Table 7.1. Selected US Census of Agriculture Statistics for Delaware County

	1982	1987	1992	1997
Farms (number)	1,067	883	716	717
Land in farms (acres)	297,071	225,899	192,116	183,667
Average size of farm (acres)	278	256	268	256
Total cropland (farms)	1,019	825	686	677
Total cropland (acres)	131,550	106,871	96,680	94,676
Harvested cropland (farms)	978	788	652	624
Harvested cropland (acres)	90,021	72,883	65,298	68,572
Market value of ag products sold ($1,000)	66,908	55,295	51,163	43,498
Market value of ag products sold avg/farm ($)	62,707	62,622	71,457	60,666
Market value livestock, poultry, & produce ($1,000)	64,836	51,488	46,623	38,652
Cattle and calves inventory (farms)	843	642	506	472
Cattle and calves inventory (number)	65,246	46,821	39,288	34,685
Beef cows (farms)	233	160	140	185
Beef cows (number)	1,944	1,540	1,865	2,479
Milk cows (farms)	598	463	336	267
Milk cows (number)	31,709	26,023	20,706	16,337
Cattle and calves sold (farms)	816	618	486	460
Cattle and calves sold (number)	29,616	26,368	16,872	15,705
Hogs and pigs inventory (farms)	75	55	44	39
Hogs and pigs inventory (number)	486	276	673	237

Table 7.1. Selected US Census of Agriculture Statistics for Delaware County (cont.)	1982	1987	1992	1997
Hogs and pigs sold (farms)	41	25	34	20
Hogs and pigs sold (number)	955	407	628	269
Sheep and lambs inventory (farms)	48	44	33	35
Sheep and lambs inventory (number)	814	1,303	900	875
Chickens >=3 months old inventory (farms)	129	94	54	57
Chickens >=3 months old inventory (number)	18,688	19,795	17,602	1,824
Corn for grain or seed (farms)	32	31	18	15
Corn for grain or seed (acres)	1,370	1,305	1,061	718
Corn for grain or seed (bushels)	123,046	163,665	90,809	72,850
Corn for silage or green chop (farms)	398	293	227	200
Corn for silage or green chop (acres)	15,623	11,494	9,565	8,308
Corn for silage/green chop (tons, grn)	207,612	171,277	139,560	115,105
Hay-all (farms)	934	737	611	562
Hay-all (acres)	76,035	63,450	59,788	62,275
Hay-all (tons, dry)	156,133	134,268	117,086	100,997
Source: 1992 and 1997 US Census of Agriculture.				

C. Estimated Phosphorus Loadings

1. Direct Measures of Phosphorus Loading

a. Whole Cannonsville basin estimates

Table 7.2. shows the phosphorus loading estimates for farmland types from the DEP reports reviewed in Chapter 4. Only the "GWLF models" work is strongly based on corroborating water quality measurements to validate its overall estimates of loading.

Table 7.2. NYC DEP's whole-watershed estimates of phosphorus loading from agricultural and related land			
Source: *Proposed Phase I Phosphorus TMDL Calculations for Cannonsville Reservoir. September 1996.*			
	Area (ha)	**Assumed unit load (kg/ha/yr)**	**Load (kg/yr)**
Corn/alfalfa	3,479	2.00	6,958
Grass/shrub	40,902	0.20	8,180
Forest*	69,580	0.05	3,479
Source: *Calibrate and verify GWLF models for remaining Catskill/Delaware Reservoirs. January 1998.*			
	Area (ha)	**Derived unit load (kg/ha/yr)**	**Load (kg/yr)**
Corn	1,530	~7.0	11,000
Hay/pasture	30,254	~0.3	10,000
Barnyards (not applicable)			<1000
Forest and grass/shrub*	80,250	~0.1	10,000
Groundwater*			8,000
*Provided for reference			

As noted in Chapter 3, DEP considers the GWLF model to be a relevant screening model for phosphorus. It estimates all sources of phosphorus in the basin, including those prominent during storm flows for which earlier studies underestimated loadings.

GWLF includes a term for "groundwater" loading, but DEP's report does not specify which part of the basin contributes to that term. Undoubtedly some of this loading originates from agricultural land.

The approach used to fit the GWLF model to observed water quality data in watershed streams (most importantly the West Branch of the Delaware River at Beerston), ensures that the aggregated model results for the overall basin are consistent with the measured data at Beerston. The model calculates the total phosphorus load that will enter the reservoir based upon land use and meteorological data for the watershed. There are coefficients associated with each type of land use that determine each land uses' contribution to the load. These coefficients are first estimated without direct reference to actual basin water quality, instead using regional or national reference material. These initial coefficients are adjusted to make the calculated basin total results match the Beerston sampling data for one time period ("calibration"), then tested by applying the same adjusted coefficients with different weather data during a different time period and checking the basin total against the Beerston data for the second time period ("validation"). When the model result comes close to the Beerston sampling results in this second test, there is some confidence gained in the coefficient values and model structure.

However, this approach can misattribute loadings among the different land uses if the pre-calibration GWLF coefficient estimates are uncertain and if there is not much change in land use between the calibration and validation time periods. For example, the calculated loading from corn cropland could be overestimated if the assumptions about its initial coefficients resulted in overestimates of loading relative to coefficient assumptions about other land uses. If one source is overestimated, there have to be corresponding underestimates of other sources. Adding loadings from multiple sources cancels errors when models are applied in this fashion.

Because of the credibility of the Beerston sampling results, and the way that the GWLF model is fitted to them, the model's split of total phosphorus between point sources and nonpoint sources in the basin (90% from nonpoint sources and 10% from wastewater treatment plants) should be reasonably robust if the point source data are robust.

Based on NYC DEP's GWLF simulations it seems reasonable to use a figure of around 22,000 kg/yr total phosphorus for farmland exclusive of ground water. This corresponds to about 5,000 kg/yr of dissolved phosphorus and 17,000 kg/yr particulate. (Note: These figures correspond to pre-Whole Farm Plan conditions, around 1996. Today's actual loading is likely to be smaller due to a further reduction in active farmland and early implementation of controls on concentrated phosphorus sources within farms,

such as milking center waste treatment systems.)

b. One farm in detail

The DEC samples a stream draining a small watershed containing one farm and a second stream draining a similar semi-forested, unfarmed watershed, to help determine the effects of implementing whole farm plans. Table 7.3 shows a summary of data from the two sites. This represents pre-implementation conditions over two years, and one year post-implementation. Note that the majority of the farm basin is actually forested; thus the "farm" measurements represent runoff that has lower phosphorus concentrations than runoff from pure cropland.

Although annual and seasonal variability render it premature to derive firm conclusions from only three years, some improvement in TDP (total dissolved phosphorus) and SRP (soluble reactive phosphorus) appears to be detectable. This important assessment for the Watershed Agricultural Program is continuing.

Table 7.3. Annual runoff and nutrient/sediment loads for pre-implementation period (Pre-1 and Pre-2) and first year of the post-implementation (Post-1) period.

SITE	PERIOD	RUNOFF	PP	TDP	SRP	TSS	NO_x	$T\text{-}NH_3$	TKN	TOC
		(cm)	(kg)							
Farm	Pre-1*	70	91.7	74.6	51.5	34,825	605	168	437.	4,663
	Pre-2	53	97.8	77.9	59.6	37,023	355	80.4	318.	4,785
	Post-1	77	167.	43.2	21.0	71,752	709	73.2	550.	5,273
Control	Pre-1	60	6.76	4.50	0.833	4,016	67.9	3.61	68.7	1,329
	Pre-2	49	8.83	3.64	0.612	5,479	43.0	4.21	81.4	1,338
	Post-1	74	15.2	6.17	0.326	8,381	75.7	5.34	126.9	1,947

*Pre-1: June 1993-May 1996. Pre-2: June 1996-May 1995. Post-1: Nov 1996 - Oct 1997.
Source, Longabucco, P., M. R. Rafferty, and J. Lojpersberger. 1999. Effectiveness of Whole Farm planning and implementation in achieving water quality improvement and protection of New York City water supplies.

2. Indirect Measures

The Watershed Agricultural Program's reviews of cooperating farms provide a basis for summarizing, in a semi-quantitative way, phosphorus aspects of farms. Except at the monitored farm discussed in the previous section, currently accessible data do not permit estimates of phosphorus loadings to water, since there are no local relationships established between the indirect data collected on the farms and phosphorus emissions to water.

The five parts of this section review nonpoint phosphorus sources, prior to whole farm plan implementation, using five types of data:

1. "Agronomic" phosphorus in fields - representing diffuse sources of phosphorus that moves in soluble forms.

2. Sediment-bound phosphorus in fields — representing diffuse sources of phosphorus that moves in particulate forms.

3. Farm mass phosphorus balances.

4. Whole farm plan recommendations for diffuse sources, soluble and particulate.

5. Whole farm plan recommendations for concentrated sources, soluble and particulate.

Most of these data represent conditions prior to whole farm plan implementation. On these farms implementation of the Whole Farm Plan recommendations is complete or well underway as of spring 1999.

These data represent about one third of the farms in the Cannonsville basin, a sizeable but possibly unrepresentative sample.

a. Diffuse sources: "agronomic" phosphorus

Diffuse phosphorus sources on farms are primarily cropped fields, pastures, and barnyard areas. The Watershed Agricultural Program's data that help to characterize fields include whole farm mass phosphorus balances and field-by-field soil phosphorus measurements. These data apply to current and projected cropland. Forested land owned by farmers is not covered.

Most contemporary dairy farms will accumulate phosphorus in their field soil over time, increasing diffuse phosphorus losses unless compensating measures are taken. Because no farm can be 100 percent efficient in handling phosphorus, the sum of phosphorus amounts brought in (in feed, fertilizer, purchased livestock) is higher than the sum of amounts exported from the farms (in dairy products, animals, crops). The excess of imports over exports represents what accumulates and what may later leave unintentionally. The accumulation manifests in soil, where manure is spread or deposited.

The Watershed Agricultural Program tests every active field of each of its cooperating farms for phosphorus content, at the beginning of the planning cycle. (In a few farms having early whole farm plans, repeat sampling has been done three years afterward.) The particular test used for phosphorus (Lathwell and Peech, 1964) measures only an "agronomic" portion of the total phosphorus in soil, that portion most available for plant roots to take up. That is similar to the portion most likely to move in runoff (or in tile drainage, which has a small extent in the Cannonsville basin). Soil erosion will

remove all phosphorus in the soil eroded, so the agronomic phosphorus test results underestimate the total amount of phosphorus that is subject to diffuse loss from fields.

Table 7.4 indicates that, on an acreage basis, almost 90 percent of the farmland on 115 farms had agronomic phosphorus test results of "low" or "medium" (under 40 lb P/acre). Fields in corn at the time of sampling or in the recent past tended to have higher phosphorus content than fields growing other crops. Soil in pastures tended to have lower phosphorus content.

The agronomic phosphorus measure correlates with another measure of phosphorus called "phosphorus saturation." (Kleinman and others, 1999). The concept of phosphorus saturation is that each soil will have a capacity for binding phosphorus atoms via chemical reactions based on the soil's iron and aluminum contents. The more iron and aluminum present, the more phosphorus that the soil can build up in immobile forms without it "leaking" easily.

Table 7.4. Agronomic Phosphorus Soil Test Results from 115 Farms in the Watershed Agricultural Program

Agronomic phosphorus content	Corn %	Grass %	Pasture %	Other* %	Grand Total %
Low (0-9 lb/acre)	23	51	68	68	49
Medium (10-39 lb/acre)	55	40	27	22	40
High (40-80 lb/acre)	17	7	4	10	9
Very high (>80 lb/acre)	6	2	1	0	2
Acres	3,838.8	13,418.8	3,954.8	304.4	21,516.8

* mostly idle in the year sampled.
Source: Watershed Agricultural Program soil sampling files, as of November 1998. Represents most recent samples taken. Almost all represent conditions before Whole Farm Plan implementation.

For Catskills soils, Kleinman and others (1999) computed the threshold of saturation beyond which all added (soluble) phosphorus becomes mobile to be about 62 lb P/acre, expressed in terms of the agronomic phosphorus test result. (The 62 lb figure is a preliminary one from a draft of the cited reference, not then subject to extensive peer review.) This is a "high" figure in agronomic terms, indicating that no more manure or fertilizer (except specialized types at planting) need be added for a crop to receive adequate phosphorus.

Using the 62 lb/acre preliminary figure as a breakpoint, 97 percent of the 21,000+ acres on WAP's tested Cannonsville watershed fields have phosphorus contents below that figure and three percent have phosphorus contents above that figure. Even if a threshold were as low as 40, there would still be a very small minority of cropped field acreage that would exceed a possible "leakage prevention target" beyond which most added soluble phosphorus would be expected to leave the surface soil in runoff or leachate.

Space and Time Variability of Diffuse Phosphorus Loss Risks

The agronomic soil phosphorus measures interpreted above provide an averaged view. Other things equal, soil with more phosphorus in it will leak more phosphorus via runoff and shallow subsurface flow (as in tile drains). In reality a major source of variability that can dominate these averages is the timing of application of manure. (Fertilizer use is relatively modest compared to manure on dairy farms, and is being lowered in the WAP via systematic application of soil testing and manure allocation.) If manure application is timed perfectly relative to weather, the phosphorus in manure will remain on soil for long enough to "accumulate." In the worst case, such as application to steeply sloping frozen soil shortly before a major rain-on-snow event, there won't be any kept for long enough to accumulate. There are strong elements of randomness and seasonality.

There is also variation of phosphorus loss potential between fields within a farm. WAP classifies fields using three hydrologic sensitivity classes based on slope, flooding frequency, drainage class, and other factors. (A fourth non-hydrological class also is used, to reflect constraints on accessibility or odors.) Fields in the most sensitive class (3) would have the highest probability that some applied manure would be washed away. Fields in the least sensitive class (1) would have the lowest probability of losses by runoff. Table 7.5 shows WAP classifications for 35 of the 115 farms where soil tests have been performed, representing 7,743 of 21,517 acres.

Table 7.5. Pollutant Runoff Risk Categories for Fields on 35 WAP Farms

Risk level	Fields	Acres	% of acres
1 (least sensitive)	231	1780	23
2	373	3120	40
3 (most sensitive)	284	2500	32
4 (restricted for non-hydrological reasons)	31	343	4

Given Delaware County's terrain, it is not surprising that a third of the cropped acreage of these 35 farms can be characterized as having at least one of the following characteristics: slopes of at least 10 percent (at least 15 percent for perennial crops), slope lengths of at least 500 ft, a frequent flooding frequency, poor drainage, or sections subject to concentrated water flow.

b. Diffuse sources: whole farm plan recommendations

WAP planners assess the adequacy of farm nutrient management strategies, structural aspects related to nutrient management (such as manure spreaders), and erosion prevention.

A measure of the extent of diffuse sources on farms is the frequency of whole farm plan recommendations for changes to farm operation. WAP records for approved whole farm plans in the Cannonsville basin covered 94 farms as of early November 1998. These are a subset of the 115 farms for which soil sampling data were available. The 21

farms not counted represent one that dropped out of the program, one that participated in the program only to receive a nutrient management plan, and 19 others that were early in the planning process as of early November, 1998.

Diffuse sources: agronomic phosphorus

Consider the time pattern of a cropped field receiving manure and possibly fertilizer each year, in amounts in excess of plant uptake potential (Figure 8.4). Starting out with a soil having little phosphorus, much of the phosphorus added initially will be bound up with the aluminum and iron, leaving only a small fraction of newly added phosphorus mobile enough to be taken up by plants or to be leached by flowing water. As more and more phosphorus is added each year (moving to the right on the horizontal axis of the Figure), there is less and less opportunity for it to encounter aluminum and iron available to bind with phosphorus. Thus a greater fraction of the added phosphorus is mobile. After a number of years, all of the accessible iron and aluminum (typically about half of the total in soil) are occupied; the soil is termed "saturated." Any subsequently added phosphorus will be mobile, easily available to plant roots or vertically or laterally percolating water.

Switching to the fate of the mobile phosphorus (Figure 8.5), and getting closer to water quality implications, the mobile phosphorus is divided among plant uptake and washout. As the mobile phosphorus levels continue to increase (faster after iron+aluminum saturation was reached than before), the maximum plant uptake potential also becomes fully satisfied. Beyond that point increasing amounts of mobile phosphorus are essentially all available for leaching. For some combinations of soil and plant, the mobile phosphorus content corresponding to maximum plant uptake could be lower than the mobile phosphorus content that is reached at iron+aluminum chemical saturation.

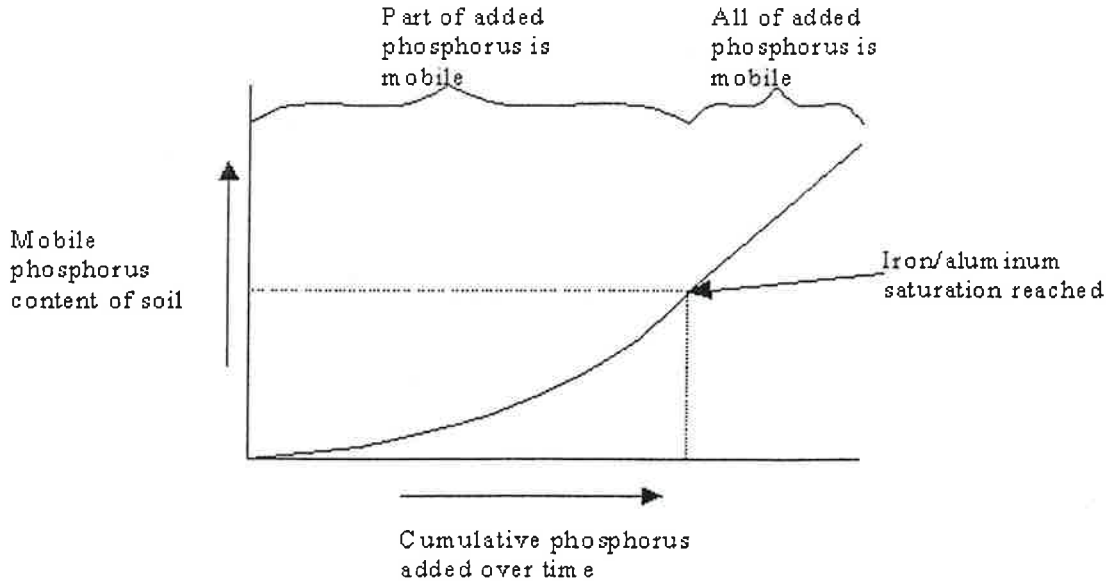

Figure 7.4. Concept: soil phosphorus saturation and mobility

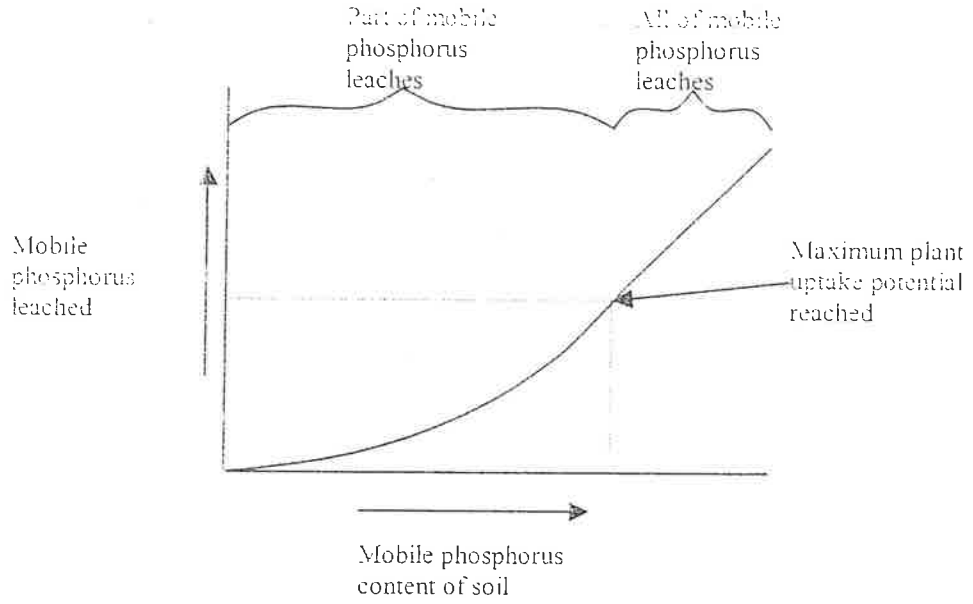

Figure 7.5. Concept: competition between plant uptake and leaching for mobile phosphorus

Research about the phosphorus saturation measure has not yet considered the effects of macropores and has not been extended in the field below surface soil. Based on experience with other substances that formerly were considered to be mobile only over the surface, it is likely that some mobile and even some "immobile" phosphorus will be carried downward and laterally by water flowing in large pores. These "macropores" can be structural cracks, earthworm holes, root holes, and other openings that provide a relatively large conduit for water and dissolved materials, and even suspended materials. If macropores extend deeply enough, they can convey mobile and particulate phosphorus deeper in soil than the active rooting zone, thus skewing the partition between plant uptake and deeper leaching.

Real Catskills agricultural soils have three additional features that, when associated with macropores, provide subsurface flow conduits that can make subsurface flow an unexpectedly large conveyor for phosphorus to nearby surface water. These features are hardpans, shallow bedrock, and artificial drainage. Each of these adds to the probability that subsurface flow will not stay underground for long enough for dissolved phosphorus it is carrying to encounter soil zones below iron+aluminum saturation. In cases of especially short subsurface travel time there may even be turbid water containing particulate phosphorus delivered to streams.

Two pollutant categories in the whole farm plan summaries are most relevant to diffuse phosphorus sources

Pollutant Category	Types of Practices
Nutrient Management	Manure handling equipment and access roads, subsurface drainage, other structural practices; nutrient management plans
Sediment – Diffuse	Pasture and Hayland management, diversions, conservation cropping practices.

Table 7.6 indicates that 76 farms received some nutrient management improvements that involved program funds to implement. The program invested $2.5M in such practices.

Table 7.6. WAP BMP recommendations in pollutant categories related to diffuse and concentrated phosphorus sources on 94 farms

Category	# of farms with BMP	# of farms with no issues meriting BMP
Diffuse		
Nutrient Management Plans	62	32
Other Nutrient Management	76	18
Sediment – Diffuse	54	40
Concentrated		
Storage, Manure and Fertilizer	13	81
Nutrients – Concentrated:		
-Barnyard	82	12
-Feed / Silage Leachate	6	88
-Milkhouse	21	73
Sediment – Concentrated	46	48

c. Concentrated sources: whole farm plan recommendations

There is very little direct phosphorus emission data for concentrated sources on Catskills farms. As a surrogate, this section uses WAP decisions as a basis for defining if there was a concentrated source problem on a farm. The data used in this section correspond to the same 94 farms for which diffuse-source BMPs were discussed above.

Three (later four) pollutant categories used in WAP environmental reviews and whole farm plans relate to concentrated phosphorus sources:

Pollutant Category	Types of Best Practices
Storage – Manure and Fertilizer	Well situated and secure storage of manure and fertilizer.
Nutrients – Concentrated	Barnyard, Milking Center, and Silage leachate management.
Sediment – Concentrated	Access road improvement, critical area protection, and fencing.

In the Cannonsville basin, WAP is investing approximately twice as much to control concentrated nutrient sources as it is spending on diffuse nutrient sources. The large majority of the spending is on barnyard improvements, which are recommended on almost 90 percent of the farms.

d. Farm mass balances

The soil sampling discussed earlier results represent a snapshot of the recent past. Farm mass phosphorus balances can be used to make general projections of the rate of accumulation of phosphorus in soil. As with earlier data in this section, the mass phosphorus balance data from WAP cover conditions prior to implementation of whole farm plans.

Numbers in this paragraph and the following chart are preliminary. On fifteen Cannonsville dairy farms having sufficient data to estimate annual phosphorus balances, the operators imported about 72 tons of phosphorus and exported about 25 tons, leaving a net accumulation of 47 tons per year (Figure 7.6). These farms grew crops on about 5200 acres. These farms are somewhat larger on average than the 115 used in the broader assessments.

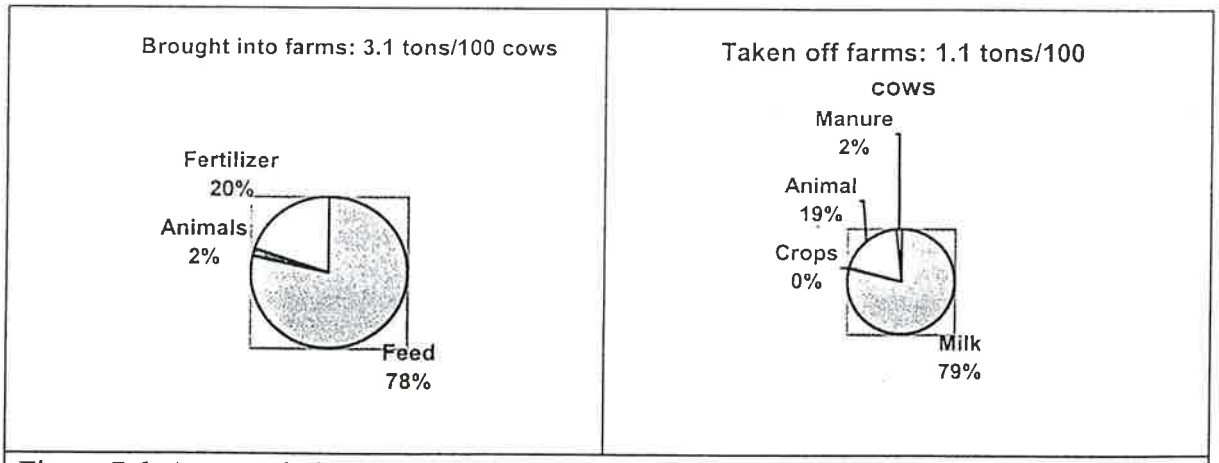

Figure 7.6. Averaged phosphorus mass balance for fifteen WAP dairy farms in the Cannonsville watershed over one calendar year, 1995, 1996, or 1997. Expressed for a 100-cow farm. Charts are scaled so that the left one is 1.6 times the linear size of the right one, to keep the circles' areas proportional to the different amounts they represent.

Some of the surplus will exit the farm in water as discharged milkhouse waste, barnyard runoff, and other concentrated sources. As Whole Farm Plans are implemented, the loadings from these sources, where they in fact existed before the plan, would generally be curtailed. Typical best practices for these involve recycling phosphorus into the manure storage system, from where the phosphorus is routed to fields.

If the surplus (as manure) were spread evenly over all 5,200 acres of cropland on these farms, the accumulation rate would be about 18 lb/acre/year. If one third of this represented the agronomically available forms, at 6 lb/acre/year it takes only a decade for a field to rise from zero to 60 lb/acre. Furthermore, this rate optimistically assumes that the manure is spread very evenly. One reason why such a small portion of the farm acreage has high and very high agronomic phosphorus content is that the farmers tend to concentrate manure spreading on more accessible fields, which can be few on some farms during the winter.

3. Expected Changes in Loadings

WAP expects that phosphorus loadings from farms in the Cannonsville basin will go down with time as whole farm plans are implemented and maintained. Taking a broader view, there are several factors that would lead to decline and others that would lead to increase.

Factors favoring decline are:

- Trend of declining farmed acreage;
- Implementation of controls for concentrated sources on WAP farms;
- Nutrient management plan implementation that reduces washoff risk and should redirect manure away from fields close to or above P saturation; also may reduce fertilizer imports;
- Increase in planned grazing systems, reducing feed imports on some farms.

Factors favoring increase:

- Accumulating phosphorus in fields due to persisting annual mass balance surpluses;
- Increase in herd size and animal concentration as farms consolidate; manure spread on smaller amount of land, thus more rapid approach to saturation;

- Economic pressure to increase per-animal production, requiring increases in purchased feed relative to use of on-farm forages.

While the directions of these can be projected, most cannot be quantified without data beyond that which WAP currently maintains. Future results from the monitored farm study by the DEC should help to quantify the expected decreases.

D. Relevant Best Management Practices

WAP applies a variety of national-standard and locally favored practices that individually and together attempt to control aspects of phosphorus on farms to various degrees. In managing and controlling pathogens, WAP has applied the precautionary principle to minimize risk of pollution.

This section summarizes the types of phosphorus related practices and lists the extent of recommendation of individual practices on the 94 farms having approved whole farm plans in the Cannonsville Basin as of November, 1998.

1. Watershed Agricultural Program Standard Practices

WAP organizes its array of candidate BMPs according to the pollutant categories in their Environmental Review/Problem Diagnosis form. Table 7.7 arrays the practices by pollutant category and subcategory against three "barriers" in the landscape. The "source" barrier attempts to limit the presence of a pollutant on farm or to contain it very securely. A "landscape" barrier attempts to control the movement (or destruction, for some categories) of a pollutant that is exposed in the open environment. A "stream edge" barrier attempts to filter out a pollutant just before it would otherwise enter the watercourse.

Within this context, WAP reviews the need for changes on the farm and prescribes specific BMPs from a large repertoire of candidate management options. Table 7.8 identifies how frequently different types of practices in the repertoire have been recommended on the 94 farms with approved plans in the Cannonsville watershed.

In its pathogen management WAC has given greatest attention to the first barrier. This it has pursued by promoting animal health to avoid or eliminate cryptosporidiosis. By such management measures WAC has applied the precautionary principle.

Table 7.7. Types of BMPs used in developing WAP whole farm plans				
Pollutant category	**Subsections**	**Source barriers**	**Landscape barriers**	**Stream edge barriers**
I. Parasites and phosphorus	Animal waste storage	NRCS specs for permanent waste storage structure/pond and temporary waste field storage	None required	None required
III. Phosphorus - fertilizer storage		Covered, watertight facilities with floor	None required	None required
V. Nutrients - concentrated sources	Barnyard	Clean water exclusion, scraping schedule, size and use efficient, filter strip	Not relevant	Not relevant
	Milking center	Treatment system	Not relevant	Not relevant
	Silage leachate	Low moisture content, clean water exclusion, filter strip, special handling of concentrated leachate	Not relevant	Not relevant
VI. Nutrient management		Ration balancing	Manure and fertilizer applications take account of P in soil; erosion control of high P fields; nutrient management plan	Stream crossings protected; livestock lingering limited
VII. Sediment - diffuse	Cropland	Not relevant	NRCS Resource Management System	None required
	Pasture	Not relevant	Grazing density limited; good vegetation cover	None required
VIII. Sediment - concentrated		Upland runoff diverted, plantings and maintenance of vegetative cover, NRCS NHCP practices	NRCS NHCP practices	Streambanks stabilized with NRCS NHCP practices
Source: Watershed Agricultural Program. Progress Report. December 1997.				

Table 7.8. WAP Detailed BMP recommendations for 94 farms in the Cannonsville Watershed.		
Excludes practices recommended fewer than 10 times or costing less than $1000 in aggregate (except for nutrient management plans which are not listed as having costs).		
Source: Watershed Agricultural Program plan summary database.		
Practice Codes	# of times recommended	Description of practice
590	226	Nutrient Management
707, 3010	123	Barnyard Water Management System; Barnyard Water Management - Roofed Barnyard
382	81	Fencing
328	70	Conservation Cropping Sequence
3410 and related	60	Manure Spreader, Loader, Manure Truck, Manure Scraping system, Agitator - Pump, Manure Agitator
510, 512	55	Pasture And Hayland Management; Pasture And Hayland Planting
362	51	Diversion
606	51	Subsurface Drain
585, 586	48	Stripcropping – Contour; Stripcropping - Field
574	46	Spring Development
560	41	Access Road
393, 393a	34	Filter Strip
193, 312, 313	33	Waste Field Storage; Ag Waste Management System; Waste Storage Facility
561	32	Heavy Use Area Protection
633	31	Waste Utilization
556	28	Planned Grazing System
575	25	Stock Trails And Walkways
412, 468	22	Grassed Waterway Or Outlet; Lined Waterway Or Outlet
3700	17	Misc. Farm Equipment
528, 528a	13	Prescribed Grazing - Lime
580	13	Streambank And Shoreline Protection
314, 3900	12	Brush Management
558	11	Roof Runoff Management
340	10	Cover And Green Manure Crop
342	10	Critical Area Planting
620	10	Underground Outlet

2. Controlling the Phosphorus Surplus on Dairy Farms

Controlling the overall accumulation of phosphorus in a farm's soil has not been a priority goal of the Watershed Agricultural Program. Greatest attention has been given to controlling pathogens. However, there have been three tactics applied on some farms that reduce accumulation and that could be applied at additional locations or in different degrees in the future:

1. *Reduction of phosphorus fertilizer use.* Nutrient management plans generally take advantage of phosphorus in soil and phosphorus in manure, leaving fertilizer to a supporting role, such as for starting corn. Adoption of nutrient management plans by farmers is very important if the county is to reduce the phosphorus load to the Cannonsville.

2. *Feed changes.* A few farms have increased the proportion of animal diets that is derived from grazing. If this corresponds to a reduction in purchased feed while keeping milk production nearly the same (or increasing it), there is a beneficial reduction in phosphorus imports. There have also been suggestions to reduce phosphorus contents of the purchased feed itself. However, farmers considering this may be deterred by concerns about nutritional risk to their animals, or about increased needs to monitor forage quality because an earlier "cushion" (oversupply) of phosphorus has been eliminated.

3. *Manure transfers off the farm.* There are at least two farms in the Cannonsville basin that transfer manure to other nearby farms. There was one Phase I plan that involved rental of additional land for manure spreading. These effectively increased the acreage of the manure-producing farm. One of these two farms receives feed from their partner farms. To the extent that this substitutes for commercial feed, then the mass balance effect is favorable.

3. Indirect "Monitoring" of Future Phosphorus Reductions

DEC's monitored farm and companion forest site produce a substantial amount of data — about one farm having one management approach and one natural setting. This site produces WAP's core information about the phosphorus control effectiveness of the program. It is desirable to have additional objective data over a broader base, to help the program to adjust itself and to give some confidence to participating farmers that the burdens they bear in operating management practices actually have some environmental benefit.

a. Monitoring phosphorus changes in soil

Phosphorus content in soil is much less affected by short-term weather than is stream water. Cornell's soil sampling protocols recommend retesting soil at three-year intervals for agronomic purposes. This is a reasonable interval to expect to see changes from large manure or fertilizer use changes on a field. The effects of small changes may take longer to be evident in sampling results.

Some nutrient management plans restrict manure usage on certain fields, particularly where hydrologic sensitivity is assessed. If the total annual manure rate for a field is reduced to below plant uptake requirements for phosphorus, the soil phosphorus

level should fall. That is an objective indicator of the farm operator's observance of the nutrient management plan. A particular drawback is that application of manure to frozen soil washes off directly into the water instead of going through the soil. Where winter spreading occurs, therefore, the soil phosphorus might decrease but the phosphorus contribution to the watercourses may continue.

b. Monitoring changes in the mass balance

The phosphorus mass balance of a farm is constructed from the following data, that the farmer can usually obtain from records kept for other business purposes:

Imports

- Animals purchased - count and average weight
- Fertilizer purchased - weight and phosphorus content
- Feed purchased - weight, dry matter content, and phosphorus content; can use estimates for dry matter and phosphorus content, given description of feed type
- Manure brought in - weight

Exports

- Milk sold - weight
- Adult animals sold - count and average weight
- Young animals sold - count and average weight
- Plant crops sold - weight and description
- Manure sent out - weight

The change in the mass balance over time is a leading indicator of net soil phosphorus accumulation, that will eventually be reflected in soil test results.

c. Monitoring concentrated sources

Concentrated phosphorus sources have two benchmarks, the original environmental review and the list of recommended changes in the whole farm plan. Follow-up observation, by the farm operator or a WAP planning team, could document

the later status of the farm relative to either of these benchmarks. The changes in the whole farm plan that are related to concentrated phosphorus sources can all be verified by inspection and judgment without making measurements. For example, a farm's fertilizer storage unit may have been identified in the environmental review as not meeting WAP's criteria based on observations by the planning team. The plan may or may not have recommended a physical change. A follow-up observation could perform the same environmental review using the same criteria, against the storage structure in place at the follow-up date. A comparison of earlier and later environmental review results would permit an assessment of progress in loading or risk reduction.

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Addendum: WAP Manure Infrastructure Committee Initial Assessment of Phosphorus Management Needs

In order to evaluate the need and feasibility of managing agricultural sources of phosphorus, staff of the Manure Infrastructure Committee of the Watershed Agricultural Program conducted a preliminary phosphorus study. Six well managed farms were selected. Each farm already has a WAC approved plan. The purpose was to ascertain what the additional costs might be of retrofitting phosphorus management onto the existing plans. For each farm, a mass balance was performed in order to determine how much phosphorus accumulates on each farm. The results of the mass balances are shown in Table 7.9. (Note: some of these farms were included in the 15 covered by Figure 7.6).

Table 7.9. % phosphorus remaining on six test farms.

Farm	A	B	C	D	E	F
% P Remaining	67	47	57	48	74	66

Source: Manure Infrastructure Committee Phosphorus Study

In addition, soil tests were done on all fields to classify fields as having various levels of soil phosphorus from "very low" to "very high." Tables 7.10 summarizes these data.

Table 7.10. % of fields on each test farm that fall into various categories of soil phosphorus levels.

Farm	A	B	C	D	E	F
Very Low	0	0	0	0	0	0
Low	8	50	0	23	12.5	21
Medium	21	21.5	12	25	12.5	32
High	52	21.5	75	34	37.5	47
Very High	19	7	13	18	37.5	0

Source: Manure Infrastructure Committee Phosphorus Study (unpublished)

Based upon the mass balance and soil phosphorus test results, the expected soil phosphorus test result after the implementation of various management practices was estimated. The basic practices evaluated were:

a. Daily spreading of manure without field conservation practices

b. Daily spreading with field conservation practices

c. Daily spreading with no-till corn production

d. Daily spreading with no row crops

e. Manure storage 6 months with field conservation practices

f. Manure storage 12 months with field conservation practices

It was concluded that the soil phosphorus on the farms could be controlled at the "medium" or "low" level by implementation of these practices. In addition, the study computed initial estimates for implementation of best management practices on the farms. These practices include examination of a ration balancing approach to reduce phosphorus inputs in feed, minimizing livestock traffic in wetlands and stream corridors, improving stream and crop buffer areas, runoff diversion mechanisms, construction of manure storage facilities, equipment for daily spreading of manure, as well as other practices. The estimated total costs to implement these practices on each farm are summarized in Table 7.11.

Table 7.11. Estimated costs of implementing BMPs for phosphorus reductions on six test farms.

Farm	A	B	C	D	E	F
Cost ($)	$76,375	$10,000	$10,000	$72,500	$34,000	$108,000

Each farm in the county will have particular issues that will need to be addressed in order to reduce the phosphorus load from the farm. This preliminary study is suggestive only regarding what the additional associated costs might be of implementing phosphorus management practices on all the farms in the county.

Chapter 8.
Forests

Managed forestland is an important part of upstate New York's economy. New York's highly conducive humid climate, arable soils, and seed abundance and proximity all promote the rapid natural regeneration of forestland. This allows overall forest growth to exceed timber removal 3 to 1, thereby creating a situation that not only encourages stable, thriving ecosystems and landscapes, but advances the wood production industry to a rank of sixth overall within the state's manufacturing sector. Delaware County's economy is moderately dependent on the forest industry with 10-19.9 percent of the county's total manufacturing workforce (12,517 people) involved in wood production (Canham & King, 1998).

A. Extent and Types

Forest dominates land cover within the Cannonsville Basin, representing about 70,000 - 90,000 hectares. Approximately 75 percent of the basin is forested. Of this, a substantial portion of the land area is comprised of private land. 30 percent of the watershed's land within farms consists of forests (Watershed Forestry Program, personal communication).

Delaware County watershed forests are known for their steep slopes and deep V-shaped valleys, overlying primarily sedimentary bedrock of sandstone and shale with thin, stony, acidic and medium fertility soils. They consist mainly of Northern hardwoods: beech, sugar maple, red maple, white ash, black cherry, yellow birch, red, white; and chestnut oak with some hemlock, white pine and red spruce at high elevations. Their forest growth is rapid and prolific with continual regeneration of numerous species, providing a stable atmosphere for the logging industry (Watershed Forest Ad Hoc Task Force, 1996).

Forests play three roles within the Cannonsville basin from a phosphorus perspective. A portion of basin forest land is actively managed for wood products (i.e. silviculture). It is rare for phosphorus to be added to this land except for trace amounts from the atmosphere; however phosphorus already present in plant and soil forms can escape from land to water if there is a net loss of organic matter or when soil erodes. Most of the rest of the basin's forest land is unmanaged or used for very low intensity recreation (such as hunting and hiking). Few or no products are extracted and there is little human traffic apart from paved roadways. This land yields the lowest amount of phosphorus per unit of land area of any type in the basin, representing a "background." The final forest type is quite small in land area but can be very important per unit of area -- managed riparian buffers are designed mini-forests that take advantage of the ability of forest ecosystems to filter sediment and accumulate nutrients in biomass.

The relative proportions of actively managed and unmanaged forest land are not derivable from summarized land use data available to this project. For silvicultural forest land, transient land disturbances meriting BMPs cover only a few percent of the total managed land in any given year; timber harvests from a given plot typically occur at 10-20 year intervals (NYS DEC, 1998) and rapid-reestablishment of new trees would limit the duration of a disturbance.

B. Estimated Phosphorus Loadings

Among all land uses in the watershed, unmanaged forest land yields the least amount of phosphorus and sediment runoff per unit area, with very minimal soil erosion and transport. Managed forest land can yield more phosphorus and sediment per unit area if standard BMPs are not applied, but the small extent of significantly disturbed managed forest land limits the overall significance of forests as a phosphorus source.

Table 8.1 summarizes three generations of NYC DEP estimates of phosphorus loadings from forest land. (There are no distinctions drawn between actively managed forests and unmanaged forests in available phosphorus loading estimates.) As with the agricultural loading estimates, the newest estimates -- those using the GWLF model -- are considered to be much more complete in their coverage of phosphorus due to the calibration to river sampling data that represent high flow conditions much better than earlier sampling did. The higher total loading number in the newer work does not represent an increase, it represents a greater degree of completeness of sampling.

Table 8.1 NYC DEP Phosphorus Loading Estimates from Forested Land

Source	Overall total phosphorus loading	Forest total P loading (kg/yr)	% of total loading	Total forest area (ha)	% of basin in forest	Unit area total P export (kg/ha/yr)
Cannonsville Phosphorus Study, 1993	35,804	4,301	12.0	81,160	70	0.04
Phase I TMDL report, 1996	30,045	3,479	11.6	69,580	59	0.05
GWLF Report, 1998	46,152	10,000*	21.2	69,580	59	0.14

*lower bound; some additional groundwater loading from forests

For practical purposes, forest land offers few opportunities to reduce phosphorus loading to the Cannonsville Reservoir.

C. Relevant Best Management Practices

1. Managed Riparian Forests as BMPs associated with other land uses

"Managed riparian forest" BMPs consist of plantings of vegetation along, beside, and up-gradient of streambanks and water bodies. These are designed to minimize the impacts of soil erosion, nutrient runoff and sedimentation, as well as intercepting surface runoff, subsurface flow and wastewater, subsurface flow and deeper groundwater flows. Besides water quality benefits, managed riparian forests improve biodiversity and wildlife habitat (Ad Hoc Forest Task Force, 1996). Managed riparian forests can be applied to the following land areas:

1. Adjacent to permanent temporary streams at the edges, or up-slope from cropland, grassland or pasture;

2. Around the perimeter of ponds and other water bodies, at the edges or up-slope from cropland, grassland or pasture;

3. Around the perimeter of marshes, wetlands and other temporary or permanent open-flooded, environmentally sensitive lands, at the edges or up-slope from cropland, grassland or pasture;

4. On karst formations and any other groundwater recharge inlets, sinkholes, at the edges or upslope of cropland, grassland or pasture.

Newly established forests can act as temporary sinks, constantly drawing up and sequestering nutrients within plant biomass, for later removal by logging. Several mechanisms work to enhance sediment retention and nutrient uptake within streamside forests, most importantly reduced water flow from forest litter obstructions and contact with the forest floor's porous soil structure, vegetation, and organic matter. Since the majority of total phosphorus is bound to soil particles, forest buffers that trap sediment considerably reduce total phosphorus loads. Only a few percent of attached phosphorus is able to filter through a properly designed riparian forest.

Managed riparian forests require periodic maintenance to prevent the development of concentrated flow channels. These short circuit the forest; the forest floor is what provides the "treatment."

2. BMPs for Silvicultural Forest Land

The following Information is taken from NYC DEP's*: Potential Nonpoint Source Pollution Control to Achieve Phase I TMDLs Allocations in New York City Water Supply Reservoirs (1997),* and from NYS DEC's *Silviculture Management Practices Catalogue for Nonpoint Source Pollution and Water Quality Protection in New York State (1993).* Consult those sources for details about BMP design and effectiveness.

- **Planned Harvest Operations:** Programs where consideration is given to the soil (type, depth, and characteristics), slope gradient, and water resources of individual

forestlands to constrain the spatial extent and intensity of a proposed harvest, in order to control erosion and nutrient losses. This practice requires additional time for planning, but it improves the overall efficiency of the proposed harvest while protecting water quality. Tactics may be tailored to the sensitivity of nearby water.

- **Access Routes/Road Water Management:** Proper design and maintenance of logging roads and skid trails is crucial to minimizing soil erosion and sedimentation from forestland. The recommended BMP reduces roadway erosion by 50 percent and also improves the efficiency, maintenance, and cost of road construction and hauling operations. Road management and planning should be a primary focus in logging decisions.

- **Watercourse Crossings:** Water crossings should be avoided if at all possible. They are prone to be a short inlet for nonpoint source pollution. However, stable structures can be constructed across waterways to allow temporary logging access to minimize erosion impacts. The structures can be culverts, bridges or fords equipped with runoff diversion devices. Prior to any construction a thorough analysis must be conducted to evaluate harvest operations, vehicle needs and natural resource implications. The design of these structures must consider wildlife impacts such as fish spawning and migration. All disturbed lands must be stabilized immediately after water crossing structures are removed and installed. Routine maintenance inspections should be performed periodically to remove any sediment/debris and secure crossing structures.

- **Sediment Barriers:** Usually silt fences and/or straw bale dikes are constructed near a disturbance to reduce the velocity (detain) sheet flow (limit the inlet of sedimentation of the land).

- **Vegetation Establishment/ Revegetation:** Planting of vegetation along landings, skid trails and road slopes to prevent severe erosion and nutrient transport to water bodies (can reduce soil loss by over 90 percent). The procedure not only reduces sediment loss put promotes wildlife habitat and can be implemented with fast growing plant species and then trees and shrubs.

D. Special Programs

1. Watershed Forestry Program

The Watershed Forestry Program was established by the Watershed Agricultural Council (WAC) to provide forestry planning and management ("Watershed Forestry Plans") to forestland owners, whereby trained foresters tailor management practices and their implementation to landowner goals and the Watershed Agricultural Program's (WAP) water protection efforts. The program's main objectives are: to protect reservoir

water and retain forestland by helping forest owners maintain the profitability of their forested land to ensure that forestland will be sustained and continue to protect water quality.

"Watershed Forestry Plans" are 100 percent cost- shared through the WAP. The service is entirely voluntary and is provided to those who have ten or more acres of forest. These plans are prepared by certified consultant foresters and then inspected by DEC foresters. They comply with all Federal Forest Stewardship guidelines and contain several provisions for the protection of soil and water resources. Currently the success rate of these plans has been positive, with 5,136 acres of private lands within the Cannonsville basin approved for plan development.

Lennox Forest, Delancey (Delaware County) is the first watershed demonstration site promoting a shared management approach to forestland management.

2. USDA's Conservation Reserve Program

This program is designed to ensure the health and productivity of private forest lands within the basin, through demonstration, education, assistance and incentive. Having the ultimate goal of maintaining and promoting the preferred land cover identified for water quality protection within the NYC watershed.

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Chapter 9.
Toward Managing Phosphorus in Delaware County

A. Living within Phosphorus Limits

Point/non-point source trading is one potential solution to Delaware County's phosphorus difficulties. Since the largest portion of phosphorus output in the County comes from non-point sources, trades between point and nonpoint sources could offer significant reductions. However, such trading may be greeted with great reluctance by municipalities and businesses in Delaware County, none of whom benefit from water quality improvements in the Cannonsville Reservoir.

Attempts are being made in several watersheds in the U.S. to establish trading programs between various sources of potential water contamination with variable success. The following briefly discusses some issues and experiences as a basis for trading that may be considered in Delaware County in the future.

1. Case Studies of Trading Programs

Several case studies illustrate the possibility of reducing pollution through point/non-point source trading. While these programs are fairly new, they do provide Delaware with a variety of trading methods and frameworks. After a careful look at these programs, it is possible to speculate about what methods might be a realistic choice for Delaware County.

Cherry Creek Basin, Colorado

As of December 1996, the Cherry Creek Basin Authority of Colorado was in the process of developing guidance for trading in the Basin. Point/non-point source phosphorus trading has been allowed since 1985, but no trades had occurred by December 1996. Approximately 80 percent of the Basin phosphorus load comes from non-point sources (a similar situation exists in Delaware County), and point/non-point source trading is considered one option to address this problem. The Cherry Creek Basin Authority, the key institution in this trading program, has broad responsibilities and powers for Basin water quality management. The Authority's Board of Directors includes representatives from two counties, two cities, two towns, and seven water and wastewater special districts; seven ex-officio members represent regional, state, and federal watershed protection organizations.

The Authority plans to engage in Authority project trades and private project trades. Four Authority projects for phosphorus reduction in non-point sources have already been completed, and credits from these projects will be placed in a "Trade Pool."

Private projects for phosphorus reduction in non-point sources will be reviewed, and credits for these will be placed in the "Trade Pool" as well. Dischargers may purchase these credits provided they meet certain basic requirements. As of December 1996, this program had not yet been tested.

Lake Dillon, Colorado

Point/non-point source trading has been permitted in Lake Dillon since 1984. Lake Dillon completed a few point/non-point source phosphorus trades as of December 1996. In 1984, the Dillon control regulation established a 1 kg: 2 kg trading ratio between point and non-point sources. This regulation also specified what information point source discharge permits should provide during a trade: a record of the credit amount, specified construction requirements for non-point source controls, monitoring and reporting requirements for non-point source BMPs, and operation and maintenance requirements for BMPs.

The Summit County Water Quality Coordinating Committee coordinates the Lake Dillon trading program. The Committee identifies potential BMP projects and distributes phosphorus credits. Furthermore, the Committee reviews all activities in the watershed that may potentially impact water quality, and reports to the State Water Quality Control Commission on Lake Dillon trading and other water quality management efforts. The Lake Dillon trading program is an example of a simple administrative structure, where trading is organized and overseen by a dedicated group. Lake Dillon has maintained high water quality for over twelve years, despite population growth and development.

Tar-Pamlico River, North Carolina

The Tar-Pamlico Basin Association's (TPBA) trading strategy has been developing since 1991. TPBA is composed of 14 point source dischargers. This strategy establishes an annual loading cap of nutrients for the Association as a whole, and treats the Association as one unit for nutrient reduction purposes. As a group, the Association may purchase non-point source reductions as nutrient offsets (members may also trade with each other in a point/point fashion). Two nutrients of concern are nitrogen and phosphorus. The cost of offsetting credits is $29 per kilogram, and the Association pays the state agriculture cost share fund, which supports the installation of BMPs. These credits are good for between three and ten years. The State Division of Soil and Water Conservation inspects BMP implementation and performance.

More is known about recent developments in Tar-Pamlico than in the previous two areas. In fact, statistics have been obtained that show the progress of the Tar-Pamilco effort between 1991 and 1997 (see Table VI.1). This table illustrates credit accrued by TPBA during 1996 and 1997 for nitrogen loading reduction.

Since 1991, trades of this sort have helped to reduce total nitrogen discharges from 392,527 kg to 325,223 kg: a 17.2 percent decrease. Phosphorus has been reduced

even more dramatically, with the total dropping from 63,158 kg to 36,232 kg: a 42.6 percent decrease. Tar-Pamlico has been able to remain below the trading cap for the seventh consecutive year. Both dischargers and water quality officials alike seem to be pleased with the results of the program. Paul Blount, Basin Association Technical Committee representative, remarked, "It seems to be working as we, the dischargers, and the Division of Water Quality Personnel had envisioned."

2. Trading Arrangements between Phosphorus Reductions and Additions

In the short term, while the Cannonsville Reservoir remains in "phosphorus restricted" status, within the MOA framework the County has no choice but to implement some type of trading arrangement if it sees a need to expand the capacities of village wastewater facilities beyond currently permitted limits. Under the MOA, this requires that there be a 2:1 or 3:1 ratio between old loads reduced and new loads added. As part of its short term tactics, County entities would implement phosphorus load reductions at existing sources as early as possible, then accumulate such reductions until needed to offset a proposed increased loading from a wastewater facility. Further, the County program would not look only at locations near to villages potentially needing additional wastewater capacity when considering places to reduce loadings. It matters little to the reservoir whether a kilogram of phosphorus originates in Stamford or Beerston. Since the reductions may be implemented before they would be needed for any trade, and at places possibly unrelated to locations needing to add phosphorus, some mechanism is needed to pool reduction credits, hold them until needed, and apply them where needed.

For any sort of watershed trading program in Delaware County, the possibility of a formal watershed phosphorus "accreditation" of the reductions achieved should be explored. Rather than two parties trading directly, trading partners could participate in a pool that could offset proposed increases in discharge of P against the pollutant reductions. The value of such a trade is determined by TMDL development. A watershed trading system, in exchange for some consideration, enters into binding legal agreements with sources implementing pollution controls. The arrangements could be regulated by a State authority, but can also be run by a public, private, or nonprofit entity.

The most complicated job of a watershed arrangement engaged in trading involves setting prices for reduction credits. When setting prices, any arrangement should consider:

- Availability of non-point pollution load reduction opportunities in the watershed.
- How other non-point pollution control programs will affect this availability.
- Costs of administrative arrangements and unexpected costs associated with pollution control measures over time.

- Technical feasibility and time constraints of developing multiple pollution control programs simultaneously.

Various concerns are associated with watershed trading arrangements. Pollutant trading was initiated in the context of the Clean Air Act, but unfortunately this concept has not been very successful. In air pollutant trading, credit banks are supposed to be useful as marketplaces where credit buyers and sellers can trade at minimal cost. However, air pollutant banks have not promoted trading, and firms have not deposited many credits. The uncertain nature and value of the banked credits may be contributing to this lack of interest. Regulatory policy changes can devalue or eliminate credits, and limited credit-life means that credits may disappear before they can be used.

3. Accommodating New Phosphorus Sources

A key challenge for Delaware County involves new sources of phosphorus. In particular, the MOA does not allow for the implementation of new surface discharging wastewater treatment plants or expansion of existing surface discharging wastewater treatment plants in phosphorus restricted basins, except under stringent trading conditions. Under the phosphorus pilot offset program, fairly strict regulations are set governing possible trades between wastewater treatment plants and other sources (including a 1:3 phosphorus trading ratio). A general phosphorus trading program for Delaware County would probably not be most successful following these guidelines. However, Delaware County may have to initiate additional trades to accommodate new businesses. Is it feasible for a point/non-point source trade to take place under the conditions of the phosphorus pilot offset program?

A recent development in Wayland, Massachusetts suggests that such a trade is possible. In late September 1998, EPA approved a first-of-its-kind "pollutant trading" permit for an office building complex in Wayland. Congress Group Ventures, the developer, is redeveloping a former Raytheon manufacturing facility. When Congress Group Ventures approached EPA last year about obtaining a wastewater discharge permit for its office complex, EPA denied their request, saying that the Sudbury River was already too degraded. Now, EPA, the Town of Wayland, and Congress Group Ventures have made a deal; instead of installing more expensive wastewater controls at the office building, the developer will help repair leaking septic systems on two-dozen neighboring properties. Wayland has been trying to reduce bacterial pollution into the Sudbury River, which is mostly coming from outdated septic systems. This trade presents an opportunity to replace the septic systems with sewers. Participants seem fairly enthusiastic about the agreement. The President of Congress Group Ventures remarked, "The end result is a unique and creative solution for addressing a series of complicated problems. I'm especially pleased that we're going to be able to ultimately improve the water quality of the river." John DeVillars, EPA's New England Administrator, called the effort "an example of regulatory flexibility at its best."

The conditions surrounding the Wayland trade seem quite strict, but the developer will still save money in the process. The permit is based on a 3 to 1 trading ratio for phosphorus. In practice, this means that the plant will be limited to discharging 0.125 lb/day of phosphorus, while being required to reduce loadings by at least 0.375 lb/day. Furthermore, the permit requires that all sewer connections be in place within two years, and mandates an overall reduction of 80 percent in phosphorus discharges. The developer must also complete a special technology study and implement recommendations for even further reductions. Nevertheless, Congress Group Ventures' costs will be substantially reduced. Implementing wastewater controls at the office itself would cost much more. Both economic and environmental benefits seem likely to come from this agreement.

It is still questionable whether Delaware County can achieve something similar. The agreement here to repair old septic systems is rather unique, and a comparable option may not exist in Delaware County. Notably, the MOA already provides for extensive septic system repair, and these reductions are not usable in the phosphorus pilot offset program. Finding another non-point source option that would work as effectively may be difficult. However, the recent activities in Wayland shed a hopeful light on the situation. The agreement in Wayland shows the importance of coordination between key officials when negotiating a trading option; similar coordination and cooperation will be essential in Delaware County.

4. Action Planning Considerations

Any action plan for Delaware County in the realm of point/non-point source trading must address many concerns. There are many options to consider, and many difficulties in the realm of watershed trading. Responses to EPA's Draft Framework for Watershed-Based Trading indicate what the County should keep in mind if it proceeds with the following efforts.

a. Regulatory Concerns

After reviewing the EPA Guidance Document's section on point/non-point source trading, different groups expressed concerns about some of the regulatory aspects of the plan. Environmental groups would like to see additional water quality monitoring to demonstrate compliance (specifically, responsibility should be made a NPDES permit condition). Dischargers feel trading should not result in harsher compliance requirements than not trading would. Various agencies are concerned non-point source monitoring might incur many additional costs. Any trading program, then, would need to set clear guidelines for monitoring, and should be mindful of what is appropriate for point source discharger responsibility. The most economic system of managing non-point sources should be a goal.

b. Accountability and Enforcement Concerns

Environmental groups commenting on the Guidance Document feel that accountability should either be included in NPDES permits or in State regulation of non-point sources. Dischargers and others felt that too much burden was being placed on point sources. The feeling was that any point/non-point source trading program should be sure to focus on effective non-point source regulation, to avoid making the point source owners too dependent on uncertain non-point source controls.

Under a watershed Pilot Phosphorus Offset program, monitoring and offset requirements would be incorporated into the expanded WWTP's SPDES permit.

c. Institutional Concerns

Various groups thought that the Guidance Document did not give enough attention to how trading opportunities might be identified. Others were concerned that it might be difficult to access information about which non-point sources are trading candidates. Some thought that federal and state agencies should play a greater role in identifying trading partners. Clearly, any trading program needs to establish a strong, centralized information keeper.

B. Delaware County Program Needs

Certain general needs are common for any point/non-point source trading program. First, guidelines for trading should be established, which can involve setting a TMDL for a county or region, and setting some sort of trading ratio. In the case of Delaware County, the MOA includes such guidelines: New York City is developing TMDLs, and the trading ratio for a pilot phosphorus program has been set at 1:3 kg. Point/non-point source trading in Delaware can be developed in the context of the pilot program (thus adopting the 1:3 ratio), or may be developed as a separate plan (thus enabling a different ratio to be set). Thus, Delaware County has already made progress towards completing the first step. Other needs, which the County has not yet begun addressing, are as follows: technical understanding and support, information management and dissemination (including tracking and documentation), facilitation and brokering, and supportive research.

1. Technical Support to Communities

Technical issues must be considered when trading point sources with non-point sources. First, in order to predict effects on water quality, involved parties will need an

understanding of how non-point source loadings behave relative to point source loadings as they enter a waterbody. Point sources discharge loads continuously at specific points, while non-point sources have varying concentration and are released intermittently. Communities and businesses will need assistance when looking at relative locations of trading partners and trying to determine impacts on receiving waters. Broadly, these issues can be thought of as "spatial considerations."

"Temporal considerations" should also be examined. Point source loadings are somewhat predictable, and are thus given daily and monthly average limits in their discharge permits. Non-point sources, on the other hand, can be more random and variable, for they are more likely to be influenced by daily and seasonal weather conditions. Non-point sources usually increase loadings during rainy seasons and decrease loadings during dry seasons; since point sources loadings are relatively greater during dry season, it is critical (when trading) to estimate loads coming from a point source during low flow periods. Trading partners will need to develop an understanding of these temporal issues.

Finally, communities and businesses will need to be educated on "chemical considerations." There may be chemical differences between the same pollutant coming from a point source and a non-point source. Pollutants from point sources usually reach waterbodies in a dissolved form; other pollutants from non-point sources can be attached or absorbed to sediment when they reach water. Involved parties in a trading program in Delaware County will need to learn about what this means for point/non-point source trades.

Thus, technical assistance is especially necessary for point/non-point source trading. Involving non-point sources means that guidance about BMPs should be provided, especially when non-point source owners are trying to instill these practices themselves. A separate group may need to be solicited in Delaware County for providing this guidance: a potential candidate is the NYS Department of Agriculture & Markets. Perhaps AEM can be of use here.

2. Information Clearinghouse

Managing information about possible trading partners is crucial. Potential traders should be cataloged by a centralized service. Candidates for operating such a service include regulatory agencies, resource management departments, watershed groups, trade organizations, and non-point source organizations. Management in Delaware County might be best accomplished at the county level, since local groups have easier access to information about potential trading partners in their area. As far as non-point sources are concerned, help could be solicited from Agriculture & Markets in identifying where BMPs are needed. GIS might also be able to play a role. Other options for conveying information include local newspapers, existing environmental and association publications, trading-specific newsletters, and electronic bulletin boards.

After a trade is completed, the information management organization(s) will also have the responsibility for tracking and documentation. Feedback must be provided to regulatory agencies and natural resource managers to ensure that the trade has been consistent with water quality objectives. In addition, this feedback is necessary for keeping the trading partners list up-to-date, as well as for reference in future trades. Information to track and pass on includes: parties to a trade, number of loading reduction credits available/needed, terms of a trade (type of arrangement, price, ration, monitoring/maintenance conditions, etc.), location and type of point and non-point sources, and type of management planned or implemented.

The information management group(s) could also serve as the facilitator/broker for trades. A facilitator or broker will probably be necessary for conducting point/non-point source trades. Rather than directly dealing with non-point sources themselves to make the actual trade, point sources would most likely prefer to go through a third party. The facilitator or broker should be familiar with the participants and the issues involved and should be willing to give traders a measure of independence. Candidates for facilitators/brokers include watershed associations, conservation districts, nonprofit groups, private firms, and some government agencies. A fairly localized organization is probably needed in Delaware (which means the DEP would not be a good candidate). Perhaps one watershed group, committed to overseeing the entire process, could coordinate these efforts; this group could manage information and act as the facilitator/broker. The "group" could be a combination of smaller watershed groups or organizations specially formed for this project.

The key component of this strategy is establishing an administrative structure: how can a trading program in Delaware County be instituted? Who will establish, operate, and oversee the program, and how will they do this? Without a clearly defined institutional framework, successful trading will not be possible.

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CWT # Ex 9

Delaware County Action Plan DCAP II for Watershed Protection and Economic Vitality

May 2002

Delaware County thanks all who contributed to this revision of DCAP

See Acknowledgements – Appendix D

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DCAP: Executive Summary

Under Section 18-83 of the Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources a Comprehensive Strategy was developed to meet the needs of the county as a result of the Cannonsville Basin being designated a phosphorus-restricted basin. The Delaware County Action Plan (DCAP) is that comprehensive strategy.

DCAP Mission: To assist the county's residents, farmers, businesses, and communities in meeting water quality parameters and objectives without loss of opportunities for economic vitality.

Specific Goals: To successfully accomplish that mission, two specific water quality goals were identified. These objectives are:

1. Institute specific contaminant reductions for individual management sources of the contaminants;
2. Meet overall basin level goals of contaminant load reductions such as the operational goal of reducing phosphorus by 10,000 kg/year.

DCAP Management Components: To reduce pollutant loads associated with phosphorus, pathogens and other contaminants, DCAP addresses the management needs of the following components:

- Basinwide stormwater and drainage management
- Comprehensive precision farm nutrient management
- Improving septic systems and septage disposal
- Erosion control and phosphorus reduction through stream corridor protection and rehabilitation

Note: *DCAP assesses and determines the management needs of these components comprehensively within their basin-wide context*

DCAP Institutional and Operational Procedures: There are five key features:

1. DCAP establishes and is based upon a credible and sound scientific foundation.
2. Planning, management and evaluation depend upon sound quantification using extensive monitoring and modeling.
3. It is conducted cooperatively with the partners to the MOA, complements and enhances other watershed programs, and is transferable to other watersheds.
4. DCAP is locally led and has developed county based technical capacities.
5. Within the terms of the Memorandum of Agreement (MOA), fosters voluntary participation and management by local governments, landowners, residents, and businesses.

Accomplishments to-date:

- DCAP has completed a comprehensive quantified assessment of the Cannonsville Reservoir Basin.
- DCAP has established an operational goal of reducing phosphorus by 10,000 kg/year.
- Through work associated with DCAP and other sources, DCAP has identified agriculture as the most significant source of phosphorus.
- A management plan for each of DCAP's components is now being developed and implemented.

DCAP is demonstrating that a locally led watershed program is economically frugal and comprehensively effective in protecting water quality.

I. Introduction

Delaware County has great natural beauty and resources, with a rich heritage and culture. Its attractions make it an appealing location in which to live and work. It also has fine recreational amenities. It was the pristine waters that attracted the City of New York to view the Catskills, and Delaware County in particular, when searching for water to quench the ever growing thirst of its residents. Years passed, and presently watershed towns now must meet water quality standards in an effort to maintain the high quality water supply that New York City is accustomed to.

The protection and enhancement of water quality in the New York City Watershed depends upon the cooperation and efforts of the communities and residents of the watershed. Under the Surface Water Treatment Rule (SWTR) of the Safe Drinking Water Act (SDWA), to avoid filtration requires that the "public water system must demonstrate through ownership and/or written agreements with landowners within the watershed that it can control all human activities" (Federal Register 2000). The New York City Watershed Memorandum of Agreement (MOA) provided that control and is the mechanism that allowed the United States Environmental Protection Agency (EPA) to grant a Filtration Avoidance Determination (FAD). Involvement of local stakeholders in meeting the TMDL requirements of the Clean Water Act is also a necessity recognized by EPA. Therefore, under both the Safe Drinking Water Act and Clean Water Act, local agencies and communities have a significant role in watershed protection.

Under the New York City watershed regulations, Delaware County was faced with a prohibition on the expansion or building of new Waste Water Treatment Plants (WWTP) with surface discharges in the Cannonsville Basin of the New York City watershed. This prohibition created a clearly negative impact on economic vitality and opportunities for growth.

The negative economic consequence of the regulations on a major section of Delaware County, created the circumstances under which the county was compelled to take action under one of the variance provisions for its own economic well-being. The county chose Section 18-83 of the New York City Watershed Regulations as it provides for new WWTPs or the expansion of an existing WWTP. As a practical matter, only by complying with Section 18-83 can the county create the most flexibility in complying with the regulations in a phosphorus-restricted basin, protect water quality, and address its economic objectives. Under section 18-83 a Comprehensive Strategy is required in a phosphorus-restricted basin. The DCAP is that comprehensive strategy. While the greatest water quality challenges face the Cannonsville Reservoir basin due to its designation as a phosphorus-restricted basin, there are parallel needs and opportunities elsewhere in the Delaware and Susquehanna watersheds. Indeed, it appears appropriate to consider opportunities for a County-wide DCAP and for possible advantages in sharing regional interests.

This is the first revision of the DCAP. The DCAP is an evolving program and this revision reflects the changes made, achievements of this writing and recommendations for the near future. The DCAP reflects the efforts of many watershed partners and Delaware County is thankful for the continuing commitment of its partners to implement DCAP. DCAP is consistent with the spirit of the MOA and other watershed programs that advocate

the importance of maintaining and enhancing water quality, economic vitality and the social character of the watershed.

II. New York City Watershed Objectives

The overriding objective of the New York City rules and regulations, and watershed protection programs is to protect public health by providing safe drinking water to over nine million residents in and around New York City as required under the SDWA - SWTR.

In the landmark MOA between New York City and upstate communities it is recognized that "the goals of drinking water protection and economic vitality within the Watershed communities are not inconsistent". The parties further declared to "cooperate in the development and implementation of a Watershed Protection program that maintains and enhances the quality of the New York City drinking water supply system and the economic vitality and social character of the Watershed communities" (MOA 1997).

The DCAP mission and objectives are consistent and compatible with the protection of public health and enhancing the local economic vitality and social character.

III. DCAP Mission, General Goals, Specific Goals and Time Frame

A. DCAP Mission

The mission of DCAP is to assist the county's residents, farmers, businesses, and communities in meeting water quality standards and objectives without loss of economic vitality.

B. General Goals

1. To reduce phosphorus loading to, and phosphorus concentrations in, the Cannonsville reservoir to improve water quality and for relief from the phosphorus restrictions.

2. To establish and sustain DCAP as a watershed management program to ensure that the Cannonsville remains below phosphorus regulatory thresholds.

3. Provide technical resources and information to assist community leaders in sustaining home rule related to water quality, economic and social concerns affecting the community and the water supply.

4. To assist the non-regulated community in reducing NPS phosphorus loading.

C. Specific Goals

There are two specific goals necessary for successfully meeting the operational goals of DCAP:

1. Institute specific contaminant reductions for individual management sources of the contaminants;

2. Meet overall basin level goals of contaminant load reductions such as the operational goal of reducing phosphorus by 10,000 kg/year.

- Delaware County developed benchmark operational goals for phosphorus reduction to guide decision-making. The average load of phosphorus (P) from non-point sources to Cannonsville from entire basin (including Trout Creek) in "typical" loading years is approximately 48,000 kilograms per year. Based on current estimates of phosphorus loads, the interim reduction goal is 10,000 kilograms or approximately 20% of the overall phosphorous load. An explanation is provided under Appendix A of this document as to how this goal was developed.

D. Time Frame for Implementation

DCAP implementation began in 1999 and will continue for the foreseeable future. Implementation is dependent upon such factors as funding, personnel, contractors and community and county resources. The preferred implementation process is priority based.

IV. DCAP Management Components:

Management components outlined below reflect the tasks necessary to accomplish our mission, and general and specific goals.

A. MOA Context of Components

Contamination of drinking water supply may result in serious public health implications, and thus source water should be protected from pollution and therefore degradation. This fact becomes of particular importance in the New York City watershed, where unfiltered surface water, supplied by the upstate reservoirs, is provided to the 9 million residents of New York City and its suburbs. Various strategies must be implemented to ensure public health safety and drinking water quality protection.

In order to comply with the Watershed Rules and Regulations and to prevent the contamination of its reservoirs, while ensuring the economic viability of the region, the Delaware County developed its Action Plan (DCAP). This Program concentrates mostly on source water protection through control of and reduction in non-point sources of pollution (i.e. phosphorus, sediments and pathogens).

Since the Cannonsville Reservoir basin is classified as phosphorus restricted, a lot of emphasis in DCAP is given to the best management practices, which reduce phosphorus loading to this reservoir. Phosphorus has been identified in the watershed as a limiting nutrient, and an enrichment of the reservoir with this nutrient causes its eutrophication, with subsequent algae blooms and enhanced production of natural organic matter. The latter then reacts with disinfectants to form a broad class of disinfection byproducts (DBPs), some of which have been reported to cause serious detrimental health effects. Algae blooms also contribute to the increased particulate matter content, which in turn,

undermines the efficiency of disinfection. In addition, in many instances sources of phosphorus also represent the sources of pathogens, and thus reduction in phosphorus load may consequently result in pathogen reduction.

1. Phosphorus accounting

Accounting for Phosphorus Loading Reduction: The MOA provides for a pilot offset trading program for phosphorus, in which certain phosphorus reductions may be created and counted to offset increases in wastewater discharges to surface water. Although this provision may be further explored through the DCAP, the challenges it provides indicates that this may not be the favored option for the long run.

A preferable solution appears to be to achieve a favorable basin-wide phosphorus balance through aggregated phosphorus reductions, there by allowing for a prosperous local economy while protecting water quality. However, it will constitute a scientific and administrative challenge to account for non-point source phosphorus reductions as they are implemented. Unfortunately, it is likely to be many years before water quality sampling validates with complete confidence the effectiveness of the reductions through measured gains in water quality in the reservoir. Therefore, Delaware County has developed a surrogate scientific technique to measure the effectiveness of its DCAP as a basis for current management steps so the county does not depend upon and need not await future water quality sampling results. It is important to note that such estimated measures are not intended to serve as replacements for observed water quality in the reservoir. Rather the measures will guide decision making and management for point and non-point sources. By this procedure, the lag between land management and measurable effects on water quality will not defeat the necessity for immediate management decisions. The observed and estimated effectiveness by which reductions in phosphorus are accumulated will also expedite making desirable iterative adjustments in management decisions and policies over time.

From the perspective of the watershed communities the offset options direct very limited time and resources in communities, where only small amounts of phosphorus runoff are produced, to an administrative process that does very little to reduce phosphorus, is difficult to administer, implement, and handcuffs communities when opportunity for economic vitality comes to the forefront. Although intended to provide options to communities, when discussed at the local level the offset programs are perceived to serve no purpose other to regulate for the sake of regulation. The process, protocol and time frame for acquiring an offset is not readily clear to watershed communities. As understood today, it could take 18 months to obtain approval on an offset pre-application. This uncertainty is not compatible to businesses that may wish to expand or establish themselves in the watershed in a timely fashion and obviously can put them and the region at a competitive disadvantage. We propose a concerted effort by watershed partners to reduce non-point source phosphorus as a much more constructive and productive pursuit for water quality than that of offsets. In the interim we propose that a dialogue begin to clarify and streamline the offset process. In light of the time-lapse between implementation of Non - Point Source (NPS) practices and resulting improvements to water quality below current regulatory thresholds the offset options are an important tool that should be improved.

2. Multiple barrier approach to risk reduction

Under DCAP we have adopted a multibarrier approach to addressing potential pollutants. The barriers utilized are, the Initial Source Barrier, the Transport Barrier and the Stream Corridor Barrier.

The concept of barriers used in DCAP is equivalent to that used in the NYC Watershed Agricultural Program, which itself was inspired by an analogous concept in water supply regulation. A "barrier" is a deliberate pollution prevention or control measure between an original pollutant source and a location where pollutants can cause harm. In the US, water supply consumers are protected from pollutant sources via one or more of three "barriers": watershed protection, filtration, and disinfection. These work in series -- a pollutant which evades a watershed protection barrier may still be trapped or destroyed by a later, second or third barrier. DCAP's barrier concept applies between pollutant sources and stream channels. The *Initial Source* barrier attempts to prevent a pollutant from being introduced into the environment in the first place. This may mean complete containment or it may mean having people and their sources generate less of the pollutant in the watershed. The *Transport* barrier attempts to impede the movement of a pollutant within the environment. For example this could be a stormwater treatment system that removes pollutants before stormwater enters a stream. The *Stream Corridor* barrier attempts to remove pollutants at the edge of the stream. A riparian forest buffer is a classic example.

B. Stormwater and Drainage Management

DCAP continues to develop its comprehensive approach to stormwater management. For ease in expressing our approach this section is presented as Community Stormwater and, Highways and Stormwater for planning and implementation. A third section contains our research, monitoring modeling and evaluation needs of stormwater management in the basin.

By far the greatest load of phosphorus and other contaminants is transported to the reservoir during periods of high flows. Treatment of stormwater, and reduction of peak flows during floods, may offer substantial benefits in phosphorus reductions. Stormwater and flood management systems also offer significant collateral economic benefits especially if incorporated in a wider economic revitalization program. Such benefits include: the direct funding support provided to the business or municipality to implement the systems, landscaping projects, a main street revitalization projects undertaken in conjunction with the creation of the infrastructure required for stormwater or flood management. Stormwater management strengthens the Transport barrier and may contribute to the Stream Corridor barrier.

Photo courtesy of the Department of Economic Development

1. Community stormwater

Goals:

- The county seeks to be part of the dialogue with the New York City Department of Environmental Protection (DEP) and the New York State Department of Environmental Conservation (DEC) for overall administrative procedures, guidance, and prior acceptance of technical standards and specifications adopted under flexible regulatory rules. We seek inclusion in the regulatory negotiations for establishing standards for performance standards and BMP standards.

- To assist small businesses and residential owners in identifying non-complying regulated activities (NCRA) and assisting them with the registration process of the Non-complying Regulated Activities Program.

- Support communities in the Cannonsville Basin. Continue to identify and adopt stormwater pollution prevention measures and specifications that can be used with existing structures or impervious surfaces in village centers and hamlets to reduce phosphorus and improve stormwater management.

- Assist communities who wish to develop a Stormwater Protection Plan for the purposes of acquiring a waiver from Section 18-39 of the rules and regulations.

- Complete a community by community assessment of stormwater management needs and opportunities. This is underway. The assessment provides information regarding: existing stormwater systems, identification of point source discharges of stormwater, identification and stormwater yield calculations of community's sub-basins, opportunities for identifying and promoting large scale municipal stormwater projects as a basis for 'main street revitalization' projects.

- Assess and apply options for the creation of amenities (such as landscape designs incorporated into the projects) or other benefits potentially available to businesses and communities in developing the stormwater/flood management projects.

- The maintenance of the BMPs will be based on a maintenance schedule developed by the Planning Department derived from the GPS and GIS work begun in 2001. Additionally, the county through a combination of grants and the local tax levy has purchased a vacuum truck to maintain these and other stormwater practices where possible.

2. Highways & stormwater

Road design, condition and maintenance have a bearing on the potential pollutant load originating from the roads in the Cannonsville Basin. Road maintenance practices, such as the application of sand, cinders and salt for public safety and the cleaning of ditches to ensure proper drainage create opportunities for accumulation and transport of sediment and pollutant loads to adjacent water courses. It is recognized that roads and the associated stormwater structures also serve as a conduit of pollutant delivery originating from contiguous land uses.

Phosphorus loading from the different road surfaces is estimated at approximately 3,911 kg/yr of total phosphorus of which 1,737 kg/yr is in the form of dissolved phosphorus (McIntyre 2001). This represents less than ten percent of the total load but is still a significant source of phosphorus to address due to the phosphorus restriction.

Depending upon funding, an in-depth evaluation, pollutant loading calculation, and recommended Stormwater Management Practice (SMP) designs and maintenance procedures will be provided for several characteristically "critical" roadways, with the results of this work shared with local highway superintendents, town supervisors, local, state, and federal agencies that effect highway design, construction, and maintenance. The long-term steps are outlined below:

- Inventory/Assessment

  The Delaware County Department of Public Works (DPW) has already completed an inventory, assessment and priority list for the county highways. Contingent upon available funding, the DPW will now begin conducting the same for towns that would like to participate. Resultant county and town data will be converted and stored in the county GIS database. The long term goal of this process will be a Highway Management Plan (HMP). The HMP is an inventory of all roads and stormwater structures within a town, an analysis of the condition of the road and accompanying stormwater appliances and watercourse crossing structures, prioritized list of roads to be addressed and recommendations as to how best address any substandard conditions.

- Municipal Plan Development

  At the conclusion of a HMP for each town or respective county highway, the DPW, contingent upon funding, will develop a ten-year plan for each town and county highway that identifies and prioritizes areas for implementation of SMPs.

With limited resources it is only prudent to develop a comprehensive plan for identified priority areas.

- Maintenance of Current Road System

  Maintenance of roads includes the application of materials for public safety including sand, cinders and salt. Sand, for example, accumulates in the culvert and requires maintenance removal every few years. The removal results in dislocation of the soil and the potential for erosion. An assessment of alternative means of road maintenance and ice and snow removal is ongoing.

- Roads as Conduits of Pollutant Delivery

  Delaware County intends to integrate the planning process with town/village roads. Delaware County will conduct planning with the use of the spatially distributed model under development as part of DCAP for identifying priority areas within the Cannonsville watershed. Highways are conduits for stormwater drainage for or to surrounding land. This will complement the HMP Program.

- Local Capacity Building

  It will be necessary to develop institutional arrangements and capacity within towns to assess potential load reductions from town roads and provide training to Town Highway Superintendents on road maintenance. The DPW will utilize the GIS database and relevant modeling methods to assist in the assessment of potential load reductions. Equally important will be the development of a program to work with towns to address phosphorus management on their roads and implement SMPs. Since town roads represent the largest surface area of roads in the Cannonsville Basin, this element is essential to the success of the program. Again, this is a complementary component to the HMP Program.

- Implementation of Pilot SMPs

  As an initial effort, Delaware County would like to install SMPs identified through the HMP program in areas in close proximity to the reservoir and streams that have an obvious potential for contributing to the phosphorus load in the reservoir. These pilot projects would include the development of monitoring sites to evaluate of the impact of the SMP. The DPW with the assistance of the Planning Department, will input the monitoring data into the county GIS database. Relevant modeling methods will be used to assess the impact of the SMP. These projects will serve as a learning tool for customizing the SMPs for the roads in Delaware County.

3. The scientific needs for stormwater management

- Characterize and quantify the contributions from various types of stormwater runoff urban/impervious sources, such as storage facilities, parking lots, dirt roads, and highways, in the Cannonsville Reservoir basin as a basis for planning and designing projects. An important concern is the extent to which stormwater runoff is a source of not only phosphorus, but also pathogens.

- Continue work underway to determine relationships between main categories of urban/impervious areas and the quantity and quality of

runoff/stormwater/floodwaters generated by such land uses in the basin to establish guidelines.

- Continue work ongoing to establish the scientific basis for developing comprehensive village stormwater projects.

- Identify and adopt specific BMPs in impervious areas/stormwater projects according to appropriate quantified design criteria. Bovina, Walton, Delhi and the municipal solid waste facility are examples of where this has been done.

- Critically examine the efficacy and applicability of BMPs to provide treatment to reduce both particulate and dissolved phosphorus so these reductions can be documented as progress towards the desired favorable phosphorus balance in the basin. Funding has been received to construct stormwater BMPs that hold potential as offsets at WWTPs. The county is currently seeking funding to monitor the BMPs. A critical need is to establish a consistent administrative protocol for collection, analysis and then documentation of the reductions with DEP for expansion at WWTPs.

- Assess benefits of the phosphorus controls applied in reducing other contaminants that would otherwise affect water quality of the reservoir. The County Scientific Support Group (CSSG) has discussed this.

- Assess best management options for attenuating and retarding floodwaters to reduce phosphorus and other contaminant loadings and explore incorporating such measures in selected projects. Integrate stormwater and flood management within the proposed comprehensive stream corridor management program for the Delaware West Branch system to obtain extra protection from pollution at the stream corridor.

- Develop and make readily available the scientific rationale and evaluation of each project as it is developed, implemented and demonstrated.

Recommendation: Secure funding for planning, implementation, monitoring and scientific efforts from the Catskill Watershed Corporation, federal, state and local sources.

C. Nutrient Management

The use of acronyms runs rampant regarding nutrient management and causes confusion so the definition of three acronyms are outlined below to alleviate confusion with DCAP efforts and the corresponding support of the nutrient management team from Cornell.

1. CFNMS = Comprehensive Farm Nutrient Management System. Our view is that it represents a more holistic systematic approach to nutrient management that we use in this document. It is our opinion that it represents a new standard for nutrient management.

2. CUNMPS = Cornell University Nutrient Management Plan System. Essentially this is the same as the CFNMS. For the purposes of this document we use CFNMS to avoid confusion with third acronym below. The CUNMPS is only used in the component section entitled: "Scientific Development and Support for Comprehensive Farm Nutrient Management Systems." Portions of that text are authored by Professor Dan Fox, of Cornell, the architect of CUNMPS and cuNMPs and we present his text as written.

3. cuNMPs = Cornell University Nutrient Management Plan Software. This integrated software package ties together the components of the CFNMS.

A history of phosphorus accumulation in agriculture

Agriculture has been identified as the largest source of phosphorus loading in the Cannonsville Basin. Delaware County farmers have a strong ***documented*** stewardship record with regard to implementing conservation practices. Clearly farmers have not purposely created a problem, so why and how has this come about?

There are a variety of reasons that help explain how this has transpired. It is important to note that the history of accumulation on the farm is a long one, complex and the solutions to reverse the status are not immediate. Most, if not all, are unintended consequences of economic survivability in highly competitive industry. Productivity gains in agriculture equal or exceed those of any industry. In fact, the genetic potential of many dairy cattle exceed the ability to meet all their nutrient requirements in early stages of milk production. The increases in productivity and efficiencies was and is driven by consumer demand for cheap food and subsequent federal policies that support that demand. In the past, the federal government subsidized the application of phosphorus on the land to increase crop productivity. This helps explain why years later idled farmland may still be a source of phosphorus. The increases in productivity of dairy cattle, noted above, resulted the need for increased purchases of grain from outside the region to support increasing milk production. The imported grains used to meet nutrient requirements can contain far more phosphorus than is needed for both milk production and crop production. The net result is accumulation on farms and a larger pool of phosphorus that can release from farms in runoff. An additional reason for accumulation is that farmers have traditionally balanced their crop's nutrient needs based on its nitrogen and not phosphorus requirements. Mass Balance on dairy farms illustrates the accumulation of P on farms. This is common throughout the northeast and farms in the Cannonsville Basin are consistent with this. Mass balance for phosphorus has shown that approximately 70-80 percent of the annual phosphorus inputs remain on the farm. This issue was clearly understood in the Ad Hoc Task Force Discussions on Agriculture in the New York City watershed (1991). These negotiations led to the formation of the Watershed Agriculture Program (WAP). Adding to the problem is a belief that still exists on some farms that extra phosphorus be fed as insurance to assure successful reproductive performance. Fortunately, there are viable options that can help mitigate the challenge of phosphorus reduction.

General agriculture objectives

Agriculture is a very important industry in Delaware County. The DCAP recognizes this and developed initiatives to, at minimum, sustain agriculture and hopefully enhance its

value while addressing water quality concerns. Dairy farming constitutes approximately 80% of agricultural sales in Delaware County. Our estimates show that Delaware County farms represent 80% of the dairy farms in the New York City watershed area. The Cannonsville Basin contains approximately 80% of all dairy farms in the NYC watershed.

DCAP goals focus on large pools of phosphorus where opportunities for broad phosphorus reductions exist that lead to relief from the phosphorus restriction and may hold potential for offsets. DCAP initiatives for agriculture originated over concerns in the Cannonsville basin but are developed with the entire county in mind. DCAP initiatives for agriculture are voluntary, incentive based (where possible), locally administered and ultimately can benefit farmers with minimal interference in the farm operation while providing technical support and reducing nutrient and pathogen loading. How we address this is discussed later.

Institutional overview

The DCAP framework for addressing agriculture phosphorus issues is highly integrated. The county is looking to Cornell Cooperative Extension staff of Delaware County to develop the integration of multiple components with Cornell University faculty and presumes a partnership with the Watershed Agricultural Program (WAP) to implement some components.

The Watershed Agricultural Program (WAP) is a New York City funded program established for the delivery of water quality practices on farms for the protection of the New York City water supply. The Watershed Agriculture Council (WAC) is the governing body of the WAP program composed of farmers, local agribusinesses and DEP. The WAC subcontracts with Delaware County agencies, the Soil and Water Conservation District (SWCD), Cornell Cooperative Extension of Delaware County (CCE/DC) and the USDA/Natural Resources Conservation Service (NRCS) for the technical, administrative and subject matter expertise to develop and implement whole farm plans including the design, engineering and implementation of best management practices and they represent the necessary partners in the WAP. The WAC's primary water quality objective is directed towards pathogen management.

Despite the many successes achieved by the WAP regarding nutrient management to date it has not addressed the long term accumulation of nutrients on farms, especially phosphorus. Such accumulation of nutrient is as the root of the nutrient management challenge in the northeast dairy industry, and especially in the Cannonsville Reservoir basin. Through the development of a Comprehensive Farm Nutrient Management System (CFNMS) we intend to raise the standard for CFNMS. Currently, in the New York City watershed, nutrient management plans are being conducted at the same standard as every place else in New York State. We suggest here that integrating the work of DCAP and WAP that the standard can be raised for one of the most critical water supplies, in the United States. These combined efforts can set the stage for continued voluntary approach to nutrient management.

Having said this, it is important to recognize that the WAP has set as a goal to implementation Comprehensive Nutrient Management Plans (CNMP), (NRCS 590), on

90% of its farms using the Cornell University Nutrient Management Planning software (cuNMPS) - Cropware. In April of 2002 the WAC adopted a policy that addresses the importation of surplus phosphorus in purchased concentrates and mineral supplements. Also structural BMPs have been implemented that will have a positive impact on P loading. For example, recent work conducted by United States Department of Agriculture - Agriculture Research Service (ARS) on Town Brook concluded that milk house filter strips are effective year round (Gburek 2001). This is a highly soluble form of phosphorus that can now effectively be kept out of streams. However, balancing for phosphorus on crops is the largest challenge and will not become a viable possibility unless combined with the forage systems, manure management on and off farm and also linked to the adoption of precision feeding on the farm. We refer to this as the Comprehensive Farm Nutrient Management System (CFNMS).

CFNMS components

Continuing work under DCAP demonstrates the application of the *cu*NMPS significantly reduces imports of phosphorus and nitrogen to the farm by 25 percent or more. This remarkable management result is achieved by using CFNMS. The *cu*NMPS software for precision feeding methods in conjunction with improved manure nutrient management and forage production on the farm fosters efficient recycling of nutrients in the soil, and diminishes losses of the nutrients to watercourses. Improved forage management also reduces the need for imports of nutrients to the farm. Finally, by avoiding excess applications of nutrients in manure, or by not applying manure on frozen soil, or in other hydrologically sensitive areas, farmers can further reduce very significantly reduce the risk of losses of nitrates, total and dissolved phosphorus, and pathogens, to watercourses. The CFNMS can also provide significant economic benefit to the farmer. Cumulative benefits can greatly reduce levels of phosphorus and nitrogen in drainage water and runoff from the farm thereby achieving pollution prevention combined and may provide economic gains for the farmer.

As the cuNMPS software supporting precision feeding, forage systems management and manure nutrient management is being developed at Cornell University, it is proposed that Cornell Cooperative Extension staff in partnership with Cornell University faculty develop the CFNMS and lead the development of the cuNMPS software and provide training to Whole Farm Planners within the WAP program to integrate whole farm forage systems management planning with the current manure nutrient management planning underway in the WAP.

Components of CFNMS:

1. Reducing the import of nutrients to the farm through precision feeding.
2. Enhancing the recycling and re-use of phosphorus and nitrogen on the farm through comprehensive farm forage system management.
3. Avoiding excess applications of phosphorus and nitrogen in manure to farm fields through manure management.
4. Ongoing scientific development.

1. Reducing the import of nutrients to the farm through precision feeding

Objective: To reduce phosphorus excretion through the reduction of phosphorus purchases in the form of mineral supplements and purchased concentrates. This directly reduces the Initial Source leading to an improvement of the mass nutrient balance on farms and reduced phosphorus accumulation on the farm.

The proposed precision feeding program will build upon the experiences in this area under the DCAP Phosphorus Reduction Through Precision Feeding Program – Project 1 initiated in 1999 in the Cannonsville basin. The program will focus on reducing nutrient imports on to dairy farms by reducing purchased feed imports and utilizing more homegrown nutrients in the dairy diet. The proposed program will seek however, to work more closely with the feed industry and will retain the feed industry's present role as herd nutritionist in making dietary changes. The results of this work primarily serve the long term objective of reducing phosphorus concentrations and total P load below regulatory thresholds in the Cannonsville reservoir. This project will provide the technical, scientific and practical basis to ensure confident adoption and implementation by farms and dairy nutritionists of precision feeding principles on farms across Delaware County, the surrounding region and the recently adopted WAC policy. The project will also be done in cooperation with the AEM program.

Program and results: Currently four farms in the Cannonsville Basin continue to cooperate in developing an implementation, demonstration/education and applied research project to document the effectiveness of this approach. The work is being conducted by CCE/DC in cooperation with Cornell under the New York State Agriculture Environmental Management (AEM) umbrella. Data is collected and analyzed with regard to phosphorus content of forages produced on the farm. The forage contribution to the diet is balanced with purchased concentrates to meet the requirements of the dairy cows.

The results are impressive, this project demonstrates that phosphorus excretion can be reduced 25% or more without affecting production. This is accomplished through reduced mineral supplementation and/or reduced phosphorus concentration in the purchased grains. These results are quantified and have been implemented on dairy farms.

Recommendations: Currently the project involves four farms. We recommend that project be expanded to 10 or more farms broadening the scope of demonstration. This does two things. First, the implementation and acceptance of this approach would be enhanced by a larger number of farmers participating. Second, also it would involve a broader audience of private sector of feed companies and dairy nutrition consultants. We recommend a three year program for this project to adequately transition into the private sector. It is the norm to have the feed industry provide dairy nutrition services to the farm community, as it requires more frequent interaction with the farmers than the public sector can provide. It is also the norm for Cornell Cooperative Extension staff to bring land grant information to the private sector for adoption. Delaware County recently received a Watershed Enhancement Assistant Program (WEAP) grant to pursue this work.

The proposed program will facilitate the feed industry in this role by assisting in the gathering of farm data, providing feed analysis, and provide nutritional consultation and training when needed. In addition to these roles, the program will document P reductions achieved on farms, facilitate the development and implementation of the reduced dietary P strategies on farms, and continue to develop and augment usage of the Cornell Net Carbohydrate and Protein System (CNCPS), the dairy cattle management software component of the cuNMPS. Additionally the program will, as part of its research and development focus, explore and develop new and emerging precision feeding initiatives, such as a dairy herd replacement precision feeding program.

The program is organized around a core staff of a Precision Feed Specialist and technician(s). These personnel will be employed through CCE/DC. The number of technicians will vary according to the number of farms under taken in the project (1 technician per 20 farms), which will in turn be a function of the availability of funding resources. Cornell University staff in the Department of Animal Science will be employed in the development and usage of the CNCPS in coordination with the watershed based staff.

It is proposed that the program be implemented in phases, with the first phase consisting of a pilot phase to further refine the precision feeding process as it engages the feed industry and more farms in the NYC watershed. This pilot phase would initiate with a minimum of 10 farms and function over a 3 year period. The delivery of this program should carried out in collaboration with the WAP educational efforts.

It is anticipated that knowledge acquired in this effort will eventually be a standard component of balancing rations on farms and may yield economic benefits on some farms depending on changes that may be made in the current feeding regime. The net result of implementation is a neutral or positive impact on farm finances.

The proposed program can be summarized as follows.

1. Engages feed industry in their current ration balancing role with their clients.
2. Employs CCE/DC dairy specialist to manage program and work with feed industry in implementing P reduced rations.
3. Employs technician(s) to work with specialist and feed industry in gathering data on farms.
4. Employs Cornell University to further develop, test and train feed industry on CNCPS software.
5. Begin implementation with a pilot program involving 8-12 farms.
6. Development of further precision initiatives such as a dairy herd replacement program.
7. This program would eventually be extended to more farms in the basin following modification of the process as developed in the pilot implementation phase.

Photo courtesy of Keith Porter

2. Enhancing the recycling and re-use of phosphorus and nitrogen on the farm through comprehensive farm forage system management

Objective: To improve nutrient cycling within the farm boundary and reduce nutrient loss from the farm through management of the homegrown forage crops. This objective contributes to reducing the Initial Source barrier and the Transport barrier leading to improved mass nutrient balance and reduced phosphorus accumulation on the farm and subsequent risk to runoff.

Program and results: Forage system management is the logical next step to integrate with and enhance Precision Feeding. It also links crop nutrient planning and precision feeding. Improved or highly intensive forage system management leads to improved forage quality, which in turn leads to more forage consumption and less purchased concentrate or mineral supplementation. This work was initiated through DCAP under a Safe Drinking Water Act grant. The work is nearing completion and there are indications that:

1. There is a significant potential for improved phosphorus cycling on the farm with corresponding reductions in imported phosphorus.
2. Under intensive forage management phosphorus content of the forages increases. This allows for decreased mineral P imports in feed as the result of increased crop removal of P from soil.
3. Through the use of different forage systems phosphorus losses to the water can be reduced.
4. These reductions are quantifiable.

5. The unique feature of this is that DCAP is demonstrating and quantifying water quality benefits while enhancing the economic strength of the farming community.

Proposal discussion: Through the implementation of a phased pilot project it will be further demonstrated how the objective of this component can be achieved. It will be accomplished through a greater removal of soil P by crops and producing improved quality of homegrown forage that will allow for greater inclusion of homegrown nutrients in dairy cattle diets on the farm thereby reducing the need for imported nutrients. Additionally, this component will seek to implement forage management techniques that will reduce loss of nutrients from the farm via erosion runoff and leaching. This component primarily serves the long term DCAP goals of relief from the phosphorus restriction and maintaining water quality below those thresholds in the Cannonsville Basin.

This component is related to the third component of the program, manure nutrient management, in that manure nutrients are applied in supply of crop nutrient requirements. However, the comprehensive farm forage systems management addresses many façets of forage management beyond crop nutrient supply, such as forage crop species selection (which impacts soil erosion and hence nutrient loss, soil nutrient removal by crops, as well as animal feeding management), fertility management (which impacts nutrient applications and removals and animal feeding management), and harvest management (which again impacts crop nutrient removals as well as animal feed management) among others. New technologies and management strategies will offer many other opportunities to impact nutrient cycling on the dairy farm.

Recommendation: CCE/DC specialists will work with farmers in a "one on one" basis to assess the forage system on their farms and determine the opportunities to improve nutrient cycling on their farms, help these producers assemble strategic and tactical plans to realize these opportunities, and then assist in the implementation of these plans. As forage produced on the farms becomes part of the feed inventory for the dairy cattle on the farm, it is logical that these farms participating in whole farm forage system planning would also be participating in the precision feeding program, in order to fully realize nutrient cycling benefits.

A forage systems management program will need to begin with a pilot phase (Phase 1) to develop, test and refine the planning and implementation process, as this process is not as well defined and is more complex than the precision feeding program. Modeling and documentation of the affects of various forage management strategies on the nutrient cycles of the farms will be facilitated through further development and use of the cuNMPS software. Cornell modeling specialists involved in the development of the cuNMPS will work side by side with CCE/DC forage planning specialists in developing and implementing forage management plans, assisting in the adoption and refinement of the cuNMPS.

The institutional needs for implementing a basin wide program will be examined. The proposed farm forage systems management program could be implemented in phases in accordance with funding availability. The development and testing of this program will

be conducted through CCE/DC, Cornell University and the New York State Agriculture Environmental Management program. Given that nutrient management plans would be

highly integrated with forage systems management, it would be most appropriate to develop a program and administrative process with the Watershed Agricultural Program in the New York City watershed for the purposes of transitioning the implementation of the program to the farming community.

This program was developed with the idea that it potentially operate as an incentive based program in which farmers, if funding was available, could receive financial assistance to make voluntarily changes in their forage systems. The transition costs to different forage systems will vary from farm to farm and costs will vary widely as well. However, through this project we will better understand what will be required to make the transitions. The following is a summary of the proposed comprehensive farm forage systems management program.

1. Begin process development and pilot on 10 farms (hopefully in conjunction with the same ten farms demonstrating precision feeding).
2. Employ CCE/DC crop specialists and Cornell University CUNMPS software team in developing and piloting the whole farm forage systems planning and implementation process, including development of software planning tools and their application in the field.
3. Will engage the CCE/DC specialist in integrating precision feeding strategies on these farms and assisting with process development.
4. Develop new initiatives as technologies emerge.
5. This program will eventually be extended to more farms in the basin following development and testing of the planning process.
6. Determine administrative and institutional needs for delivery.
7. Train whole farm planners to use Forage System Management in the Whole Farm Planning Process.

3. Avoiding excess applications of phosphorus and nitrogen to farm fields through manure management

The proposed manure nutrient management component would include the work that is currently being conducted in nutrient management planning under the WAP. This includes the manure nutrient management plans as they relate to crop nutrient needs and farm hydrologic conditions, which addresses nutrient loss via timing of spreading and soil nutrient accumulation in individual fields (manure nutrient distribution). The proposed nutrient component would go beyond manure application management to also include options for manure nutrient export from the farm and watershed.

The current manure nutrient management program implemented by contracting agencies in the WAP, is already established and should continue to provide nutrient management planning for watershed farmers. Manure application plans need continual updating as crop conditions change in order for them to be useful to the farmer. For this reason a viable and responsive team of specialists dedicated to the development and maintenance of manure nutrient planning, using the cuNMPS Cropware software for manure nutrient application planning is critical.

On farms that are participating in the whole farm forage systems management program, it is logical and necessary that there be a very close working relationship between the manure nutrient applications planning and the whole farm forage systems planner. The whole farm planner performing the manure nutrient application planning on farms may in fact be the same person conducting forage systems planning due to the integration needed for both components.

The usage of cuNMPS Cropware software by Cornell Cooperative Extension Planners in the WAP represents perhaps one of the most widespread uses of this software in New York State. As a state of the art tool that incorporates the best science, this is of great benefit to the stakeholders in the NYC watershed. Further refinements and adaptations of this software as a result of its application on farms in the NYC watershed will be not only likely, but useful for its continued usage in the watershed. Support will be provided to Cornell University to work with nutrient planners in applying this software and making future refinements.

Manure Management Component

1. Manure nutrient application planning continues as it has evolved under the direction of CCE/DC Staff and the Natural Resource Conservation Service (NRCS) as part of the WAP.
2. Employ Cornell University for continued development and training on cuNMPS software.
3. CCE/DC forage systems specialist continues to interface with and provide guidance for current program, assisting in the adoption and implementation of the Cornell Cropware software.
4. We propose that the CCE forage systems planner would most likely work with a WAP whole farm planner responsible for manure and nutrient management planning on cooperating pilot farms.
5. This program needs to integrate firmly with the whole farm forage systems management program long term.
6. Develop new initiatives as technologies emerge.

Proposal discussion: Manure redistribution, removal, treatment, and use is a key component to improving water quality in the Cannonsville Reservoir. This initiative was identified in the Ad Hoc Policy discussion regarding agriculture (1991) as critical to decreasing nutrient loading to the water supply. This component would evolve directly from the nutrient management work that is currently being conducted in nutrient management planning under the WAP. This includes the nutrient management plans as they relate to crop nutrient needs and farm hydrologic conditions, which addresses nutrient loss via timing of spreading and soil nutrient accumulation in individual fields (manure nutrient distribution). This component would go beyond manure application management to also include manure nutrient export from the farm and watershed, such as through a composted product derived from either an on farm or centralized compost facility. This effort contributes to improving the success of the transport barrier.

Early work conducted under DCAP and funded through a WEAP grant, indicates that one option to reduce the loading of phosphorus specifically in manure appears to be

adopting a manure management system that may include composting. The study shows that manure export via composting has the potential to significantly reduce P loading to the

Cannonsville reservoir. From a water quality perspective the form of manure exported is irrelevant. Opportunities for the export of raw manure will also be explored as well. In fact exports of small amounts of raw manure may hold potential for offsets as well. Manure management is therefore a key nutrient management strategy of the CFNMS. Management of manure nutrient through a compost process, if managed properly, may also provide the benefit of destroying pathogens. This component would serve both the short and long term objectives of DCAP. It bears repeating that participation by farmers in any manure P offset program would be voluntary.

Recommendation: Develop a business plan to determine the actual costs associated with implementing manure management strategy. In the event a business plan is implemented, it is anticipated that the WAP would incorporate this into their "tool box" of options to meet nutrient management thresholds.

A DCAP Business Plan for Manure Management Strategy is being compiled under DCAP, which includes capital and operating costs based on local data. This committee includes participation from a variety of watershed partners. The main components of that study are outlined below and are continuing to develop.

Business plan outline

1. Marketing compost.
2. Determining where the excess manure is.
3. Composting alternatives to evaluate, associated infrastructure and farmer needs.
4. Offset development.
5. Administration of this project and drafting the work-plan for Army Corps.
6. Determine post project long term oversight/administration of offsets and implementation.

4. Scientific development and support for comprehensive farm nutrient management systems

(A reminder here that Dr. Fox's text uses the CUNMPS acronym where we use CFNMS.)

Software Development: Of critical importance is the continued development of the cuNMPS package of software. Professor Danny Fox (Animal Science, Cornell) leads a team in the development of such software. Below is a summary of who is involved and a history behind the development of the software.

Project Leaders: Danny Fox (Department of Animal Science), Karl Czymmek (PRO-DAIRY), Quirine Ketterings (Department of Crop and Soil Sciences), Tom Tylutki, Greg Albrecht and Caroline Rasmussen (Department of Animal Science).

Collaborators:

- CALS Integrated Nutrient Management Program Work Team (CALSINMPWT)
- New York State Water Resources Institute
- Cornell Cooperative Extension of Delaware County
- New York City Watershed Agricultural Program

Background: In 1999, the United States Department of Agriculture (USDA) and Environmental Protection Agency (EPA) released guidelines for developing Comprehensive Nutrient Management Plans (CNMPs) for Animal Feeding Operations (AFO) to protect water quality from non-point sources of pollution. New York State (NYS) has developed the Agricultural Environmental Management (AEM): initiative to protect water quality from agricultural pollution and, thereby, address USDA and EPA guidelines for comprehensive nutrient management. The NYS Soil and Water Conservation Committee is responsible for the development, coordination, and establishment of policy for the AEM initiative. The state AEM Steering Committee is responsible for recommending policy to the aforementioned committee, generating a statewide plan of work, and developing training programs and materials to implement the policy and plan of work. Program work teams at the county-level, comprised of local Cornell Cooperative Extension (CCE), Soil and Water Conservation District (SWCD), Farm Service Agency (FSA), Natural Resource Conservation Service (NRCS), and Department of Environmental Conservation (DEC) personnel, are then responsible for implementing the state policy and plan of work. The primary tools developed by the state AEM Steering Committee for applying AEM policy have been the guidelines and worksheets that define a five-tiered approach to the planning and implementation of CNMPs. As outlined in Tier 3B, the CNMP should provide the strategies and tactics for environmentally and economically sound agricultural production based on the recommendations of the land grant university (Cornell University) and partnering agencies in NYS. Most livestock farms in NYS will be expected to develop a CNMP, so implementing and refining efficient mechanisms for the delivery, application, and evaluation of such recommendations will greatly assist in the development of effective plans and the protection of water resources.

Because of the complexity in accounting for all of the variables involved in developing a workable CNMP and to insure the use of Cornell recommendations based on the best science available, the state AEM committee strongly supported the development of the Cornell University Nutrient Management Planning System (*CU*NMPS) to provide a software system for use as a common standard in developing Comprehensive Nutrient Management Plans on farms in NYS. Three members of the AEM committee, NRCS, Dept. of Agr. and Markets and DEC, provided the financial support for the development of the *CU*NMPS. This software package, comprised of two computer programs, is being distributed at no charge to all CCE, SWCD, and NRCS field staff, as well as any other interested parties in NYS. The combination of both herd and crop nutrient management programs allows the *CU*NMPS to be used for improving on-farm nutrient recycling and profitability. Within the *CU*NMPS, the Cornell Net Carbohydrate and Protein System (CNCPS) software enables the user to develop progressive animal nutrition plans to maximize nitrogen (N) and phosphorus (P) use efficiency across the herd by reducing both nutrient inputs associated with purchased feeds and nutrient excretion from livestock. Also within the *CU*NMPS, the Cornell Cropware program enables the user to allocate manure and fertilizer nutrients based on soil type, crop requirement and environmental risk

indices. The Cornell Cropware program contains equations and coefficients needed to implement Cornell nutrient management guidelines for meeting crop requirements with manure and inorganic fertilizer nutrients. The software also allows for the assessments of P runoff risk, via the NYS P Index, and N leaching loss, via the NYS Nitrogen Leaching Index. Recommendations and nutrient management plans generated using Cropware are designed to comply with NRCS standards.

The next step needed to successfully implement the *cu*NMPS in the New York City Watershed Agriculture program is to provide the training and support for implementation of this software to reduce non-point source pollution from agricultural activities on NYS livestock and field crop farms. Such a step includes the following:

1. Implement the Cornell Nutrient Management Planning System on as many farms as possible in the New York City Watershed and provide training and support for users of the software. Implementing both the herd nutrition and crop and manure nutrient management software will reduce nutrients entering the farm gate via feed and fertilizer (source control) and improve field allocation of manure through the application of agronomic recommendations, the P Index, and the N Leaching Index.
2. Utilize Case Study Farms to determine how to integrate the herd nutrition and crop components for use in developing whole farm nutrient management plans that reduce imported nutrients through an integration of precision feeding and crop/forage management programs.
3. Develop new and improved releases of the software based on user feedback and continuing research. Included will be record keeping and crop rotation optimization components, and to foster an increased use of the *CU*NMPS for Comprehensive Nutrient Management Planning in the New York City Watershed.

This project is supported at the University and in the field by the extension efforts of the following Cornell Programs: CALS Integrated Nutrient Management Program Work Team, CSS Nutrient Management Spear Program, Dairy Management Program, and the PRO-DAIRY Program. Animal nutritionists, consultants, agronomists, natural resource conservationists and AEM Planners across NYS, from both public and private sectors, will be provided with the results of this work and enhancements made to the cuNMPS, thus providing an outstanding grass-roots implementation effort necessary for continuing effective nutrient management in NYS.

Ongoing Science: On-farm Phosphorus and Management Studies

The phosphorus balance and associated management issues on the farm will be scientifically evaluated on pilot farms. The uniquely extensive water quality database available from the upland monitoring farm provides a basis for further research into tracking phosphorus generation and movement on that farm should they choose to continue. With agreement by and permission from the upland farm owners, field-scale monitoring along with detailed modeling would greatly increase the value of the water quality data already obtained. A major objective would be to construct a phosphorus mass balance that accounts for loads as measured by DEC at the tributary outlet of the farm. The

methodology developed through such scientific assessment would then be applied to other farms to aid in identifying critical source areas and specific management options.

These farm assessments would assist in identifying management measures to reduce phosphorus losses from the farm. The feasibility and potential advantages of precision farming techniques for improved feeding strategies, crop production, and application of manure and commercial fertilizers, would also be evaluated for farms in the basin. Management measures identified and agreed upon with the cooperating farmers could then be implemented on their farms. The assessments should also consider potential benefits in reducing pathogen and other risks. It is likely that management measures designed to control losses of phosphorus will also have significant additional benefits of controlling pathogens and nitrogen. Under certain conditions nitrogen can, for a short period of time, become the limiting nutrient for algae growth in Cannonsville Reservoir. It would therefore be helpful to perform an assessment of the reduction in risk posed by these potential contaminants.

Monitoring and evaluation

The proposed farm scale work will continue, which began in fall 1999 under an approved WRDA-WEAP grant to Delaware County. The later work will seek to change the forage resources on the pilot farms. Like the WEAP Project, however, supplementation strategies will be identified and altered (if necessary) to reduce phosphorus imports and excretion. Changing forage resources on the pilot farms explores more fully the extent to which feed phosphorus imports might be reduced on typical dairy farms. In 2002 it is anticipated that monitoring on a lowland farm will begin to examine the dynamics of another farm type.

D. Septic systems and septage disposal

Scientific needs were recently answered regarding septic system assessment include in a study entitled, Phosphorus Impacts From Onsite Septic Systems to Surface Waters in the Cannonsville Reservoir Basin, NY.

This study was undertaken to determine the potential phosphorus contributions from onsite wastewater treatment systems (OWTSs), commonly known as septic systems within the watershed of the Cannonsville Reservoir.

The glacial till soils of Delaware County, typically located in the uplands of the county have characteristics that interfere with treatment functions of conventional OWTSs. Restrictive subsoil conditions in the basin strongly favor perched water tables and thin zones of "interflow" across much of the landscape.

Based on DEP records and NRCS soil mapping, GIS analysis strongly indicate that the majority of OWTSs use effluent distribution devices of designs inappropriate for the soils in which they were installed. The problems caused by the inappropriate fit between soil characteristics and OWTS leach field design increase the likelihood of inadequate treatment of septic system effluent. This may have public health implications beyond environmental phosphorus discharges, such as pathogens transport.

Existing research has demonstrated that phosphorus is relatively immobile in soils when compared to most solutes. However, soils have a relatively fixed capacity to sorb P and, once this capacity is saturated, further P additions will advance at a rate to be determined by the interaction of effluent, soil and groundwater flow parameters.

It is estimated that existing residential OWTSs in the basin, number about 6773. Assuming a typical effluent P concentration of 5.3 mg / L, the 6773 OWTSs would produce a total of 6257 kg of P per year in their effluent. An average distance of 417 feet separates the OWTSs and surface waters. The average age of OWTSs in the basin is about 30 years (Day 2001).

Considering the estimated average OWTS age of 30 years and the generally poor fit between existing soils and OWTS designs, it would appear advantageous to have some form of regular inspection, maintenance, and rehabilitation of OWTSs in the basin. Inspection would help illuminate the magnitude of the OWTS problems, and appropriate maintenance should follow, ideally. Rehabilitation or replacement will probably be appropriate for a large portion of OWTSs, based upon the information presented here. It is recognized, however, that a dedicated program to effect regular inspection and maintenance seems unlikely to occur without some form of financial assistance to the homeowner, along with some form of assurance that inspection would not open them up to potentially large financial obligations.

Recommendation: Assure adequate funding at CWC for the replacement repair, and maintenance of OWTSs. Assist communities in the establishment of septic districts to insure reliable and adequate maintenance of individual septic systems.

E. Stream corridor protection and rehabilitation

The West Branch of the Delaware River basin above the Cannonsville Reservoir covers an area of 353.5 square miles with a total of 662.4 stream miles. Due to an array of contributing factors, there are numerous areas of unstable stream reaches that contribute to the sediment supply and associated nutrient loading within the system. Aquatic habitat is also significantly impacted.

Delaware County recognizes that major work is already planned for the management of stream corridors in the Cannonsville Reservoir Basin. Without duplicating this work, opportunities for coordination between the DCAP and this existing work, in particular with the DEP's Stream Management Program is currently being organized.

Delaware County Soil and Water Conservation District is developing a practical Stream Corridor Management Plan (SCMP) with crucial input from residents, local and state agencies, and other interested organizations to aid in managing the West Branch of the Delaware River basin in order to achieve the objectives as defined by these groups.

The SCMP will utilize a fluvial geomorphic approach for use by local agencies and residents when addressing water quality improvements, aquatic habitat enhancement, flood hazard mitigation, stream channel stabilization, and other pertinent objectives.

A GIS database and library system has been set up and organized for use in managing current data obtained from DEP and future data as it is compiled. Aerial photographs have been scanned into the GIS system and georeferenced with the current digital ortho quarter quad photographs (DOQQ's) for the main stem of the West Branch and Town Brook in Stamford. Stream edges have been identified and maps have been produced with this data for use in identifying priority areas and stable reference reaches and as an aid for stream classification. Rosgen Geomorphic Characterization for these watercourses have been completed. This process is part of the stream classification protocol that categorizes streams into specific types with similar characteristics. This information is extremely useful in developing future restoration plans and management scenarios. Riparian owners along the West Branch main stem have been identified and data based to facilitate program/landowner contact. A Project Advisory Committee has been established consisting of local agency representatives and residents to consult with the Project Team, assist in the SCMP development, to help solicit input from riparian landowners. Additionally, a public outreach effort is under development. A USGS stream gauging station has been calibrated and the information will be added to the current database for use in watershed assessments.

Recommendation: Acquire funding to implement three streambank protection demonstration projects.

Note: *DCAP assesses and determines the management needs of these components comprehensively within their basin-wide context*

V. DCAP Institutional and Operational Procedures:

A. DCAP establishes and is based upon a credible and sound scientific foundation

It is a basic tenet that the Delaware County Action Plan must be formulated on a credible, scientific foundation. Two principal issues are: The achievement of specific contaminant reductions by individual management options adopted under DCAP, and meeting overall basin level goals of contaminant load reductions. The DCAP proposes to reduce risks by applying the precautionary principle. This principle requires managing risks so that uncertainty and variability are taken into account in developing and evaluating management practices. The County Scientific Support Group (CSSG) was convened and remains actively involved in providing the necessary technical expertise for this effort. The functions of the CSSG are described in section V: D. Beyond applicable regulatory requirements, DCAP is voluntary and dependent upon the availability of funding.

All projects are collaborative and depend upon one or more of the following elements of scientific support: knowledge of basin and site-specific hydrology and loading mechanisms, use of mathematical models, and results from field, stream and reservoir monitoring. There is already a very solid foundation of phosphorus loading information gathered over many years by the DEC and an extensive water quality and quantity database for the Cannonsville Reservoir basin developed by several entities including DEP, Upstate Freshwater Institute, United States Geological Survey (USGS) and DEC. These data enable characterization of past and existing loads of phosphorus and other contaminants from the watershed and corresponding reservoir trophic conditions. In addition,

considerable modeling of the reservoir's contributing watershed with the Generalized Watershed Loading Function (GWLF) model, and the reservoir itself with the Cannonsville Nutrient-Phytoplankton model developed by Upstate Freshwater Institute (UFI), has been accomplished. These, and other, models have provided a basis for assessing future expected loads under different scenarios achieved by BMPs proposed within each implementation project of the DCAP and their potential effects on reservoir water quality.

DCAP adopts the following scientific assumptions:

- The purposes and performance of the Delaware County Action Plan require solid/scientific support.

- Quality of the NYC Water Supply depends upon identifying and reducing risks. Risk reduction will assume the precautionary principle.

- To the extent feasible, scientific support should be provided by an inter-agency group of scientists and associates with the expertise in the Cannonsville Basin, as well as those generally concerned with the New York City Watershed. This group aims to seek and maintain a scientific consensus for the DCAP as it is developed and implemented.

- The projects, and the scientific rationale underlying their selection and their technical designs, should be properly documented to advance or meet policy, regulatory or public informational needs at local, NYC, state or federal levels.

- Technical design criteria for implementation projects should be derived from calculations of risks, to provide quantitative estimates of the contaminant load reductions the projects will achieve. A key scientific step is to estimate the frequency or range of possible loadings over time associated with management practices. By defining an upper bound of the estimated range as a design level for the practice, inherent variability can be quantifiably taken into account. The design level then becomes a conservative estimate of the load associated with that practice. In calculating overall load reductions sought, the error will be on the side of underestimating the actual reductions achieved.

- As economically feasible, implementation projects should incorporate redundancy, such as multiple barrier considerations, to ensure water quality aims are met under all the design conditions for each project. This precautionary objective allows for uncertainty.

- Specific phosphorus load reductions, and other contaminant controls, achieved by implementation projects should be accounted for in terms of how they quantitatively contribute to phosphorus reductions, and to the overall phosphorus balance in the Cannonsville Basin, to the extent possible. While there is no language in the MOA or regulations to administer and implement a phosphorus credit program or a bank of documented projects

that could be used as offets, Delaware County seeks aid from DEP, the state and acceptance from EPA to develop one.

- Financial guidance and economic assessments have been and continue to be undertaken for each selected project to determine the best means of meeting the costs of implementing the projects and to yield information by which the economic costs to businesses and communities in meeting the phosphorus restrictions can be estimated.

B. Planning, management and evaluation depend upon sound quantification using extensive monitoring and modeling.

Proposed monitoring and evaluation to support DCAP

The DCAP proposes to comprehensively manage point and non-point sources of phosphorus to relieve the phosphorus restriction imposed in the Cannonsville Reservoir basin. There are very high economic stakes for the businesses, farmers, communities, and residents within the reservoir basin. It is critical, therefore, to continue with a scientifically sound management program for the basin.

In order to record accomplishments of the DCAP in reducing phosphorus loading to the Cannonsville Reservoir, establishing surrogate measures for water quality monitoring must be established and applied. There continues to be a need to identify, select, implement and record management measures to reduce phosphorus loading. Such decision making cannot be deferred while waiting for validation from long-term water quality monitoring. Ultimate validation of the success of the DCAP in reducing phosphorus, however, will be provided by water quality monitoring. It is important therefore, that the DCAP be coordinated with DEC and DEP water quality monitoring programs. This coordination function could be achieved through the CSSG.

Existing scientific foundation

A comprehensive, event-based monitoring program has been carried out on the West Branch of the Delaware at Beerston under the leadership of the DEC. The DEC is also carrying out a paired sub-basin study. This study is a sound basis for evaluating the effectiveness of management practices adopted by the WAP. There have also been high quality studies of Cannonsville Reservoir itself and a mechanistic model developed by Upstate Freshwater Institute that links load inputs to reservoir water quality. This provides the means to relate, through monitoring and modeling, the response of the reservoir to external loadings. With additional monitoring and modeling for the purpose of developing a more complete accounting of phosphorus, its sources and their distribution in the basin and in time, comprehensive management of phosphorus in the basin could be better accomplished. Hence, both residents of the basin and consumers of New York City water would be well served.

Purpose

The purpose of the work proposed is to evaluate and guide the development and implementation of the phosphorus reduction program in the Cannonsville Reservoir basin. It is critical to achieve phosphorus reductions from all significant sources of the nutrient. It is equally necessary to develop a reliable methodology for measuring and confirming those reductions in meeting the requirements of the phosphorus restriction. Such measurement and confirmation will assist in the implementation of the management program and in verifying scientifically to those concerned that it meets its objectives.

In 1995, an inter-agency Research Action Group, jointly established under the auspices of the WAP and the DEP, assessed and identified scientific needs and objectives.Particular needs included a monitoring and modeling agenda for the Cannonsville Reservoir basin. It was suggested through the group that the proposed scientific assessment of the Cannonsville basin explicitly consider a balance between four geographical scales: the field scale; the farm and community scale; the sub-basin scale; and the entire basin scale. DCAP has implemented these suggestions developed by the Research Action Group. The work at each scale will be carefully integrated to ensure a balanced use of funding and staff resources to provide the best management information achievable.

- **Field Scale.** Specific monitoring and modeling needs identified at the field scale are to ascertain levels of dissolved and particulate phosphorus under different conditions and the mechanisms controlling those levels. Of particular importance is the need to further investigate loss of dissolved phosphorus in subsurface flows. As suggested by certain research studies, this could be a hitherto significantly underestimated source of phosphorus from manured fields and possibly subsurface wastewater disposal systems. Another need is to track phosphorus movement on farms by modeling generation and transport at the field scale. This will assist in application of criteria for identifying high risk areas and in development of appropriate BMPs. The current upland monitoring farm provides a suitable site for initiating this work as DEC, through its present monitoring efforts, has in-stream load information that can be linked back to field scale studies. Also, extensive work has already been done on this farm at the field scale which can be built upon.

- **Whole Farm Scale.** Intensive monitoring of an upland farm is already being conducted by the DEC under contract with WAC. The value of the information being obtained shows the desirability of both continuing this type of monitoring and extending it to include at least one complementary lowland farm. Lowland farm monitoring is scheduled to begin in 2002.

- **Community Scale**. It is desirable to monitor at the community scale to better quantify contributions from and urbanized area. Stormwater monitoring has been conducted but in a recent peer review of the SWAT model at Cornell it was recommended that more be done to make the database supporting SWAT more robust.

- **Sub-Basin Scale.** It is highly desirable to give high priority to installing additional stations in this basin. This will assist in completing the monitoring to provide scientifically sound and more detailed knowledge of the distribution of the principal

phosphorus sources, their impact spatially and in time, and the effectiveness of management measures to reduce the levels of phosphorus released by the sources. Town Brook is already being monitored at its outlet by DEC and at its headwaters by USGS.

- **Entire Basin Scale.** There is already a major monitoring station at Beerston just upstream of the reservoir on the West Branch. It is recommended that this site be continued for the long-term. Automated sampling has begun. Beerston, however, only accounts for 80% of the entire Cannonsville Reservoir basin. Trout Creek drains most of the remaining 20%. Monitoring by DEC of the Trout Creek Basin is expected to begin in 2002.

- **Wastewater Treatment Plants.** In the 1999 version of DCAP it was recommended that increased sampling of WWTPs in the Cannonsville Reservoir basin be undertaken to provide more accurate estimates of current and future phosphorus loads from these point sources. More frequent sampling would help account for diurnal, weekly and seasonal variations in effluent phosphorus concentrations and lead to better estimation of loads.

  From that recommendation, DEC increased sampling frequency at the Walton WWTP in October 1999 from quarterly to monthly and initiated sampling at the Delhi WWTP in September 2001. DEC now collects seven consecutive 24-hour composite samples every month at both Walton and Delhi and analyzes them for total and dissolved phosphorus. DEC also utilizes discharge and phosphorus data provided by the WWTP operators through their self-monitoring program to calculate loads. Results indicate that effluent phosphorus loads at Walton have been decreasing over time as improvements to the plant have been made. This upgrade was not online as of this writing.

  In Walton the local dairy processing plant, which pipes its wastewater to the WWTP for treatment, has recently invested significantly in pre-treatment technology. Reverse osmosis equipment for whey waste has been installed and capital investments for the implementation of a spill prevention program have been made. The Walton WWTP manager believes these changes have contributed to improved performance of the WWTP. Flow from the plant is more consistent and the Biological Oxygen Demand (BOD) load is less problematic (2002).

  We recommend that this sampling regime continue through the implementation of the WWTP upgrades and for a time thereafter to monitor the impact of the upgrades. This will assist in better defining both point and non-point sources phosphorus loads to Cannonsville Reservoir over time.

Integration and analysis through models

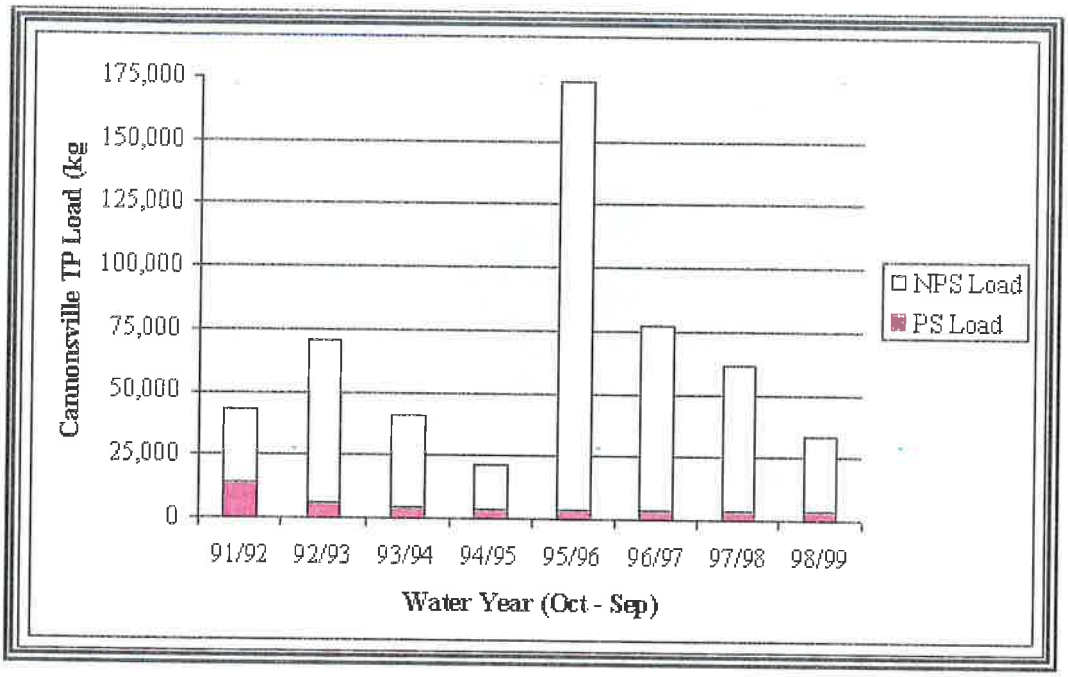
Under projects within the Delaware County Action Plan, Delaware County has adapted a watershed model for hydrology and phosphorus, and has integrated with GIS databases. At this time the set would cover at least the whole basin and sub-basin scales by the time that this proposed work begins.

- The model set would be applied and enhanced during this proposed project. Applications would include (1) the design of special studies and (2) the interpretation of the earliest data yielded from the sub-basin and community scale monitoring to relate observed stream quality to activities on land within the influencing catchments. As in the 1999 model applications, the models also serve as synthesizers of various field data for use in priority-setting and basin- and community-scale phosphorus management projects.

- One model enhancement expected during this period would include increased spatial resolution within the catchment areas whose outflow is monitored at the community scale (smaller than sub-basin). Continued monitoring at Beerston (full basin scale) would increase the database patterns in phosphorus delivery to the reservoir.

- Although point source reductions will reduce phosphorus loading monitoring data clearly suggests that point source controls will not adequately reduce the phosphorus load to the Cannonsville enough to minimize the impact of the variability of non-point source loading. Although the watershed regulations will help reduce the level of phosphorus in the Cannonsville by requiring more stringent phosphorus limits at existing wastewater treatment plants, phosphorus loading from point sources currently represents small portion (less than 10% of future predicted load) of the annual load of total phosphorus (Fig. 1). Data published by the DEC relating to phosphorus loading from point and non-point sources in the Cannonsville Basin indicate that "phosphorus loading from point sources has been steadily reduced over the last decade (the reduction was due mainly to a major upgrade of the largest facility, i.e., the Village of Walton). As noted earlier significant improvements at the local dairy plant are contributing to those reductions as well. Non-point source loads, in comparison, are large (approximately 90% of predicted load) and exhibit a considerable variability from year to year as evidenced by the low and high load years of 1994/95 and 1995/96, respectively," as illustrated in Figure 1, (Longabucco 2001).

Figure 1. Point source (PS) and Non-Point Source (NPS) Loads in the Cannonsville Reservoir



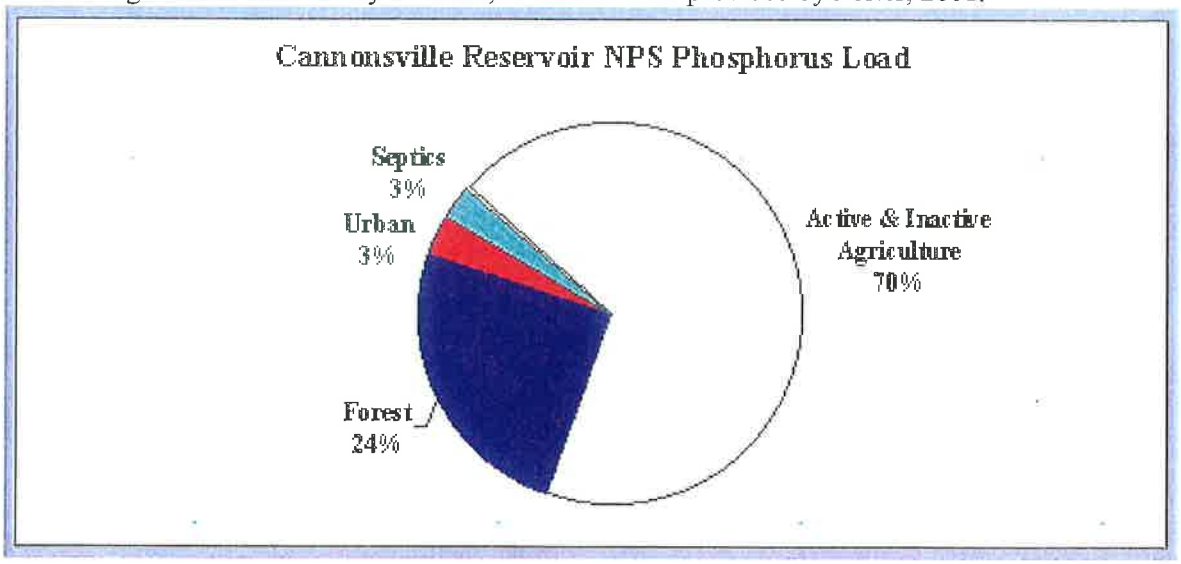
(Longabucco 2001)

Other than the upgrade of existing wastewater treatment plants (WWTPs), the other phosphorus-specific control measures required by the watershed regulations are a prohibition of new surface water discharges from sewage treatment plants and a requirement that new or modified facilities prepare stormwater pollution prevention plans for phosphorus removal. While these measures will help prevent the water quality from further degradation, they will result in little actual water quality improvement.

A rational control program for non-point source should rank manageable sources in order of potential contribution and target those for management that pose the greatest threat. Threat can be determined by the relative abundance of the source, its proximity to, or ability to, enter watercourses, and other factors. An examination of the relative breakdown of P contribution by the source to Cannonsville Reservoir in "typical" year suggest likely areas that should be targeted by the Delaware County management effort as illustrated in figure 2.

While smaller sources, such as urban areas and point sources must not be ignored, it is imperative the Delaware County management effort effectively target the most significant source in the watershed to ensure reductions sufficient enough to prevent phosphorus restrictions in the future.

Figure 2. "NPS load by land use," Data for chart provided by Porter, 2001.



Pie chart provided by Patricia Bishop, (DEC) 2001

Continued monitoring and assessment efforts are integral for a number of different purposes including:

1. Providing input for testing, calibrating and validating models.

2. Evaluating the specific goals for the county in terms of phosphorus reductions.

3. Aiding in the development of a cost-effective, targeted strategy to reduce phosphorus loads from major sources.

4. Estimating the amount of contaminants conveyed immediately from the managed site, in runoff or subsurface flows to streams, and hence to the reservoir before and after the completion of the projects.

5. Tracking changes in water quality after BMP implementation, including quantifying phosphorus reductions achieved.

Application of watershed models to select initial implementation project sites

A primary function of modeling continues to be hydrological and phosphorus assessment at the site-specific, sub-basin and basin scales. There are several candidate models that are well regarded and widely used. Several models have been developed for the Cannonsville basin through the efforts of scientists at Cornell, the DEP and the DEC. These models are helpful but do not satisfy the more detailed evaluations required for the management program proposed by DCAP. Delaware County is using the Soil and Water Assessment Tool model as the model of choice for basin and sub-basin decision making and "what if" scenarios in the Cannonsville basin and has been modified to meet the specific needs of this basin. This effort has been complemented by the evolution of GIS technology at the county level and training of county staff in its applications. Staff continue

to work towards completing GPS and GIS work to inventory stormwater systems and highways in the basin. A complete hydrological and mathematical analysis of the entire basin, combined with the requisite GIS, has required cooperation, sharing and further development of GIS and modeling resources of Delaware County, DEP, DEC, WAP, and other cooperating parties. In the work supported by the WEAP and SDWA funds, obviously important sites have been selected for implementation prior to the completion of a detailed basin-wide hydrological and phosphorus assessment. Concurrently, an assessment for targeted phosphorus management and evaluation of its results is being completed. To initiate the DCAP a 'broad brush' evaluation of the whole basin was made. For the purpose of initial selection and evaluation of project sites, detailed analyses were applied at two levels: to phosphorus source categories and to sub-basins. In particular, mathematical modeling was applied to undertake frequency analyses as a basis for specifying design criteria to be met by BMPs in each project and in accounting for the reductions in loads the BMPs accomplish.

Modeling

Modeling links with data derived from monitoring and other assessment means for the purposes of:

- Estimating the relative contribution of particulate and dissolved phosphorus forms from watershed sources at basin, sub-basin and local geographic scales, as well as from within the reservoir itself.

- Estimating the phosphorus load reduction to Cannonsville Reservoir necessary for maintaining the average in-reservoir total phosphorus concentration at or below the 20 ug/L guidance value, in the most scientifically defensible fashion possible, using the most up-to-date and accurate data and methods available.

- Identifying local critical hydrological areas in the reservoir basin, such as areas prone to flooding or which represent sources with higher risks of contaminant loss.

- Ascertaining where there are needs and opportunities to reduce peak flood/storm water flows and associated peak contaminant transport to the reservoir, and helping to determine priorities and specific sites for storm water management.

- Assisting in assessment and selection of specific sites for risk-based management projects.

- Assessing and selecting BMPs for projects where possible. Additional research may be necessary for confirming the abilities of lesser understood or new BMPs to reduce phosphorus.

- Establishing an independent basin-wide ability through a GIS platform to estimate phosphorus loads, or other contaminant loads, and to reliably

determine the cumulative reductions accomplished by all the projects so these can be recorded in the projected phosphorus balance as previously described.

C. It is conducted cooperatively with partners to the MOA, complements and enhances other watershed programs and is transferable to other watershed basins.

In the past five years, the watershed communities have learned much about how to work together on water quality issues and programs. It has also become apparent that some of the local municipal governments have the will, but they do not have the staff or budget to take full advantage of the potential funding sources for water quality protection. Catskill Watershed Corporation's role, as determined by the MOA, is to administer the MOA programs. The CWC has not been commissioned to perform long term comprehensive planning for the communities. Under the MOA, the New York State Department of State (DOS) provided planning funds for local municipalities. Those funds have been successful in helping small municipalities conduct planning for discreet projects. In order to fast track these programs and to perform comprehensive planning similar to the DCAP, we need to have the county governments take an active role in assisting the local communities in planning and coordination. The counties will provide the infrastructure for the local municipalities to perform planning; the projects will be selected and implemented at a local level; and economies of scale in planning and technical support will be provided by CWC and the counties. All of this work would be done in cooperation with the state, city and federal governments. It is also anticipated that here will be a sharing of services and expertise between counties possibly coordinated by CWC so that a successful program can be duplicated from community to community.

Although other basins in the Catskill/Delaware system are not currently phosphorus-restricted, the work and experience in Delaware County is relevant and applicable elsewhere in the NYC Watershed, potentially the state and elsewhere with similar NPS management concerns. The agricultural components of DCAP have been developed in partnership with the state AEM process and have the support of the New York State Department of Agriculture as they serve interests outside of the New York City Watershed. We seek to gain similar support from other watershed partners on other DCAP components. Therefore, it would be mutually advantageous to proceed with the DCAP cooperatively with the CWC and the WAC as a source of funds under the MOA. Sharing to avoid duplicative efforts is clearly desirable with both the WAC and CWC. Similarly, there are opportunities for Delaware County to explore taking proactive steps with respect to that part of the county within the Susquehanna River Watershed and the lower Delaware Watershed to extend the DCAP to that part of the county. By such steps the whole of Delaware County will benefit from the strategy developed through DCAP.

For its own reasons, Delaware County established the Delaware County Office of Watershed Affairs. Under the coordination of that office, Delaware County developed DCAP to reduce phosphorus and other contaminants in the Cannonsville Basin. As part of that planning process, Delaware County developed some water quality protection programs that have potential benefits across the entire watershed. At the urging of its other watershed partners, the Coalition of Watershed Towns (CWT) has introduced the DCAP concepts and programs to the other counties within the watershed. The key benefit of DCAP is that the county uses its planning and technical resources to provide the local towns and communities with the ability to plan for the future with regard to water quality. In order to take advantage of the success of DCAP and to provide comprehensive

stormwater planning for its watershed communities, these other counties could rely on existing departments. For example, in Ulster County, the primary service provider would

likely be the Ulster County Health Department. In Greene County, the main service providers could be the Greene County Soil and Water and the Greene County Planning department. Schoharie County is more likely to contract out through its planning department (potentially with other county agencies) for additional services. In particular, these other counties have indicated they want to duplicate the following:

- Comprehensive stormwater planning being performed for the hamlets and villages
- Stormwater planning along state and town roads
- Education and outreach to local towns and villages; and
- Stream restoration work being done by Greene County Soil and Water

County staff could perform the following functions:

- Educate the town/village boards on the need to address stormwater, septic and other water quality issues
- Educate the towns/villages and assist the towns and villages in obtaining funding for projects
- Assist the towns and villages in planning associated with septic and sewers
- Assist towns and villages with comprehensive planning associated with the special challenges of the watershed regulations
- Educate county officials and agencies on watershed related issue
- Educate the public relating to the watershed regulation and water quality management as suggested by the Coalition of Watershed Towns to extend, enhance and complement the educational efforts of the CWC

DCAP – NPS management, Total Maximum Daily Loads (TMDLs) and source water protection

DCAP is a comprehensive watershed management program to reduce phosphorus and other potential contaminants. It addresses NPS in agriculture and rural communities, small businesses with limited resources. It quantifies potential reductions through frugal programs and practices that reduce phosphorus loading. It has demonstrated and developed an institutional framework of multi-agency partners to foster local capacities to assist communities and agriculture.

- DCAP is a model applicable elsewhere to address non-point source load allocations in watersheds that have TMDLs, in watersheds otherwise stressed, or with other objectives to improve or protect water quality.

- DCAP has adopted an operating goal to reduce phosphorus loading from three areas: stormwater, septic and agriculture. In the area of agriculture we quantify reductions in phosphorus imports to a basin based mainly on reductions in phosphorus excretion in dairy cattle manure, the largest source of phosphorus applied to the landscape. DCAP demonstrates how to address NPS reductions in a comprehensive way.

- We have demonstrated that quantification of phosphorus reductions from NPS is possible. It can be done at relatively low cost. Very importantly the methods may result in economic benefits to those who implement practices.

D. DCAP is locally led and has developed county-based technical capacities.

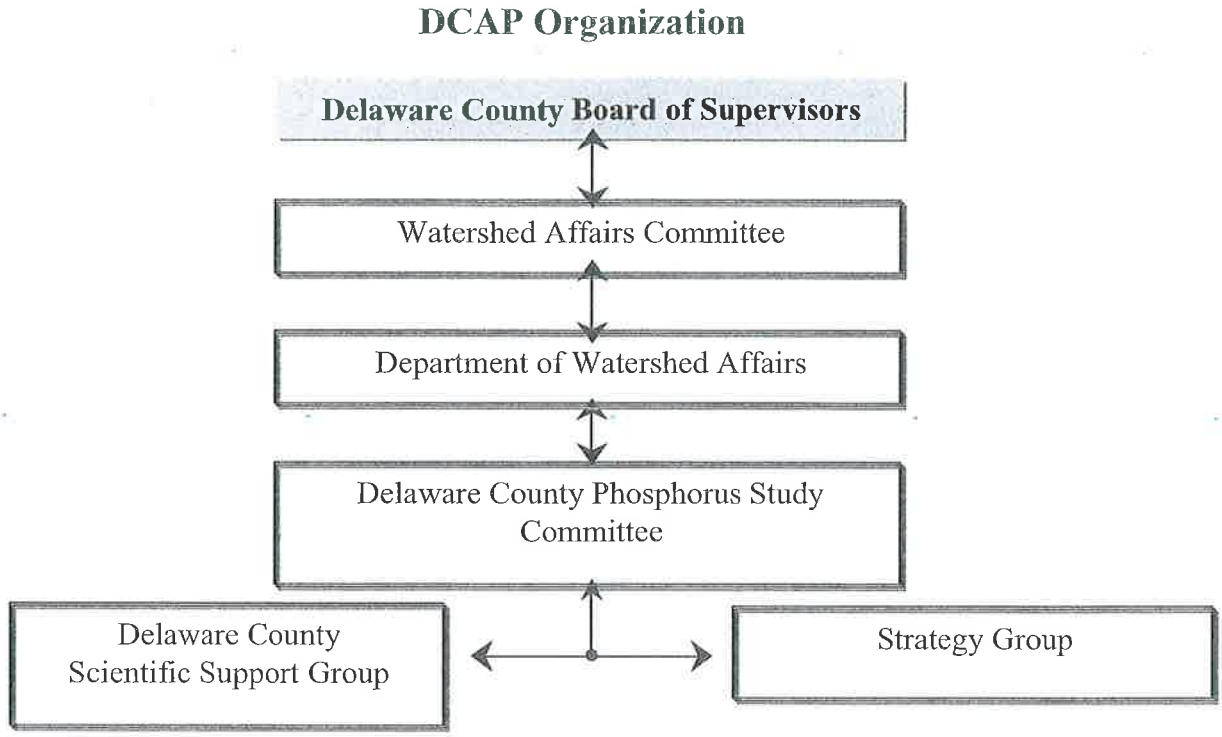
1. Organization and administration

Residents of Delaware County need technical assistance in addressing the DEP regulations. Small businesses and communities can easily become overwhelmed when dealing with the city regulations. To that end the county has, as part of DCAP, formed the Department of Watershed Affairs, added three full-time staff positions to the Delaware County Department of Planning and organized committees for the purpose of aiding residents in complying with the new regulations and meeting the goals of DCAP.

Delaware County in cooperation with the DEP and other watershed partners hopes to make compliance with the regulations more user friendly, expeditious and efficient. DEP has developed guidance materials on key sections of the Watershed Rules and Regulations and is committed to making it easier for the regulated community to understand them.

As shown in Figure 3. DCAP is under the auspices of the County Board of Supervisors, in cooperation with watershed partners. For its ultimate success, DCAP depends upon local decision-makers, landowners, especially farmers, businesspersons and other stakeholders. Full and voluntary participation of these stakeholders continues to be fostered through DCAP. Core support for county residents is provided through County Departments and County Agencies.

Figure 3. Illustrates the organizational framework for the operation and management of DCAP.



2. Committees and their functions

☞ *Delaware County Watershed Affairs Committee*

This committee consists of Supervisors appointed by the full Board of Supervisors. Its purposes include establishing and reviewing county watershed policies. In practice, the above network of committees and agencies they represent is highly effective in fostering and maintaining communication and cooperation for shared watershed purposes.

☞ *Office of Watershed Affairs*

The purposes of the Office of Watershed Affairs include coordination of the overall DCAP program, management of DCAP contracts, development of public information, and liaison to local, regional, state, federal and New York City agencies. The Office of Watershed Affairs reports to the Delaware County Watershed Affairs Committee.

☞ *County Phosphorus Study Committee (CPSC)*

The purpose of the CPSC is to provide a higher level inter-agency forum to discuss and advise the Delaware County Board of Supervisors regarding the activities and planning conducted under DCAP and to relate these activities to other aspects of the NYC Watershed Program. Its membership includes primarily state and watershed partners.

☞ *County Scientific Support Group (CSSG)*

The purpose(s) of the CSSG are to: 1) provide a sound scientific basis for assessing needs and options in the Cannonsville Reservoir basin; 2) substantiate the adoption of

preferred management measures; and 3) subsequently evaluate the effectiveness of the management options implemented review the scientific bases of DCAP. Its membership includes local, state, and federal agencies, watershed and academic partners.

☞ *Strategy Committee*

The purpose of the strategy committee is to provide the agencies or groups working on different components of DCAP to meet and exchange frank views about progress, problems and potential new initiatives or activities.

The CSSG and CPSC are scheduled to meet every month and the Strategy Committee is scheduled to meet every two weeks.

A large number of agencies groups and individuals have participated in the creation of DCAP and will continue to be engaged in its performance. Watershed partners serve on one or more of the DCAP committees and include: the Departments of Watershed Affairs, Public Works, Planning, Economic Development, the Delaware County Soil & Water Conservation District together with representatives from Cornell Cooperative Extension of Delaware County, the Industrial Development Agency, Chamber of Commerce, New York State Water Resources Institute (WRI), New York City Department of Environmental Protection (DEP), New York State Departments of: Environmental Conservation (DEC), Health (DOH), State (DOS), Agriculture and Markets (A&M), the Watershed Agricultural Council (WAC), the Catskill Watershed Corporation (CWC), Delaware County Farm Bureau and other organizations and experts.

3. Capacity building

An important output of DCAP is the building of technical capacity and scientific understanding of DCAP initiatives. This has strengthened the ability of the county to support the local constituency in managing decisions related to non-point source issues. CCE/DC, the SWCD, the DPW and Planning department have each demonstrated their capability to advance the technical and scientific understanding of issues related to reducing pollutant loading and at the same time take into consideration the needs of entire groups and communities in making decisions to reduce pollutant loading risk.

A prominent example is the work of CCE/DC in the arena of precision feeding and forage systems management. This work has demonstrated outstanding potential to reduce phosphorus importation into the basin and better mass nutrient balance on farms while providing potential improvement of finances on the farm.

A second and very critical example is the work of the Planning Department to strengthen the decision making capacity of local communities. Through the application of Geographic Positioning Systems for data collection and the subsequent incorporation into a Geographic Information System (GIS) platform they can now go to the communities and illustrate the power of using sophisticated technology in developing a comprehensive stormwater plan for the communities in the context of a comprehensive community plan. This will assist them in setting priorities for projects.

The purpose of Delaware County's GIS is to provide decision-making support for overall phosphorus reduction and management. GIS is used as a repository for baseline

land use information and data for specific projects under such broad categories as septic systems, stormwater management, highway projects and stream corridor restoration. GIS data being collected will be used for modeling phosphorus runoff given land use conditions and environmental characteristics. The county is currently using RUNQUAL and is currently investigating other models to assist with watershed management in the basin.

At this time there are three (3) full-time staff in the Planning department dedicated to GIS: a GIS Coordinator, a GIS Analyst and a GIS Technician. In addition, the Planners, who will be coordinating the Comprehensive Plans for the communities within the Cannonsville basin, are responsible for the production of their GIS products for each community. While the GIS Coordinator focuses on data standards and maintenance, the GIS Analyst is responsible for ensuring that the modeling programs received will run properly and smoothly. The GIS Technician's role in DCAP is to support related tasks such as assisting with correction of field data and creating maps for papers and discussion.

Delaware County is interested in exploring opportunities to work with the DEC GIS Program: NYC Watershed Data Management and Software Tool Development to capitalize on the resources the state is developing in the watershed and across the state.

A large format plotter and computer software is utilized to support public outreach and display pertinent data to land use professionals and elected officials. The GIS data server is located in Delaware County's Information Technology department, in a dust free, climate-controlled and secure room and is regularly backed up. County GIS Personnel access the server via high-speed fiber optic connection. A small format printer laser-jet printer, capable of printing tabloid size is utilized for supporting smaller maps. The Real Property Tax Service Agency is currently in the process of purchasing a large format scanner/plotter that will be accessible through the GIS network. The county also has an operational GPS Base Station from which correction files are posted to a website that will soon be publicly accessible. For now when correction files are needed, they can be downloaded from SUNY Delhi via a non-public website. The GIS staff, as well as the environmental staff, will continue to receive training in the models the county receives.

VI. Accomplishments

- DCAP has completed a comprehensive quantified assessment of the Cannonsville Reservoir Basin.
- DCAP has an operational goal of reducing phosphorus by 10,000 kg/year.
- A management plan for each of DCAP's components is now being developed and implemented.
- Increasing reliability in accounting for different types of non-point sources of dissolved phosphorus in different parts of the Cannonsville basin.
- Ability to communicate how land use, soil, and management factors affect non-point source phosphorus loadings, via maps and charts.
- Community stormwater systems have been inventoried by GPS and has been converted into a GIS data layers for incorporation in to the county wide system. This data can be provided in the form of maps or software to local communities to make decisions on stormwater management. Meetings have already begun with local communities.

- The Planning department can now provide the technical support to communities in developing, implementing and maintaining their comprehensive stormwater management plans in the context of their Comprehensive Community Plan.
- Comprehensive plans are in various stages of development from just beginning to completed with the assistance of grant dollars.
- Stormwater management practices are being installed in three communities with funds from CWC, Army Corps of Engineer, and the Environmental Protection Fund.
- The Department of Public Works has purchased a vacuum truck for maintaining stormwater practices, using funds from CWC and the county.
- Inventory of county roads and structures for stormwater have been converted in to a GIS format from GPS data. This information will be incorporated into the umbrella of the SWAT model under development.
- DPW has completed bench scale laboratory testing to test the efficacy of tire chips in retaining soluble phosphorus in storm water. The results are encouraging with up to a 40% reduction in soluble P.
- Manure has been identified as the primary source of phosphorus and pathogens.
- Phosphorus excretion reductions through precision feeding and forage system management have been quantified and practices implemented.
- It has been demonstrated that phosphorus reductions may be accomplished with a neutral or positive impact on the finances of the farm.
- Precision Feeding and Forage Systems Management have been developed under the New York State Agriculture Environmental Management (AEM) Program umbrella. Precision Feeding and Forage Systems programs are being incorporated into the statewide AEM program.
- DCAP agriculture components are being discussed as an example of how non-point sources may be addressed under the TMDL umbrella.
- A study on the suitability of soils for OWTS has been completed indicating that at least half of the systems installed prior to 1990 are likely to fail.
- Organized an effective partnership and institutional framework from villages to the federal agencies.
- Outreach regarding the purposes and accomplishments of DCAP locally and with partners at the state and federal level is ongoing.

DCAP is demonstrating that a locally led watershed program is economically frugal and comprehensively effective in protecting water quality

VII. Continuing Work/Goals

- Continue monitoring, modeling and science for the purposes of local decision making support, evaluation and documentation of reductions for the purposes of reaching phosphorus reduction goals.
- Begin monitoring of the Trout Creek basin of the Cannonsville.
- Begin monitoring on a lowland farm.
- Based on priorities developed from comprehensive stormwater management plans and information generated from models, identify specific storm water projects for implementation and seek appropriate funding.

- Complete development of basin SWAT model needed for decision making and the generation of the impact of practices on phosphorus loading.
- Development of Comprehensive Stormwater Management Plan by communities in the Cannonsville Basin and extend to Pepacton and Susquehanna Basin.
- Assist communities who wish to develop a Stormwater Protection Plan for the purposes of acquiring a waiver from Section 18-39 of the rules and regulations.
- Develop and implement a comprehensive maintenance plan for stormwater structures.
- Identify and prioritize projects for implementation.
- Implement projects contingent upon contractor and funding availability.
- Secure funding to implement forage system management pilot farms and document the reductions net nutrient accumulation on farms.
- Extend implementation of Precision Feeding to more farmers and the feed industry representatives utilizing the human and financial resources of the WAP where appropriate.
- Continue the development of software to support precision feeding and forage systems and its integration with Cornell's crop ware software.
- With funding, inventory all town roads for the purposes of identifying key areas to address stormwater and provide technical support and training for town staff on the importance of managing roads to minimize phosphorus loading.
- Begin maintenance of stormwater systems with vacuum truck and documentation of phosphorus reduction.
- DPW - Find funding to extend and conduct work on the use of tire-chips as a medium to treat stormwater for soluble phosphorus retention. Two tasks are at hand. 1.) Evaluate different tire chip physical characteristic for their effectiveness in retaining soluble phosphorus. 2.) Test tire chips as a medium in the field for capturing soluble phosphorus. 3) Evaluate.
- Work with the state to improve coordination of state activities with initiatives under DCAP that could be implemented at the same time.
- Capitalize on funding from CWC for stormwater management projects and funding from the state related to economic development that could lead to synergistic combination for both water quality and community development.
- Advance DCAP as a model/example/case study for rural communities, agriculture and businesses to adopt for NPS management.
- Secure match funding for the Stream Corridor projects the Delaware County Soil and Water Conservation District need to implement.
- Improve collaboration and coordination with CWC and WAC to maximize efforts.

VIII. Projects Funded

Delaware County has invested in protecting water quality and its economic concerns. Delaware County clearly recognizes and appreciates the numerous grants received for the development and implementation of DCAP. Without them we could not accomplish what we have. We have received grants from: Watershed Resource Development Act funds ($1,685,500), Safe Drinking Water Act ($1,221,000), Environmental Protection Fund/Bond Act ($51,195). DOS Enhanced Master Planning and Zoning Incentive Award Program: $15,000 to Delaware County, $15,000 to Village of Walton. Small Cities grants have also been awarded.

CWC grants awarded to communities in the Cannonsville Basin under the Stormwater Retrofit program contributing to phosphorus reduction. These grants not only assist communities but also directly contribute to the goals of DCAP.

- Village of Walton two projects: $304,170: The county facilitated the acquisition of funding for match from US Army Corps WRDA funds and state Environmental Protection Fund (EPF) funds for this project. $450,000 for a second stormwater project.

- Village of Delhi: $513,657: The county facilitated the acquisition of funding for match from the US Army Corps WRDA funds and state EPF funds for this project.

- Village of Hobart: $75,000.

- Delaware County Department of Public Works (DPW) for County Route 6 in the Hamlet of Bovina Center: $562,500: $187,500 match provided by US Army Corps WRDA funds awarded to the county. Second, DPW project $168,500 for maintenance of stormwater structures through the purchase of a vacuum truck matched $51,728 by the county.

- Village of Stamford: $196,000.

Delaware County looks forward to a continued partnership for protecting water quality and our economic and social needs.

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IX. Appendices

Appendix A

Phosphorus Reduction Goal

Developing the Operational Goal:

As part of DCAP, interim reductions goals for the phosphorus levels have been developed. The average load of phosphorus (P) from non-point sources to Cannonsville from entire basin (including Trout Creek) in "typical" loading years is approximately 48,000 kilograms per year. The reduction goals serve as benchmarks against which management decisions can be guided. Based on current estimates of phosphorus loads, the interim reduction goal is 10,000 kilograms or approximately 20% of the overall phosphorus load.

Sources:

Point source discharges: Now range from 3,200 - 3,600 kg P per year.

Non Point Sources:

Cattle: Currently it is estimated there are approximately 13,000 cattle in the Cannonsville Basin. Allowing for size and age, the total P from these animals is estimated, using two different sources of phosphorus excretion predictions, 220,000 kg/year to 345,000 kg/year. If it is assumed the loss from the farms is in the range of 10%, the corresponding range of total loss of phosphorus would be 22,000 kg/year – 34,500 kg/year at 10%. This would then account for up to 70% of the target loading.

Forested areas: From the Shaw Rd monitoring site, 0.162 kg TP/ha/year is the average of the five years of monitoring. The estimated forest land area in the Cannonsville Basin is ~70,000 ha, therefore the total phosphorus load from forested areas is 11,300 kg/yr.

Urban runoff: Unfortunately only limited sampling of stormwater has been conducted in the Cannonsville basin. Three simple but different methods were used by Steve Pacenka, of the New York State Water Resources Institute, to estimate the average loading of phosphorus from urban areas. All three produced about the same load for Walton, N.Y., estimating an "average" loading rate for urban areas or 1.38 kg/ha/year. It is assumed that the area is about 1,013 ha (Brown et al) then the total annual loading of phosphorus becomes: 1.38kg/ha x ~1,013 ha = 1,398 kg P/year.

Septic Systems: The amount of phosphorus originating from septic systems is very difficult to estimate the amount that actually reaches the streams. However, the work of Larry Day (2001) shows that most of the septic systems in the Cannonsville reservoir basin do not meet current standards of design. Furthermore, the soils in the Delaware County are unfavorable for residential on-site wastewater treatment. The soils are generally shallow with a high water table or underlying impervious fragipan. Consequently, a substantial

fraction of the total amount of phosphorus (and pathogens) originally in the wastewater could be conveyed to adjacent watercourses. The total load of phosphorus that passes through septic systems is estimated to be 6,257kg P/year (Day 2001). It is unlikely no phosphorus reaches watercourses from septic systems. It is equally unlikely that all the phosphorus would be conveyed to water. Day (2001) state that the percentage of total phosphorus reaching water courses from septic systems is likely to have the range of 15%-35%. Assuming this range, the amount of phosphorus reaching watercourses attributable to septic system sources would be between 939 kg P/year and 2,190 kg P/year with the average 1,600 kg P/year.

As shown above, farming is the dominant source of phosphorus while stormwater and septic systems contribute a far lesser load (less than 10%). Controlling stormwater and septic sources remains important because they are also major sources of other contaminants, especially pathogens. Therefore, reduction goals for stormwater, septic systems, and farming of 2000 kilogram, 1000 kilogram and 7000 kilogram, respectively are plausible and constitute the overall reduction goal of 10,000 kilograms.

The following is one simplified example of how phosphorus will be reduced. The work conducted under DCAP has shown that phosphorus excreted from animals can be reduced by as much as 33% by controlling the phosphorus content in the feed. If it were assumed that a reduction of 25% can be achieved on half the farms by reducing the phosphorus content of the feed, then the total estimated loading would be reduced from 220,000 kilograms to 192,500 kilograms per year, a reduction of 27,500 kilograms per year. If, for design purposes, it is assumed that 10% of the phosphorus applied to the land as manure enters the watercourse, then the reduction achieved would be 10% of 27,500, or 2,750 kilograms per year. This one reduction represents a third of the desired reduction of 7,000 kilograms per year.

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Appendix B

Agency Acronyms

A&M	NYS Department of Agriculture and Markets
BoS	Delaware County Board of Supervisors
CCE/DC	Cornell Cooperative Extension of Delaware County
CWC	Catskill Watershed Corporation
CWT	Coalition of Watershed Towns
DCCoC	Delaware County Chamber of Commerce
DCPD	Delaware County Planning Department
DEC	New York State Department of Environmental Conservation
DED	Delaware County Department of Economic Development
DEP	New York City Department of Environmental Protection
DOH	New York State Department of Health
DOS	New York State Department of State
DPW	Delaware County Department of Public Works
DWA	Delaware County Department of Watershed Affairs
IDA	Delaware County Industrial Development Agency
NRCS	United States Department of Agriculture Natural Resources Conservation Service
SWCD	Delaware County Soil & Water Conservation District
USEPA	United States Environmental Protection Agency
WAC	Watershed Agricultural Council
WAP	Watershed Agricultural Program
WRI	New York State Water Resources Institute

Appendix C

Abbreviations and Acronyms

AFO	Animal Feeding Operation
AGNPS	Agricultural Non-point Source Model
ARS	United States Department of Agriculture/Agriculture Research Service
BMP	Best Management Plan
BOD	Biological Oxygen Demand
CALSINMPWT	College of Agriculture & Life Sciences Integrated Nutrient Management Program Work Team
CFNMS	Comprehensive Farm Nutrient Management System
CNCPS	Cornell Net Carbohydrate & Protein System
CNMP	Certified Nutrient Management Plan
CPSC	County Phosphorus Study Committee
CREP	Conservation Reserve Enhancement Program
CSSG	County Scientific Support Group
CST	Conventional Shallow Trench
cuNMPS	Cornell University Nutrient Management Plan Software
CUNMPS	Cornell University Nutrient Management Plan System
CWT	Coalition of Watershed Towns
DCAP	Delaware County Action Plan
DOQQ	Digital Ortho Quarter Quad
EPF	Environmental Protection Fund
FAD	Filtration Avoidance Determination
FSA	Farm Service Agency
GIS	Geographic Information System

GPS	Global Positioning System
GWLF	Generalized Watershed Loading Function
HMP	Highway Management Plan
HRU	Hydrologic Response Units
MOA	Memorandum of Agreement
N	Nitrogen
NPS	Non-Point Source
NURP	National Urban Runoff Program
NYC	New York City
NYSAEM	New York State Agricultural Environmental Management
OWTS	Onsite Wastewater Treatment System
P	Phosphorus
PMP	Pavement Management Plan
PS	Point Source
RUNQUAL	Modeling Program
SCMP	Stream Corridor Management Plan
SDWA	Safe Drinking Water Act
SEQRA	State Environmental Quality Review Act
SMP	Stormwater Management Practices
SPDES	State Pollutant Discharge Elimination System
SPPP	Stormwater Pollution Prevention Plan
SWAT	Soil and Water Assessment Tool
SWTR	Surface Water Treatment Rule
TMDL	Total Maximum Daily Load

TPAS	Town Planning Advisory Service
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WEAP	Watershed Environmental Assistance Program
WRDA	Water Resources Development Act
WWTP	Wastewater Treatment Plant

Appendix D

Acknowledgements

We thank all the agencies and organizations for their contributions to this document

Cornell Cooperative Extension of Delaware County
Catskill Watershed Corporation
Delaware County Board of Supervisors
Delaware County Department of Economic Development
Delaware County Department of Public Works
Delaware County Department of Watershed Affairs
Delaware County Planning Department
Delaware County Soil & Water Conservation District
New York City Department of Environmental Protection
New York State Department of Agriculture and Markets
New York State Department of Environmental Conservation
New York State Department of Health
New York State Department of State
New York State Water Resources Institute

United States Department of Agriculture Natural Resources Conservation Service
United States Environmental Protection Agency
Watershed Agricultural Council
Watershed Agricultural Program

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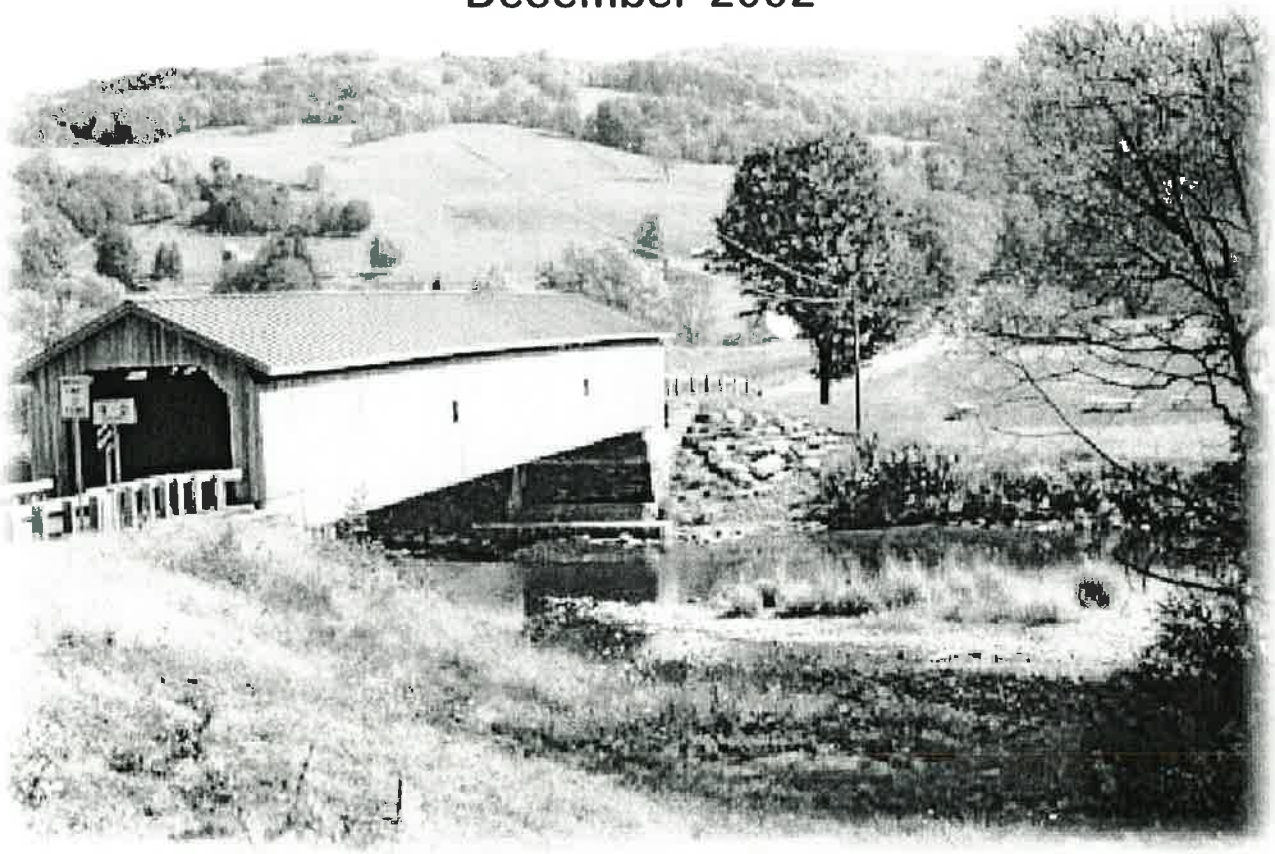
DCAP Report:
to the
Phosphorus Study Committee
and Partner Agencies

December 2002



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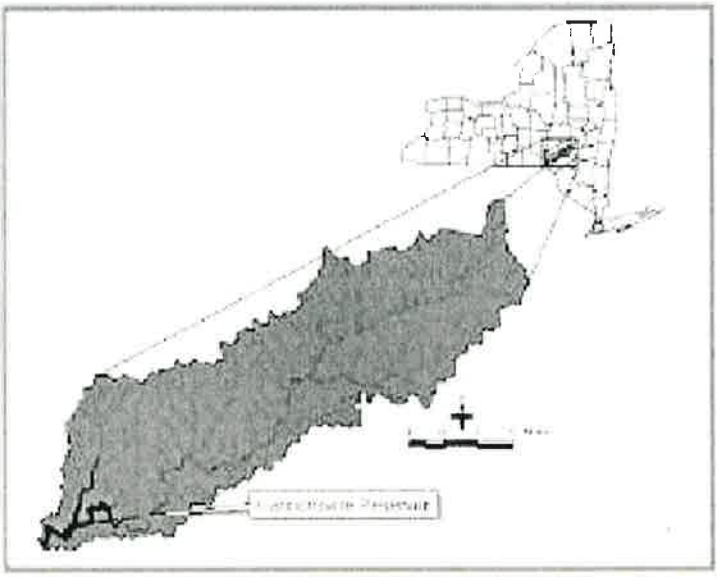
DCAP Progress Report to the Phosphorus Study Committee and Partner Agencies

Characterization of the Watershed Management Effort

DCAP History

This report summarizes substantial accomplishment in what is a comprehensive watershed management program. This progress is remarkable given that DCAP is only three years old.

Following the adoption of the Watershed Agreement, businesses in Delaware County increasingly expressed concerns to the Delaware County Board of Supervisors over the economic side-effects of the phosphorus restriction in the Cannonsville Reservoir Basin. In March 1998, the Chairman of the Delaware County Board of Supervisors invited the New York State Water Resources Institute (WRI) to assist the County in developing a strategy. Section 18-83 of the Regulations provided for a pilot program for phosphorus offsets allowing new or expanded wastewater surface discharges. A key condition in Section 18-83 was that the County, in which new or additional wastewater surface discharges were proposed, must be preparing, or have already prepared, a Comprehensive Strategy in partnership with the NYC Department of Environmental Protection (DEP) and other local partners. The County Board of Supervisors sought the assistance of WRI in meeting this condition. However, it also sought an action plan through which it could so reduce overall loading of phosphorus throughout the basin that the phosphorus restriction would be lifted altogether. Hence, the long-term aim was to lower the overall annual loading of phosphorus and remove the phosphorus restriction.



From the outset, the County proposed three premises.

1. ***An interagency institutional framework should support and assist in the performance of the Strategy.***
   The County recognized that it needs intergovernmental participation in the creation and implementation of the Strategy. Therefore the County created a hierarchy of inter-

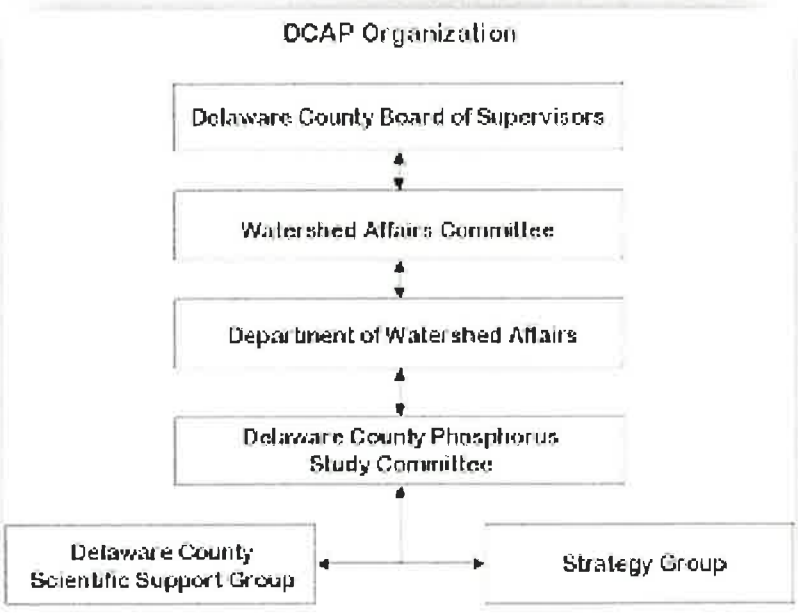
agency Committees (see figure at the bottom of the page).

2. ***The Strategy should jointly serve and satisfy local economic interests and water quality objectives.***
   The County seeks measures to protect water quality while taking into account the economic needs of County businesses and residents. This aim confirms to the spirit and letter of the NYC Watershed Agreement.

3. ***It was essential to develop sound scientific credentials for the Strategy.***
   Meeting water quality goals, such as the P-restriction or Total Maximum Daily Load (TMDL) targets, requires sound scientific quantification. The County recognized its strategy would be subject to critical scientific appraisal of its effectiveness in serving water quality purposes.

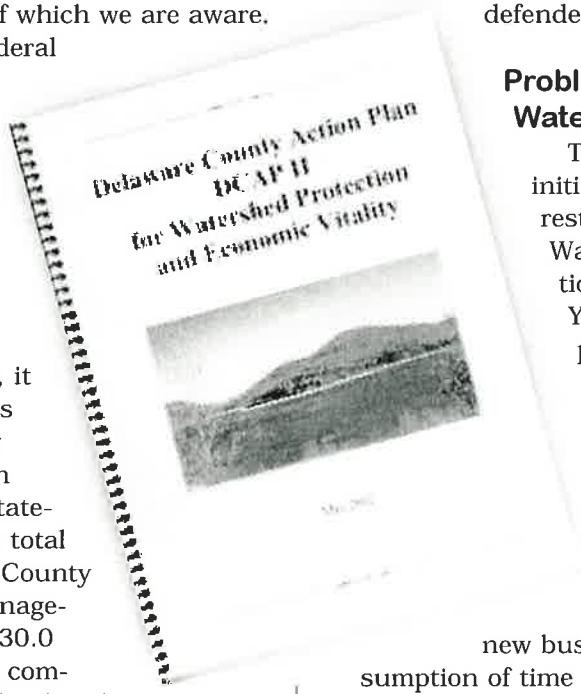
Beginning in the spring of 1998, there were innumerable meetings, discussion papers and draft versions of an emerging Comprehensive Strategy. During the subsequent months of 1998 difficulties were especially formidable. Initially, there was a shared unfamiliarity with concepts of guidance values, monitoring programs, mathematical models, phosphorus loading and TMDLs. In these early months, WRI's efforts were devoted to preparing informational reports and giving presentations to foster understanding of these watershed issues and corresponding management needs. There were also very substantial disagreements between the partnering agencies about

what needed to be done, how it should be done (or paid for) and by whom. However, the discussions progressively fostered acceptance that a local watershed program could be at least worthwhile. Staff of the Division of Water in the NYS Department of Environmental Conservation were particularly supportive of this progress. Confidence also grew in the County's ability to assume and carry out a local management program to protect the Cannonsville Reservoir. Although the County professional staff is limited in number, it is highly competent and motivated. Professional staff from County Departments of Planning and Public Works, the Delaware County Soil & Water Conservation District, Cornell Cooperative Extension, and the Catskill Watershed Corporation, all played a critical role.



Early in 1999, WRI, in close partnership with the County Planning Department, began to work with County and Watershed agencies to create an acceptable strategy. The strategy, designated the Delaware County Action Plan (DCAP), was submitted to the Board of Supervisors of

Delaware County for approval in September 1999. To implement the strategy on October 1st 1999, the Board of Supervisors of Delaware County established the Delaware County Department of Watershed Affairs. (Resolution no. 229: pursuant to the authority granted by Section 204 of the County Law). This is the only such County Department of which we are aware. Subsequently, state and federal partners to the Watershed Agreement accepted the strategy after their joint review.



The comprehensive watershed program summarized in this document represents the subsequent implementation of DCAP. Given its accomplishments, it is easily forgotten DCAP has formally existed now barely three years. As can be seen from the DCAP Financial Statement in this document, the total funds applied by Delaware County for DCAP purposes and management already approaches $30.0 million. This total is largely composed of County, State, Federal and New York City Funds (including funds awarded through the CWC).

Watershed Characteristics

The Cannonsville Reservoir is the third largest in the New York City Water Supply with a capacity of 96 billion gallons and has the largest catchment of approximately 290,000 acres. This catchment epitomizes key watershed management questions of how to:

- Protect major drinking water supplies at their source with catchments including significant nonpoint and point sources;
- Successfully engage community and government leaders, farmers, business persons, and individuals in watershed protection; and
- Sustain watershed protection on a sound scientific and economic basis.

The watershed is 70 percent forest, 25 percent farms and 5 percent urban. Dairy production is primary with 13,000 animals on 125 farms owned and operated by family farmers. It is hilly with narrow river valleys. There are four villages and seven hamlets. Communities and farms face economic decline. Economic considerations rank with environmental. Watershed residents are conservative, independent, and favor limited government. New York is a home rule state. Local rights and responsibilities are fiercely defended.

Problems Facing the Watershed

The Cannonsville Basin was initially designated phosphorus restricted under the NYC Watershed Rules and Regulations. It is also on the New York State 303d list as phosphorus impaired and subject to a TMDL.

Real or perceived, small businesses in Delaware County consider the New York City Watershed a difficult place to do business or to establish facilities for new business. The costs and consumption of time imposed upon the businesses of Delaware County are viewed as onerous by the business community. There is a critical need to improve the applications of the regulations on the part of New York City on one hand, and to facilitate their adoption by the business community on the other.

The Watershed Plan

The Plan is the Delaware County Action Plan (DCAP). Under the County Board of Supervisors, DCAP proceeds through committees addressing policy, science and management. DCAP is a collaborative partnership with the CWC, the WAC, the DEP and state and federal watershed partners. The Plan comprehensively addresses all significant nonpoint contaminant sources in the basin to meet water quality objectives including satisfying allocations (to satisfy the P restriction and meet prospective TMDL objectives).

Goals: The short-term goal is to establish a comprehensive watershed plan for all significant nonpoint sources in partnership with communi-

ties and residents, and regional, state and federal partners. The long-term goal is to assist the county's residents, farmers, businesses, and communities in meeting water quality objectives without sacrificing economic vitality. Two objectives are to reduce:

(i) Contaminants from their individual sources; and

(ii) Total load of phosphorus, basin wide, by 10,000 kg/year.

To verifiably meet specific water quality objectives such as the P restriction or TMDLs, requires management aims and results be quantified. This is a primary reason for the scientific basis of DCAP.

These management options are evaluated within their watershed-wide context through comprehensive monitoring and modeling to provide a sound scientific basis for decision-making and evaluation. The primary watershed model is SWAT.

DCAP Institutional and Operational Procedures: Five key procedures apply to DCAP programming:

1. Established, and is based, upon a credible and sound scientific foundation using extensive monitoring and modeling;
2. Conducted cooperatively with the partners to the New York City Watershed Agreement, and complements and enhances other watershed programs;
3. Led locally, and continues to develop technical capacities at the local level.
4. Fosters voluntary participation and management by local governments, landowners, residents and businesses; and
5. Developed transferable concepts and principles for watershed management to other New York City basins and beyond.

Identification and Prioritization of Projects. Phosphorus sources have been comprehensively assessed for:

- Basin wide stormwater and highway drainage,
- Agricultural nutrient management through the Agricultural Environment Program (AEM),
- Solid and hazardous waste,
- Septic systems, septage disposal,
- Wetlands, and
- Streambank erosion.

Load allocation goals have been established for agriculture, stormwater and onsite wastewater in particular. Phosphorus imports in dairy feeds are the largest source of imported phosphorus yielding surplus phosphorus in manure.

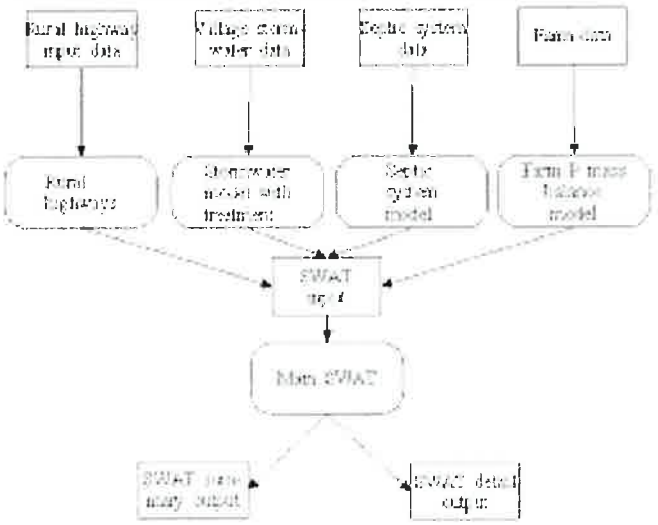
Responsible Entities for DCAP. DCAP is coordinated by the Delaware County Office of Watershed Affairs, under the auspices of the Delaware County Board of Supervisors.

DCAP and its projects are consistent with and complementary to the Safe Drinking Water Act, the Clean Water Act, Filtration Avoidance Determination issued to NY City by the US EPA, the NYS Nonpoint Source Protection Program, and the NYS Agriculture Environmental Management Program (AEM). It also complements the NYC Watershed Program. The NYC Watershed Protection and Partnership Council (WPPC) acknowledged DCAP for its efforts in phosphorus reduction during its five-year review of the landmark Memorandum of Agreement between watershed communities and NYC Department of Environmental Protection. DCAP quantified watershed methods show how to allocate Total Maximum Daily Loads (TMDLs) loads for all significant nonpoint sources. DCAP methods are also applicable to Confined Animal Feeding Operations compliance.

DCAP
Management Components

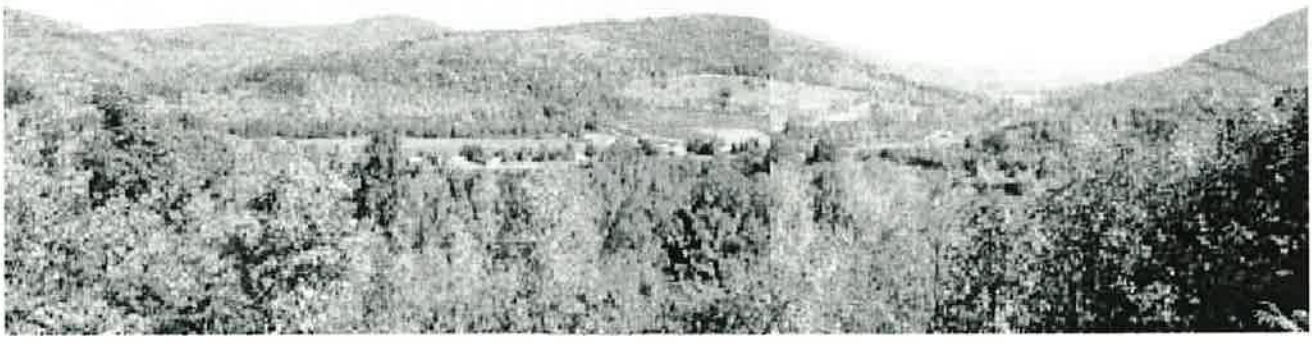
Purpose

DCAP's purpose is to protect water quality through pollution prevention. Its management components constitute a balanced and comprehensive watershed protection program. It is especially motivated by New York City's restrictions on phosphorus discharges and prospective TMDLs. Therefore, its first priority is the quantified reduction of phosphorus loadings to the Cannonsville Reservoir. Management practices under DCAP also encompass other public health priorities such as trihalomethanes (THMs), turbidity, and pathogens. Bioavailable phosphorus supports the growth of algae in the reservoir, which in turn can produce THMs. Given that much of the organic particulate fraction in the reservoir is related to algae, reductions in phosphorus loading will be helpful in relation to turbidity. In its controls of phosphorus DCAP also reduces sediment loadings.



Stormwater treatment and stream corridor management is another barrier to contaminants reaching streams and hence the reservoir.

Many nonpoint sources of pathogens are also sources of phosphorus. For example, improved management of onsite wastewater disposal as endorsed by DCAP will reduce risks of pathogen emissions to streams. DCAP's advocacy of composting as a livestock manure management option recognizes the effectiveness of composting in killing *Cryptosporidium* oocysts.



Barriers to nonpoint source pollution

DCAP favors a basin-wide phosphorus balance through quantified and aggregated phosphorus reductions. Emphasis is given to controls at the sources of contaminants such as septic systems, the collection of hazardous and toxic materials, and the initial production of manure by animals. This is a first barrier for preventing pollution. A second barrier is the landscape such as farm fields or highways and community stormwater systems. A third and final barrier is the stream corridor. Implementation across all three barriers provides some redundancy and accommodates uncertainties and variations inevitably associated with nonpoint sources. It is a scientific challenge to account quantifiably for nonpoint source controls as they are implemented across each of these barriers. There can be a lag of many years before water quality sampling validates with confidence the effectiveness of the management. Therefore, DCAP has developed sound scientific surrogate measures of the effectiveness of DCAP, including comprehensive monitoring and modeling. This quantified understanding will also guide iterative adjustments in management decisions and policies over time.

Scientific and Economic Framework

Monitoring and modeling provides a credible scientific foundation for identifying management options and for evaluating the subsequent adoption and implementation of management practices. Specific management practices fall within principal DCAP components which together fully account for sources of phosphorus and other associated contaminants. The components encompass both community and farming sources. These are briefly described in the following pages. The integrating scientific foundation of the monitoring and modeling is summarized first. Community and agricultural components follow. Finally, economics is a most critical framework for DCAP and the County constituents it represents. Economic considerations govern all the components of DCAP. Economics is described briefly as a final governing DCAP component.

Integrated Monitoring and Modeling

(NYS Department of Environmental Conservation)

Monitoring and modeling serve a number of purposes related to water quality and the effects of land use and management programs upon it. Used together, monitoring and modeling can assist in decision-making by helping managers understand how environmental systems work and how these systems may react to changes made on the land.

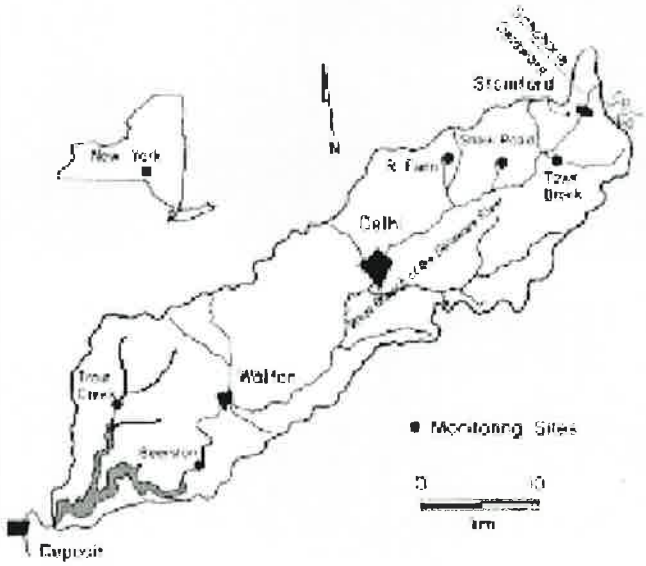
Monitoring is typically used to gather information about how systems naturally operate. Objectives of monitoring might include one or all of the following:

1. Establishment of baselines;
2. Identification of trends;
3. Quantification of processes;
4. Identification of management options;
5. Evaluation of direct changes in water quality as a result of implementation of management practices;
6. Track down of causes of detected water quality problems; and
7. Collection of data to construct, calibrate and validate models.

Due to the large amounts of time and resources needed, monitoring can only be conducted on a limited basis. As an alternative, models can be employed to simulate natural systems and provide information on what could be expected at a given site under specified conditions. Results of smaller-scale, site-specific monitoring studies can be used to construct and test models which are then applied to larger scales and/or other locations. Models can vary from simplistic, relying on very little data input, to complex with large data requirements.

Cannonsville Basin Monitoring

Current water quality monitoring efforts in Delaware County include long-term event-based sampling by DEC of the West Branch of the Delaware River (WBDR) at Beerston, a site which represents nearly all of the contribution of this primary tributary to Cannonsville Reservoir (see Figure). Also conducted by NYSDEC is the event-based monitoring on an upland farm and a background, forested area. These two small-scale (< 350 acres) sites are being used in an evaluation of the effect of Whole Farm Planning and implementation of agricultural best management practices (BMPs) on water quality. Another water quality monitoring study is being conducted by the DEC at the outlet of Town Brook, a mixed land-use sub-basin of the WBDR. Thus, three different scales, entire basin, sub-basin and farm-scale, are currently being monitored for water quality using event-based sampling methods.



Using Monitoring Results

DCAP takes advantage of and builds upon these monitoring activities in several ways. First, more informed management decisions will be made by utilizing the available water quality information to evaluate inter-annual variability in nonpoint source phosphorus loads, and assess relative contributions by sources in the Cannonsville watershed. DCAP has identified and is filling a gap in water quality data by installing an event-based monitoring station on Trout Creek which drains about ten percent of the Cannonsville basin, but has historically not been monitored.

Secondly, DCAP is making use of the available water quality data as input to various models that can be used to estimate future loads to the reservoir under different management scenarios. The data is also crucial for calibrating and validating the models. Models that accurately stimulate measured loads under current conditions will then be selected and applied with confidence when predicting future conditions. The SWAT model has been successfully applied to the three watershed scales using data from the monitored sites in the WBDR basin and promises to be a useful tool for decision-making and planning in the future.

Despite an abundance of monitoring data currently being produced, more information is needed in certain areas to assist in making informed management decisions. Confirmation by monitoring and modeling of the ability of selected BMPs to significantly reduce phosphorus losses is one important need. If management programs are to be targeted at animal and human waste sources, there must be confidence that BMPs will work. Although Delaware County has been removed from the phosphorus restriction given its in-reservoir concentrations dropping below the 20 µgl/L guidance value, continued monitoring of loads to the Cannonsville Reservoir are necessary to track progress and ensure point and nonpoint source management programs continue to have a positive effect. Water quality must not only be secured; it must be confirmed.

Coupled Assessment through Integrated Climate and Terrestrial Models

(Cornell University / NYS Water Resources Institute)

Weather patterns demonstrate it is prudent to assume future extreme patterns in weather will affect watershed hydrology. Through the Northeastern Regional Climate Center at Cornell, climatological patterns and available data will be used to integrate the climatological studies with a watershed model, Soil and Water Assessment Tool (SWAT). This will provide a comprehensive evaluation of existing hydrological conditions and future scenarios in the basin. Appropriate models have rarely been linked creating a fully comprehensive, basin wide analysis of the effect of climate and land use changes and their impacts on aquatic systems within the basin.

Linking Models

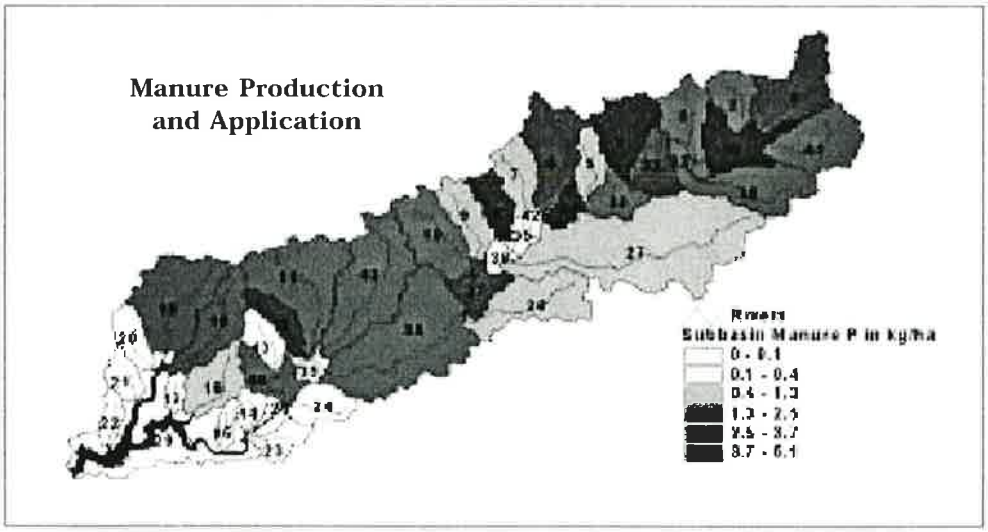
Climatological data linked with a terrestrial model enables the assessment of water management and land use decisions from a basin-wide perspective, incorporating ecological and economic values. Such assessments are needed to facilitate the ability of basin residents, planners and decision-makers to formulate reasonable water management, economic and social goals and policies. The integrated climatological and terrestrial modeling will:

- Describe and integrate knowledge of the system under current and historical conditions;
- Allow for the assessment of prospective future scenarios (i.e., climatological changes and land management options allowing for uncertainties); and
- Evaluate changes due to management or natural conditions within the river basin.

We will provide training to watershed stakeholders in the use of the model.

Applying SWAT

Different models are being applied according to different geographic scale. SWAT is a watershed scale model. A first step was to apply SWAT to represent the total hydrology of the Cannonsville Basin. A second step was to investigate the sources and transport of sediment via hydrological processes to the reservoir. Thirdly, substantial progress has been made in modeling



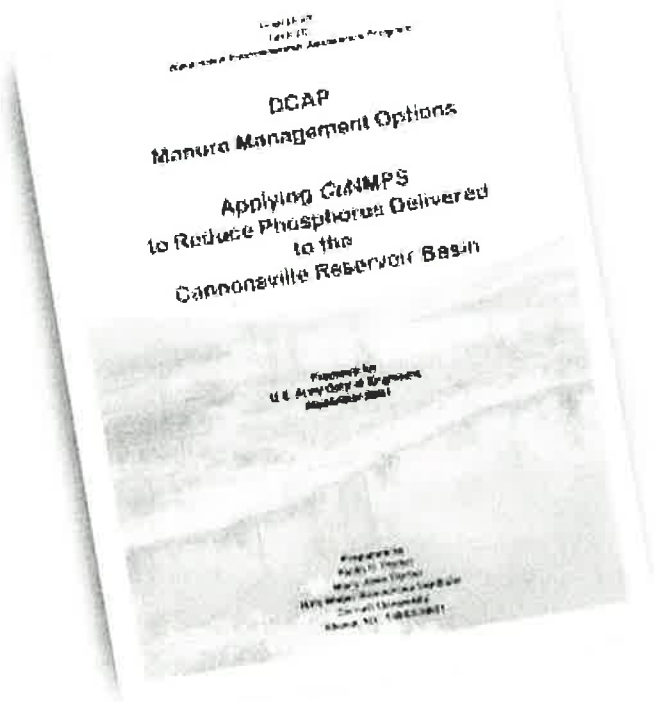
the sources and transport of phosphorus within the Basin. This work has been successfully calibrated and validated with different sets of data. Recently, the SWAT work was peer reviewed by scientists representing lead agencies at both State and Federal levels. The peer review comments on the results achieved to date were encouragingly positive.

Phosphorus Trends?

A significant recent result of the SWAT research is that the model predicts that phosphorus loading will increase to the reservoir. The basis for this prediction is the continued applications of manure which build up phosphorus in the soil This result is an incentive to pursue the DCAP manure management initiative conducted under the auspices of the Department of Watershed Affairs.

Management and Stakeholder Involvement:

Modeling is conducted in close cooperation with members of the interagency DCAP Scientific Support Group. Progress is reported regularly to the County's Phosphorus Study Committee, a representative body of principal stakeholders. A particular objective is to encourage a modeling capability in County and CWC staff.



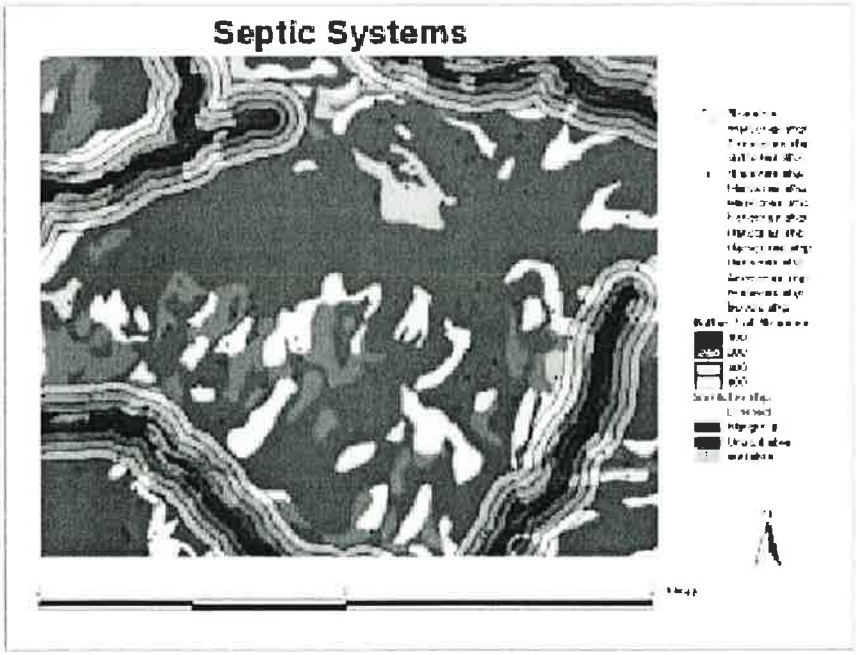
Septic System Program
(Soil & Water Conservation District)

Soils in Delaware County represent a challenge to farmers and engineers alike. The soils tend to be thin, overlying a highly impervious fragipan. Frequently the soils have a marked slope given the hilly topography of the County. Staff at the SWCD are leaders in soil and site evaluation for septic systems.

From the SWCD's 2001 study of septic systems in the Cannonsville Reservoir Basin, it is apparent that the majority of the existing systems were not well designed for the soil conditions and are likely to be providing inadequate treatment. SWCD staff estimate that the septic systems contribute from 2 – 4 percent of the total phosphorus load to the reservoir. This relatively small load understates the significance of septic systems however, given they are also a potential source of pathogens and other contaminants. The SWCD is working with the CWC to assist in the acquisition of funding for a septic system rehabilitation and maintenance program.

Wetlands

SWCD staff conducts a wetland delineation service for the County and its municipalities. A particular initiative is the Oxbow Hollow Wetland Bank currently under construction by the Delaware County Department of Public Works with consultation by the SWCD.



Highway Management Activities

(Department of Public Works)

Through its Department of Public Works, Delaware County, completed an assessment of highway stormwater impacts in 1999 and continues to maintain a comprehensive highway inventory and assessment program. This program has been recently expanded to fully document, using GIS methods, the location, maintenance, and management of roadway and stormwater infrastructure of the County. Under this program, all major drainage features such as culverts, swales, catch-basins, and bridges have been inventoried, mapped and assessed. Efforts to minimize negative water quality impacts include both ongoing management practices and capital construction projects.

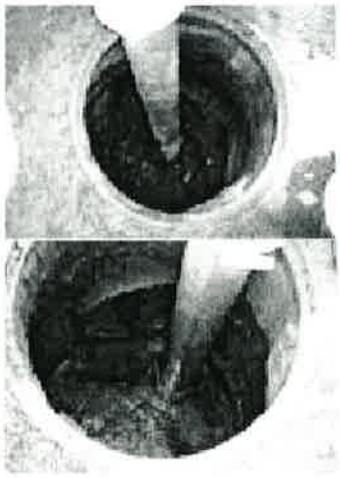
Near Term Capital Construction Projects

These include the stormwater retrofit for County Route 6 in Bovina, and a proposal for stormwater treatment for the Page Avenue parking lot in Delhi. The County Route 6 retrofit is currently in design and scheduled for construction in 2003 and consists of replacement and new installation of stormwater catch basins and structures to manage stormwater adjacent to the Little Delaware River. The Page Avenue parking lot project, currently in proposal stage, calls for the treatment of stormwater conveyed from the parking lot servicing the Delaware County Probation Office, Office of Veterans Affairs, Board of Elections, and DPW offices. The Page Avenue stormwater collection is to be connected with the Village of Delhi's stormwater treatment system for Bridge Street.

Ongoing management practices include: sediment removal, culvert stabilization, and deicing material controls.

Sediment removal: With the critical financial support of the Catskill Watershed Corporation, the DPW recently purchased and put into service a vacuum truck capable of removing sediment from culverts and catch basins with a 30 foot pipe reach and 12 cubic yard sediment holding capacity. This truck is being used to remove sediment throughout the County and is eligible for use in neighboring Watershed counties on an "as-needed / as-available" basis. Approximately 700 cf of sediment has been removed during the first month of operations. This sediment removed from drainage systems is disposed of securely, thereby eliminating this contaminant source to the Cannonsville and Pepacton reservoirs. The County proposes to sample removed sediment in order to quantify the specific volume of phosphorus and other contaminants removed. Should the County acquire a second vacuum truck, the rate sediment removal and culvert and catch basin maintenance would be performed on a 5-year rotating cycle. This 5 year cleaning cycle is believed to be sufficient for long term maintenance of these drainage structures.

Culvert stabilization: Extensive visual inspection conducted by the vacuum truck crew has identified culverts needing repair or replacement. Culvert



failure is a source of water quality degrading sediment infiltration requiring stabilization to mitigate against these sediment inputs. Traditional culvert replacement requires the physical excavation, placement in kind, and backfilling of culverts; with a resulting soil surface disturbance and short term aggravated sediment during this procedure. The County proposes to slip line failed culverts wherever possible as a preferred method of culvert stabilization absent the sediment creation during traditional excavation. Where applicable, slip lining affords a fast, environmentally preferable and financially competitive method of repair.

Deicing material control: Implemented for the first time during the 2001/2002 winter, DPW has been achieving improved control and limits on the application of roadway deicing materials through the installation of DICKEY-John (tm) controllers on plow trucks. These low cost control units, used for conveyor/spinner systems on grit and salt trucks used for winter maintenance, allow the truck operator to apply granular deicing material precisely. Excess is eliminated by synchronizing the application rate with truck speed. As the truck speeds up or slows down, the conveyor/auger rate adjusts to match truck speed. When the truck stops, the material application stops. To date, three plow trucks have been retrofitted with the DICKEY-John controller. An additional 25 plow trucks remain in the DPW fleet to be retrofitted.

Highway Management Plans for Towns

The County's 1999 highway assessment identified 60 percent of roads in the Cannonsville Basin as being Town roads. Therefore, to be comprehensive, highway stormwater efforts require including Town roads. DPW proposes to extend the highway management program to Towns to address inventorying and assessment of Town roads, identification of priority stormwater management practices (SMPs), capacity building through the provision of expertise and training to Town Highway Superintendents for the SMP management practices and installations, and evaluation and monitoring of these SMPs. The first phase of the Highway Management Plan program includes the initial development of inventorying and assessment procedures, coupled with internal training and experience with SMP projects, as DPW is currently doing. To extend the Highway Management Plan to the Towns as a next phase will require hiring a dedicated stormwater / highway engineer responsible for providing the leadership and expertise to meet the demands of the program. A primary function of the highway engineer will be to assist towns with prioritizing their highway capital projects. Many of the areas identified as critical areas for redesign are being repeatedly damaged by poor drainage; however

many towns don't have a dedicated budget for Stormwater projects. The stormwater engineer will be responsible for accessing the funding available through the CWC Stormwater Retrofit Program and matching those funds with the annual regular capital planning in the town highway budgets. This will maximize the investment of the towns by targeting the areas most in need of redesign, repair and rebuilding, and will also maximize the CWC funds by allocating

those funds to the most critical areas in regards to water quality.

Comprehensive Solid Waste Services: Department of Public Works — Solid Waste Division

Solid Waste Management Center: DPW provides transportation and disposal services for municipal solid waste generated within Delaware County. Specifically, this includes ownership and operation of a double composite lined MSW landfill, a lined C&D landfill, recycling center and intermediate processing facility, and a fleet of transfer vehicles. In 2001, Delaware County began construction of a 128,000 square foot compost facility capable of processing all current and future wastewater treatment plant biosolids and municipal waste organic materials. Design and construction plans for this facility have been modified, at the County's sole effort, to accommodate 10,000 tons of agricultural manures. DPW is building the compost facility presently, and anticipates initial operation in late 2003. The ability to stabilize nutrients and destroy pathogens in biosolids and manure will greatly assist in reducing the potential load of

surplus phosphorus in the Cannonsville basin.

Operation CLEAN SWEEP: Annually for the past six years, DPW has been the lead sponsor of a multi-agency effort to safely remove hazardous and semi-hazardous wastes from homes, farms, and small businesses throughout Delaware County and the NYC Watershed. With steady financial aid from DEC and NYC's Watershed Agriculture Council, and periodic support from USEPA, CWC, and SWCD, the County has accepted for proper disposal waste flammables, corrosive and oxidizing substances, pesticides and toxics, PCB wastes, batteries, CFCs, and hazardous electronic wastes. Through generous

FLAMMABLE LIQUIDS
acetone
degreasers
lighter fluids
solvents & strippers
brake & transmission fluids
oil based paints

CORROSIVE ACIDS
muriatic acid
sulfuric acid
phosphoric acid

CORROSIVE BASES
ammonia hydroxide
ammonia
fixer & cleaner (pH 12)

OXIDIZERS
sodium hypochlorite
chorine

PESTICIDES (LIQUID & SOLIDS)
carbaryl
isopropylamine
arsenites
pyrethrins
chlordane
malathion
simazine
lindane
dinoseb
methoxychlor
diazinon
captan
DDT
zineb

ELECTRONIC WASTES
computer monitors & TVs
copiers & laser printers
fax & communications
microwaves
power supplies
peripherals & cables

financial support, this service is provided at no cost to households and farms, and at a subsidized rate for small businesses. In 2002, CLEAN SWEEP serviced 282 participants, resulted in the proper disposal of over 81,000 pounds of wastes, at a cost of $66,000. An extremely valuable service, CLEAN SWEEP provides area residents with an environmentally sound alternative to dumping hazardous liquids down the drain, on the back forty, or in the burn barrel. (Note: DEC funding comes from a long standing HHWCD grant program that is a substantial mainstay to these activities!)

Research and Demonstration Projects: Department of Public Works

Dissolved Phosphorus Removal in Stormwater: DPW, with financial assistance from the USACOE, has sponsored research with the State University of New York College of Environmental Science and Forestry to evaluate the potential use of high iron content materials for the removal of dissolved phosphorus in stormwater. Use of chipped passenger tires as an iron source, and monitoring phosphorus laden stormwater under controlled laboratory conditions, research indicates a potential dissolved phosphorus removal rate upwards of 50

percent. A promising stormwater treatment advancement, continued research will focus on an expanded analysis of sustainability and life cycle of the DP removal process, ancillary water quality impacts from use of tire chips, and field based constructability.

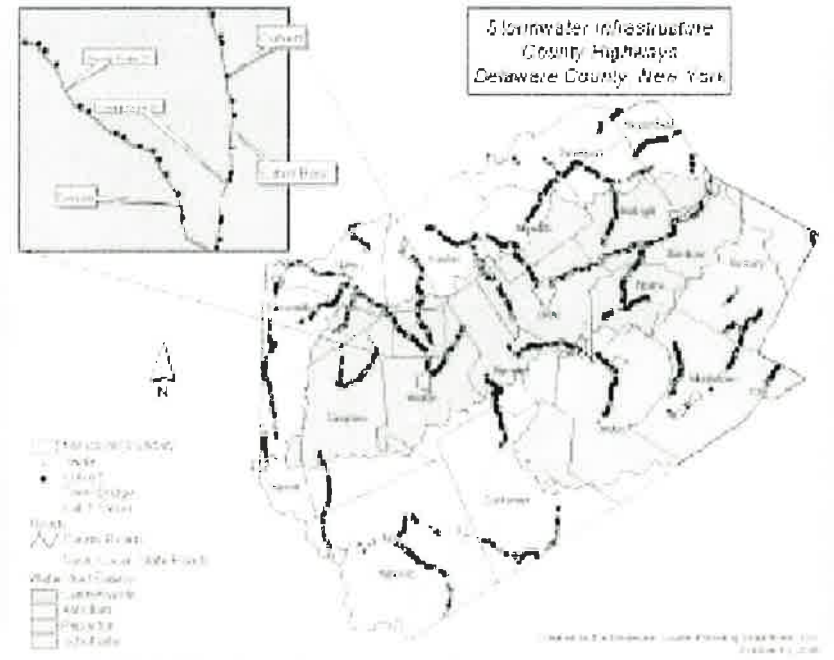
Oxbow Hollow Wetlands Bank

In an effort to increase wetland habitat and environs with the County, DPW has recently constructed 2 acres of palustrine wetland on County owned property adjacent to the Delaware River West Branch. The existing two acre Oxbow Hollow Wetland Bank contains many "obligate" and "facultative+" wetland species, including: pondweed, cattail, red top, water carpet, spearmint, watercress, soft rush, and jewel weed. Consultation and support is provided by the Soil & Water Conservation District and construction has been done with County staff. Up to twenty acres of new wetland creation is planned for the property and provides an important environmental enhancement and construction training ground for equipment operators and facility designers.

Municipal Stormwater Management
(Delaware County Planning Department)

Objective

A significant source of water quality impairment in the New York City Watershed is urban stormwater runoff. Within the Cannonsville Basin, it has been estimated that such runoff contributes approximately 3200 kg of phosphorus per year to the reservoir (six percent of the total P load). To address this issue, the Delaware County Planning Department is working with each of the nine towns, four villages and nine hamlets within the Basin to develop a program to better manage urban stormwater runoff. Our program emphasizes three areas:



1. Identifying point and nonpoint sources of stormwater in the municipalities that pose a threat to water quality;
2. Assessing existing stormwater infrastructure and identifying problem areas and deficiencies; and
3. Incorporating stormwater control into municipal planning.

Work Completed to Date

A detailed evaluation of stormwater generation and management was conducted for the Villages of Walton and Delhi. Locations and characteristics of large impervious surfaces and stormwater infrastructure were field collected during the summer of 2002 using Trimble Global Positioning System (GPS) units. This data was converted using Pathfinder software into an ESRI Geographic Information System (GIS) format to facilitate manipulation with other GIS layers of interest: soils, land use, topographic and planemetric maps. At the same time, preliminary estimation of sub-basin runoff and pollutant loading were calculated. In conjunction with this work and that of representative consultants, site-specific structural collection, conveyance and treatment methods were designed for three municipalities.

Next Steps

A comprehensive evaluation will be conducted for each municipality located within the Cannonsville Basin including an infrastructure database, runoff/pollutant loading calculations, and recommended Stormwater Management Plan (SMP) designs and maintenance procedures. The long-term programs are outlined below.

1. **Inventory/Assessment/Evaluation**
   - Municipal Stormwater Infrastructure: develop a GIS database to support the characterization of stormwater sources and sinks and inventory existing stormwater infrastructure for the four Villages and nine Hamlets.

   - Comprehensive Planning: develop and cultivate local directive and initiative of water quality protection through stormwater management. This task entails working with each municipality, under the auspices of the Town Planning Advisory Service (TPAS), to develop Comprehensive Master Plans that clearly define and demonstrate the role of water quality in relation to community economic development.

   - Monitoring and modeling will improve the estimation of contaminant loads in stormwater and allow appropriate management options to be assessed and stormwater decisions to be evaluated.

2. **Municipal Plan Development**
   - Stormwater Pollution Prevention Planning (SPPP): develop comprehensive SMPs consistent with Section 18-81 of the Watershed Regulations for each of the four Villages and nine Hamlets.

3. **Local Implementation**
   - Local Strategy Development: within the TPAS framework, Delaware County will advise and assist each municipality in the development of an implementation strategy to meet water quality goals. Each strategy will analyze and incorporate previous programmatic work to develop a prioritized plan to meet current and future needs for infrastructure repair, expansion and implementation.

   - Local Regulation / Ordinance Development: each municipality will develop a specific Stormwater Ordinance based on the inventory and SPPP.

   - Implementation: once the implementation strategy is developed, the Planning Department and the DPW will assist municipalities with grant applications, design review and project implementation.

Stream Corridor Management Program

Soil & Water Conservation District

Stream corridors are an important final barrier to nonpoint source contaminants entering watercourses. Working with WAC, villages and hamlets, stream corridors have been assessed and mapped. Corridor protection is being planned and implemented according to determined priorities and availability of funds.

The Delaware County Stream Management Program was developed in support of the Filtration Avoidance Agreement with US EPA. It is conducted in partnership with the DEP and USACE and is funded by the DEP for $1,218,433. In particular, the program will provide guidance for future stream corridor management.

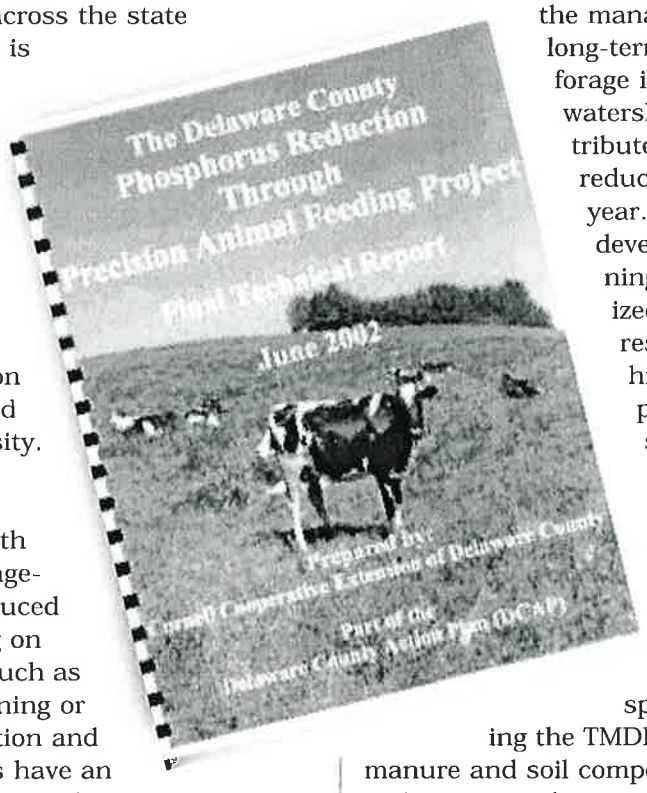
Progress to-date includes:

- Developed GIS database;
- Historic aerial photographs scanned, geo-referenced, and stream edges digitized for West Branch main stem and the Town Brook sub-watershed;
- Calibrated 3 USGS stream gages for development of Regional Curves;
- Surveyed and compiled data for one reference reach;
- Completed Rosgen Level I classification;
- Rosgen Level II in progress on West Branch main stem;
- GPS mapping in progress for West Branch main stem;
- Partial funding obtained for 2 identified project reaches;
- Partial funding obtained for one additional project;
- Established a Project Advisory Committee; and
- Expanded public outreach

Agriculture

(Cornell Cooperative Extension, Cornell University, and WAC)

DCAP's integrated nutrient management methods are developed and applied under the auspices of the New York State Agricultural Environmental Management (AEM) Program. This association provides for the extension of management methods across the state through AEM. The work is conducted also in close cooperation with the Watershed Agricultural Council (WAC).



Integrated nutrient management methods, including animals, crops, soils and water, have been established on a scientifically quantified basis at Cornell University. These methods are now being adopted on pilot farms, in compliance with AEM. Animal feed management methods have reduced amounts of P remaining on farms annually by as much as 50 percent while sustaining or increasing farm production and reducing costs. Farmers have an economic incentive to adopt these management methods and are enthusiastic about them.

Nutrient Management Through Forage Intensive Feed Systems

Studies by Cornell University show about two thirds of the nutrients imported onto dairy farms accumulate as surplus on the farm increasing risk of runoff. Purchased feeds account for 65-85 percent of the nutrients imported. Comprehensive Nutrient Management must include improved production and utilization of farm grown forages through implementation of forage intensive feed systems. The Cornell studies show in practice that scientifically sound integrated nutrient management provides economic gains to the farmer as well as better protecting water quality. Economic incentive for farmers is therefore built into the management practices. The long-term goal is to implement forage intensive feed systems on watershed dairy farms to contribute to the phosphorus reduction goal of 10,000 kg per year. Short-term goals are to develop forage systems planning process and computerized tools, improve forage resources and implement high forage diets on three pilot farms, and demonstrate the impact of these systems on mass nutrient balance pilot dairy farms.

Forage intensive feed systems will reduce imports of phosphorus into the farm and will correspondingly assist in meeting the TMDL goal. The forage, cow, manure and soil components will represent a truly integrated nutrient management plan.

Monitoring and Evaluation

Forage and manure phosphorus content are documented. Dairy rations maximize forage dry matter consumption. Dairy rations and milk production are monitored monthly. Changes in ratios of forage types and forage to purchased concentrate are documented and the composition of forages tested. Whole Farm mass nutrient balances are calculated. Crop and feed management changes are related to phosphorus reductions in the farm mass nutrient balances.

Management and Stakeholder Involvement

The forage systems management is supported by local, state and federal entities. It has the support of the Commissioner of the NYS Department of Agriculture and Markets as part of the state Agriculture Environmental Management program.

Technical Expertise Needed

Expertise is available locally and from Cornell faculty covering agronomy, dairy nutrition, nutrient management, farm finance, software development and hydrology. Key Cornell principals principals are Dr. Danny Fox, Department of Animal Science and Dr. Quirine Ketterings, Department of Crop and Soil Sciences. Project management and leadership — Paul Cerosaletti and Dale Dewing, Cornell Cooperative Extension of Delaware County (CCE/DC).

Stakeholders Playing A Role

Farmers, CCE/DC, Soil and Water Conservation District (SWCD), USDA Natural Resource Conservation Service, Army Corps of Engineers (ACOE), Delaware County Agriculture and Farmland Protection Board, Cornell University, NYS WRI and the Watershed Agricultural Program all play a key role. Cerosaletti, Dewing and Cornell Faculty facilitate the adoption of the results locally, regionally and statewide, collaborating with farms, agribusiness and agencies through the AEM Program.

Extension through Partnerships

This program is founded on soundest science and economics. It represents a substantial supplement to the work under WAC. The Soil & Water Conservation District and Cornell Cooperative Extension are now partnering with WAC to augment the latter's focus on pathogens.

Simultaneously, the benefits of this DCAP work are being incorporated into AEM's farm planning steps.

Economic Development Strategy
(Department of Economic Development)

The Department of Economic Development is pursing a dual approach:

1. Encouraging traditional economic and industrial development in the county outside the NYC Watershed areas; and
2. Pursuing environmentally compatible initiatives in Watershed communities and businesses.

The communities within the NYC watershed are attractive as places to live, work and visit. Unfortunately, they have been subject to significant economic decline. This has created a major need for renovation and repair in most of the villages and hamlets. The Department accordingly is promoting a revitalization program to expand opportunities for retailers, speciality services, tourism, and high-technology businesses. Encouraging growth within these communities, as opposed to elsewhere in the watershed, consolidates impervious areas and facilitates focused measures to protect water quality. Diffused growth is less amenable to pollution prevention.

As stated in the 1999 *West of Hudson Economic Development Study*, "the well-being of the watershed depends upon the economic health of the surrounding area." It was this recognition that led the proponents of this study to advocate for the pursuit of economic development activities in areas "just" outside the Watershed. The development of these "adjacent centers of employment" will provide jobs for Watershed residents without substantial effects on the Watershed.

Delaware County has taken this guidance firmly to heart. The Delaware County Industrial Development Agency and the Department of Economic Development have concentrated their efforts on establishing new industrial parks in areas outside the Watershed as a means of attracting new businesses and creating new jobs for Watershed residents, without impacting water quality within the Watershed. Of the areas of focus, two (Deposit and Sidney) were specifically named within the West of Hudson study as having potential for being developed as "adjacent centers of employ-

ment", and two (Hancock and Davenport) are in the only towns in Delaware County that are not in the NYC Watershed.

Main Street Revitalization

A particular aspect of the economic strategy is to promote Main Street Revitalization in partnership with watershed partners including the Catskill Center for Conservation and Development, and the Delaware County Chamber of Commerce. A pilot program is now established funded entirely with County funds. To date twelve projects have been approved or completed. More funds are critically needed.

Regulatory Assistance for Business

Businesses in the Cannonsville Reservoir Basin are finding it difficult, on an individual basis, to meet regulatory requirements. The problem is that each business has to work matters out for itself with very little assistance or guidance. We need a dedicated individual to work with the businesses and DEP staff to expedite meeting regulatory needs. We therefore recommend that a program be established to provide support through one agency. Such a professional would promote timeliness, consistency and predictability for both the businesses and the DEP staff responsible for ensuring regulatory requirements are satisfied. As a result, we would gain timely protection of economic and water quality interests. This would accomplish a great deal in addressing the current problems in the watershed.

DCAP
Outreach Activities

The goal for the proposed outreach activities is to share and extend the methods and understanding gained through DCAP, and its NYC Watershed partners (including specifically the Catskill Watershed Corporation and the WAC) to the entire New York City Watershed, to New York State, and to elsewhere in the US. This outreach goal would also enhance DCAP in providing feedback, the exchange of ideas and methods, and increased institutional standing. There are thus four geographic components for the proposed outreach.

Scientific, Technical and Economic Methods of Watershed Management

Under local leadership, DCAP delivers technical assistance to rural communities and promotes learning, acceptance and application of holistic planning and implementing solutions to the multifaceted rural environment. We propose a comprehensive training program to foster the transfer of DCAP methods for watershed assessment, management and evaluation, including especially: Understanding of climatological effects integrating with a terrestrial model such as SWAT, determining watershed management options and assessing their implementation to meet TMDL and other water quality objectives; planning methods for integrated nutrient management across the farm including enhanced forage systems, and options and methods fostering local engagement and adoption of the watershed management program. Identifying management options is insufficient. Economics is also critical for watershed protection. Resources of local governments are limited. It is imperative local decision-makers and public managers understand and manage resources and finances to effectively respond to community needs. It is also critical for constituency groups of the communities to be integrated into the planning and implementation processes to promote "ownership" in shaping the future. This last point is of particular significance as the private sector is increasingly being relied upon for the delivery of services to the public, and the public is increasingly providing oversight of the services provided by both the private and public sectors.

Public and private audiences for outreach: Governmental and Community leaders, NGOs, Farmers and other business persons, Students including K-12 and college students, agency staff and the general public. DCAP and its NYC Watershed partners have and are producing an immense volume of relevant scientific and technical reports. It would be an extravagant loss for the knowledge this material represents not to be made accessible to the above audiences. The proposed informational methods for the outreach include: Information Technologies:

Web sites; Power Point presentations etc.; Printed materials; Physical exhibits (i.e. for use by the Water Museum and in the WET program). The overall outreach Principal is WRI in collaboration with the Environmental Finance Center at Syracuse University (EFC). Specific organizational instruments for the outreach include for each geographic domain:

- ***The New York City Watershed within Delaware County* (Inreach):**
  Delaware County, DEP, Delaware River Basin Commission (DRBC), Susquehanna River Basin Commission (SRBC). Organizational instruments of DCAP will be employed. (Principals: Frazier, Franzese, and Weidenbach.)

- ***The entire New York City Watershed:***
  Delaware County, the Catskill Watershed Corporation (CWC) and the WAC, in cooperation with their NYC Watershed Partners (Principals: Alan Rosa, Executive Director of the CWC, and Alan White, Executive Director of WAC).

- ***New York State*:**
  - o Delaware County and statewide distribution of results of the agricultural project cooperatively with AEM.
  - o Non-farm components of the outreach will be coordinated through the NYS Nonpoint Source Coordinating Committee in conjunction the NYS Soil and Water conservation Committee and its associated network of SWCDs. Additionally, EFC facilitates a network of lead representatives in rural communities. A particular intent is to convene a New York State Workshop to foster transfer and sharing of knowledge and experiences.

- ***Multi State Collaboration***
  Existing DCAP links to the Susquehanna River Basin and to the Delaware River provide opportunities to communicate with the Chesapeake Bay Greater Watershed and with the Delaware River Basin. These links will be pursued to promote mutually beneficial exchanges and communication across the states concerned.

- ***National***
  The NYS Water Resources Institute at Cornell (Director, Keith Porter), and the Environmental Finance Center at Syracuse University are members of three national networks. This provides national opportunities to market and distribute project materials and information nationally.

Management and Stakeholder Involvement

Outreach will be conducted with DCAP and NYC Watershed partners at the Watershed level. The project will also collaborate with the developing Catskill Partnership Water Museum in creating and displaying materials for the public and as an archive for DCAP and NYC Watershed materials. At the state level, the outreach will be coordinated with the NYS Nonpoint Source Coordinating Committee and the NYS AEM Steering Committee. At the national level, outreach will proceed in collaborative consultation with Water Education for Teachers (WET), the National Institutes of Water Resources (NIWR), and the Environmental Finance Center Network. We also note that USDA, USGS and EPA are partners in the DCAP and NYC Watershed programs.

Monitoring and Evaluation

(Performance Measures and Quarterly Progress Goals)

Monitoring and ongoing evaluation are essential for the sustained success of DCAP. All of the DCAP components incorporate monitoring in some form. Through modeling, the components will be evaluated both individually and in the watershed context. Data from multiple stream and field monitoring stations will check the climatological and terrestrial modeling. Institutional monitoring and evaluation of the project will be comprehensively provided by the hierarchies of Advisory, Steering and Governmental Boards that regularly review and advise DCAP staff and programs. We have proposed that an Expert Panel of Watershed Experts of national standing be formed to critically review and report upon the Plan and its projects.

Milestones to determine realization of DCAP project goals

- ***Year 1***:
  Form and convene Expert Review Panel with expertise in watershed management, Forage systems Planning methods alpha tested on farms with feed and crop advisors. The coupled Climatological and terrestrial models will be calibrated and validated. (SWAT has been calibrated and validated). A modeling team will be created including staff from watershed agencies.

  A training program will be developed to foster transfer of the monitoring and modeling methods to assess water quality needs and options to meet objectives. (Including specifically how to allocate and evaluate meeting TMDL nonpoint source objectives under local watershed leadership). We specifically propose, under the auspices of the Scientific Support Group, to conduct training to establish a watershed capability to use SWAT. Training will be arranged with the SWCD, CWC, and Delaware County Planning Departments. The NYC Department of Environmental Protection has also expressed interest in participating this transfer.

  Outreach educational and informational materials and activities such as a proposed NY Project WET Make A Splash (Watershed) Festival in conjunction with the Catskill Partnership Water Museum, will be developed, reviewed and instituted.

- ***Year 2***:
  The coupled modeling methods will be transferred to the watershed and training provided for transfer to other NYS Watershed Programs. The materials will be made available nationally.

  Forage Management Plans implemented on farms feed systems initiated. Whole Farm nutrient management will be extended through AEM.

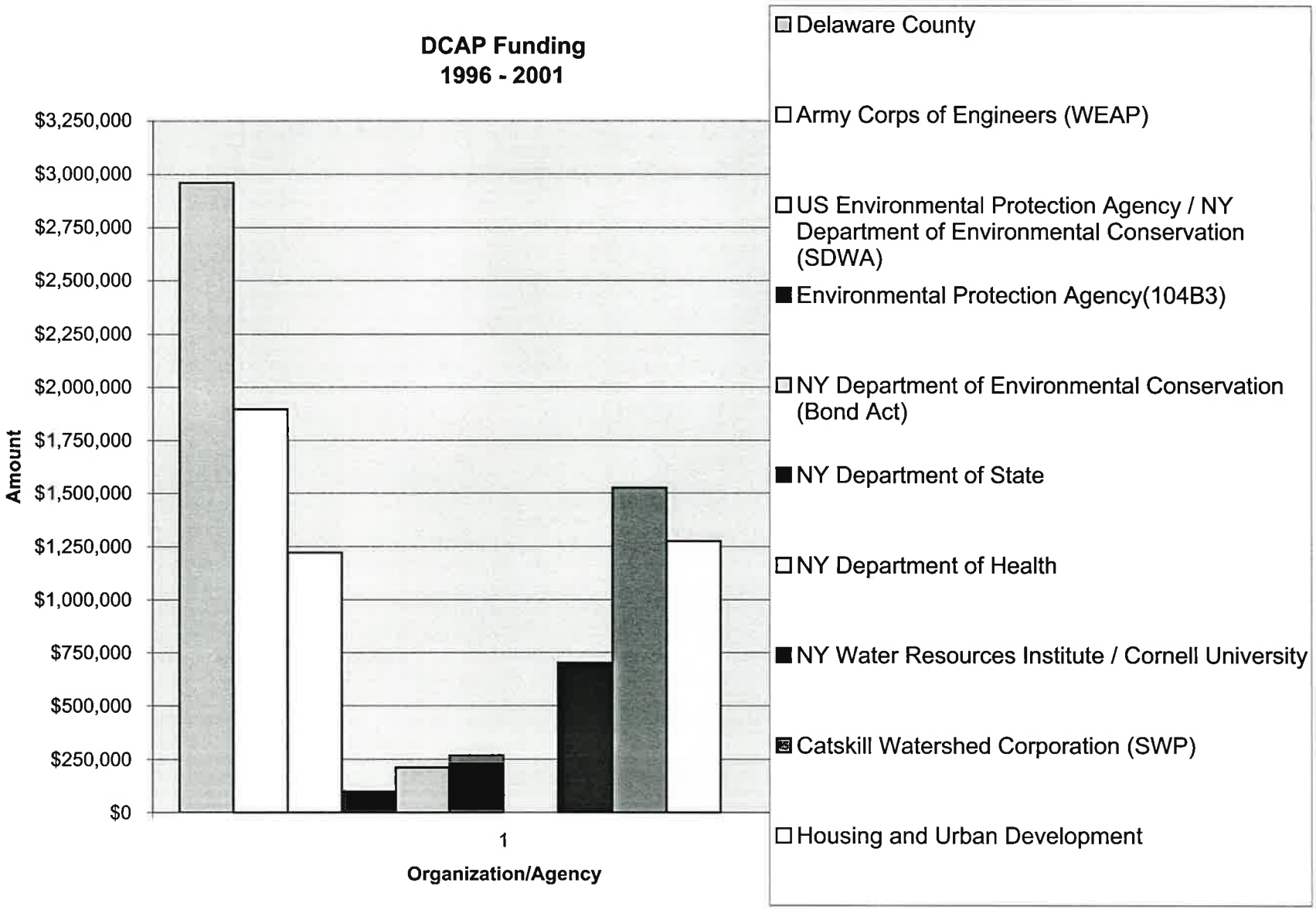
  Outreach materials will be disseminated and tested at all levels.

  The Expert Panel will meet again in conjunction with an invitational Watershed Workshop.

- ***Year 3***:
  On-farm impacts on nutrient balances measured and documented. Overall progress of DCAP in meeting local and watershed water quality objectives measured and assessed.

  Particular effort will be made to foster statewide adoption of the methods through AEM and the NYS Nonpoint Source Coordinating Committee.

Finally, Delaware County assumes its interagency partners will continue to provide review and guidance as we proceed.


DCAP Funding
1996 - 2001
$3,250,000
$3,000,000
$2,750,000
$2,500,000
$2,250,000
$2,000,000
$1,750,000
$1,500,000
$1,250,000
$1,000,000
$750,000
$500,000
$250,000
$0
Amount
1
Organization/Agency
Delaware County
Army Corps of Engineers (WEAP)
US Environmental Protection Agency / NY Department of Environmental Conservation (SDWA)
Environmental Protection Agency(104B3)
NY Department of Environmental Conservation (Bond Act)
NY Department of State
NY Department of Health
NY Water Resources Institute / Cornell University
Catskill Watershed Corporation (SWP)
Housing and Urban Development

Summary of Environmental Grants

Imminent Threat Grant – 1996

- Housing and Urban Development (HUD) grant valued at $600,000.
- Grant application submitted by staff at Delaware County Planning and Economic Development
- Reconstruction and stream bank stabilization effort along the Delaware River and its tributary in Walton, NY.

Wastewater Relocation - 1997

- Housing and Urban Development grant valued at $675,000.
- The grant application submitted by Delaware County Department of Planning and Economic Development.
- Construction of a pipeline from Frasers, NY to the Delhi Wastewater Treatment Plant in Delhi, NY.

Phosphorus Study and Action Plan Development – 1997

- A grant for $50,000 was secured from the New York State DEC as seed money to initiate a comprehensive phosphorus study.
- Delaware County provided $50,000 as a match.
- Cornell University / WRI assists Delaware Co. complete the county's strategy
- The county purchases a global positioning system (GPS) for current and future phosphorus studies.
- A Delaware County Action Plan (DCAP) was developed

Safe Drinking Water Act (SDWA) – 1997

- A grant valued at $150,000 received from the USEPA administered by the NYSDEC.
- There was no match required for this particular grant.
- Simple model developed for stormwater management.
- Staff trained to use the model.
- Phosphorus risk assessment tool developed.
- RunQual simulation tested for phosphorus loading.
- GIS equipment purchased for Del. Co. Planning Dept.
- Stormwater monitoring in the Villages of Walton and Delhi.

Watershed Environmental Assistance Program (WEAP) – 1998

- A grant values at $600,000 received from the U.S. Army Corps of Engineers.
- Required a 25% match either as in-kind services or actual cash match.
- Survey of infrastructures of villages and hamlets to determine phosphorus sources and losses to watercourses.
- Prepared designs for phosphorus attenuation.
- Precision feed study.
- Determine sources and amounts of phosphorus in soil.
- Determine best management uses of manure.
- Manure management business plan (still under study).
- Septic system study.
- Highway infrastructure inventory.
- Outreach to the public for various tasks.
- GIS support implemented for various tasks.

Safe Drinking Water Act (SDWA) – 1999

- A grant valued at $100,000 received from the USEPA and administered by the NYSDEC.
- The Environmental Protection Fund grant received by the Del. Co. Soil and Water Conservation District provided a match of $51,000.
- Intensive forage systems explored for phosphorus reduction capabilities.

Watershed Environmental Assistance Program (WEAP) – 1999

- Catskill Watershed Corporation (CWC) provided $1,526,156 from the "Stormwater Retrofit Program".
- A grant valued at $396,785 received from the Army Corps of Engineers and administered by the NYSDEC to be used as partial match to the stormwater projects.
- Delaware County Planning Department was successful in sequiring $111,814 from the NYS Bond Act / Environmental Protection Funds to provide partial match to the stormwater projects.
- Provided stormwater infrastructure for the Village of Delhi
- Provided stormwater infrastucture for the Village of Walton
- Provided stormwater appliances for the County Route 6 corridor through the hamlet of Bovina Center.

Safe Drinking Water Act (SDWA) – 2000

- A grant valued at $444,700 received from the US Environmental Protection Agency USEPA and administered by NY Department of Environmental Conservation (NYDEC).
- Required a 100% match either as in-kind services or actual cash match.
- Delaware County provided $94,700 as match.
- Cornell University provided $350,000 as match.
- Working paper for review about offsets for stormwater treatment systems.
- Handheld computer used for tracking stormwater maintenance operations.
- Prepare, provide formal review, and complete trial simulations using the SWAT model.
- On-farm monitoring, modeling and management studies.
- Drafting of quantitative phosphorus audit worksheets to promote best management practices.
- Pilot training of selected AEM planners.
- Compile and edit base GIS layers for modeling.
- Implement GIS modeling methods for community and business phosphorus reduction management.
- Training of staff and communities to use GIS.
- Manage the SDWA 2000 grant.

Safe Drinking Water Act (SDWA) 2001

- A grant valued at $526,205 received from the US Environmental Protection Agency USEPA and administered by NY Department of Environmental Conservation (NYDEC).
- Required a 100% match either as in-kind services or actual cash match.
- Delaware County providing $63,665 as in-kind match.
- New York State DEC providing $110,700 as match.
- Cornell University / WRI providing $351,841.
- Water Quality Monitoring to Estimate Phosphorus Losses from a Lowland Farm.
- Report about formal review of DCAP SWAT model.
- Journal articles about uncertainty analysis, stochiastic analysis, optimization.
- Report about refined calibration with increased monitoring data.
- Report and meeting materials about additional trial simulations reflecting management options.
- Software and data installation at Delaware County agencies.
- Refined software for livestock feed assessment and planning technical support to staff testing software.
- Completed on-farm testing of materials by selected AEM planners.

- Release of revised materials for wider testing or production use, depending on evaluation.
- Compile, create and edit base GIS layers necessary for modeling.
- Implement GIS modeling methods for business and community phosphorus reduction management.
- Project management and outreach.

104B3: *Enhanced Pathogen Management for the Susquehanna River Basin*

- A letter, indicating a grant award valued at $100,000 has been received from the USEPA.
- Delaware County Soil and Water Conservation District will be providing $72,980. to aid in the completion of this project.
- 60 enhanced pathogen management surveys utilizing AEM worksheets will be completed.
- Progress report to the AEM Technical Committee.
- After the assessment HACCP methods to determine critical control points to integrate nutrient and pathogen enhanced management.
- Reports to EPA will be filed.
- Informational and technical ways in which Enhanced Pathogen Management may be extended elsewhere in NYS will be developed.

104B3: *Rural Community Stormwater: Sustainable Drainage Systems*

- A grant valued at $94,000 is being sought from the USEPA.
- Creation of overall Watershed Management Steering Committee.
- Establishment of local community Stormwater Working Teams.
- Formulation of overall watershed objectives integrating on-going 104 funded farm work.
- Creation of overall community criteria and overall stormwater plan.
- Selection of specific conveyance and treatment methods for each community.
- Production of stormwater plans integrated holistically into strategies for the Ouleout and Charlotte Valley Basins.
- Production and release of informational materials for the use in other rural communities.

104B3: *Watershed Initiatives*

- A grant application has been submitted for the *Watershed Initiative* proposal. If successful, the grant being requested is valued at $1,282,940.
- The following entities have agreed to provide the required match:
    1. Syracuse University - $15,000
    2. New York Water Resource Institute - $90,000

3. Cornell University - $176,179
4. Delaware County - $79,980
5. Delaware Co. SWCD - $4,500
6. Delaware Co. CCE - $53,700
7. Watershed Ag. Council - $105,000

- Nutrient management through forage intensive feed systems.
- Climate and Terrestrial watershed modeling.
- DCAP outreach, evaluation and administration.

DCAP Program Summary

Situation		DCAP Program	Long – term Funding Requirements (10-years)	Near – term Funding Requirements (2- years)	Funds Obtained to Date
Agriculture	• 65 – 85% of imported nutrients on farms are from purchased feeds	Precision Feeding	$1,309,000		$1,150,000
	• Improved farm forage production can reduce phosphorus imports and improve phosphorus recycling • Farm forage management has a large impact on 'edge of field' nutrient and pathogen losses	Forage Systems Management	$5,825,000	>$466,940	$0.
	• Livestock manure is a concentrated source of nutrients (particularly phosphorus) and pathogens • Manure represents the greatest source of nutrients applied to the land • Treatment of relatively small amounts of manure can substantially reduce phosphorus losses to the reservoir	Manure Management	$7,150,000.	?	$90,000.
Septic	• Soils in Delaware County represent a challenge to engineers with regards to on-site septic systems • Topography of Delaware County also provides a challenge with these systems. • Staff at Soil and Water Conservation District office in Delaware County is working with CWC to assist in the acquisition of funding for the septic system rehabilitation and maintenance program	Septic Systems Replacement or Rehabilitation	Delaware County supports the water quality efforts of the Catskill Watershed Corporation as provided for in the Memorandum of Agreement and required by the Filtration Avoidance Determination		

	Situation	DCAP Program	Long – term Funding Requirements (10-years)	Near – term Funding Requirements (2- years)	Funds Obtained to Date
Highway Management	• Culvert installation mobilizes sediment and nutrients • Slip lining technology is cost competitive that benefits multiple parties	Culvert Stabilization and Slip Lining	$162,000.	$32,400.	$0.
	• Ice control on highways necessary for the safety of the motoring public are also a source of sediment and nutrients • Application control equipment provide a management technology to minimize the introduction of sediment and deicing materials	Deicing Material Application Control System	$67,500.	$5,400.	$8,100.
	• Provide method for removal of sediments with containment of nutrients and contaminants • Restores stormwater structures to functional conditions • Provides on-going inspection of stormwater structures	Vacuum Truck Operations	$1,394,000.	$326,000.	$273,000.
	• Expansion of wetlands environs for wildlife yields known water quality benefits • Establishment of a bank for trading created acres with unavoidable wetlands losses	Wetlands Construction	Delaware County is not requiring any funding of this project at this time		$0.00

	Situation	DCAP Program	Long – term Funding Requirements (10-years)	Near – term Funding Requirements (2- years)	Funds Obtained to Date
Municipal Stormwater	• Point and non-point sources of stormwater in the villages and hamlets were identified • Assessment of existing stormwater appliances and infrastructure and ultimately identify deficiencies • Provide information to municipalities for planning purposes for the purposes of stormwater control	Community Stormwater Planning	$3,099,721. (for 5-year period)	1,240,000.	$0.
	• The majority of road miles are owned by towns • Roadway stormwater structures convey stormwater and contaminants directly to water sources. • Towns in Delaware County currently have limited resources and expertise • Highway Management Plans (HMP) focus on highway maintenance to mitigate water quality impairment • HMP leverage resources more efficiently to maximize results and minimize costs	Highway Management Plans for Towns	$6,995,000.	$250,000.	$0.

	Situation	DCAP Program	Long – term Funding Requirements (10-years)	Near – term Funding Requirements (2- years)	Funds Obtained to Date
Stream Corridor Management	• Stream corridors are the final barrier to nonpoint source contaminants entering the watercourses • Corridor management is a requirement of the Filtration Avoidance Determination	Stream Corridor Management	$1,200,000.	$953,200.	$246,800.
Economic Development	• Economic stagnation has led to the significant need for renovation and repair in most villages and hamlets. • Commercial sprawl, with associated increased areas of impervious surfaces as a result of continued degradation of the county's business centers. • Business development in areas lacking adequate water quality protection facilities.	Main Street Revitalization	$0.	$500,000.	$40,000.
	• Certain industrial development may not be compatible with NYC water quality regulations • There is a lack of high paying job opportunities for residents of the watershed • Industrial parks are located outside the NYC watershed	Industrial Park Development: Deposit, Sidney and Davenport	$7,500,000.	$1,500,000.	$1,400,000.
	• Businesses in the watershed find it difficult to meet the regulatory requirements • Watershed regulations can be time consuming and inconsistent at times • Program being suggested is an ombudsman to work with the businesses and the DEP staff to expedite meeting the regulatory needs.	Regulatory Guidance	$250,000.	$50,000.	$0.

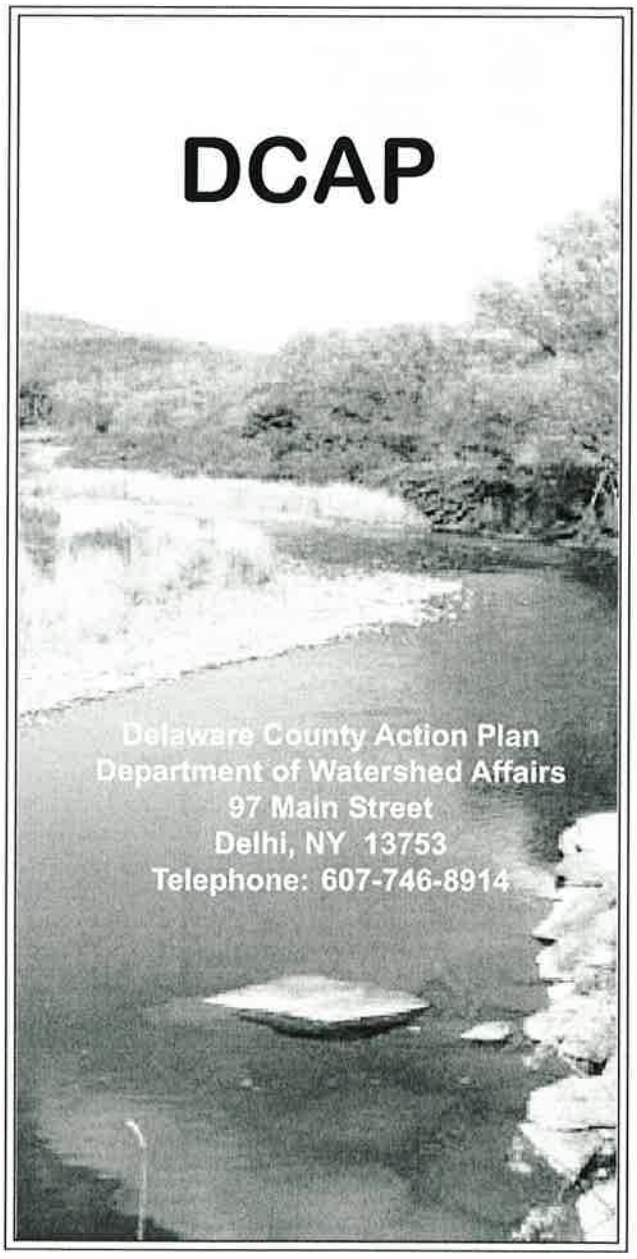
Situation		DCAP Program	Long – term Funding Requirements (10-years)	Near – term Funding Requirements (2- years)	Funds Obtained to Date
Solid Waste Management Center	• Provides a complete closed loop for nutrient management and pathogen destruction for WWTP biosolids • Inclusion of manure with compost facility inputs allow an additional management technique for excessive manure within the Cannonsville Basin	Compost Facility at the SWMC	Currently, no water quality grant programs have been identified for this type of project		$0.
Outreach & Education	• DCAP seeks to extend the methods and experiences to areas outside the watershed to NYS and beyond • Outreach to the watershed public necessary to aid the decision-makers and public managers understand and manage resources and finances effectively • Comprehensive training of water quality professionals within the watershed regarding the use of the water assessment model	Outreach and Education	$1,350,000.	$270,000.	

Acknowledgment

This document evolved from the presentations given to the DCAP Phosphorus Study Committee on October 8th, 2002. The SWAT modeling component of DCAP recently instituted a critical peer review that proved to be constructively positive. This encouragement prompted the suggestion we solicit a review by the Phosphorus Study Committee. This document is intended to provide a further basis for review initiated by the presentations in the October 8th meeting.

On behalf of the Delaware County Board of Supervisors, we acknowledge the support and guidance provided by the Interagency (and other) members of the Phosphorus Study Committee. We trust this document provides a fair basis for assessing the progress of DCAP and its component parts.

DCAP



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CWT 11

Proposed Phase II Phosphorus TMDL Calculations for Ashokan Reservoir

March 1999

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Many people, in several agencies, have contributed to the development of the Phase II TMDL Reservoir Reports.

Michael Principe (Director of Drinking Water Quality) David Lipsky (Deputy Chief of Drinking Water Quality Control) and Lorraine Janus (Section Chief of Upstate Field Operations) have all provided guidance for the TMDL project from the earliest stages of the program. Several individual groups in the Bureau of Water Supply, Quality and Protection have contributed to the overall TMDL project, including Operations and Engineering, Watershed Planning, Limnology, Water Quality Impact Assessment, Modeling and GIS Mapping. The Limnology Group in particular has played a crucial role, not only in providing the necessary reservoir data and limnological analyses but also by critically reviewing the scientific aspects of the project. And finally, Elliot Schneiderman and Mark Zion provided the GWLF Model results and revised the Vollenweider Model for the Phase II Reservoir Reports.

The TMDL Technical Working Group, composed of scientists and engineers from of the New York City Department of Environmental Protection, the New York State Department of Conservation, the New York State Department of Health and the United States Environmental Protection Agency, has been a driving influence throughout the TMDL project. The comments, suggestions, and technical guidance have been extremely useful.

Finally, the Department would like to thank all the reviewers from the participating agencies and the general public who provided constructive criticism on the Phase I TMDLs. Many of the changes incorporated in the Phase II TMDLs are due to these thoughtful reviews. Last but not least, many thanks to Pat Girard and others for all their assistance in producing the final documents.

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1. Introduction

This document summarizes the data analysis and modeling results supplied by the NYC Department of Environmental Protection (DEP) for use in the development of Phase II phosphorus Total Maximum Daily Loads (TMDLs) for Ashokan Reservoir.

1.1 Regulatory Background

The TMDL Program in the NYC watershed is a joint effort among the United States Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (DEC) and the New York City Department of Environmental Protection. The Clean Water Act of 1977, as amended in 1986, requires each state to follow certain guidelines established by the EPA to maintain or improve their water quality. Section 303(d) of the Clean Water Act requires states to:

1. identify those waters where technology based or other controls are not stringent enough to implement applicable water quality standards and still require TMDLs;
2. establish a priority ranking for those waters;
3. establish the TMDL for the pollutant(s) of concern;
4. submit the TMDLs and the related Wasteload Allocations and Load Allocations (see below) to EPA for review and approval; and
5. incorporate TMDLs into the state's water quality management plan and begin implementation for point and nonpoint sources.

DEC is responsible for meeting the 303(d) requirements in New York State. The NYC reservoirs have been on the New York State 303(d) list since 1994, with phosphorus given as the primary pollutant. DEP volunteered to do the necessary data analysis and modeling to set the phosphorus TMDLs, and the individual reservoir reports are DEP's technical contribution to the State TMDL program.

Even though the TMDL process is required by the Clean Water Act and would occur regardless of other activities in the watershed, the development of phosphorus TMDLs in the NYC watershed has been incorporated into the January 1997 New York City Watershed Memorandum of Agreement (Watershed MOA), which includes revised NYC Watershed Regulations and a new EPA Filtration Avoidance Determination issued in May 1997 with respect to the Catskill and Delaware water supplies (FAD)(DEP, 1997). The inclusion of the TMDL process in these documents is appropriate since TMDLs provide a tool for water quality protection and assist in watershed management. Specific milestones are included in the Watershed MOA to assure that the process continues to move forward.

1.2 Overview of the TMDL Process

The TMDL process is a tool for assessing compliance with water quality standards and integrating the management of point and nonpoint sources of pollution using a watershed approach. TMDLs can be calculated for any pollutant of concern, and can be expressed in terms of either mass per time, toxicity, or other appropriate measure that relate to a water quality standard. Despite the name, TMDLs are not required to be daily values or maximum values, instead the way a TMDL is expressed depends on the type of parameter involved and the approach used in the analysis. In the case of a nutrient like phosphorus, an annual or growing season value is appropriate. A phased process of TMDL development was adopted for the NYC watershed so that pollution (i.e. phosphorus) reduction strategies can be implemented as soon as possible based on the Phase I results, while further modeling and data analysis is conducted in Phase II.

The objective of a TMDL is to allocate permissible loads among different pollutant sources so that water quality standards are met. The permissible load allocated to point sources of pollution is referred to as the Wasteload Allocation (WLA). Each point source in the NYC watershed, such as a wastewater treatment plant, is given a wasteload allocation for phosphorus. The permissible load allocated to nonpoint sources of pollution is referred to as the Load Allocation (LA). The load allocation can be specified as an aggregate for the basin or separated by land use or subbasin. One final component of a TMDL is the margin of safety (MOS). The MOS is the part of the load left unallocated. The MOS accounts for the uncertainty about the relationship between the pollutant load and the resulting water quality of the waterbody.

The term "TMDL" is often used in both a literal sense and a more general sense. In a literal definition, the TMDL is the critical load for a pollutant. However, the term is often applied to the entire process and refers to the components of a TMDL as well, including the WLA, LA, MOS, associated modeling of sources, and implementation measures.

1.3 Importance of Phosphorus TMDLs to NYC's Water Quality Management Plan

The phosphorus TMDLs are an important part of the NYC's overall Water Quality Management Plan. Phosphorus is a required nutrient for algae. The reservoirs in the NYC watershed, as well as many waterbodies in this region, are considered "phosphorus limited". Phosphorus is the nutrient in lowest supply compared to the algal demand, and thus is limiting the growth of algae. Therefore, an increase in the amount of phosphorus will result in a greater abundance of algae. While some algae growth in a reservoir is acceptable, excessive algae growth leads to other water quality problems such as taste and odor, low dissolved oxygen in the bottom waters, release of metals from anoxic bottom waters and disinfection problems (DEP, 1994; DEP, 1997; DEP, 1999). These water quality problems constitute a "use impairment" given that the use of this water is as a public water supply. Water bodies that contain excessive amounts of algae are called eutrophic; waters

with intermediate amounts of algae are called mesotrophic and waters with low amounts of algae are called oligotrophic. A number of the NYC reservoirs, primarily in the Croton System, are classified as eutrophic.

A TMDL is based on a water quality standard or guidance value. In the Phase I TMDL decision letter from EPA, it was noted that the State guidance value for phosphorus (20 $\mu g\ l^{-1}$), which was utilzed in the development of the Phase I TMDLs, was derived to protect aesthetic and recreational uses of the water body. DEC, and therefore the interagency TMDL workgroup, was charged with evaluating whether this value was adequate to protect a public water supply prior to the completion of the Phase II TMDLs.

Currently, there are no federal standards for phosphorus, algae or chlorophyll *a* in the source water of a public water supply. EPA is, however, currently pursuing the development of regional nutrient criteria as part of the Clean Water Action Plan (EPA, 1998). EPA has developed a national strategy to accelerate the development of scientific information concerning the levels of nutrients that cause water quality problems and to organize this information by type of water body and ecoregion. The individual states are expected to adopt numeric nutrient criteria not only based on the type of waterbody and ecoregion, but also the designated use of the waterbody by 2003. These nutrient criteria will then be available for development or revision of TMDLs or permits for wastewater treatment plants.

While the State guidance value may be appropriate for recreational purposes, it may not be stringent enough to protect the NYC reservoirs. Using a combination of water supply literature and site-specific data analysis, DEP has proposed a site-specific (i.e., NYC watershed-specific) phosphorus guidance value of 15 $\mu g\ l^{-1}$ (DEP, 1999a). This proposed guidance value has been presented as an interim value, pending the development of national nutrient criteria (EPA, 1998) and the establishment of mechanistic models for the NYC watershed. In the future, reservoir-specific guidance values may be developed which take into account the location and strategic importance of a reservoir within the water supply, i.e. terminal reservoir, as well as the unique character of the subwatershed and reservoir.

The implementation of the TMDLs will result in phosphorus load reductions in the basins that currently exceed the phosphorus guidance value. The phosphorus load reductions are likely to involve point and nonpoint sources of phosphorus. As part of the Watershed MOA, all existing wastewater treatment plants in the NYC watershed are being upgraded to meet the requirements of the City's revised Watershed Regulations. In addition, the SPDES permits for all of the wastewater treatment plants are being revised to include phosphorus limits for all the plants. Once the wastewater treatment plant upgrades are completed, these new limits will result in less phosphorus from point sources. If additional phosphorus load reductions are required in some basins, then

nonpoint source management techniques may be used to target specific areas for reduction in non-point phosphorus loads. DEC is responsible for designing and implementing the phosphorus reduction plan.

In addition to the State TMDL program, DEP is addressing phosphorus loading to the reservoirs. The recently promulgated revised NYC Watershed Regulations (entitled "Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources") allow the City to designate reservoir basins as phosphorus restricted. A phosphorus restricted basin is defined as the drainage basin of a reservoir or controlled lake in which the phosphorus load to the reservoir or controlled lake results in the New York State phosphorus water quality values being exceeded as determined by the Department pursuant to an annual review. Under the Watershed Regulations, new or expanded wastewater treatment plants with surface discharges are prohibited from being located within phosphorus restricted basins and any projects requiring a stormwater pollution prevention plan within a phosphorus restricted basin must include an analysis of phosphorus loading before and after development and provide for greater stormwater treatment. It should be noted that if a basin is exceeding its TMDL, a new surface point source discharge will not be approved by the State, regardless of the basin's phosphorus restricted status with the City.

There are many similarities between the TMDL program and phosphorus restricted basins. Both programs utilize the same guidance value for phosphorus, and incorporate a five year average of phosphorus data. There are, however, several differences between the two programs, including but not limited to the following:

- the governing agency is different;
- the regulatory implications of the programs are different;
- TMDLs are specified as annual loads of phosphorus whereas phosphorus restricted basin determinations are solely based on monitored phosphorus concentrations;
- TMDLs are intended as a one-time calculation, with revisions as necessary, whereas phosphorus restricted basins are revised annually as more current data becomes available;
- Phosphorus Restricted Basins is an assessment tool which can be used to determine if a basin is meeting its TMDL.

Due to these differences, the list of basins that exceed their TMDL and the list of phosphorus restricted basins will not necessarily be the same at any given time.

1.4 Phase II Schedule And Supporting Documents

The schedule for developing and implementing the Phase II TMDLs is set out in the Watershed MOA and the FAD. The Phase II methodology report, initially proposed by DEP (DEP, 1996t), was approved by DEC and EPA in June 1998 (DEP, 1998). The deadline for the individual reser-

voir reports is stated as "the later of 6/30/98 or 9 months from agreement on Phase II methodology" which results in March 1999. Following DEP's submission of the reservoir reports, DEC is required to review the information and submit the TMDLs to EPA within six months. EPA is then required to review the TMDLs and issue a determination within one month of the official TMDL submittal. In addition to the TMDL reports mentioned above, there are also several reports concerning the implementation of the TMDLs and subsequent DEP evaluation of the implementation measures.

Previous TMDL-related documents include a Phase I methodology report (DEP, 1996a), nineteen individual Phase I Reservoir Reports (DEP, 1996b-s), two reports coauthored by DEC and DEP on potential nonpoint source management practices (DEP/DEC, 1997a; DEP/DEC, 1997b), and one DEC report on the Phase I implementation (DEC, 1998).

2. Summary of Phase II Methodology

The complete methodology for deriving Phase II TMDLs for phosphorus can be found in the DEP document entitled "Methodology for Calculating Phase II Total Maximum Daily Loads (TMDLs) of Phosphorus for New York City Drinking Water Reservoirs" (DEP, 1998)(Figure 2.1). In brief, the TMDL process can be separated into two distinct components: modeling of phosphorus sources in the basin and calculating the TMDL components. The modeling in the Catskill and Delaware watersheds takes advantage of a separate, comprehensive modeling effort conducted as part of the FAD.

2.1 Modeling Phosphorus Sources in the Basin

The model results are not used in the TMDL calculation directly. The primary phosphorus sources are modeled to improve our understanding of the phosphorus budget in each basin and assist in planning and implementing phosphorus reduction measures.

In the Croton System:

- phosphorus sources in the basin are modeled annually for 1993 - 1996, as well as a four year composite, using the Reckhow model;
- phosphorus loads from wastewater treatment plants utilize available data;
- phosphorus loads from nonpoint sources are estimated based on land use and phosphorus export coefficients;
- the Vollenweider Model is utilized to calculate the predicted phosphorus concentration from the modeled phosphorus load from the watershed.

In the Catskill and Delaware Systems:

- phosphorus sources are modeled annually for 1993 - 1996 using the Generalized Watershed Loading Function Model (GWLF);
- phosphorus loads from wastewater treatment plants utilize available data;
- phosphorus loads from nonpoint sources in GWLF are driven by precipitation and air temperature data. Monthly nutrient exports are calculated using common empirically-derived equations which employ export coefficients of nutrient concentrations in the sediment, groundwater and overland runoff;
- the Vollenweider Model, modified with an additional settling term to be compatible with the GWLF results, is utilized to calculate the predicted phosphorus concentration from the modeled phosphorus load from the watershed.

2.2 TMDL Components

The complete TMDL analysis for a basin includes the critical load (TMDL) as well as allocations of this critical load to point sources, nonpoint sources and a margin of safety. The load reductions that can be expected from the upgrades of the wastewater treatment plants are estimated. If a reservoir has upstream reservoirs, an estimate of the load reduction realized when the upstream reservoir meets the proposed guidance value is also estimated.

- The TMDL is calculated, using the Vollenweider Model, to achieve both the proposed phosphorus guidance value of 15 $\mu g\ l^{-1}$ and the existing phosphorus guidance value of 20 $\mu g\ l^{-1}$.
- The Wasteload allocation (WLA) is the part of the TMDL reserved for point sources. This is calculated assuming the phosphorus effluent standards given in the Watershed Regulations, and the maximum permitted flow in the SPDES permit for each point source.
- The Load allocation (LA) is the part of the TMDL reserved for nonpoint sources. This is calculated by subtracting the WLA and a margin of safety (MOS) from the TMDL (i.e. LA = TMDL-MOS-WLA).
- The available load is the sum of the WLA and LA (=TMDL-MOS).
- The current load is calculated, using the Vollenweider Model, from reservoir monitoring data.
- The difference between the available load and the current load yields the total load reduction required or the load still available in the basin.
- A comparison of the WLA and the most recent (1996) estimate of the point source load indicates if point source reductions can be credited toward the total load reduction.
- An estimate of the load reduction due to potential load reductions in upstream reservoirs can be calculated from the modeling.

2.3 Comparison of Phase I and Phase II

The Phase II analyses will provide several enhancements over the Phase I results, in both the phosphorus modeling and the data available for inclusion in the calculations.

- In Phase I, the reservoir was the only water body explicitly modeled. In Phase II, the watershed model used in the Croton watershed has been revised to explicitly account for phosphorus retention by the larger lakes and ponds in the watershed. DEP is calling this approach the "Nested Reckhow Model".
- In Phase I, the Reckhow model was applied to the entire watershed. In Phase II, the Generalized Watershed Loading Function (GWLF) model has been used for the Catskill and Delaware watersheds.
- In Phase I, one year (1993) was modeled for all reservoir basins. In Phase II four consecutive years (1993 - 1996) have been modeled. These four recent years contain unusually wet conditions, as well as drought conditions, and should provide a rigorous test for the phosphorus model. In addition, these years contain a more comprehensive database due to heightened sampling of the reservoirs and wastewater treatment plants.

- In Phase I, the TMDL was calculated as the five year average that results in an in-reservoir concentration of 20 $\mu g\ l^{-1}$. In Phase II, a new phosphorus guidance value has been proposed which, in the opinion of the Department, more adequately addresses eutrophication-related use-impairment for a public water supply. The proposed Phase II phosphorus guidance value is 15 $\mu g\ l^{-1}$. The Phase II TMDL has been calculated using both the proposed and existing guidance values.
- In Phase I, the TMDL was calculated using data from 1990 - 1994. In Phase II, the TMDL has been calculated using data from 1992 - 1996 and is a more current assessment of the reservoir status.

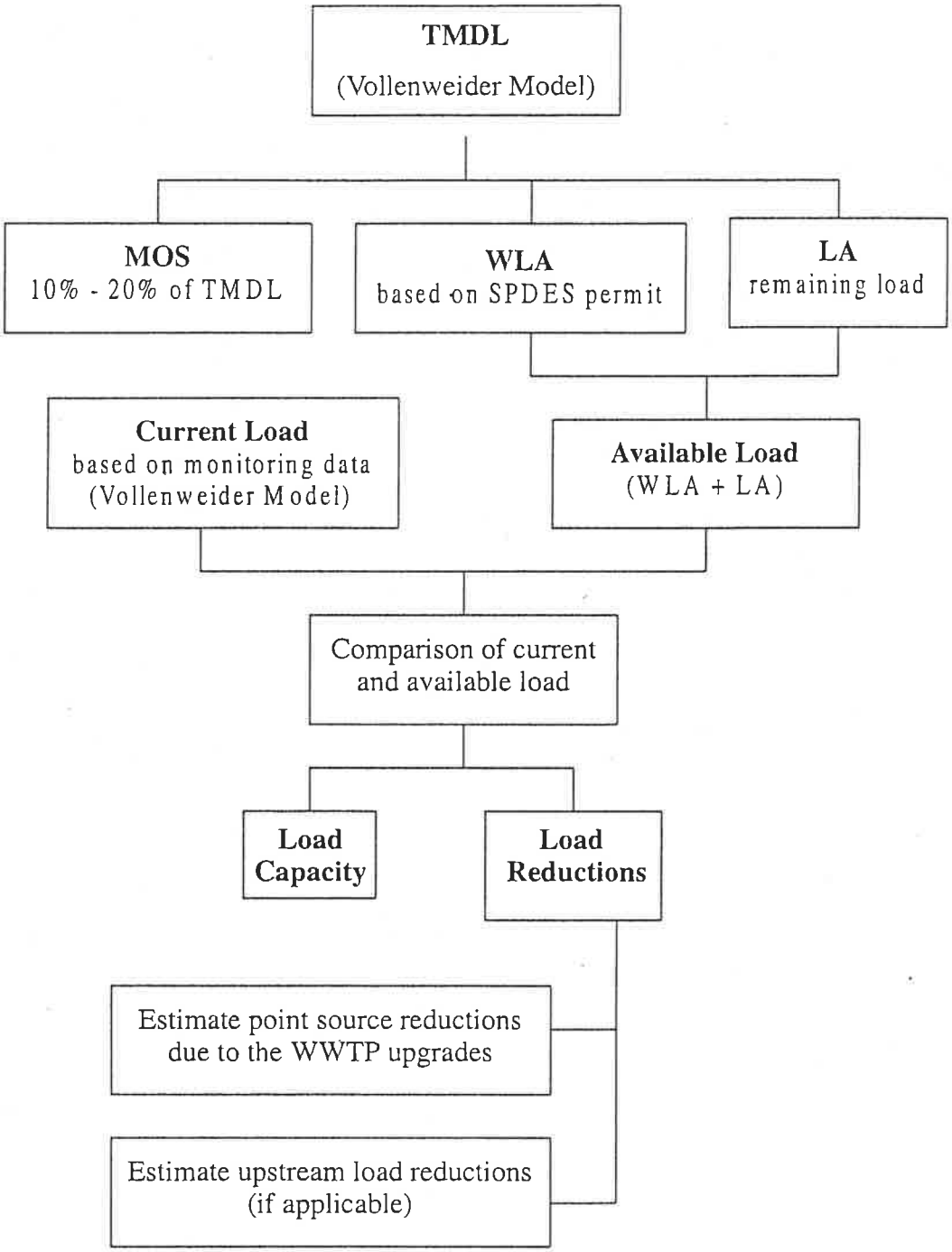

Figure 2.1 Phase II Flowchart.

3. Background Data Utilized

3.1 Reservoir and Basin Description

Ashokan Reservoir is one of two reservoirs in the Catskill system and was placed in service in 1915. The basin covers 661 km^2 and is located in Ulster and Greene Counties. The watershed is primarily forested with a small percentage of grass and shrub land. The physical characteristics of the reservoir are given in Table 3.1 and 3.2. Ashokan Reservoir is split into two basins by a dividing weir, and the physical and water quality characteristics are given for each basin separately. Water enters the reservoir primarily from the Esopus Creek in the northwest part of the reservoir. The Shandaken tunnel enters the Esopus Creek approximately 11 miles north of the West Basin. The West Basin has a dam, release structure and a spillway. The East Basin has a spillway and diversion structure. Water flows from the West Basin to the East Basin both through and over the dividing weir. The Catskill Aqueduct can draw on water from both basins, but typically draws from the East Basin, maximizing the time allowed for settling. Water flows down the Catskill Aqueduct to the Kensico Reservoir.

Ashokan Reservoir receives a large percentage of water from surface runoff in its own basin, as well as a fair amount from the Schoharie Reservoir (via the Shandaken Tunnel). The pattern of annual precipitation follows that seen in the rest of the NYC watershed; average in 1993 and 1994, but unusually dry in 1995 and unusually wet 1996. The annual water budgets for 1993 - 1996 are given in Table 3.3 and 3.4. The flood in early 1996 and the subsequent above average rainfall during the remainder of the year is reflected in the water budget by a lower than normal flow down the aqueduct as well as a much higher than normal flow over the spillway. Ashokan Reservoir experienced extreme turbidity from the 1996 flood from its own watershed as well as from the water entering from Schoharie. The residence time of water in the Ashokan Reservoir, and particularly in each individual basin, varies depending on the operation of the system.

3.2 Water Quality

Water quality is closely monitored in all the NYC reservoirs. Surveys are currently performed on a monthly basis for all reservoirs during the growing season and semi-monthly coverage for the terminal reservoirs (Rondout, Ashokan, Kensico, West Branch and New Croton) as well as the West-of-Hudson reservoirs. Sampling sites are generally located along the main axis of the reservoir and at other key locations (e.g. aqueducts). The number of the routine sampling sites varies with the size, complexity and relative location of the reservoir in the NYC water supply. At each sample site, field measurements are taken (e.g. Secchi depth) and water samples are withdrawn from multiple depths for analysis in the NYC laboratories. A complete description of the sampling program can be found in the Surveillance Monitoring Report (DEP, 1997). Rarely, a reservoir survey is omitted due to excessive reservoir drawdown or emergency surveys required in other basins at the same time.

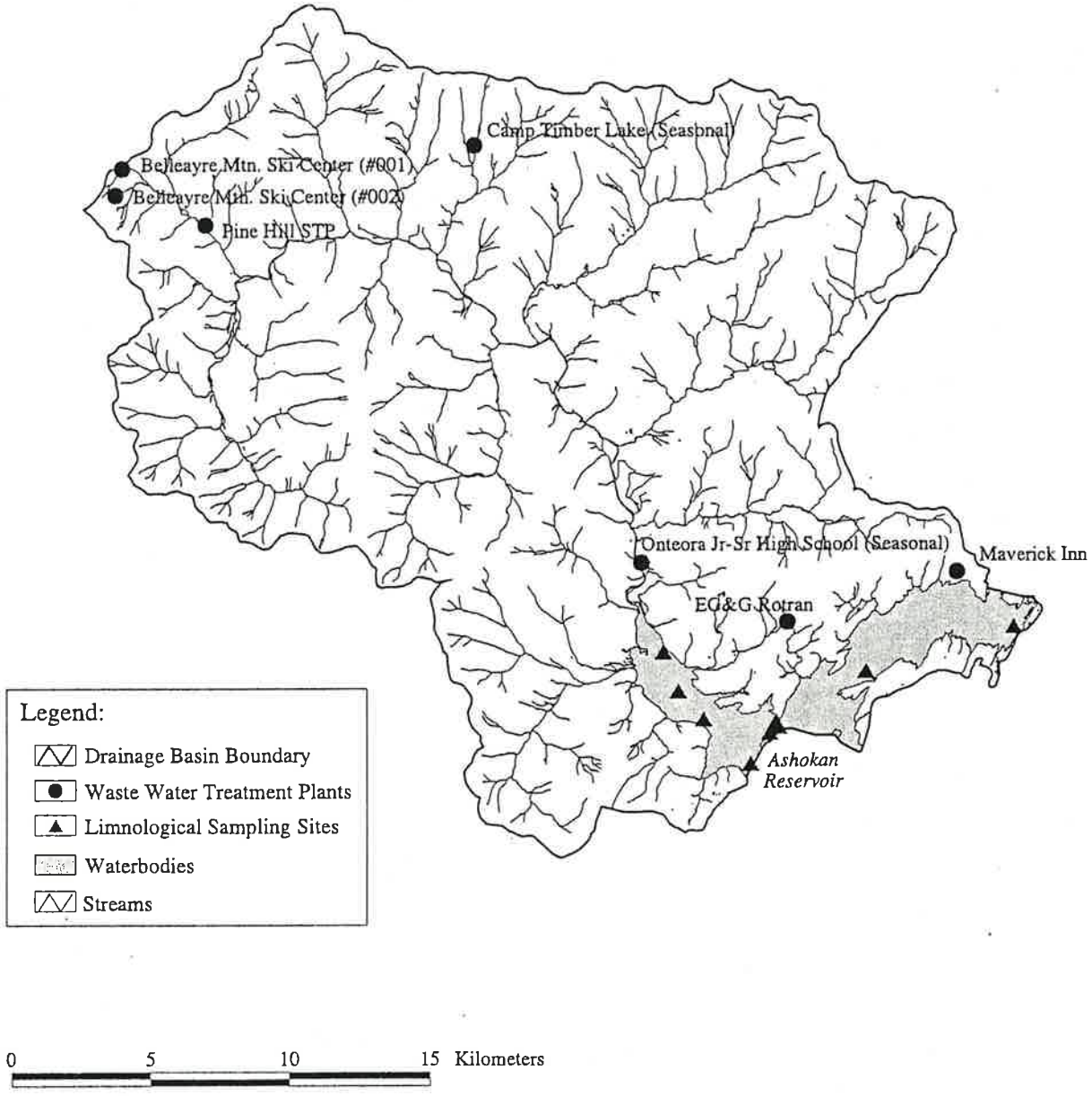

Figure 3.1 Watershed Map

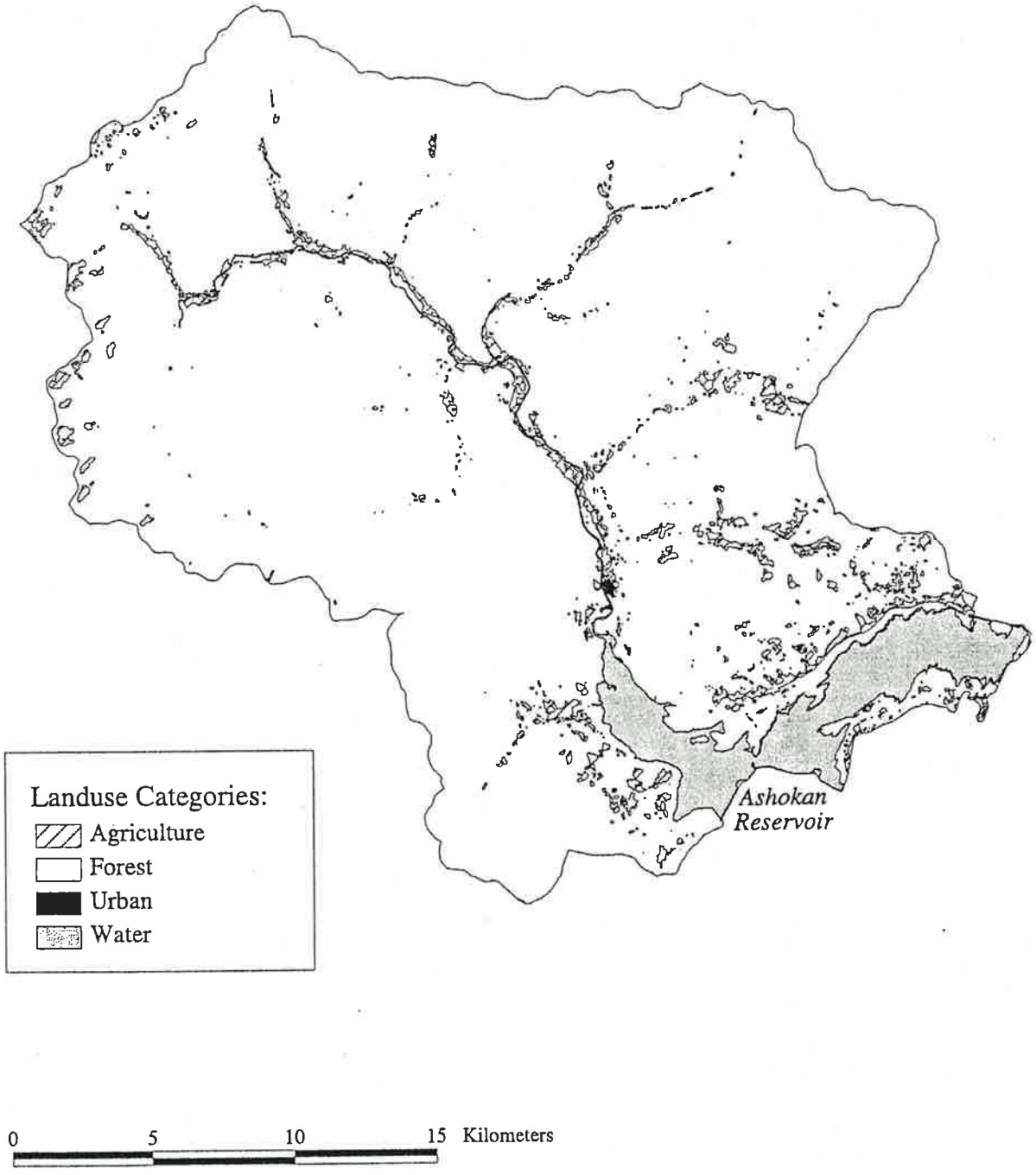

Figure 3.2 Land Use Map

Table 3.1. Physical Characteristics of Ashokan-West Reservoir.

	1992	1993	1994	1995	1996
Watershed Area (km^2)	602.2	602.2	602.2	602.2	602.2
Reservoir Mean Surface Area (km^2)	11.03	11.25	11.37	11.99	12.78
Reservoir Mean Volume (MG)	36738	39105	39900	40380	46645
Residence Time (yr)	0.18	0.22	0.18	0.21	0.23
Maximum Depth (m)	58.0	59.0	58.0	58.0	58.0
Mean Depth (m)	12.5	13.1	13.2	13.1	13.8

Note: maximum depth is calculated at full reservoir volume.

Table 3.2. Physical Characteristics of Ashokan-East Reservoir.

	1992	1993	1994	1995	1996
Watershed Area (km^2)	63.5	63.5	63.5	63.5	63.5
Reservoir Mean Surface Area (km^2)	17.34	17.37	17.91	18.63	20.61
Reservoir Mean Volume (MG)	54717	55346	59900	63720	78390
Residence Time (yr)	0.26	0.27	0.31	0.31	0.38
Maximum Depth (m)	26.0	26.0	26.0	26.0	26.0
Mean Depth (m)	11.9	12.4	12.5	12.9	14.4

Table 3.3. Ashokan-West Water Budget.

	1993	1994	1995	1996
Inputs				
Watershed Runoff (MG)	115448	94208	121582	193965
Aqueduct (MG)				
Upstream Reservoirs (MG)	70299	110212	76169	26761
Wastewater Treatment Plants (MG)	93	93	81	111
Storage Change (MG)	11440	-13122	4460	14072
Outputs				
Aqueduct (MG)		2		
Outside Community (MG)				
Spill and Release (MG)	17440	217632	193372	206765
Residence Time (yr)	0.224	0.183	0.209	0.226

Table 3.4. Ashokan-East Water Budget.

	1993	1994	1995	1996
Inputs				
Watershed Runoff (MG)	12640	10704	13951	21163
Aqueduct (MG)				
Upstream Reservoirs (MG)	174400	217632	193372	206765
Wastewater Treatment Plants (MG)				
Storage Change (MG)	-19916	33949	367	20972
Outputs				
Aqueduct (MG)	180201	186996	178627	123321
Outside Community (MG)				
Spill and Release (MG)	26755	7368	98	80967
Residence Time (yr)	0.267	0.308	0.308	0.379

Ashokan West

The West Basin of the Ashokan Reservoir has average water quality for the Catskill System. Growing season values for several water quality variables are given in Table 3.5. The phosphorus concentrations will be discussed in more detail later in this section, but are included in Table 3.5 for a comparison with other water quality variables. Chlorophyll *a* is a measure of algal biomass and is often used to determine the trophic state of a water body. The Ashokan West Basin has average concentrations of chlorophyll *a* and is generally classified as mesotrophic. Secchi depth and turbidity are common optical water quality variables. Secchi depth is a field measurement of water transparency while turbidity is a laboratory measurement of light scattering and is inversely related to transparency. The entire Catskill region tends to have a high amount of clay in the streams and in the surface runoff which leads to high turbidities and shallow Secchi depths. The effects of the 1996 flood event is clearly seen in the data by the elevated turbidity and phosphorus values and decreased Secchi depth in 1996.

Ashokan East

The East Basin of the Ashokan Reservoir has above average water quality for the Catskill System. Growing season values for several water quality variables are given in Table 3.6. The phosphorus concentrations will be discussed in more detail later in this section, but are included in Table 3.6 for a comparison with other water quality variables. Chlorophyll *a* is a measure of algal biomass and is often used to determine the trophic state of a water body. The Ashokan East Basin has below average concentrations of chlorophyll *a* and is generally classified as mesotrophic. The effects of the 1996 flood event is clearly seen in the data by the elevated turbidity and phosphorus values and decreased Secchi depth, however the effects have been attenuated by the Schoharie Reservoir and the west basin prior to reaching the east basin.

Table 3.5. Ashokan-West Water Quality.

	1993	1994	1995	1996
Total Phosphorus ($\mu g\ l^{-1}$)	7.4	11.4	12.8	22.6
Chlorophyll *a* ($\mu g\ l^{-1}$)	3.39	3.01	4.39	4.16
Secchi Depth (m)	2.97	3.65	3.09	1.87
Turbidity (NTU)	2.17	1.95	3.29	10.74
Dissolved Oxygen ($\mu g\ l^{-1}$)	8.4	8.1	8.7	11.9
Trophic Status	M	M	M	M

Note: Values are growing season (May-Oct.) averages; total phosphorus values are the geometric mean. Chlorophyll *a* is calculated from surface samples only, other variables include all sample depths.
Trophic Status is calculated using chlorophyll *a* data; O = Oligotrophic, M = Mesotrophic, E = Eutrophic.

Table 3.6. Ashokan-East Water Quality.

	1993	1994	1995	1996
Total Phosphorus ($\mu g\ l^{-1}$)	12.7	10.0	13.0	16.2
Chlorophyll *a* ($\mu g\ l^{-1}$)	2.16	2.91	4.59	4.78
Secchi Depth (m)	3.53	4.54	3.72	3.54
Turbidity (NTU)	1.40	1.11	1.50	4.35
Dissolved Oxygen ($\mu g\ l^{-1}$)	8.6	9.1	9.1	15.7
Trophic Status	O	M	M	M

Note: Values are growing season (May-Oct.) averages; total phosphorus values are the geometric mean. Chlorophyll *a* is calculated from surface samples only, other variables include all sample depths.
Trophic Status is calculated using chlorophyll *a* data; O = Oligotrophic, M = Mesotrophic, E = Eutrophic.

The amount of dissolved oxygen present in a reservoir is another important water quality variable which can affect reservoir phosphorus concentrations. When the reservoir is completely mixed (spring and fall turnover), all levels of the water column have had recent contact with the atmosphere and contain relatively high levels of oxygen. When the reservoir is thermally stratified however, the bottom waters remain isolated from the atmosphere and can become depleted in oxygen. Organic matter in the sediment and the water column decays and as a result uses up the oxygen in the water. Depending on the amount of material that decays and the length of stratification, the bottom waters can become anoxic ($< 1\ \mu g\ l^{-1}$). This condition is referred to as hypolimnetic anoxia.

Not all reservoirs develop hypolimnetic anoxia. It is dependent on variables such as the shape of the basin, the residence time of the water, the period of stratification and the amount and distribution of organic material. Some of these dominant variables vary annually. Typically, hypolimnetic anoxia is most pronounced at the dam where the reservoir generally reaches its maximum depth and thermal stratification is well developed. Other sites in the reservoir may not become anoxic.

Some reservoirs exhibit an unusual oxygen profile, where there is a mid-depth oxygen minimum. This can be caused by decomposition of organic matter in the water column, prior to the material settling to the bottom of the reservoir, or by lateral movement of water (interflow) that has a high oxygen demand. In a few cases, the oxygen depletion can progress to complete anoxia. If hypolimnetic anoxia is also present, then a complex oxygen profile exists, with two zones of anoxic water separated by oxygenated water. As stratification continues, these two anoxic zones can eventually expand to where they merge together, resulting in anoxic bottom water and oxic surface water.

The level of dissolved oxygen in the bottom waters of a reservoir can affect the phosphorus budget. Under severe anoxic conditions, phosphorus is released from the sediments once the nitrate contained in the bottom waters is completely depleted. This source of phosphorus is often called an internal load since it is generated within the reservoir itself. The magnitude of this internal load will be estimated later in the phosphorus modeling section of the report. Generally, the internal phosphorus load is small with respect to the external phosphorus load delivered from the watershed.

The East Basin of the Ashokan Reservoir generally develops minor hypolimnetic anoxia during stratification. At the dividing weir, hypolimnetic anoxia begins between mid August and mid September, and lasts an average of 1 month. The maximum vertical extent of the anoxic water above the sediments averages 5 m. At the mid-reservoir sampling sites, hypolimnetic anoxia begins between late August and early September, lasts an average of 1 month, and only reaches an average of 3 m above the sediments.

The West Basin of the Ashokan Reservoir generally develops minor hypolimnetic anoxia during stratification. At the dividing weir, hypolimnetic anoxia begins between late September and mid October, and lasts an average of 0.5 month. The maximum vertical extent of the anoxic water above the sediments averages 3 m. The mid-basin sampling sites do not experience hypolimnetic anoxia each year. When present, hypolimnetic anoxia begins between late September and mid October, lasts an average of 0.5 month, and reaches an average of 4 m above the sediments. During 1996, the West Basin did not go anoxic.

3.3 Phosphorus Monitoring Data and Basin Status

An annual summary of the phosphorus monitoring data is presented in Tables 3.7 and 3.8. The geometric mean phosphorus concentration of the growing season is given for each year, as well as the number of reservoir surveys and the number of samples analyzed for total phosphorus. The growing

Table 4.3. Phosphorus Model Results for Ashokan Reservoir, East Basin.

	1993	1994	1995	1996	Percent Min	Percent Max
Point Sources						
WWTPs (kg yr^{-1})	0	0	0	6	0%	0%
Upstream (kg yr^{-1})	4806	13822	8139	16255	84%	94%
Nonpoint Sources						
urban (kg yr^{-1})	16	18	14	24	0%	0%
septic (kg yr^{-1})	236	234	214	244	1%	4%
grass/shrub (kg yr^{-1})	0	0	0	0	0%	0%
grass (kg yr^{-1})	187	205	326	532	1%	3%
bare soil (kg yr^{-1})	0	0	0	0	0%	0%
corn (kg yr^{-1})	0	0	0	0	0%	0%
alfalfa (kg yr^{-1})	0	0	0	0	0%	0%
deciduous forest (kg yr^{-1})	303	306	640	954	2%	7%
coniferous forest (kg yr^{-1})	0	0	0	0	0%	0%
mixed forest (kg yr^{-1})	4	4	8	12	0%	0%
barnyard (kg yr^{-1})	0	0	0	0	0%	0%
groundwater (kg yr^{-1})	175	132	135	256	1%	3%
water (kg yr^{-1})	210	210	210	210	1%	4%
Total Load (kg yr^{-1})	5937	14931	9685	18494		
Predicted concentration ($\mu g\ l^{-1}$)	4.6	12.9	7.3	13.6		
Observed concentration ($\mu g\ l^{-1}$)	12.7	10.0	13.0	16.2		
Difference ($\mu g\ l^{-1}$)	-8.1	2.9	-5.7	-2.6		
%difference	64%		44%			

Note: phosphorus loads are calculated using the GWLF, predicted concentration is calculated using the adjusted Vollenweider Model, % difference is only calculated if the difference is greater 5 µg l-1.

4.4 Model Verification

The TMDL Technical Working Group agreed that development of defensible TMDLs require that each reservoir be adequately modeled. This means that phosphorus loads from all sources are identified and the model is verified with actual water quality data. The Phase II criteria for determining if a reservoir basin is adequately modeled is as follows:

- the predicted phosphorus concentration should be within 50% of the observed concentration for all four years;
- the predicted phosphorus concentration should be within 20% of the observed concentration for any two out of these four years;
- any year where the predicted phosphorus concentration is within 5 $\mu g\ l^{-1}$ of the observed phosphorus concentration is considered adequately modeled regardless of the percentage of the observed concentration;
- the TMDL Technical Committee may allow exceptions to the above guidelines if the reasons are scientifically justified.

Ashokan Reservoir is not adequately modeled according to the above criteria. Neither basin is well modeled during 1993, which appears to be due to an underestimation of the upstream load. The phosphorus concentration is also underpredicted for 1996 for both basins.

4.5 Discussion

The GWLF model has been calibrated for the West Branch of the Delaware River at Beerston (entry to Cannonsville Reservoir). In general, the load estimates are quite good. However, the GWLF model underpredicted the loads for 1996. In January of 1996 there was a large flood event in the watershed resulting from several inches of rain which melted the existing snow pack. This storm generated record floods and generated unprecedented flows and phosphorus loads, which because of the particular nature of this storm were not well simulated by GWLF. This underestimation of input loads can be associated with the underestimation of the reservoir phosphorus concentration.

5. TMDL Calculation

5.1 Methodology

The total maximum daily load of a pollutant is the sum of all individual waste load allocations for point sources, plus the sum of load allocations for nonpoint sources, plus a margin of safety, which will result in meeting the applicable water quality standards.

$$TMDL = WLA + LA + MOS \leq LC \qquad (4)$$

where:

TMDL = total maximum daily load of phosphorus (kg y^{-1});
WLA = wasteload allocation for point sources (kg y^{-1});
LA = load allocation for nonpoint sources (kg y^{-1});
MOS = margin of safety (kg y^{-1});
LC = loading capacity (critical load; kg y^{-1}).

The total loading from point sources (WLA) and nonpoint sources (LA), allowing for a margin of safety (MOS), should not exceed the critical load for a reservoir (TMDL). The allowable load is the sum of the WLA and the LA.

The TMDL is the phosphorus load that will achieve a critical phosphorus concentration as a geometric mean phosphorus concentration during the growing season (Table 5.4). The Phase II TMDL has been calculated for both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}). A five year average (1992 - 1996) is used for the TMDL calculation and the current load to accommodate annual variability in either loading or hydrology. This timeframe is short enough to reflect current conditions yet long enough to prevent setting a limit based on one or two unusual years.

The MOS is ..ired component of TMDL development which is intended to account for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (*EPA*, 1991). The Phase II MOS consists of two parts. A factor of 10% is applied as a baseline to each reservoir to account for general uncertainty in the analysis. An additional factor is added to this 10% to reflect the phosphorus variability in each reservoir. This additional factor is based on the standard error of the five-year mean used to determine the TMDL (DEP, 1998).

The WLA is the portion of the TMDL allocated to point sources. Each wastewater treatment plant in the watershed is assigned a fixed daily phosphorus load, which is calculated using the design (permitted) flow for the plant and the phosphorus effluent concentrations in the Watershed Regu-

lations. Seasonal facilities are treated according to their SPDES Permit and if year round flow is permitted, then year round operation is assumed for the wasteload allocation. This method is patterned after other DEC regulatory programs, and results in a conservative estimate of the maximum phosphorus load a plant can legally discharge. The sum of all the individual wasteload allocations equals the current WLA for the basin. It should be noted that the WLA is not based on monitoring data, but rather on the SPDES Permit requirements and the limitations in the Watershed Regulations. Significant changes in the WLA would only occur if point source permits are revised, new plants come on line or old plants are decommissioned.

The LA is the portion of the TMDL allocated to nonpoint sources. The initial aggregate LA is equal to the remaining load in the TMDL after the MOS and WLA are accounted for. The observed nonpoint source load can be estimated by subtracting the point source loads (calculated from monitoring data) from the current load (calculated from reservoir concentration data).

If the current phosphorus load exceeds the available phosphorus load, then load reductions are required. Some of this total load reduction may come from the point sources in the basin. DEP is currently upgrading all existing (as of November 2, 195) WWTPs in the watershed to tertiary level treatment plus added phosphorus removal, so that all they comply with the effluent limits in the Watershed Regulations. In some cases, this will result in a reduction of phosphorus. In order to estimate the load reduction that can be expected from the WWTP upgrades, the basin WLA (sum of each individual WLA) is compared to the 1996 point source phosphorus load calculated for the basin. If the basin WLA is less than the 1996 phosphorus load, then the difference between them is the expected load reduction. If the basin WLA is greater than the 1996 point source phosphorus load, then no reduction in phosphorus resulting from the WWTP upgrades can be credited toward the total required load reduction. Since the WLA assumes the maximum SPDES flow, a plant can be discharging phosphorus at a higher concentration than allowed under the regulations but with less flow resulting in a total phosphorus load less than the WLA prior to the upgrade of the plant. Any remaining load reduction after the estimated point source reduction is accounted for must be derived from nonpoint sources.

Table 5.1. TMDL Calculation for Ashokan-West Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	45399	60532
MOS (10% of TMDL; SE = 1.0)	4540	6053
Available Load (TMDL - MOS)(kg yr^{-1})	40859	54479
WLA (kg yr^{-1})	,264	264
LA (kg yr^{-1})	40595	54215
Current load (kg yr^{-1})	32833	32833
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	0	0
Remaining reduction (kg yr^{-1})	0	0

note: excludes 1996, see text for further information.

Table 5.2. TMDL Calculation for Ashokan-East Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	19542	26056
MOS (10% of TMDL; SE = 0.9)	1954	2606
Available Load (TMDL - MOS)(kg yr^{-1})	17588	23450
WLA (kg yr^{-1})	4	4
LA (kg yr^{-1})	17584	23446
Current load (kg yr^{-1})	16484	16484
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	1	1
Remaining reduction (kg yr^{-1})	0	0

5.2 Basin Results

West Basin Results

The TMDL calculations for Ashokan Reservoir, West Basin are given in Table 5.1 using both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}). The TMDL is based on the annual data from 1992 - 1995 only. The 100-year flood in the early part of 1996 delivered a tremendous phosphorus load to Schoharie Reservoir, greatly increasing the annual phosphorus concentration. Since this was clearly an unusual event, it is inappropriate to use the data from 1996 in a predictive, regulatory tool such as the TMDL. The current and critical phosphorus loads for each of the five years in the analysis are given in Table

3.7. The MOS for the West Basin is 10% due to a low amount of variability in the annual phosphorus concentrations. Between 1992 and 1995 the annual geometric mean phosphorus concentrations ranged from 7.4 to 12.8 $\mu g\ l^{-1}$. Subtracting the MOS from the TMDL results in an available load which is apportioned between point and nonpoint sources. The WLA for the individual WWTPs are given in Table 3.9; the basin WLA is 264 kg yr^{-1}. The load remaining for nonpoint sources depends on the guidance value utilized.

The current phosphorus load is below the available phosphorus load, so load reductions are not required. A comparison of the basin WLA (264 kg yr^{-1}) and the total point source load for 1996 (174 kg yr^{-1}) indicates that no load reduction may be credited from the WWTP upgrades. Even if a WWTP is discharging below the SPDES permitted flow, it can legally discharge up to its WLA, and therefore must still be allocated this amount of phosphorus unless the SPDES permit is modified. An examination the WWTP phosphorus loads (Table 3.7) indicates that the point source phosphorus loads decreased 110 kg yr^{-1} from 1993 to 1996, and the basin as a whole is currently below the WLA. The principal phosphorus source in the West Ashokan watershed is forested land use and the upstream reservoir.

East Basin Results

The TMDL calculations for Ashokan Reservoir, East Basin are given in Table 5.2 using both the proposed phosphorus guidance value (15 $\mu g\ l^{-1}$) and the existing phosphorus guidance value (20 $\mu g\ l^{-1}$). The current and critical phosphorus loads for each of the five years in the analysis are given in Table 3.8. The MOS for the East Basin is 10% due to a low amount of variability in the annual phosphorus concentrations. Between 1992 and 1996 the annual geometric mean phosphorus concentrations ranged from 10.0 to 16.2 $\mu g\ l^{-1}$. Subtracting the MOS from the TMDL results in an available load which is apportioned between point and nonpoint sources. The WLA for the individual WWTPs are given in Table 3.9; the basin WLA is 4 kg yr^{-1}. The load remaining for nonpoint sources depends on the guidance value utilized.

The current phosphorus load is below the available phosphorus load, so load reductions are not required. A comparison of the basin WLA (4 kg yr^{-1}) and the total point source load for 1996 (5 kg yr^{-1}) indicates that a load reduction of 1 kg yr^{-1} may be expected from the WWTP upgrades. The principal phosphorus source in the East Ashokan watershed is the West Ashokan Basin.

6. Conclusions

TMDLs are a watershed-based approach to implement water quality standards and integrate the management of point and nonpoint sources of pollution. In the NYC watershed, the development of phosphorus TMDLs are a joint effort between DEC, EPA and DEP. The reservoir reports are DEP's technical contribution to the State TMDL program. The calculations presented in the reservoir reports are preliminary values; the DEC will submit the official TMDLs to EPA at a later date. The preliminary phosphorus TMDLs for the NYC reservoirs have been calculated using both the proposed guidance value (15 $\mu g\ l^{-1}$) and the existing guidance value (20 $\mu g\ l^{-1}$).

As part of the TMDL analysis, the phosphorus sources in the watershed were modeled for the period between 1993 and 1996. The modeling results are not used for the TMDL calculation directly, but are intended to assist in the implementation of any required phosphorus reductions. The GWLF Model was applied to the watershed to predict the phosphorus load into the reservoir. An adjusted Vollenweider Lake model was used to predict the in-lake phosphorus concentration based on the watershed load of phosphorus and reservoir characteristics. This model implicitly accounts for an internal load of phosphorus from the sediments, but an estimate of the internal phosphorus load was also calculated based on monitoring data. Ashokan Reservoir generally does not develop severe hypolimnetic anoxia and therefore does not have a significant internal load of phosphorus. For each year modeled, the results are verified against reservoir monitoring data.

Ashokan Reservoir is located in Ulster County. The watershed is primarily forested with a small percentage of grass and shrub land and contains eighteen wastewater treatment plants. Ashokan Reservoir is split into two basins by a dividing weir. Both basins have a dam, release structure and a spillway. Water flows from the West Basin to the East Basin both through and over the dividing weir. The Ashokan Reservoir is not adequately modeled according to the criteria partially due to a problem estimating the phosphorus load from upstream and partially due to the 1996 flood event. The 1996 phosphorus concentration is underpredicted because the model is not designed to model such extreme events. The primary source of phosphorus to Ashokan Reservoir is forest land use.

The TMDL calculations depend on the phosphorus guidance value adopted. Using the proposed phosphorus guidance value of 15 $\mu g\ l^{-1}$, the TMDL for the West Basin is 45399 kg yr^{-1}. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (4540 kg yr^{-1}). The WLA is the load allocated to point sources. Each individual wastewater treatment plant is assigned a WLA based on the parameters in their SPDES permit (Table 3.9). The aggregate WLA for the West Basin is 264 kg yr^{-1}. The LA, which is the load allocated to nonpoint sources, is the remainder of the allowable phosphorus load. The aggregate LA for the West Basin is 40595 kg yr^{-1}.

Using the existing phosphorus guidance value of 20 $\mu g\ l^{-1}$, the TMDL for the West Basin is 60532 $kg\ yr^{-1}$. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (6053 $kg\ yr^{-1}$). The aggregate WLA for the West Basin is 264 $kg\ yr^{-1}$ and the aggregate LA is 54215 $kg\ yr^{-1}$. The percentage of the total nonpoint source load contributed by the individual land use types can be estimated from the phosphorus modeling. The percentage of the LA allocated to individual land use types is an issue for implementation and basin-wide planning. The West Basin of Ashokan Reservoir is currently below the Phase II TMDL using either guidance value.

Using the proposed phosphorus guidance value of 15 $\mu g\ l^{-1}$, the TMDL for the East Basin is 19542 $kg\ yr^{-1}$. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (1954 $kg\ yr^{-1}$). The aggregate WLA for the East Basin is 4 $kg\ yr^{-1}$ and the aggregate LA is 17584 $kg\ yr^{-1}$.

Using the existing phosphorus guidance value of 20 $\mu g\ l^{-1}$, the TMDL for the East Basin is 26056 $kg\ yr^{-1}$. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (2606 $kg\ yr^{-1}$). The aggregate WLA for the East Basin is 4 $kg\ yr^{-1}$ and the aggregate LA is 23446 $kg\ yr^{-1}$. The percentage of the total nonpoint source load contributed by the individual land use types can be estimated from the phosphorus modeling. The percentage of the LA allocated to individual land use types is an issue for implementation and basin-wide planning. The East Basin of Ashokan Reservoir is currently below the Phase II TMDL using either guidance value.

In the future, more complex models and perhaps revised guidance values will be available for a Phase III TMDL process. DEP is in the process of developing hydrodynamic and eutrophication reservoir models, as well as a terrestrial (i.e. watershed) models, for the entire NYC watershed. These models, as well as the intensive field programs associated with the model development, will provide a greater understanding of the phosphorus budget in the watershed and reservoirs. In addition, EPA is currently developing regional nutrient criteria as part of the Clean Water Action Plan. States are expected to adopt the national criteria, or develop their own, by 2003. A revision of the phosphorus guidance value would necessitate a revised TMDL for all of the reservoirs.

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Appendix A - Comparison of Phosphorus Loads from the Reckhow and GWLF Models

Introduction

The Phase I TMDL Reservoir Reports utilized the Reckhow Land Use Model to model the watershed sources of phosphorus for 1993. The Reckhow Model is a commonly used tool to determine the relative magnitude of phosphorus sources for planning purposes. Independent of the TMDL program, DEP has been developing terrestrial and reservoir models for the Catskill and Delaware reservoirs as part of the larger, more comprehensive modeling effort being conducted under the City's Filtration Avoidance Determination (*DEP*, 1996). GWLF is essentially DEP's "second generation" in terrestrial modeling and contains many advantages over the Reckhow Model. For this reason, the GWLF model is used in the Phase II TMDL Reservoir Reports.

Model Description

Reckhow Model

The Reckhow Land Use model was developed as a simple planning model to estimate the impact of development around lakes. The model is meant to estimate long-term, average loading from different land uses, based on unit area export coefficients (kg ha^{-1} yr^{-1}). Five different land use categories were used in the Catskill/Delaware districts: forest, urban, corn/alfalfa, pastureland, and water. Point sources, upstream reservoirs and proximal septic systems are added to the non-point sources to predict an annual total phosphorus load. This model was developed before the importance of storm event loading was fully recognized, and the export coefficients that are used are likely derived from baseflow monitoring data. It should be noted that since Reckhow is an average annual loading model that does not account for precipitation, it estimates the same non-point source load year after year.

GWLF Model

The GWLF model is more sophisticated than the Reckhow model in several ways. The model is driven by climatic variables (precipitation and temperature) and uses the SCS curve number to predict surface runoff. Coefficients of phosphorus concentration in runoff, for different land use types, are combined with the runoff volume to predict monthly phosphorus loads. Twelve different land use categories are used. Both dissolved and particulate components of the total phosphorus are modeled. Point sources and septic systems are also included as watershed phosphorus sources. This model incorporates storm event data, and has been calibrated to monitoring data at the Beerston USGS gage in the Cannonsville basin. An important point is that GWLF accounts for interannual variability in loadings due to year-to-year precipitation differences and is thus appropriate for estimating loads for a particular year.

Comparison of watershed model results

The Reckhow model and the GWLF model use the same point source database and the same land use database (although the Reckhow model has the land uses aggregated into more generalized categories). The predicted phosphorus loads from each model, however, are quite different. The GWLF phosphorus loads are greater than the predicted loads from the Reckhow model. The percent of the total load from each general land use category is similar between models for non-point source loads. However, the relative contributions of point sources versus non-point sources changes since GWLF predicts greater nonpoint source phosphorus loads.

The differences between the model estimates is due to the model development history and the type of input data. The Reckhow model was presumably developed using baseflow monitoring data only, and it seems to predict the fraction of the load delivered during nonstorm periods. This has been partially verified using annual phosphorus loads derived from baseflow sampling data East-of-Hudson. The GWLF model more closely predicts the total load delivered during both baseflow and storm periods.

Conclusion

Phosphorus sources in the watersheds are modeled to aid our understanding of the relative importance of the different sources and subsequently, the relationship of phosphorus load to the ambient conditions in a reservoir. The model results are intended to assist in the implementation of any required phosphorus load reductions. DEP continues to make progress in modeling phosphorus sources in the watershed, and there is an iterative evolution in both the input data and the phosphorus load estimates.

Appendix B - Derivation of the Adjusted Vollenweider Model

Introduction

As noted previously, the GWLF phosphorus loads are greater than the predicted phosphorus loads from the Reckhow Model (Appendix A). This is primarily due to the inclusion of storm-driven particulate phosphorus loads in the GWLF Model. While much of this particulate phosphorus settles out rapidly upon entering the reservoir, the original formulation of the Vollenweider Model is not designed to accommodate this type of input. The Vollenweider Model, however, can be adjusted to include a term representing the fraction of input phosphorus that does not affect mid-lake phosphorus concentrations (f_s). This adjusted Vollenweider Model has been applied to the TMDL calculations for the West-of-Hudson Reservoirs. The scientific background and the method used to estimate f_s is described in the following sections.

In-Lake Phosphorus Model

Widely used simple phosphorus budget models for lakes utilize the continuously stirred tank reactor (CSTR) approach (Reckhow and Chapra, 1983):

$$V\frac{dP}{dt} = W - QP - S \qquad (1)$$

where:

P = the in-lake total phosphorus concentration,
W = the input total phosphorus load,
Q = the total lake outflow,
V = the lake volume,
S = the loss of phosphorus from the water column to lake sediments.

The CSTR approach assumes that the lake is a completely and instantaneously mixed tank in which each constituent (in this case phosphorus) may be interpreted with one average concentration which is equal throughout the lake.

For phosphorus budgets, the major question in applying this simple model is how to quantify the loss of phosphorus to sediments, S. Piontelli and Tonolli (1964) proposed that this loss of phosphorus to sedimentation was a fixed fraction of the input phosphorus load:

$$S = f_s W \qquad (2)$$

where:

f_s = the fixed fraction of input phosphorus lost to sediments.

Another approach to sedimentation losses uses a first order decay function of the in-lake total phosphorus content (Vollenweider, 1969):

$$S = \sigma V P \tag{3}$$

where:

σ is the net sedimentation coefficient.

Each of these methods of estimating the sediment loss of phosphorus has been used successfully. Edmundson and Lehman (1981) studied Lake Washington in Washington State for a 17 year period from 1962-1978. Yearly phosphorus loss to sediments were compared to both the yearly input phosphorus load and to the in-lake phosphorus. A better correlation was found relating the phosphorus losses to the input loads suggesting that the Piontelli and Tonolli approach yielded a more reliable result.

There have been a number of studies which show the validity of the first order decay approach.(Vollenweider, 1975; Kirchner and Dillon, 1975; Larsen and Mercier, 1976; Bachmann and Canfield, 1979; Vollenweider, 1976) Through these studies the net sedimentation coefficient could be related to different combinations of hydrologic and geomorphic properties of the lake such as average residence time, areal loading rate (input load divided by lake surface area) and average lake depth. Each of these empirical relationships were derived using average historical data from a large number of lakes thus allowing inter-comparisons between lake responses.

There has been some controversy as to which approach to quantifying the in-lake phosphorus loss is more applicable. Each approach has advantages depending on the questions which are being asked. In the Lake Washington study, a long time series for a single lake was investigated. The result showed that the fixed fraction approach seemed to work best for this lake. One reason for this was that a significant amount of the phosphorus load was attributable to particulate phosphorus sorbed onto suspended sediment in the tributary streams. This particulate phosphorus quickly settles when the more turbulent streams reach the calmer waters of the lake and therefore, has little effect on in-lake phosphorus content. This phenomenon has been referred to as positional availability (Logan et al., 1979; Reckhow and Chapra, 1983). The large magnitude of this rapidly settling particulate phosphorus outweighed the more subtle biologically based first order decay effect taking place. (Chapra and Reckhow, 1983). Additionally, since lake response to phosphorus load can vary widely from lake to lake, it is not clear that the results on Lake Washington are necessarily transferrable to other lakes.

The studies using the first order decay approach looked mostly at average data for multiple lakes. This allows these models to be used for inter-comparisons between different lakes. Specifically, it allows a quick estimate of a given lake's response to input phosphorus loads based on hydrologic or geomorphic properties of the lake. These applications of the first order decay process, therefore, were comparisons between different lakes (cross-sectional differences) while the Lake Washington study was more focused on understanding the response of a single lake to input loading changes (longitudinal differences) (Chapra and Reckhow, 1983.)

The West-of-Hudson Phase II TMDL analysis is being performed for four individual years and for six different reservoirs. Therefore, the model used must be able to both predict in-lake phosphorus for both a time series for each individual lake and address the issue of transferability (of the model) between different reservoirs. For this reason, we have chosen to use the model developed by Chapra (1982) which combines the two phosphorus loss approaches to account for both the positional availability concept and the slower process of settling within the lake:

$$V\frac{dP}{dt} = (1 - f_s)W - QP - \sigma VP \qquad (4)$$

where:

f_s = the fraction of input phosphorus which is positionally unavailable.

For the Phase II TMDL's a steady state version of this model is applied annually. Under steady state conditions, solving for the in-lake phosphorus and substituting residence time, lake surface area and average lake depth, equation 4 can be rewritten as:

$$P = \frac{(1 - f_s)W}{A_s \bar{z}(1/\tau_w - \sigma)} \qquad (5)$$

where:

P = the average growing season total phosphorus concentration,
W = the average annual phosphorus load,
A_s = the average lake surface area,
$\bar{z}$ = the average lake depth, and
τ_w = the average annual residence time.

To test the efficacy of applying equation 5 for Phase II TMDL's requires independent estimates of each of the variables. For each year of testing, the growing season total phosphorus is obtained from DEP limnological sampling data (see Table 3.4). The lake surface area and average depth were obtained from DEP reservoir operations records (see Table 3.1). The input phosphorus load was estimated using the GWLF terrestrial loading model. To estimate the net sedimentation coefficient, the relationship to average annual residence time suggested by Vollenweider (1976) and Larsen and Mercier (1976) was used:

$$\sigma = \frac{1}{\sqrt{\tau_w}} \qquad (6)$$

There are no independent estimates for the fraction of total phosphorus which is positionally unavailable, f_s. To try to ascertain a value for this parameter, equation 5 was solved for f_s using the data outlined above. These results showed that using a single value as suggested by Chapra (1982) would not adequately model all reservoirs for all years. This makes sense since the positionally unavailable phosphorus is generally related to the particulate phosphorus associated with suspended solids. For years with large streamflow events, a greater percentage of the phosphorus load to the reservoir is attributed to the particulate form. For these years we would expect the fraction of quickly settling phosphorus to be larger than for years without extremely high runoff events when a greater percentage of the incoming phosphorus is in the dissolved form.

A relationship between positional availability and the fraction of input load which is in particulate form provides a means for independently estimating the fraction of positionally unavailable phosphorus, f_s. Figure B1 shows the calculated f_s values plotted against the ratio of particulate phosphorus load to total phosphorus load as calculated by GWLF. A power law function provides a good fit to data with an r^2=0.75 :

$$f_s = 0.933\left(\frac{PP}{TP}\right)^{0.913} \qquad (7)$$

where:

PP = the annual particulate phosphorus load, and

TP = the total phosphorus load (particulate plus dissolved phosphorus) as calculated by GWLF.

Because the theoretical definition of f_s is the fraction of quickly settling phosphorus, it would not make sense for f_s to exceed the particulate phosphorus fraction (PP/TP), which occurs when PP/TP exceeds 0.45. For this reason, equation 7 was used to calculate f_s for PP/TP of 0.45 or greater and f_s was set equal to the particulate phosphorus fraction for PP/TP values less than 0.45.

Results of the modeling for individual reservoirs are presented in each reservoir report. In general the results were quite good and met the evaluation criteria for the Phase II TMDL process. Clearly, the modeling presented here is highly empirical. There are no relationships of the parameters in these models to the actual processes which may or may not cause eutrophication problems within any particular reservoir. To gain a greater understanding of individual lake response, specific process studies and associated mechanistic models are being developed.

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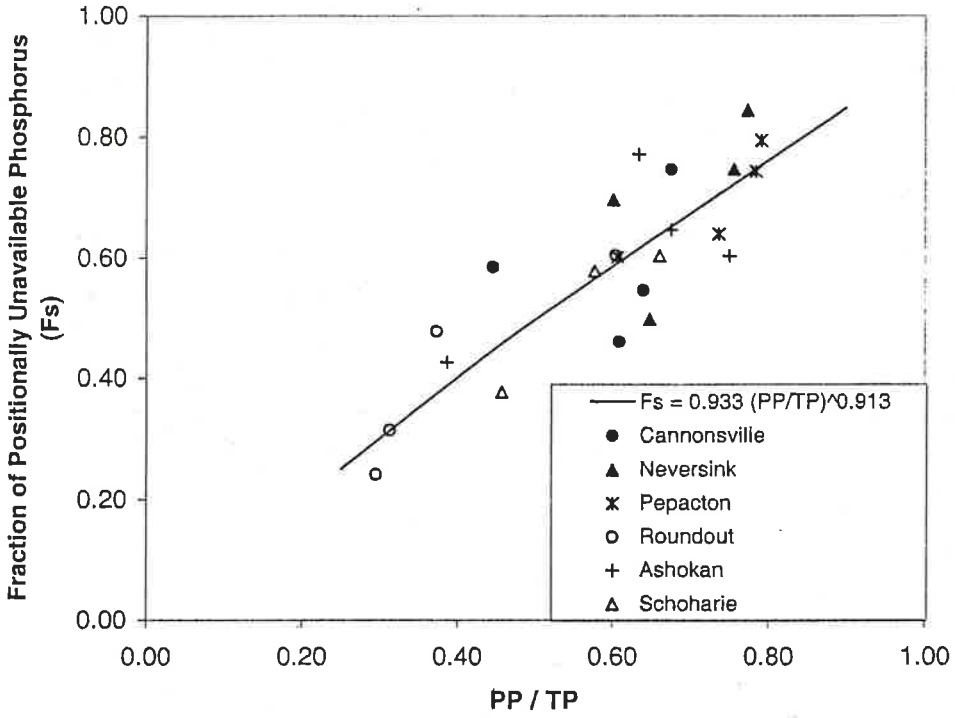
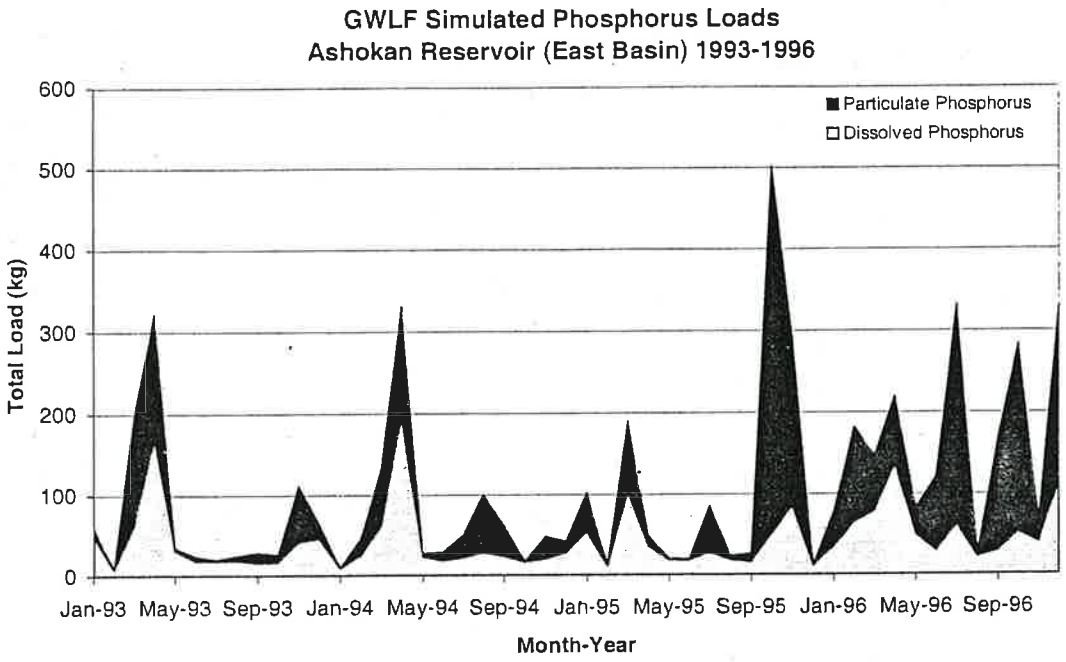


Figure B1. Fraction of positionally unavailable phosphorus versus the ratio of input particulate phosphorus to total phosphorus input for six WOH Reservoirs for 1993-1996.

Appendix C - Monthly Phosphorus Loads from the GWLF Model



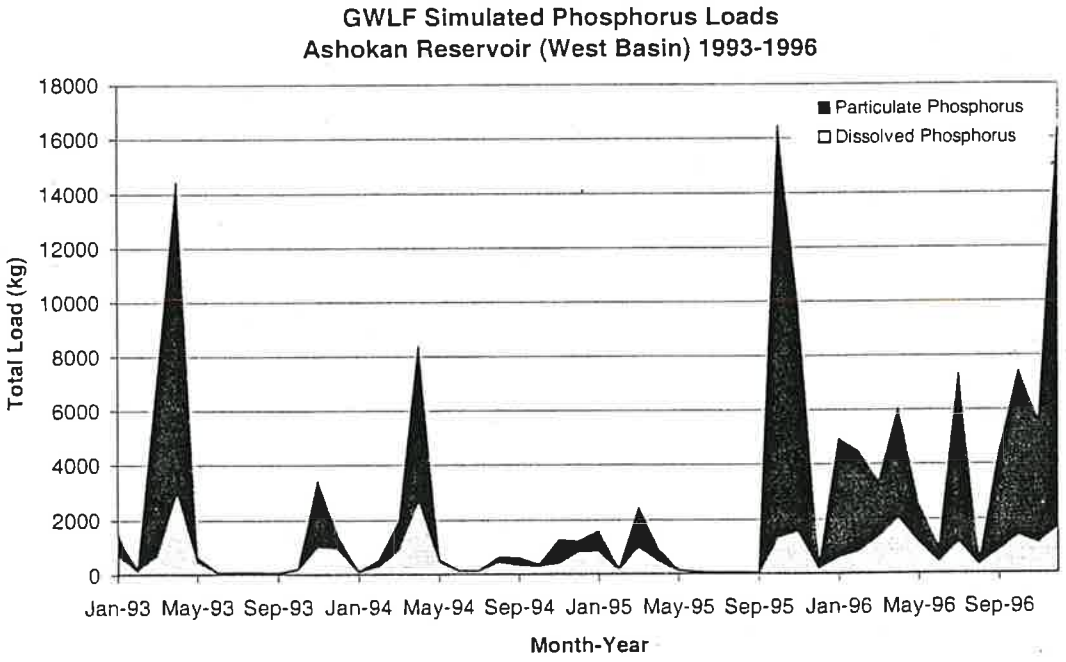


Table 3.7. Annual Phosphorus Monitoring Data for Ashokan-West Reservoir.

	1992	1993	1994	1995	1996
Geometric Mean Phosphorus[1] ($\mu g\ l^{-1}$)	11.4	7.4	11.4	12.8	22.6
Number of Surveys[2]	6	6	6	10	11
Number of Samples[1]	45	55	65	92	123
Current Phosphorus Load[3] ($kg\ yr^{-1}$)	34657	20229	37549	38899	71372
Critical Phosphorus Load[4] ($kg\ yr^{-1}$)	60802	54672	65875	60779	63076
Critical Phosphorus Load[5] ($kg\ yr^{-1}$)	45602	41004	49406	45585	47307

[1] - calculated for the whole water body (all sample depths); [2] - during the growing season (May - Oct); [3] - Based on the annual phosphorus concentration and equation (3); [4] - based on the critical phosphorus concentration (20 $\mu g\ l^{-1}$) and equation (3); [5] - based on the critical phosphorus concentration (15 $\mu g\ l^{-1}$) and equation (3).

Table 3.8. Annual Phosphorus Monitoring Data for Ashokan-East Reservoir.

	1992	1993	1994	1995	1996
Geometric Mean Phosphorus[1] ($\mu g\ l^{-1}$)	11.0	12.7	10.0	13.0	16.2
Number of Surveys[2]	6	7	6	12	11
Number of Samples[1]	42	74	62	81	92
Current Phosphorus Load[3] ($kg\ yr^{-1}$)	14280	16734	12191	17001	22215
Critical Phosphorus Load[4] ($kg\ yr^{-1}$)	25963	26353	24382	26155	27426
Critical Phosphorus Load[5] ($kg\ yr^{-1}$)	19472	19765	18286	19617	20569

[1] - calculated for the whole water body (all sample depths); [2] - during the growing season (May - Oct); [3] - Based on the annual phosphorus concentration and equation (3); [4] - based on the critical phosphorus concentration (20 $\mu g\ l^{-1}$) and equation (3); [5] - based on the critical phosphorus concentration (15 $\mu g\ l^{-1}$) and equation (3).

season is defined here as May 1 through October 31. Phosphorus data collected from all sample depths are used in the analysis. Phosphorus concentration values, like many environmental data sets, are lognormally distributed therefore a geometric mean is used to characterize the most frequently measured phosphorus concentrations. Values that are below the analytical detection limit are set equal to half the detection limit. The detection limit for DEP measurements of total phosphorus is determined each year by the laboratories, and typically ranges between 2 $\mu g\ l^{-1}$ and 5 $\mu g\ l^{-1}$.

Ashokan Reservoir was well surveyed during this time period (1992 - 1996), with at least six suveys during the growing season. In 1995, the sampling program initiated biweekly sampling for this reservoir. The geometric mean phosphorus concentrations are generally below the NYS guidance value for phosphorus. The increase in phosphorus concentration in 1996 is related to elevated runoff and turbidity due to the 1996 flood event. The in-lake phosphorus concentration can be converted into a total current phosphorus load to the lake by using the lake model described in Section 4.2. The calculation of the critical phosphorus load is similar to the calculation of the current phosphorus load, except that instead of measured values of phosphorus concentration, a critical phosphorus concentration is used. The critical phosphorus load is calculated using both the proposed and existing phosphorus guidance values. The current and critical phosphorus loads are used later in the TMDL analysis.

3.4 Wastewater Treatment Plant Data

Wastewater Treatment Plants (WWTP) are point sources of phosphorus in the watershed. There are a total of 107 WWTPs in the entire NYC watershed; seven of the plants are owned and operated by NYC. Many of the facilities are small plants which serve camps, schools or housing complexes. A few of the facilities, such as the city-owned plants, are large sewage treatment plants. Under the Watershed MOA and the Watershed Regulations, all of the WWTPs with surface discharges are being upgraded to tertiary level treatment, with additional treatment for phosphorus removal.

DEP staff inspect the WWTPs quarterly, and monitor the effluent. This is in addition to the requirements contained in the State Pollutant Discharge Elimination System (SPDES) permit which requires the plant operator to periodically monitor and report flow and effluent pollutant concentrations. DEP samples city-owned plants weekly and noncity-owned plants twice a month. The samples are analyzed at the DEP upstate laboratories. This effluent monitoring data includes phosphorus concentration. The phosphorus concentration data is used, in conjunction with flow information, to estimate phosphorus loads for each facility. The flow information used for this analysis comes from, in order of preference, 30-day mean flows listed on the WWTP Discharger Monitoring Report, flows at the time of the water quality sample, and, if no other information is available, the design flow.

Each plant is assigned a wasteload allocation (WLA) of phosphorus. The WLA is based on the maximum permitted flow of the facility and the phosphorus effluent concentration, both of which are given in the revised SPDES permit. This WLA represents the maximum phosphorus load that the facility can discharge under its permit. Seasonal facilities are treated according to the limits given in their SPDES permit, so if year-round flow is allowed, then the WLA assumes year-round flow.

Table 3.9. Wastewater Treatment Plant Phosphorus Loads and Wasteload Allocations for Ashokan Reservoir.

Plant Name	SPDES Permit Number	SPDES Flow (mgd)	Phosphorus EffluentLimit ($\mu g\ l^{-1}$)	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)	WLA (kg)
Belleayre Mountain Ski Center (#001)	34169	0.0150	1.0	5	6	4	7	21
Belleayre Mountain Ski Center (#002)	34169	0.0140	1.0	2	3	2	2	19
Camp Timber Lake	240664	0.0340	1.0	54	22	11	20	47
Onteora Jr-Sr High School	99856	0.0270	1.0	36	41	33	29	37
Pine Hill STP	26557	0.5000	0.2	193	148	74	117	139
Mountainside Restaurant	251241	0.0030	1.0	0	0	0	5	4
Basin Total				290	220	124	180	268

SPDES = State Pollution Discharge and Elimination System; WLA = Wasteload Allocation

There are five WWTPs in the Ashokan basin (Table 3.9). One facility, a summer camp, is seasonally operated. The largest facility is the Pine Hill Sewage Treatment Plant which has a maximum permitted flow of 500,000 gpd. All facilities are currently operating below their maximum flow. Interannual patterns in the flow mirror the interannual pattern of rainfall. A year with high runoff, such as 1996, results in higher flows into and out of the plants. The annual WWTP phosphorus loads to Ashokan Reservoir decreased from 1993 to 1995, but experienced an increase in 1996 due to high flows. Part of the apparent decrease in the phosphorus load may be attributable to improved flow data used in the phosphorus load calculations in more recent years. All the facilities, with the exception of Mountainside Restaurant, are below their individual WLAs. This results in the basin as a whole being 296 kg yr^{-1} below the basin WLA.

4. Model of Watershed Phosphorus Sources

A summary of the models utilized in the Phase II analysis of phosphorus sources i9s presented below. The models are discussed in detail elsewhere (DEP 1998; 1996v; Haith and Shoemaker, 1987; Chapra, 1982; Lake and Res. Man., V 14, 1998). Before describing the models used in Phase II, it is important to clarify the role of the two models used in the TMDL Project. Modeling is used to aid our understanding of the relative importance of phosphorus sources (i.e. via the GWLF Model) and subsequently, the relationship of phosphorus load to the ambient conditions in a reservoir. The TMDL is based on monitoring data and the "critical" phosphorus concentration. Phosphorus concentration measurements in the reservoir are used to estimate the total current phosphorus load. The required phosphorus load reductions are based on the difference between the current and critical (or target) load established as the TMDL. The GWLF Model apportions this total load to various point and nonpoint sources of phosphorus. This information is crucial in developing phosphorus management plans and reduction measures.

4.1 GWLF Description

The Generalized Watershed Loading Function (GWLF) Model was developed for the Catskill and Delaware reservoirs as part of the larger, more comprehensive modeling effort being conducted under the City's Filtration Avoidance Determination (*DEP*, 1996). GWLF is essentially DEP's "second generation" in terrestrial modeling, superseding the Reckhow Land Use Model. The phosphorus load estimates from the Reckhow and GWLF models are different due to different input data and model assumptions. This is described in more detail in Appendix A. Although GWLF is described in detail elsewhere (*DEP*, 1996v; *Haith and Shoemaker*, 1987), a brief summary will be supplied here.

The GWLF Model consists of a hydrologic component and a water quality component. It is driven by variations in meteorology, specifically precipitation and air temperature. Water and sediment losses from the watershed are modeled using commonly used, empirically-derived equations. Monthly nutrient exports are then calculated by employing land use-specific coefficients of nutrient concentrations in the runoff. DEP is applying GWLF to each of the West-of-Hudson reservoir watersheds. The input variables are: precipitation, air temperature, land use, soil type, topography, and point source phosphorus loads. The land use data is the same as that used for Phase I TMDLs. It is derived from LANDSAT TM scenes which have a 28.5 m resolution and were taken during 1992-1993 for the West of Hudson region. The land use was grouped into 11 categories: urban, grass/shrub, grass, bare soil, corn, alfalfa, deciduous forest, coniferous forest, mixed forest, barnyard and water (Table 4.1.). Additional model parameters related to soil erodability, sediment transport and phosphorus concentrations in groundwater, surface runoff and soil are estimated through a combination of past research studies and model calibration.

Table 4.1. Land Use for Ashokan Reservoir.

Land Use Category	Area (ha)	Percent (%)
Urban Land Use	73	0.1%
Grass Shrub Land Use	0	0%
Grass Land Use	2419	3.6%
Bare Soil Land Use	0	0%
Corn Land Use	0	0%
Alfalfa Land Use	0	0%
Deciduous Forest Land Use	52380	79.0%
Coniferous Forest Land Use	5510	8.3%
Mixed Forest Land Use	2412	3.6%
Barnyard Land Use	2	<1%
Water	3546	5.3%

DEP made several revisions and improvements to the GWLF model, including modifications in the sediment yield algorithm, and recoding of the model as originally formulated in Haith, *et al.* (1992) into the VENSIM Visual Modeling Environment (Ventana, 1995). The re-coded model is modular, provides enhanced flexibility in model application and output visualization, and permits use of calibration, verification, and statistical tools available in the VENSIM environment. The recoded model was tested to ensure results numerically equivalent to those of the original GWLF program.

Modifications to the sediment yield algorithm of GWLF were made to correct a problem in accurately simulating the timing of sediment export due to spurious sensitivity of the model to the month the simulation is started and to the choice of start month. A revision was also made in the method for calculating the monthly transport capacity of streamflow, which apportions sediment yield over the 12 months of the year. Finally, the sediment delivery ratio calculation was adjusted as a function of watershed area, based on the 1983 SCS National Engineering Handbook (USDA-SCS, 1983). These revisions were found to significantly improve the performance of the model's simulation of sediment yield timing. With the exception of these modifications, this application of the GWLF model adheres to the original formulation of the model by Haith, *et al.* (1992). The reader is referred to the original reference for detailed description of the model.

The GWLF Model has several advantages over the Reckhow Land Use Model utilized in the Phase I TMDLs. It predicts both the temporal and spatial variability in the phosphorus loads, which can assist in developing monitoring plans and phosphorus management strategies. The temporal distribution of the phosphorus load can demonstrate the effects of seasonality on both the phosphorus load and the reservoir response to that load. The spatial distribution provided by

the sub-basin loads assists in targeting areas for phosphorus reduction measures. One final advantage is that GWLF is driven by observed data on precipitation and air temperature, rather than an average annual representation. It must be kept in mind that the goal of the phosphorus modeling is to provide information for implementation measures. The TMDL is still calculated from monitoring data.

4.2 Vollenweider Model Description

The phosphorus load from the watershed can be used to predict the reservoir concentration using the Vollenweider model (*Vollenweider*, 1975; 1976) as adjusted by Chapra (1982) (Appendix B). For the Cannonsville Reservoir, this model is only used in the TMDL calculations to derive the phosphorus load from the average reservoir concentration. A mechanistic nutrient-phytoplankton model, discussed separately, has been developed to model the reservoir. The Vollenweider Model written in terms of the net sedimentation coefficient and measured data, it is given by:

$$P_\lambda = \frac{(1-f_s)W}{A_s x z(\tau_\omega^{-1} + \sigma)} \qquad (1)$$

where,

P_λ = observed phosphorus concentration (g m^{-3});

z = mean depth (m);

τ_ω = residence time (y);

A_s = reservoir surface area (m^2);

W = total mass load of phosphorus (kg yr^{-1});

σ = net sedimentation term; and

f_s = fraction of input phosphorus that does not affect mid-lake concentrations.

The hydrologic parameters of residence time, surface area and mean reservoir depth are calculated on an annual basis for each of the reservoirs. The net sedimentation term accounts for both the sedimentation of phosphorus (loss) and resolution during periods of anoxia (gain) and it is a complex function of the inflow of phosphorus, outflow of phosphorus, lake morphology (surface area, volume, mean depth), hydrology, and water chemistry. Because of this complexity it is typically derived empirically. See Appendix A of the Phase II TMDL Methodology (DEP, 1998) for a derivation of the Vollenweider equation. The fraction of input phosphorus that does not affect mid-lake phosphorus concentrations (f_s) is included as an adjustment to the total input load to account for the rapidly settleable phosphorus that is quickly and permanently lost upon entering

the reservoir (Appendix B). Since information on dissolved and particulate phosphorus loads is available for the West of Hudson reservoirs, the Vollenweider equation has been adjusted based on the GWLF model loads (Appendix B).

4.3 Model Results

The annual modeling results for Ashokan Reservoir are given in Tables 4.2 (West Basin) and Table 4.3 (East Basin). Monthly phosphorus loads, differentiate for dissolved and particulate phosphorus can be found in Appendix C. Each of the four years (1993-1996) are modeled individually and the predicted phosphorus concentrations are compared to the observed phosphorus concentrations using the adjusted Vollenweider equation (Appendix B). The percent of the total load contributed by each source category varies each year depending on the hydrology. The minimum and maximum percent contributed by each category are given in Tables 4.2 and 4.3.

The dominant source of phosphorus to the West Basin of Ashokan Reservoir is from Schoharie Reservoir upstream (5%-30% of the total load). Within the basin, forest land use: deciduous forest (31%-60% of the total load) and coniferous forest (5%-10%) are the primary sources. Agricultural land also contributes phosphorus, primarily grassland (3%-4%). The phosphorus load from groundwater is undifferentiated with respect to land use, although land use and management practices do influence groundwater concentrations of nutrients. The load from point sources is minor and contributes only 1% of the total phosphorus load.

The dominant source of phosphorus to the East Basin of Ashokan Reservoir is from the West Basin (84%-94% of the total load). Within the basin, forest land use: deciduous forest (2%-7% of the total load) and grassland (1%-3%). The phosphorus load from groundwater is undifferentiated with respect to land use, although land use and management practices do influence groundwater concentrations of nutrients. The load from point sources is minor.

One potential source of phosphorus not explicitly considered in the modeling is phosphorus released from lake sediments. This phosphorus load originates within the lake not the watershed, and is therefore referred to as the internal phosphorus load. Lake sediments are generally a sink for phosphorus, and only provide an internal load to the lake or reservoir under specific conditions. If the water contains dissolved oxygen, the phosphorus remains bound with iron and other elements in the sediments. If the water becomes anoxic, the phosphorus compounds become soluable and are released from the sediments along with other elements such as iron and manganese. The net sedimentation term in the Vollenweider model implicitly accounts for the internal load of phosphorus. Unless the internal phosphorus load is large with respect to the external load of phosphorus from the watershed, it should not be added as a separate term in the phosphorus model. Ashokan Reservoir generally does not develop severe hypolimnetic anoxia and therefore does not have a significant internal load of phosphorus.

Table 4.2. Model Results for Ashokan Reservoir, West Basin

	1993	1994	1995	1996	Percent	
					Min	Max
Point Sources						
WWTPs (kg yr^{-1})	289	219	143	174	0%	1%
Upstream (kg yr^{-1})	3810	6941	6121	3253	5%	30%
Nonpoint Sources						
urban (kg yr^{-1}kg yr^{-1})	18	23	20	35	0%	0%
septic (kg yr^{-1})	694	690	634	716	1%	3%
grass/shrub (kg yr^{-1})	0	0	0	0	0%	0%
grass (kg yr^{-1})	1200	592	1321	2681	3%	4%
bare soil (kg yr^{-1})	0	0	0	0	0%	0%
corn (kg yr^{-1})	0	0	0	0	0%	0%
alfalfa (kg yr^{-1})	0	0	0	0	0%	0%
deciduous forest (kg yr^{-1})	17169	7204	20524	40029	31%	60%
coniferous forest (kg yr^{-1})	2998	1251	3592	7000	5%	10%
mixed forest (kg yr^{-1})	1110	461	1332	2593	2%	4%
barnyard (kg yr^{-1})	48	51	38	95	0%	0%
groundwater (kg yr^{-1})	5863	5675	4715	10306	12%	25%
water (kg yr^{-1})	144	144	144	144	0%	1%
Total Load (kg yr^{-1})	33343	23251	38584	67027		
Predicted concentration ($\mu g\ l^{-1}$)	12.5	12.2	12.0	15.9		
Observed concentration ($\mu g\ l^{-1}$)	7.4	11.4	12.8	22.6		
Difference ($\mu g\ l^{-1}$)	5.1	0.8	-0.8	-6.7		
%difference	69%			30%		

Note: phosphorus loads are calculated using the GWLF, predicted concentration is calculated using the adjusted Vollenweider Model, % difference is only calculated if the difference is greater 5 $\mu g\ l^{-1}$.

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CWT 12

Proposed Phase II Phosphorus TMDL Calculations for Pepacton Reservoir

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1. Introduction

This document summarizes the data analysis and modeling results supplied by the NYC Department of Environmental Protection (DEP) for use in the development of Phase II phosphorus Total Maximum Daily Loads (TMDLs) for Pepacton Reservoir.

1.1 Regulatory Background

The TMDL Program in the NYC watershed is a joint effort among the United States Environmental Protection Agency (EPA), New York State Department of Environmental Conservation (DEC) and the New York City Department of Environmental Protection. The Clean Water Act of 1977, as amended in 1986, requires each state to follow certain guidelines established by the EPA to maintain or improve their water quality. Section 303(d) of the Clean Water Act requires states to:

1. identify those waters where technology based or other controls are not stringent enough to implement applicable water quality standards and still require TMDLs;
2. establish a priority ranking for those waters;
3. establish the TMDL for the pollutant(s) of concern;
4. submit the TMDLs and the related Wasteload Allocations and Load Allocations (see below) to EPA for review and approval; and
5. incorporate TMDLs into the state's water quality management plan and begin implementation for point and nonpoint sources.

DEC is responsible for meeting the 303(d) requirements in New York State. The NYC reservoirs have been on the New York State 303(d) list since 1994, with phosphorus given as the primary pollutant. DEP volunteered to do the necessary data analysis and modeling to set the phosphorus TMDLs, and the individual reservoir reports are DEP's technical contribution to the State TMDL program.

Even though the TMDL process is required by the Clean Water Act and would occur regardless of other activities in the watershed, the development of phosphorus TMDLs in the NYC watershed has been incorporated into the January 1997 New York City Watershed Memorandum of Agreement (Watershed MOA), which includes revised NYC Watershed Regulations and a new EPA Filtration Avoidance Determination issued in May 1997 with respect to the Catskill and Delaware water supplies (FAD)(DEP, 1997). The inclusion of the TMDL process in these documents is appropriate since TMDLs provide a tool for water quality protection and assist in watershed management. Specific milestones are included in the Watershed MOA to assure that the process continues to move forward.

1.2 Overview of the TMDL Process

The TMDL process is a tool for assessing compliance with water quality standards and integrating the management of point and nonpoint sources of pollution using a watershed approach. TMDLs can be calculated for any pollutant of concern, and can be expressed in terms of either mass per time, toxicity, or other appropriate measure that relate to a water quality standard. Despite the name, TMDLs are not required to be daily values or maximum values, instead the way a TMDL is expressed depends on the type of parameter involved and the approach used in the analysis. In the case of a nutrient like phosphorus, an annual or growing season value is appropriate. A phased process of TMDL development was adopted for the NYC watershed so that pollution (i.e. phosphorus) reduction strategies can be implemented as soon as possible based on the Phase I results, while further modeling and data analysis is conducted in Phase II.

The objective of a TMDL is to allocate permissible loads among different pollutant sources so that water quality standards are met. The permissible load allocated to point sources of pollution is referred to as the Wasteload Allocation (WLA). Each point source in the NYC watershed, such as a wastewater treatment plant, is given a wasteload allocation for phosphorus. The permissible load allocated to nonpoint sources of pollution is referred to as the Load Allocation (LA). The load allocation can be specified as an aggregate for the basin or separated by land use or subbasin. One final component of a TMDL is the margin of safety (MOS). The MOS is the part of the load left unallocated. The MOS accounts for the uncertainty about the relationship between the pollutant load and the resulting water quality of the waterbody.

The term "TMDL" is often used in both a literal sense and a more general sense. In a literal definition, the TMDL is the critical load for a pollutant. However, the term is often applied to the entire process and refers to the components of a TMDL as well, including the WLA, LA, MOS, associated modeling of sources, and implementation measures.

1.3 Importance of Phosphorus TMDLs to NYC's Water Quality Management Plan

The phosphorus TMDLs are an important part of the NYC's overall Water Quality Management Plan. Phosphorus is a required nutrient for algae. The reservoirs in the NYC watershed, as well as many waterbodies in this region, are considered "phosphorus limited". Phosphorus is the nutrient in lowest supply compared to the algal demand, and thus is limiting the growth of algae. Therefore, an increase in the amount of phosphorus will result in a greater abundance of algae. While some algae growth in a reservoir is acceptable, excessive algae growth leads to other water quality problems such as taste and odor, low dissolved oxygen in the bottom waters, release of metals from anoxic bottom waters and disinfection problems (DEP, 1994; DEP, 1997; DEP, 1999). These water quality problems constitute a "use impairment" given that the use of this water is as a public water supply. Water bodies that contain excessive amounts of algae are called eutrophic; waters

with intermediate amounts of algae are called mesotrophic and waters with low amounts of algae are called oligotrophic. A number of the NYC reservoirs, primarily in the Croton System, are classified as eutrophic.

A TMDL is based on a water quality standard or guidance value. In the Phase I TMDL decision letter from EPA, it was noted that the State guidance value for phosphorus (20 $\mu g\ l^{-1}$), which was utilzed in the development of the Phase I TMDLs, was derived to protect aesthetic and recreational uses of the water body. DEC, and therefore the interagency TMDL workgroup, was charged with evaluating whether this value was adequate to protect a public water supply prior to the completion of the Phase II TMDLs.

Currently, there are no federal standards for phosphorus, algae or chlorophyll *a* in the source water of a public water supply. EPA is, however, currently pursuing the development of regional nutrient criteria as part of the Clean Water Action Plan (EPA, 1998). EPA has developed a national strategy to accelerate the development of scientific information concerning the levels of nutrients that cause water quality problems and to organize this information by type of water body and ecoregion. The individual states are expected to adopt numeric nutrient criteria not only based on the type of waterbody and ecoregion, but also the designated use of the waterbody by 2003. These nutrient criteria will then be available for development or revision of TMDLs or permits for wastewater treatment plants.

While the State guidance value may be appropriate for recreational purposes, it may not be stringent enough to protect the NYC reservoirs. Using a combination of water supply literature and site-specific data analysis, DEP has proposed a site-specific (i.e., NYC watershed-specific) phosphorus guidance value of 15 $\mu g\ l^{-1}$ (DEP, 1999a). This proposed guidance value has been presented as an interim value, pending the development of national nutrient criteria (EPA, 1998) and the establishment of mechanistic models for the NYC watershed. In the future, reservoir-specific guidance values may be developed which take into account the location and strategic importance of a reservoir within the water supply, i.e. terminal reservoir, as well as the unique character of the subwatershed and reservoir.

The implementation of the TMDLs will result in phosphorus load reductions in the basins that currently exceed the phosphorus guidance value. The phosphorus load reductions are likely to involve point and nonpoint sources of phosphorus. As part of the Watershed MOA, all existing wastewater treatment plants in the NYC watershed are being upgraded to meet the requirements of the City's revised Watershed Regulations. In addition, the SPDES permits for all of the wastewater treatment plants are being revised to include phosphorus limits for all the plants. Once the wastewater treatment plant upgrades are completed, these new limits will result in less phosphorus from point sources. If additional phosphorus load reductions are required in some basins, then

nonpoint source management techniques may be used to target specific areas for reduction in non-point phosphorus loads. DEC is responsible for designing and implementing the phosphorus reduction plan.

In addition to the State TMDL program, DEP is addressing phosphorus loading to the reservoirs. The recently promulgated revised NYC Watershed Regulations (entitled "Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and its Sources") allow the City to designate reservoir basins as phosphorus restricted. A phosphorus restricted basin is defined as the drainage basin of a reservoir or controlled lake in which the phosphorus load to the reservoir or controlled lake results in the New York State phosphorus water quality values being exceeded as determined by the Department pursuant to an annual review. Under the Watershed Regulations, new or expanded wastewater treatment plants with surface discharges are prohibited from being located within phosphorus restricted basins and any projects requiring a stormwater pollution prevention plan within a phosphorus restricted basin must include an analysis of phosphorus loading before and after development and provide for greater stormwater treatment. It should be noted that if a basin is exceeding its TMDL, a new surface point source discharge will not be approved by the State, regardless of the basin's phosphorus restricted status with the City.

There are many similarities between the TMDL program and phosphorus restricted basins. Both programs utilize the same guidance value for phosphorus, and incorporate a five year average of phosphorus data. There are, however, several differences between the two programs, including but not limited to the following:

- the governing agency is different;
- the regulatory implications of the programs are different;
- TMDLs are specified as annual loads of phosphorus whereas phosphorus restricted basin determinations are solely based on monitored phosphorus concentrations;
- TMDLs are intended as a one-time calculation, with revisions as necessary, whereas phosphorus restricted basins are revised annually as more current data becomes available;
- Phosphorus Restricted Basins is an assessment tool which can be used to determine if a basin is meeting its TMDL.

Due to these differences, the list of basins that exceed their TMDL and the list of phosphorus restricted basins will not necessarily be the same at any given time.

1.4 Phase II Schedule And Supporting Documents

The schedule for developing and implementing the Phase II TMDLs is set out in the Watershed MOA and the FAD. The Phase II methodology report, initially proposed by DEP (DEP, 1996t), was approved by DEC and EPA in June 1998 (DEP, 1998). The deadline for the individual reser-

voir reports is stated as "the later of 6/30/98 or 9 months from agreement on Phase II methodology" which results in March 1999. Following DEP's submission of the reservoir reports, DEC is required to review the information and submit the TMDLs to EPA within six months. EPA is then required to review the TMDLs and issue a determination within one month of the official TMDL submittal. In addition to the TMDL reports mentioned above, there are also several reports concerning the implementation of the TMDLs and subsequent DEP evaluation of the implementation measures.

Previous TMDL-related documents include a Phase I methodology report (DEP, 1996a), nineteen individual Phase I Reservoir Reports (DEP, 1996b-s), two reports coauthored by DEC and DEP on potential nonpoint source management practices (DEP/DEC, 1997a; DEP/DEC, 1997b), and one DEC report on the Phase I implementation (DEC, 1998).

2. Summary of Phase II Methodology

The complete methodology for deriving Phase II TMDLs for phosphorus can be found in the DEP document entitled "Methodology for Calculating Phase II Total Maximum Daily Loads (TMDLs) of Phosphorus for New York City Drinking Water Reservoirs" (DEP, 1998)(Figure 2.1). In brief, the TMDL process can be separated into two distinct components: modeling of phosphorus sources in the basin and calculating the TMDL components. The modeling in the Catskill and Delaware watersheds takes advantage of a separate, comprehensive modeling effort conducted as part of the FAD.

2.1 Modeling Phosphorus Sources in the Basin

The model results are not used in the TMDL calculation directly. The primary phosphorus sources are modeled to improve our understanding of the phosphorus budget in each basin and assist in planning and implementing phosphorus reduction measures.

In the Croton System:

- phosphorus sources in the basin are modeled annually for 1993 - 1996, as well as a four year composite, using the Reckhow model;
- phosphorus loads from wastewater treatment plants utilize available data;
- phosphorus loads from nonpoint sources are estimated based on land use and phosphorus export coefficients;
- the Vollenweider Model is utilized to calculate the predicted phosphorus concentration from the modeled phosphorus load from the watershed.

In the Catskill and Delaware Systems:

- phosphorus sources are modeled annually for 1993 - 1996 using the Generalized Watershed Loading Function Model (GWLF);
- phosphorus loads from wastewater treatment plants utilize available data;
- phosphorus loads from nonpoint sources in GWLF are driven by precipitation and air temperature data. Monthly nutrient exports are calculated using common empirically-derived equations which employ export coefficients of nutrient concentrations in the sediment, groundwater and overland runoff;
- the Vollenweider Model, modified with an additional settling term to be compatible with the GWLF results, is utilized to calculate the predicted phosphorus concentration from the modeled phosphorus load from the watershed.

2.2 TMDL Components

The complete TMDL analysis for a basin includes the critical load (TMDL) as well as allocations of this critical load to point sources, nonpoint sources and a margin of safety. The load reductions that can be expected from the upgrades of the wastewater treatment plants are estimated. If a reservoir has upstream reservoirs, an estimate of the load reduction realized when the upstream reservoir meets the proposed guidance value is also estimated.

- The TMDL is calculated, using the Vollenweider Model, to achieve both the proposed phosphorus guidance value of 15 $\mu g\ l^{-1}$ and the existing phosphorus guidance value of 20 $\mu g\ l^{-1}$.
- The Wasteload allocation (WLA) is the part of the TMDL reserved for point sources. This is calculated assuming the phosphorus effluent standards given in the Watershed Regulations, and the maximum permitted flow in the SPDES permit for each point source.
- The Load allocation (LA) is the part of the TMDL reserved for nonpoint sources. This is calculated by subtracting the WLA and a margin of safety (MOS) from the TMDL (i.e. LA = TMDL-MOS-WLA).
- The available load is the sum of the WLA and LA (=TMDL-MOS).
- The current load is calculated, using the Vollenweider Model, from reservoir monitoring data.
- The difference between the available load and the current load yields the total load reduction required or the load still available in the basin.
- A comparison of the WLA and the most recent (1996) estimate of the point source load indicates if point source reductions can be credited toward the total load reduction.
- An estimate of the load reduction due to potential load reductions in upstream reservoirs can be calculated from the modeling.

2.3 Comparison of Phase I and Phase II

The Phase II analyses will provide several enhancements over the Phase I results, in both the phosphorus modeling and the data available for inclusion in the calculations.

- In Phase I, the reservoir was the only water body explicitly modeled. In Phase II, the watershed model used in the Croton watershed has been revised to explicitly account for phosphorus retention by the larger lakes and ponds in the watershed. DEP is calling this approach the "Nested Reckhow Model".
- In Phase I, the Reckhow model was applied to the entire watershed. In Phase II, the Generalized Watershed Loading Function (GWLF) model has been used for the Catskill and Delaware watersheds.
- In Phase I, one year (1993) was modeled for all reservoir basins. In Phase II four consecutive years (1993 - 1996) have been modeled. These four recent years contain unusually wet conditions, as well as drought conditions, and should provide a rigorous test for the phosphorus model. In addition, these years contain a more comprehensive database due to heightened sampling of the reservoirs and wastewater treatment plants.

- In Phase I, the TMDL was calculated as the five year average that results in an in-reservoir concentration of 20 $\mu g\ l^{-1}$. In Phase II, a new phosphorus guidance value has been proposed which, in the opinion of the Department, more adequately addresses eutrophication-related use-impairment for a public water supply. The proposed Phase II phosphorus guidance value is 15 $\mu g\ l^{-1}$. The Phase II TMDL has been calculated using both the proposed and existing guidance values.
- In Phase I, the TMDL was calculated using data from 1990 - 1994. In Phase II, the TMDL has been calculated using data from 1992 - 1996 and is a more current assessment of the reservoir status.

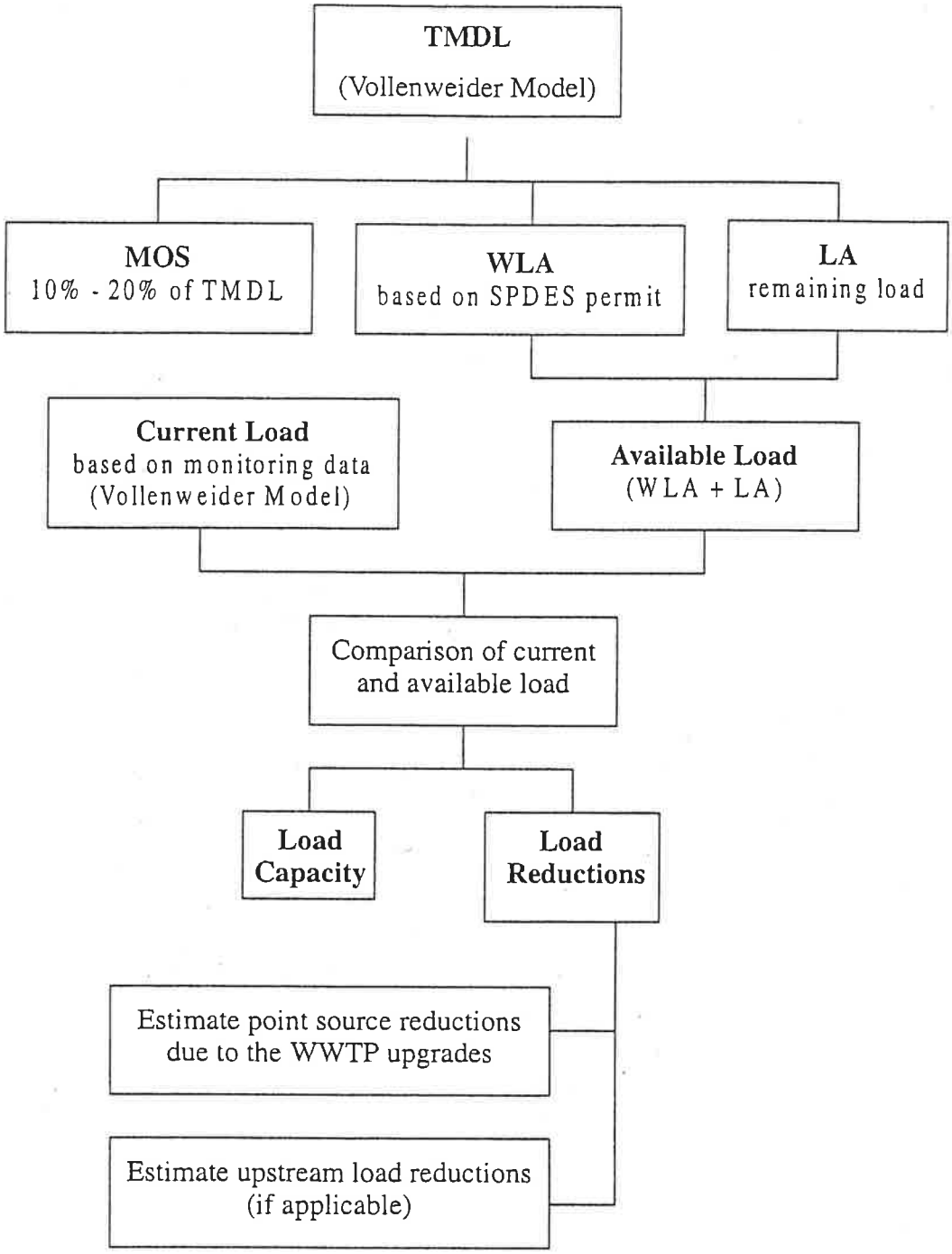

Figure 2.1 Phase II Flowchart.

3. Background Data Utilized

3.1 Reservoir and Basin Description

Pepacton Reservoir is one of the four Delaware District reservoirs and was placed in service in 1954. The basin covers 961 km^2 and is located in Delaware County. The watershed is primarily forested but does contain 20% agricultural land. The physical characteristics of the reservoir are given in Table 3.1. Water enters the reservoir primarily from the East Branch of the Delaware River, with a minor contributions from Tremper Kill and Mill Brook. Water leaves in one of three ways: a stream release at the dam, a spillway structure when the reservoir is full, and an aqueduct (East Branch Tunnel) to Rondout Reservoir.

Since Pepacton Reservoir is a headwater reservoir and does not have any reservoirs located upstream, the majority of the water is derived from surface runoff due to precipitation. Overall, the Pepacton and Cannonsville basins receive less rainfall than the basins located further east. The pattern of annual precipitation, however, follows that seen in the rest of the NYC watershed; average in 1993 and 1994, but unusually dry in 1995 and unusually wet 1996. The annual water budgets for 1993 - 1996 are given in Table 3.2. The flood in early 1996 and the subsequent above average rainfall during the remainder of the year is reflected in the water budget by a lower than normal flow down the aqueduct and a much higher than normal flow over the spillway. The East Delaware Tunnel was shut down for a period of time after the flood due to water quality concerns, and the reservoir was allowed to spill instead. The residence time of water in the Pepacton Reservoir varies depending on the operation of the system.

3.2 Water Quality

Water quality is closely monitored in all the NYC reservoirs. Surveys are currently performed on a monthly basis for all reservoirs during the growing season and semi-monthly for the terminal reservoirs (Rondout, Ashokan, Kensico, West Branch and New Croton) as well as the other West-of-Hudson reservoirs. Sampling sites are generally located along the main axis of the reservoir and at other key locations (e.g. aqueducts). The number of the routine sampling sites varies with the size, complexity and relative location of the reservoir in the NYC water supply. At each sample site, field measurements are taken (e.g. Secchi depth) and water samples are withdrawn from multiple depths for analysis in the NYC laboratories. A complete description of the sampling program can be found in the Surveillance Monitoring Report (DEP, 1997). Rarely, a reservoir survey is omitted due to excessive reservoir drawdown or emergency surveys required in other basins at the same time.

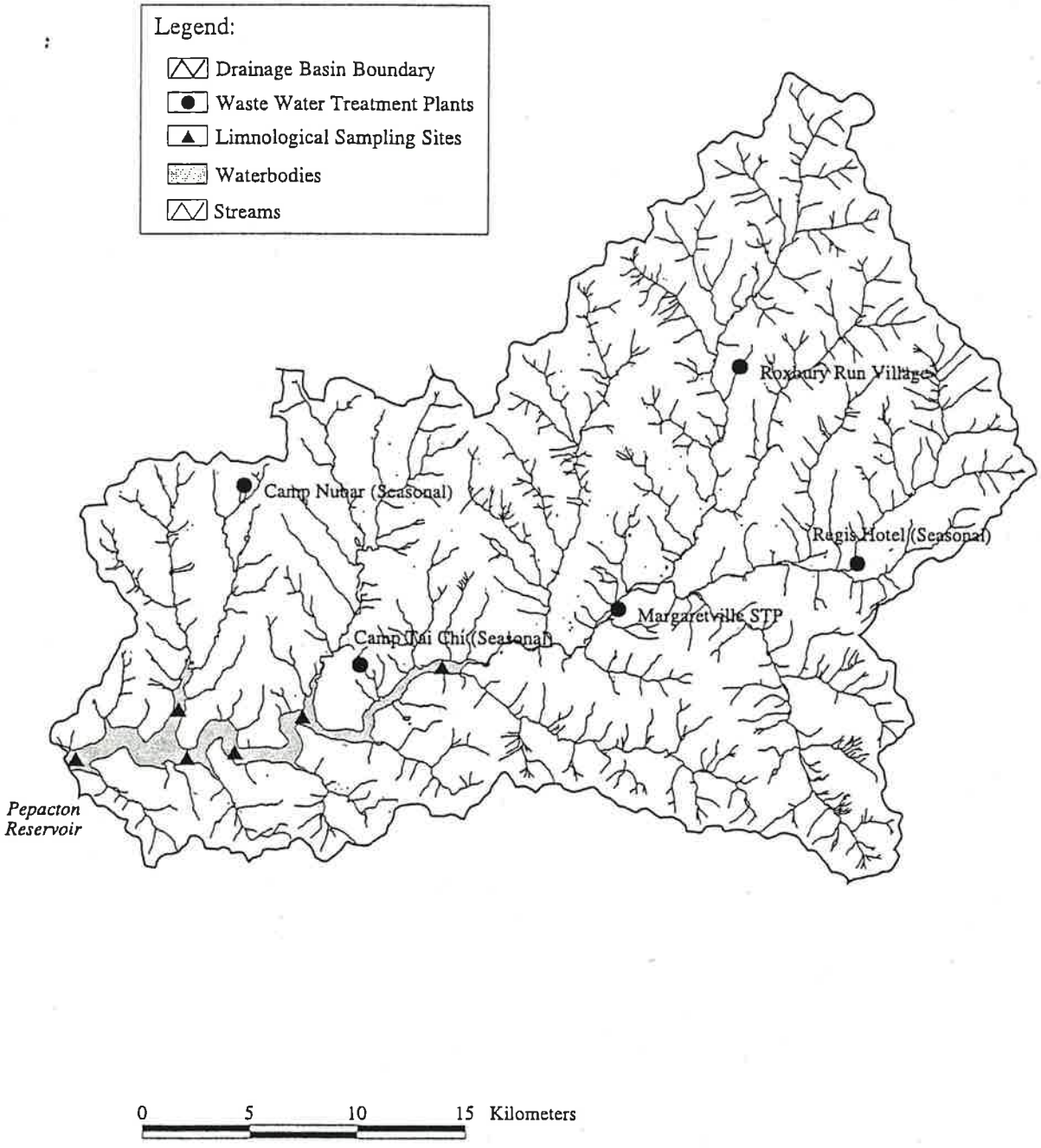

Figure 3.1 Watershed Map

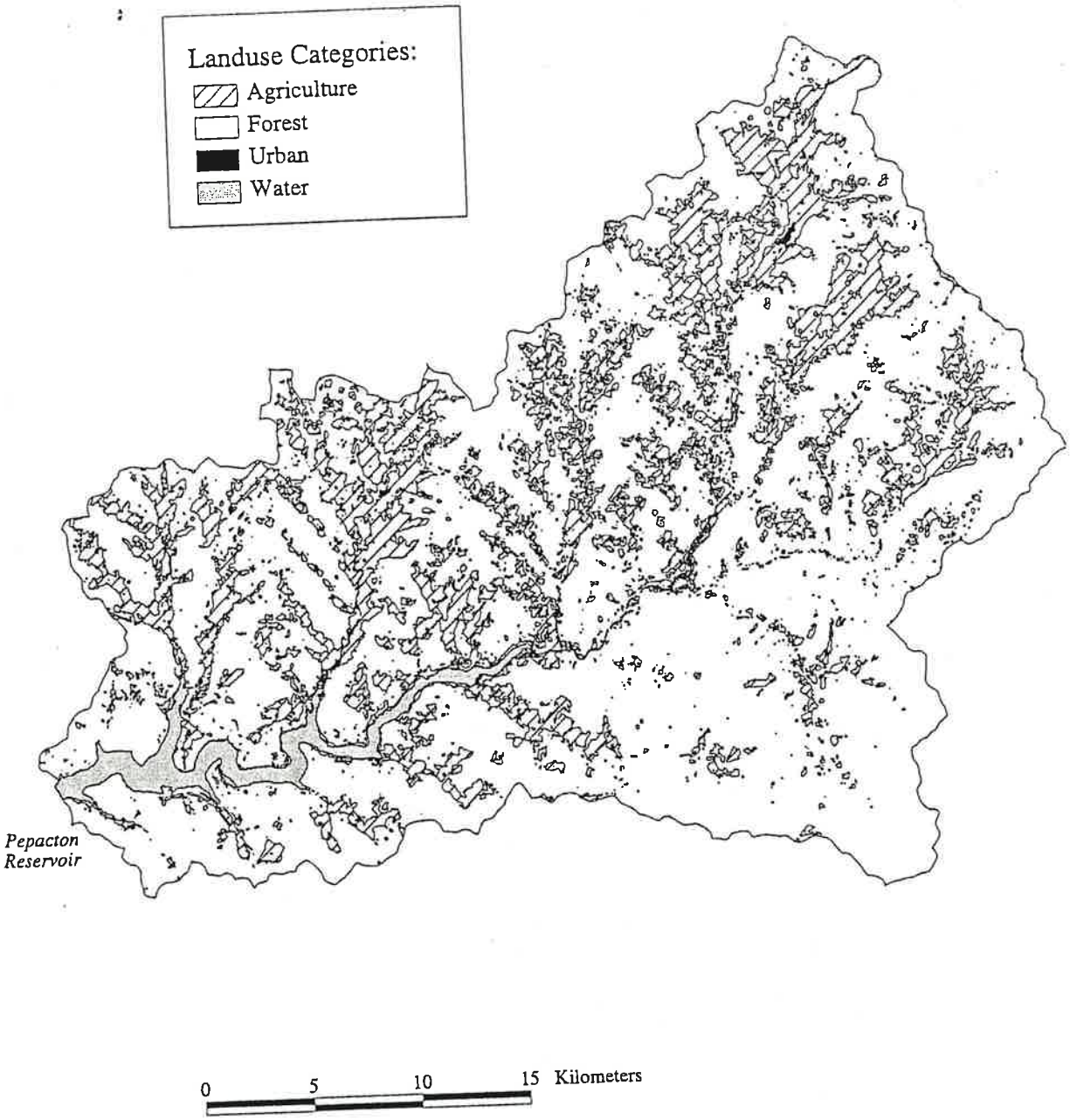

Figure 3.2 Land Use Map

Table 3.1. Physical Characteristics of Pepacton Reservoir

	1992	1993	1994	1995	1996
Watershed Area (km^2)	963.5	963.5	963.5	963.5	963.5
Reservoir Mean Surface Area (km^2)	18.52	19.05	20.10	19.33	22.15
Reservoir Mean Volume (MG)	98055	105974	114000	104700	135300
Residence Time (yr)	0.98	0.54	0.80	0.68	0.54
Maximum Depth (m)	44.0	44.0	44.0	44.0	44.0
Mean Depth (m)	20.0	20.6	21.3	20.5	23.16

Note: maximum depth is calculated at full reservoir volume.

Table 3.2. Pepacton Water Budget.

	1993	1994	1995	1996
Inputs				
Watershed Runoff (MG)	183287	164144	138129	306426
Aqueduct (MG)				
Upstream Reservoirs (MG)				
Wastewater Treatment Plants (MG)	88	98	77	118
Storage Change (MG)	-11681	22279	-16697	57664
Outputs				
Aqueduct (MG)	128407	127203	125746	117392
Outside Community (MG)				
Spill and Release (MG)	66649	14760	29157	131488
Residence Time (yr)	0.543	0.803	0.676	0.544

Pepacton Reservoir has average water quality for the Delaware System. Growing season values for several water quality variables are given in Table 3.3. The phosphorus concentrations will be discussed in more detail later in this section, but are included in Table 3.3 for a comparison with other water quality variables. Chlorophyll *a* is a measure of algal biomass and is often used to determine the trophic state of a water body. Pepacton Reservoir has above average concentrations of chlorophyll *a* for the Delaware System, and is generally classified as mesotrophic. Secchi depth and turbidity are common optical water quality variables. Secchi depth is a field measurement of water transparency while turbidity is a laboratory measurement of light scattering and is inversely related to transparency. For this time period, Pepacton Reservoir had an average Secchi depth and average turbidity compared to the other Delaware reservoirs.

Table 3.3. Water Quality for Pepacton Reservoir.

	1993	1994	1995	1996
Total Phosphorus ($\mu g\ l^{-1}$)	10.5	9.0	8.2	9.9
Chlorophyll *a* ($\mu g\ l^{-1}$)	6.97	6.48	4.16	4.22
Secchi Depth (m)	3.39	3.85	4.10	3.08
Turbidity (NTU)	1.61	1.45	1.52	2.19
Dissolved Oxygen ($mg\ l^{-1}$)	9.7	8.8	10.1	9.3
Trophic Status	M	M	M	M

Note: Values are growing season (May-Oct.) averages; total phosphorus values are the geometric mean. Chlorophyll a is calculated from surface samples only, other variables include all sample depths.
Trophic Status is calculated using chlorophyll a data; O = Oligotrophic, M = Mesotrophic, E = Eutrophic.

The amount of dissolved oxygen present in a reservoir is another important water quality variable. When the reservoir is completely mixed (spring and fall turnover), all levels of the water column have had recent contact with the atmosphere and contain relatively high levels of oxygen. When the reservoir is thermally stratified however, the bottom waters remain isolated from the atmosphere and can become depleted in oxygen. Organic matter in the sediment and the water decays and as a result uses up the oxygen in the water. Depending on the amount of material that decays and the length of stratification, the bottom waters can become anoxic ($< 1\ mg\ l^{-1}$). This condition is referred to as hypolimnetic anoxia.

Not all reservoirs develop hypolimnetic anoxia. It is dependent on variables such as the shape of the basin, the residence time of the water, the period of stratification and the amount and distribution of organic material. Some of these dominant variables vary annually. Typically, hypolimnetic anoxia is most pronounced at the dam where the reservoir generally reaches its maximum depth and thermal stratification is well developed. Other sites in the reservoir may not become anoxic.

Some reservoirs exhibit an unusual oxygen profile, where there is a mid-depth oxygen minimum. This can be caused by decomposition of organic matter in the water column, prior to the material settling to the bottom of the reservoir, or by lateral movement of water (interflow) that has a high oxygen demand. In a few cases, the oxygen depletion can progress to complete anoxia. If hypolimnetic anoxia is also present, then a complex oxygen profile exists, with two zones of anoxic water separated by oxygenated water. As stratification continues, these two anoxic zones can eventually expand to where they merge together, resulting in anoxic bottom water and oxic surface water.

The level of dissolved oxygen in the bottom waters of a reservoir can affect the phosphorus budget. Under severe anoxic conditions, phosphorus is released from the sediments once the nitrate contained in the bottom waters is completely depleted. This source of phosphorus is often called

an internal load since it is generated within the reservoir itself. The magnitude of this internal load will be estimated later in the phosphorus modeling section of the report. Generally, the internal phosphorus load is small with respect to the external phosphorus load delivered from the watershed.

Pepacton Reservoir generally does not experience hypolimnetic anoxia during stratification. During 1995, however, one sampling site exhibited anoxia in the lower two meters for 0.5 month.

3.3 Phosphorus Monitoring Data and Basin Status

An annual summary of the phosphorus monitoring data is presented in Table 3.4. The geometric mean phosphorus concentration of the growing season is given for each year, as well as the number of reservoir surveys and the number of samples analyzed for total phosphorus. The growing season is defined here as May 1 through October 31. Phosphorus data collected from all sample depths are used in the analysis. Phosphorus concentration values, like many environmental data sets, are lognormally distributed; therefore a geometric mean is used to characterize the most frequently measured phosphorus concentrations. Values that are below the analytical detection limit are set equal to half the detection limit. The detection limit for DEP measurements of total phosphorus is determined each year by the laboratories, and typically ranges between 2 $\mu g\ l^{-1}$ and 5 $\mu g\ l^{-1}$.

Pepacton Reservoir was well surveyed during this time period (1992 - 1996), with at least six surveys during the growing season. In 1995, the sampling program initiated biweekly sampling for this reservoir. The geometric mean phosphorus concentrations are consistently well below the NYS guidance value for phosphorus. The in-lake phosphorus concentration can be converted into a total current phosphorus load to the lake by using the lake model described in Section 4.2. The calculation of the critical phosphorus load is similar to the calculation of the current phosphorus load, except that instead of measured values of phosphorus concentration, a critical phosphorus concentration is used. The critical phosphorus load is calculated using both the proposed and existing phosphorus guidance values. The current and critical phosphorus loads are used later in the TMDL analysis.

Table 3.4. Annual Phosphorus Monitoring Data for Pepacton Reservoir.

	1992	1993	1994	1995	1996
Geometric Mean Phosphorus[1] ($\mu g\ l^{-1}$)	9.0	10.5	9.0	8.2	9.9
Number of Surveys[2]	6	6	6	11	10
Number of Samples[1]	101	97	105	169	158
Current Phosphorus Load[3] ($kg\ yr^{-1}$)	23330	45648	31523	30065	56068
Critical Phosphorus Load[4] ($kg\ yr^{-1}$)	51844	86948	70050	73330	113661
Critical Phosphorus Load[5] ($kg\ yr^{-1}$)	38883	65211	52538	54997	85246

[1] - calculated for the whole water body (all sample depths); [2] - during the growing season (May - Oct); [3] - Based on the annual phosphorus concentration and equation (3); [4] - based on the critical phosphorus concentration (20 $\mu g\ l^{-1}$) and equation (3); [5] - based on the critical phosphorus concentration (15 $\mu g\ l^{-1}$) and equation (3).

3.4 Wastewater Treatment Plant Data

Wastewater Treatment Plants (WWTP) are point sources of phosphorus in the watershed. There are a total of 107 WWTPs in the entire NYC watershed; seven of the plants are owned and operated by NYC. Many of the facilities are small plants which serve camps, schools or housing complexes. A few of the facilities, such as the city-owned plants, are large sewage treatment plants. Under the Watershed MOA and the Watershed Regulations, all WWTPs with surface discharges are being upgraded to tertiary level treatment, with additional treatment for phosphorus removal.

DEP staff inspect the WWTPs quarterly, and monitor the effluent. This is in addition to the State Pollutant Discharge Elimination System (SPDES) permit which requires the plant operator to periodically monitor and report flow and effluent pollutant concentrations. DEP samples city-owned plants weekly and noncity-owned plants twice a month. The samples are analyzed at the DEP upstate laboratories. This effluent monitoring data includes phosphorus concentration. The phosphorus concentration data is used, in conjunction with flow information, to estimate phosphorus loads for each facility. The flow information used for this analysis comes from, in order of preference, 30-day mean flows listed on the Discharge Monitoring Report, flows at the time of the water quality sample, and, if no other information is available, the design flow.

Each plant is assigned a wasteload allocation (WLA) of phosphorus. The WLA is based on the maximum permitted flow of the facility and the phosphorus effluent concentration, both of which are given in the revised SPDES permit. This WLA represents the maximum phosphorus load that

Table 3.5. Wastewater Treatment Plant Phosphorus Loads and Wasteload Allocations for Pepacton Reservoir.

Plant Name	SPDES Permit Number	SPDES Flow (mgd)	Phosphorus EffluentLimit ($mg\ l^{-1}$)	1993 Load (kg)	1994 Load (kg)	1995 Load (kg)	1996 Load (kg)	WLA (kg)
Camp Nubar (Seasonal)	23787	0.0125	1.0	11	11	11	3	17
Camp Tai Chi (Seasonal)	104957	0.0075	1.0	5	0	0	1	10
Margaretville STP	26531	0.4000	0.5	476	450	257	547	277
Regis Hotel (Seasonal)	100382	0.0096	1.0	7	6	5	3	13
Roxbury Run Village	99562	0.1000	0.5	27	56	28	44	69
Basin Total				526	523	301	598	388

SPDES = State Pollution Discharge and Elimination System; WLA = Wasteload Allocation

the facility can discharge under its permit. Seasonal facilities are treated according to the limits given in their SPDES permit, so if year-round flow is allowed, then the WLA assumes year-round flow.

There are five WWTPs in the Pepacton basin (Table 3.5). Three facilities are seasonal, Camp Nubar, Camp Tai Chi and the Regis Hotel. There is one large WWTP owned by NYC in Margaretville. Interannual patterns in the flow mirror the interannual pattern of rainfall. A year with high runoff, such as 1996, results in higher flows into and out of the plants. The annual WWTP phosphorus load exceeded the basin WLA each year except for 1993.

4. Model of Watershed Phosphorus Sources

A summary of the models utilized in the Phase II analysis of phosphorus sources is presented below. The models are discussed in detail elsewhere (DEP 1998; 1996v; Haith and Shoemaker, 1987; Chapra, 1982; Lake and Res. Man., V 14, 1998). Before describing the models used in Phase II, it is important to clarify the role of the two models used in the TMDL Project. Modeling is used to aid our understanding of the relative importance of phosphorus sources (i.e. via the Reckhow Model) and subsequently, the relationship of phosphorus load to the ambient conditions in a reservoir. The TMDL is based on monitoring data and the "critical" phosphorus concentration. Phosphorus concentration measurements in the reservoir are used to estimate the total current phosphorus load. The required phosphorus load reductions are based on the difference between the current and available load established as the TMDL. The Reckhow Model apportions this total load to various point and nonpoint sources of phosphorus. This information is crucial in developing phosphorus management plans and reduction measures.

4.1 GWLF Description

The Generalized Watershed Loading Function (GWLF) Model was developed for the Catskill and Delaware reservoirs as part of the larger, more comprehensive modeling effort being conducted under the City's Filtration Avoidance Determination (*DEP*, 1996). GWLF is essentially DEP's "second generation" in terrestrial modeling, superseding the Reckhow Land Use Model. The phosphorus load estimates from the Reckhow and GWLF models are different due to different input data and model assumptions. This is described in more detail in Appendix A. Although GWLF is described in detail elsewhere (*DEP*, 1996v; *Haith and Shoemaker*, 1987), a brief summary will be supplied here.

The GWLF Model consists of a hydrologic component and a water quality component. It is driven by variations in meteorology, specifically precipitation and air temperature. Water and sediment losses from the watershed are modeled using commonly used, empirically-derived equations. Monthly nutrient exports are then calculated by employing land use-specific coefficients of nutrient concentrations in the runoff. DEP is applying GWLF to each of the West-of-Hudson reservoir watersheds. The input variables are: precipitation, air temperature, land use, soil type, topography, and point source phosphorus loads. The land use data is the same as that used for Phase I TMDLs. It is derived from LANDSAT TM scenes which have a 28.5 m resolution and were taken during 1992-1993 for the West of Hudson region. The land use was grouped into 11 categories: urban, grass/shrub, grass, bare soil, corn, alfalfa, deciduous forest, coniferous forest, mixed forest, barnyard and water (Table 4.1.). Additional model parameters related to soil erodability, sediment transport and phosphorus concentrations in groundwater, surface runoff and soil are estimated through a combination of past research studies and model calibration.

Table 4.1. Land Use and Phosphorus Export Coefficients for Pepacton Reservoir.

Land Use Category	Area (ha)	Percent (%)
Urban Land Use	66	1%
Grass Shrub Land Use	6610	7%
Grass Land Use	12800	13%
Bare Soil Land Use	3	<1%
Corn Land Use	345	<1%
Alfalfa Land Use	7	<1%
Deciduous Forest Land Use	59440	62%
Coniferous Forest Land Use	14240	15%
Mixed Forest Land Use	0	0%
Barnyard Land Use	13	<1%
Water	2499	3%

DEP made several revisions and improvements to the GWLF model, including modifications in the sediment yield algorithm, and recoding of the model as originally formulated in Haith, *et al.* (1992) into the VENSIM Visual Modeling Environment (Ventana, 1995). The re-coded model is modular, provides enhanced flexibility in model application and output visualization, and permits use of calibration, verification, and statistical tools available in the VENSIM environment. The recoded model was tested to ensure results numerically equivalent to those of the original GWLF program.

Modifications to the sediment yield algorithm of GWLF were made to correct a problem in accurately simulating the timing of sediment export due to spurious sensitivity of the model to the month the simulation is started and to the choice of start month. A revision was also made in the method for calculating the monthly transport capacity of streamflow, which apportions sediment yield over the 12 months of the year. Finally, the sediment delivery ratio calculation was adjusted as a function of watershed area, based on the 1983 SCS National Engineering Handbook (USDA-SCS, 1983). These revisions were found to significantly improve the performance of the model's simulation of sediment yield timing. With the exception of these modifications, this application of the GWLF model adheres to the original formulation of the model by Haith, *et al.* (1992). The reader is referred to the original reference for detailed description of the model.

The GWLF Model has several advantages over the Reckhow Land Use Model utilized in the Phase I TMDLs. It predicts both the temporal and spatial variability in the phosphorus loads, which can assist in developing monitoring plans and phosphorus management strategies. The temporal distribution of the phosphorus load can demonstrate the effects of seasonality on both the phosphorus load and the reservoir response to that load. The spatial distribution provided by the sub-basin loads assists in targeting areas for phosphorus reduction measures. One final advan-

tage is that GWLF is driven by observed data on precipitation and air temperature, rather than an average annual representation. It must be kept in mind that the goal of the phosphorus modeling is to provide information for implementation measures. The TMDL is still calculated from monitoring data.

4.2 Vollenweider Model Description

The phosphorus load from the watershed can be used to predict the reservoir concentration using the Vollenweider model (*Vollenweider*, 1975; 1976) as adjusted by Chapra (1982) (Appendix B). For the Cannonsville Reservoir, this model is only used in the TMDL calculations to derive the phosphorus load from the average reservoir concentration. A mechanistic nutrient-phytoplankton model, discussed separately, has been developed to model the reservoir. The Vollenweider Model written in terms of the net sedimentation coefficient and measured data, it is given by:

$$P_\lambda = \frac{(1-f_s)W}{A_s x z(\tau_\omega^{-1} + \sigma)} \qquad (1)$$

where,

P_λ = observed phosphorus concentration (g m^{-3});

z = mean depth (m);

τ_ω = residence time (y);

A_s = reservoir surface area (m^2);

W = total mass load of phosphorus (kg yr^{-1});

σ = net sedimentation term; and

f_s = fraction of input phosphorus that does not affect mid-lake concentrations.

The hydrologic parameters of residence time, surface area and mean reservoir depth are calculated on an annual basis for each of the reservoirs. The net sedimentation term accounts for both the sedimentation of phosphorus (loss) and resolution during periods of anoxia (gain) and it is a complex function of the inflow of phosphorus, outflow of phosphorus, lake morphology (surface area, volume, mean depth), hydrology, and water chemistry. Because of this complexity it is typically derived empirically. See Appendix A of the Phase II TMDL Methodology (DEP, 1998) for a derivation of the Vollenweider equation. The fraction of input phosphorus that does not affect mid-lake phosphorus concentrations (f_s) is included as an adjustment to the total input load to account for the rapidly settleable phosphorus that is quickly and permanently lost upon entering

the reservoir (Appendix B). Since information on dissolved and particulate phosphorus loads is available for the West of Hudson reservoirs, the Vollenweider equation has been adjusted based on the GWLF model loads (Appendix B).

4.3 Model Results

The annual modeling results for Pepacton Reservoir are given in Table 4.2. Monthly phosphorus loads, differentiate for dissolved and particulate phosphorus can be found in Appendix C. Each of the four years (1993-1996) are modeled individually and the predicted phosphorus concentrations are compared to the observed phosphorus concentrations using the adjusted Vollenweider equation (Appendix B). The percent of the total load contributed by each source category varies each year depending on the hydrology. The minimum and maximum percent contributed by each category is given in Table 4.2. The dominant source of phosphorus to Pepacton Reservoir is forest land use: deciduous forest (30%-39% of the total load) and coniferous forest (9%-12%). Agricultural land also contributes phosphorus, primarily grassland (16%-18%) and cropland (9%-10%). Previously farmed land in the process of returning to forest (grass-shrub) contributes 4%-5%. The phosphorus load from groundwater is undifferentiated with respect to land use, although land use and management practices do influence groundwater concentrations of nutrients. The load from point sources is minor and contributes only 1%-2% of the total phosphorus load.

One potential source of phosphorus not explicitly considered in the modeling is phosphorus released from lake sediments. This phosphorus load originates within the lake not the watershed, and is therefore referred to as the internal phosphorus load. Lake sediments are generally a sink for phosphorus, and only provide an internal load to the lake or reservoir under specific conditions. If the water contains dissolved oxygen, the phosphorus remains bound with iron and other elements in the sediments. If the water becomes anoxic, the phosphorus compounds become soluable and are released from the sediments along with other elements such as iron and manganese. The net sedimentation term in the Vollenweider model implicitly accounts for the internal load of phosphorus. Unless the internal phosphorus load is large with respect to the external load of phosphorus from the watershed, it should not be added as a separate term in the phosphorus model.

One potential source of phosphorus not explicitly considered in the modeling is phosphorus released from lake sediments. This phosphorus load originates within the lake not the watershed, and is therefore referred to as the internal phosphorus load. Lake sediments are generally a sink for phosphorus, and only provide an internal load to the lake or reservoir under specific conditions. If the water contains dissolved oxygen, the phosphorus remains bound with iron and other elements in the sediments. If the water becomes anoxic, the phosphorus compounds become soluable and are released from the sediments along with other elements such as iron and manganese.

The internal phosphorus load depends on many factors such as dissolved oxygen level, nitrogen levels, pH, temperature, chemical composition of the sediment, degree of sediment mixing, biological activity, concentration gradient across the sediment/water interface and groundwater

entrainment (Reckhow and Chapra, 1983). The amount of phosphorus released varies spatially and temporally due to the hydrodynamics and morphology of the reservoir. Because of these variations, it is difficult to accurately measure or estimate the internal load of phosphorus to a lake. The Vollenweider Lake Model, as in many similar lake models, utilizes a net sedimentation term which accounts for both sedimentation (loss of phosphorus) and rerelease during periods of anoxia (gain of phosphorus). This net sedimentation term was empirically determined from studies on many lakes and implicitly accounts for the internal load of phosphorus. Unless the internal phosphorus load is large with respect to the external load of phosphorus from the watershed, it should not be added as a separate term in the phosphorus model.

The magnitude of the internal phosphorus load has been estimated using a simple method which utilizes phosphorus concentration data and lake morphology (Nurnberg, 1984). The general concept is that the high phosphorus values observed in the hypolimnion during stratification represent phosphorus released from the sediments. The average phosphorus concentration in the hypolimnion during stratification (August) is compared to the whole lake average phosphorus concentration prior to stratification (May) to determine the "excess" phosphorus due to the sediments. This excess phosphorus concentration is multiplied by the volume of water in the hypolimnetic to determine the internal load of phosphorus. In general, this estimate will be an upper bound on the magnitude of the internal phosphorus load. The method assumes the entire hypolimnion is anoxic which is rarely true. In many cases only the site closest to the dam becomes anoxic not the entire reservoir. Additionally, the anoxia typically extends only a few meters above the bottom and does not continue up to the thermocline. Therefore the volume of elevated phosphorus concentration is likely to be much less than assumed with this method. There is also a gradient in phosphorus concentration throughout the water column. The hypolimnion water samples are collected two meters off the bottom, and the phosphorus concentration will be higher than the true average for the hypolimnion. Pepacton Reservoir generally does not develop hypolimnetic anoxia and therefore does not have an internal load of phosphorus.

Table 4.2. Model Results for Pepacton Reservoir.

	1993	1994	1995	1996	Four Year Average Load	Four Year Average % total load
Point Sources						
WWTPs (kg yr^{-1})	529	523	300	597	1%	2%
Upstream (kg yr^{-1})	0	0	0	0	0%	0%
Nonpoint Sources						
urban (kg yr^{-1})	23	29	25	40	0%	0%
septic (kg yr^{-1})	544	541	502	560	1%	2%
grass/shrub (kg yr^{-1})	1842	949	1798	4246	4%	5%
grass (kg yr^{-1})	6225	3560	5539	14142	16%	18%
bare soil (kg yr^{-1})	91	48	90	211	0%	0%
corn (kg yr^{-1})	3590	1982	3321	7894	9%	10%
alfalfa (kg yr^{-1})	16	9	15	37	0%	0%
deciduous forest (kg yr^{-1})	13300	6895	12993	30702	30%	39%
coniferous forest (kg yr^{-1})	3970	2053	3883	9165	9%	12%
mixed forest (kg yr^{-1})	0	0	0	0	0%	0%
barnyard (kg yr^{-1})	180	199	156	406	0%	1%
groundwater (kg yr^{-1})	6411	6129	5260	10919	14%	27%
water (kg yr^{-1})	249	249	249	249	0%	1%
Total Load (kg yr^{-1})	36969	23166	34130	79167		
Predicted concentration ($\mu g\ l^{-1}$)	8.6	9.2	8.1	11.9		
Observed concentration ($\mu g\ l^{-1}$)	10.5	9.0	8.2	9.9		
Difference ($\mu g\ l^{-1}$)	-1.9	0.2	-0.1	2.0		
%difference						

Note: phosphorus loads are calculated using the GWLF, predicted concentration is calculated using the adjusted Vollenweider Model, % difference is only calculated if the difference is greater than 5 $\mu g\ l^{-1}$

4.4 Model Verification

The TMDL Technical Working Group agreed that development of defensible TMDLs require that each reservoir be adequately modeled. This means that phosphorus loads from all sources are identified and the model is verified with actual water quality data. The Phase II criteria for determining if a reservoir basin is adequately modeled is as follows:

- the predicted phosphorus concentration should be within 50% of the observed concentration for all four years;
- the predicted phosphorus concentration should be within 20% of the observed concentration for any two out of these four years;
- any year where the predicted phosphorus concentration is within 5 $\mu g\ l^{-1}$ of the observed phosphorus concentration is considered adequately modeled regardless of the percentage of the observed concentration;
- the TMDL Technical Committee may allow exceptions to the above guidelines if the reasons are scientifically justified.

Pepacton Reservoir is adequately modeled according to the above criteria. The difference between the predicted phosphorus concentration and the observed phosphorus concentration is less than 5 $\mu g\ l^{-1}$ for all four years.

5. TMDL Calculation

5.1 Methodology

The total maximum daily load of a pollutant is the sum of all individual waste load allocations for point sources, plus the sum of load allocations for nonpoint sources, plus a margin of safety, which will result in meeting the applicable water quality standards.

$$TMDL = WLA + LA + MOS \leq LC \qquad (4)$$

where:

$TMDL$ = total maximum daily load of phosphorus (kg y^{-1});
WLA = wasteload allocation for point sources (kg y^{-1});
LA = load allocation for nonpoint sources (kg y^{-1});
MOS = margin of safety (kg y^{-1});
LC = loading capacity (critical load; kg y^{-1}).

The total loading from point sources (WLA) and nonpoint sources (LA), allowing for a margin of safety (MOS), should not exceed the critical load for a reservoir (TMDL). The allowable load is the sum of the WLA and the LA.

The TMDL is the phosphorus load that will achieve a critical phosphorus concentration as a geometric mean phosphorus concentration during the growing season (Table 5.4). The Phase II TMDL has been calculated for both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}). A five year average (1992 - 1996) is used for the TMDL calculation and the current load to accommodate annual variability in either loading or hydrology. This timeframe is short enough to reflect current conditions yet long enough to prevent setting a limit based on one or two unusual years.

The MOS is a required component of TMDL development which is intended to account for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body (*EPA*, 1991). The Phase II MOS consists of two parts. A factor of 10% is applied as a baseline to each reservoir to account for general uncertainty in the analysis. An additional factor is added to this 10% to reflect the phosphorus variability in each reservoir. This additional factor is based on the standard error of the five-year mean used to determine the TMDL (DEP, 1998).

The WLA is the portion of the TMDL allocated to point sources. Each wastewater treatment plant in the watershed is assigned a fixed daily phosphorus load, which is calculated using the design (permitted) flow for the plant and the phosphorus effluent concentrations in the Watershed Regu-

lations. Seasonal facilities are treated according to their SPDES Permit and if year round flow is permitted, then year round operation is assumed for the wasteload allocation. This method is patterned after other DEC regulatory programs, and results in a conservative estimate of the maximum phosphorus load a plant can legally discharge. The sum of all the individual wasteload allocations equals the current WLA for the basin. It should be noted that the WLA is not based on monitoring data, but rather on the SPDES Permit requirements and the limitations in the Watershed Regulations. Significant changes in the WLA would only occur if point source permits are revised, new plants come on line or old plants are decommissioned.

The LA is the portion of the TMDL allocated to nonpoint sources. The initial aggregate LA is equal to the remaining load in the TMDL after the MOS and WLA are accounted for. The observed nonpoint source load can be estimated by subtracting the point source loads (calculated from monitoring data) from the current load (calculated from reservoir concentration data).

If the current phosphorus load exceeds the available phosphorus load, then load reductions are required. Some of this total load reduction may come from the point sources in the basin. DEP is currently upgrading all existing (as of November 2, 1995) WWTPs in the watershed to tertiary level treatment plus added phosphorus removal, so that all they comply with the effluent limits in the Watershed Regulations. In some cases, this will result in a reduction of phosphorus. In order to estimate the load reduction that can be expected from the WWTP upgrades, the basin WLA (sum of each individual WLA) is compared to the 1996 point source phosphorus load calculated for the basin. If the basin WLA is less than the 1996 phosphorus load, then the difference between them is the expected load reduction. If the basin WLA is greater than the 1996 point source phosphorus load, then no reduction in phosphorus resulting from the WWTP upgrades can be credited toward the total required load reduction. Since the WLA assumes the maximum SPDES flow, a plant can be discharging phosphorus at a higher concentration than allowed under the regulations but with less flow resulting in a total phosphorus load less than the WLA prior to the upgrade of the plant. Any remaining load reduction after the estimated point source reduction is accounted for must be derived from nonpoint sources.

Table 5.1. TMDL Calculation for Pepacton Reservoir.

	15 µg l^{-1} guidance value	20 µg l^{-1} guidance value
TMDL (kg yr^{-1})	59375	79167
MOS (10% of TMDL; SE = 0.4)	5938	7917
Available Load (TMDL - MOS)(kg yr^{-1})	53437	71250
WLA (kg yr^{-1})	388	388
LA (kg yr^{-1})	53049	70862
Current load (kg yr^{-1})	37327	37327
Total load reduction required (kg yr^{-1}) (current load - available load)	0	0
Expected WWTP reductions (kg yr^{-1})	210	210
Remaining reduction (kg yr^{-1})	0	0

5.2 Basin Results

The TMDL calculations for Pepacton Reservoir using both the proposed phosphorus guidance value (15 µg l^{-1}) and the existing phosphorus guidance value (20 µg l^{-1}) are given in Table 5.1. The current and critical phosphorus loads for each of the five years in the analysis are given in Table 3.4. The MOS for Pepacton Reservoir is 10% due to a low amount of variability in the annual phosphorus concentrations. Between 1992 and 1996 the annual geometric mean phosphorus concentrations ranged from 8.2 to 10.5 µg l^{-1}. Subtracting the MOS from the TMDL results in an available load which is apportioned between point and nonpoint sources. The WLA for the individual WWTPs are given in Table 3.5; the basin WLA is 388 kg yr^{-1}. The load remaining for nonpoint sources depends on the guidance value utilized.

The current phosphorus load is below the available phosphorus load, so load reductions are not required. A comparison of the basin WLA (388 kg yr^{-1}) and the total point source load for 1996 (598 kg yr^{-1}) indicates that a load reduction of 210 kg yr^{-1} may be expected from the WWTP upgrades. However, 1996 was an unusual year and the previous year the WWTPs were below the basin WLA. The principal phosphorus source in the Pepacton watershed is forest land use.

6. Conclusions

TMDLs are a watershed-based approach to implement water quality standards and integrate the management of point and nonpoint sources of pollution. In the NYC watershed, the development of phosphorus TMDLs are a joint effort between DEC, EPA and DEP. The reservoir reports are DEP's technical contribution to the State TMDL program. The calculations presented in the reservoir reports are preliminary values; the DEC will submit the official TMDLs to EPA at a later date. The preliminary phosphorus TMDLs for the NYC reservoirs have been calculated using both the proposed guidance value (15 $\mu g\ l^{-1}$) and the existing guidance value (20 $\mu g\ l^{-1}$).

As part of the TMDL analysis, the phosphorus sources in the watershed were modeled for the period between 1993 and 1996. The modeling results are not used for the TMDL calculation directly, but are intended to assist in the implementation of any required phosphorus reductions. The GWLF Model was applied to the watershed to predict the phosphorus load into the reservoir. An adjusted Vollenweider Lake model was used to predict the in-lake phosphorus concentration based on the watershed load of phosphorus and reservoir characteristics. This model implicitly accounts for an internal load of phosphorus from the sediments, but an estimate of the internal phosphorus load was also calculated based on monitoring data. Pepacton Reservoir generally does not develop hypolimnetic anoxia and therefore does not have an internal load of phosphorus. For each year modeled, the results are verified against reservoir monitoring data.

Pepacton Reservoir is located in Delaware County. The watershed is predominantly forested and contains five wastewater treatment plants. The model adequately predicted the observed phosphorus concentration in Pepacton Reservoir. The difference between the observed and predicted phosphorus concentration was less than 2 $\mu g\ l^{-1}$ each year. The primary sources of phosphorus to Pepacton Reservoir are forest land use and agriculture.

The TMDL calculations depend on the phosphorus guidance value adopted. Using the proposed phosphorus guidance value of 15 $\mu g\ l^{-1}$, the TMDL for Pepacton Reservoir is 59375 kg yr^{-1}. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (5938 kg yr^{-1}). The WLA is the load allocated to point sources. Each individual wastewater treatment plant is assigned a WLA based on the parameters in their SPDES permit (Table 3.5). The aggregate WLA for the Pepacton basin is 388 kg yr^{-1}. The LA, which is the load allocated to nonpoint sources, is the remainder of the allowable phosphorus load. The aggregate LA for the Pepacton basin is 53049 kg yr^{-1}.

Using the existing phosphorus guidance value of 20 $\mu g\ l^{-1}$, the TMDL for Pepacton Reservoir is 79167 kg yr^{-1}. The MOS, which is a required component intended to address uncertainty in the analysis, is 10% of the TMDL (7917 kg yr^{-1}). The aggregate WLA for the Pepacton basin is 388 kg yr^{-1} and the aggregate LA is 70862 kg yr^{-1}. The percentage of the total nonpoint source load contributed by the individual land use types can be estimated from the phosphorus modeling. The

percentage of the LA allocated to individual land use types is an issue for implementation and basin-wide planning. Pepacton Reservoir is currently below the Phase II TMDL using either guidance value.

In the future, more complex models and perhaps revised guidance values will be available for a Phase III TMDL process. DEP is in the process of developing hydrodynamic and eutrophication reservoir models, as well as a terrestrial (i.e. watershed) models, for the entire NYC watershed. These models, as well as the intensive field programs associated with the model development, will provide a greater understanding of the phosphorus budget in the watershed and reservoirs. In addition, EPA is currently developing regional nutrient criteria as part of the Clean Water Action Plan. States are expected to adopt the national criteria, or develop their own, by 2003. A revision of the phosphorus guidance value would necessitate a revised TMDL for all of the reservoirs.

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Appendix A - Comparison of Phosphorus Loads from the Reckhow and GWLF Models

Introduction

The Phase I TMDL Reservoir Reports utilized the Reckhow Land Use Model to model the watershed sources of phosphorus for 1993. The Reckhow Model is a commonly used tool to determine the relative magnitude of phosphorus sources for planning purposes. Independent of the TMDL program, DEP has been developing terrestrial and reservoir models for the Catskill and Delaware reservoirs as part of the larger, more comprehensive modeling effort being conducted under the City's Filtration Avoidance Determination (*DEP*, 1996). GWLF is essentially DEP's "second generation" in terrestrial modeling and contains many advantages over the Reckhow Model. For this reason, the GWLF model is used in the Phase II TMDL Reservoir Reports.

Model Description

Reckhow Model

The Reckhow Land Use model was developed as a simple planning model to estimate the impact of development around lakes. The model is meant to estimate long-term, average loading from different land uses, based on unit area export coefficients (kg ha^{-1} yr^{-1}). Five different land use categories were used in the Catskill/Delaware districts: forest, urban, corn/alfalfa, pastureland, and water. Point sources, upstream reservoirs and proximal septic systems are added to the non-point sources to predict an annual total phosphorus load. This model was developed before the importance of storm event loading was fully recognized, and the export coefficients that are used are likely derived from baseflow monitoring data. It should be noted that since Reckhow is an average annual loading model that does not account for precipitation, it estimates the same non-point source load year after year.

GWLF Model

The GWLF model is more sophisticated than the Reckhow model in several ways. The model is driven by climatic variables (precipitation and temperature) and uses the SCS curve number to predict surface runoff. Coefficients of phosphorus concentration in runoff, for different land use types, are combined with the runoff volume to predict monthly phosphorus loads. Twelve different land use categories are used. Both dissolved and particulate components of the total phosphorus are modeled. Point sources and septic systems are also included as watershed phosphorus sources. This model incorporates storm event data, and has been calibrated to monitoring data at the Beerston USGS gage in the Cannonsville basin. An important point is that GWLF accounts for interannual variability in loadings due to year-to-year precipitation differences and is thus appropriate for estimating loads for a particular year.

Comparison of watershed model results

The Reckhow model and the GWLF model use the same point source database and the same land use database (although the Reckhow model has the land uses aggregated into more generalized categories). The predicted phosphorus loads from each model, however, are quite different. The GWLF phosphorus loads are greater than the predicted loads from the Reckhow model. The percent of the total load from each general land use category is similar between models for non-point source loads. However, the relative contributions of point sources versus non-point sources changes since GWLF predicts greater nonpoint source phosphorus loads.

The differences between the model estimates is due to the model development history and the type of input data. The Reckhow model was presumably developed using baseflow monitoring data only, and it seems to predict the fraction of the load delivered during nonstorm periods. This has been partially verified using annual phosphorus loads derived from baseflow sampling data East-of-Hudson. The GWLF model more closely predicts the total load delivered during both baseflow and storm periods.

Conclusion

Phosphorus sources in the watersheds are modeled to aid our understanding of the relative importance of the different sources and subsequently, the relationship of phosphorus load to the ambient conditions in a reservoir. The model results are intended to assist in the implementation of any required phosphorus load reductions. DEP continues to make progress in modeling phosphorus sources in the watershed, and there is an iterative evolution in both the input data and the phosphorus load estimates.

Appendix B - Derivation of the Adjusted Vollenweider Model

Introduction

As noted previously, the GWLF phosphorus loads are greater than the predicted phosphorus loads from the Reckhow Model (Appendix A). This is primarily due to the inclusion of storm-driven particulate phosphorus loads in the GWLF Model. While much of this particulate phosphorus settles out rapidly upon entering the reservoir, the original formulation of the Vollenweider Model is not designed to accommodate this type of input. The Vollenweider Model, however, can be adjusted to include a term representing the fraction of input phosphorus that does not affect mid-lake phosphorus concentrations (f_s). This adjusted Vollenweider Model has been applied to the TMDL calculations for the West-of-Hudson Reservoirs. The scientific background and the method used to estimate f_s is described in the following sections.

In-Lake Phosphorus Model

Widely used simple phosphorus budget models for lakes utilize the continuously stirred tank reactor (CSTR) approach (Reckhow and Chapra, 1983):

$$V\frac{dP}{dt} = W - QP - S \qquad (1)$$

where:

P = the in-lake total phosphorus concentration,
W = the input total phosphorus load,
Q = the total lake outflow,
V = the lake volume,
S = the loss of phosphorus from the water column to lake sediments.

The CSTR approach assumes that the lake is a completely and instantaneously mixed tank in which each constituent (in this case phosphorus) may be interpreted with one average concentration which is equal throughout the lake.

For phosphorus budgets, the major question in applying this simple model is how to quantify the loss of phosphorus to sediments, S . Piontelli and Tonolli (1964) proposed that this loss of phosphorus to sedimentation was a fixed fraction of the input phosphorus load:

$$S = f_s W \qquad (2)$$

where:

f_s = the fixed fraction of input phosphorus lost to sediments.

Another approach to sedimentation losses uses a first order decay function of the in-lake total phosphorus content (Vollenweider, 1969):

$$S = \sigma V P \tag{3}$$

where:

σ is the net sedimentation coefficient.

Each of these methods of estimating the sediment loss of phosphorus has been used successfully. Edmundson and Lehman (1981) studied Lake Washington in Washington State for a 17 year period from 1962-1978. Yearly phosphorus loss to sediments were compared to both the yearly input phosphorus load and to the in-lake phosphorus. A better correlation was found relating the phosphorus losses to the input loads suggesting that the Piontelli and Tonolli approach yielded a more reliable result.

There have been a number of studies which show the validity of the first order decay approach.(Vollenweider, 1975; Kirchner and Dillon, 1975; Larsen and Mercier, 1976; Bachmann and Canfield, 1979; Vollenweider, 1976) Through these studies the net sedimentation coefficient could be related to different combinations of hydrologic and geomorphic properties of the lake such as average residence time, areal loading rate (input load divided by lake surface area) and average lake depth. Each of these empirical relationships were derived using average historical data from a large number of lakes thus allowing inter-comparisons between lake responses.

There has been some controversy as to which approach to quantifying the in-lake phosphorus loss is more applicable. Each approach has advantages depending on the questions which are being asked. In the Lake Washington study, a long time series for a single lake was investigated. The result showed that the fixed fraction approach seemed to work best for this lake. One reason for this was that a significant amount of the phosphorus load was attributable to particulate phosphorus sorbed onto suspended sediment in the tributary streams. This particulate phosphorus quickly settles when the more turbulent streams reach the calmer waters of the lake and therefore, has little effect on in-lake phosphorus content. This phenomenon has been referred to as positional availability (Logan et al., 1979; Reckhow and Chapra, 1983). The large magnitude of this rapidly settling particulate phosphorus outweighed the more subtle biologically based first order decay effect taking place. (Chapra and Reckhow, 1983). Additionally, since lake response to phosphorus load can vary widely from lake to lake, it is not clear that the results on Lake Washington are necessarily transferrable to other lakes.

The studies using the first order decay approach looked mostly at average data for multiple lakes. This allows these models to be used for inter-comparisons between different lakes. Specifically, it allows a quick estimate of a given lake's response to input phosphorus loads based on hydrologic or geomorphic properties of the lake. These applications of the first order decay process, therefore, were comparisons between different lakes (cross-sectional differences) while the Lake Washington study was more focused on understanding the response of a single lake to input loading changes (longitudinal differences) (Chapra and Reckhow, 1983.)

The West-of-Hudson Phase II TMDL analysis is being performed for four individual years and for six different reservoirs. Therefore, the model used must be able to both predict in-lake phosphorus for both a time series for each individual lake and address the issue of transferability (of the model) between different reservoirs. For this reason, we have chosen to use the model developed by Chapra (1982) which combines the two phosphorus loss approaches to account for both the positional availability concept and the slower process of settling within the lake:

$$V\frac{dP}{dt} = (1 - f_s)W - QP - \sigma VP \qquad (4)$$

where:

f_s = the fraction of input phosphorus which is positionally unavailable.

For the Phase II TMDL's a steady state version of this model is applied annually. Under steady state conditions, solving for the in-lake phosphorus and substituting residence time, lake surface area and average lake depth, equation 4 can be rewritten as:

$$P = \frac{(1 - f_s)W}{A_s \bar{z}(1/\tau_w - \sigma)} \qquad (5)$$

where:

P = the average growing season total phosphorus concentration,
W = the average annual phosphorus load,
A_s = the average lake surface area,
$\bar{z}$ = the average lake depth, and
τ_w = the average annual residence time.

To test the efficacy of applying equation 5 for Phase II TMDL's requires independent estimates of each of the variables. For each year of testing, the growing season total phosphorus is obtained from DEP limnological sampling data (see Table 3.4). The lake surface area and average depth were obtained from DEP reservoir operations records (see Table 3.1). The input phosphorus load was estimated using the GWLF terrestrial loading model. To estimate the net sedimentation coefficient, the relationship to average annual residence time suggested by Vollenweider (1976) and Larsen and Mercier (1976) was used:

$$\sigma = \frac{1}{\sqrt{\tau_w}} \qquad (6)$$

There are no independent estimates for the fraction of total phosphorus which is positionally unavailable, f_s. To try to ascertain a value for this parameter, equation 5 was solved for f_s using the data outlined above. These results showed that using a single value as suggested by Chapra (1982) would not adequately model all reservoirs for all years. This makes sense since the positionally unavailable phosphorus is generally related to the particulate phosphorus associated with suspended solids. For years with large streamflow events, a greater percentage of the phosphorus load to the reservoir is attributed to the particulate form. For these years we would expect the fraction of quickly settling phosphorus to be larger than for years without extremely high runoff events when a greater percentage of the incoming phosphorus is in the dissolved form.

A relationship between positional availability and the fraction of input load which is in particulate form provides a means for independently estimating the fraction of positionally unavailable phosphorus, f_s. Figure B1 shows the calculated f_s values plotted against the ratio of particulate phosphorus load to total phosphorus load as calculated by GWLF. A power law function provides a good fit to data with an r^2=0.75 :

$$f_s = 0.933\left(\frac{PP}{TP}\right)^{0.913} \qquad (7)$$

where:

PP = the annual particulate phosphorus load, and

TP = the total phosphorus load (particulate plus dissolved phosphorus) as calculated by GWLF.

Because the theoretical definition of f_s is the fraction of quickly settling phosphorus, it would not make sense for f_s to exceed the particulate phosphorus fraction (PP/TP), which occurs when PP/TP exceeds 0.45. For this reason, equation 7 was used to calculate f_s for PP/TP of 0.45 or greater and f_s was set equal to the particulate phosphorus fraction for PP/TP values less than 0.45.

Results of the modeling for individual reservoirs are presented in each reservoir report. In general the results were quite good and met the evaluation criteria for the Phase II TMDL process. Clearly, the modeling presented here is highly empirical. There are no relationships of the parameters in these models to the actual processes which may or may not cause eutrophication problems within any particular reservoir. To gain a greater understanding of individual lake response, specific process studies and associated mechanistic models are being developed.

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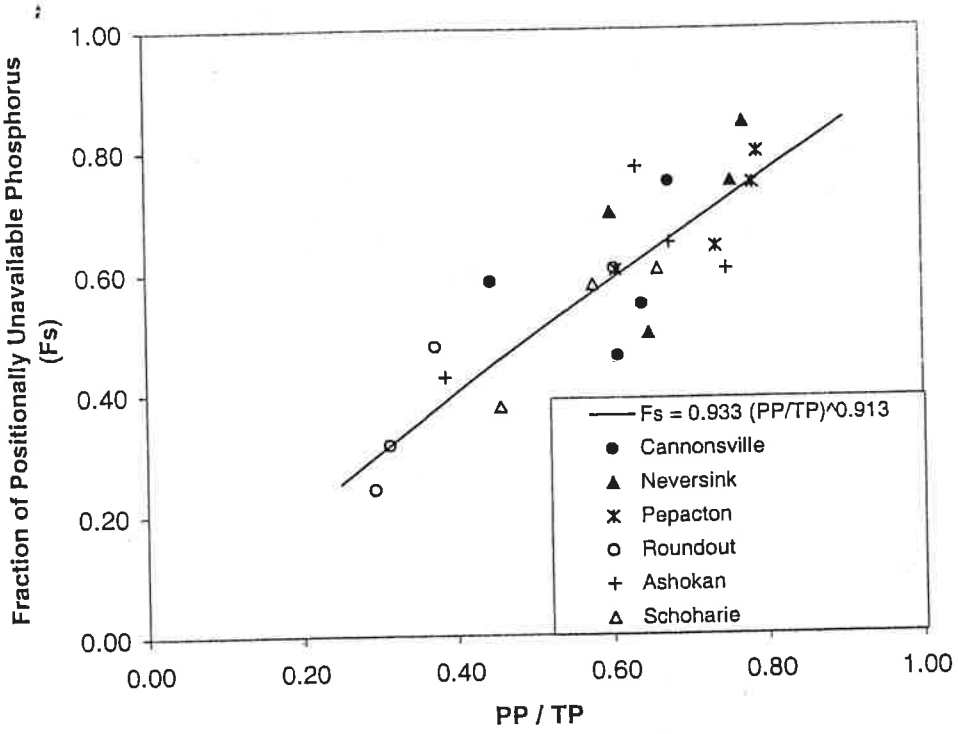
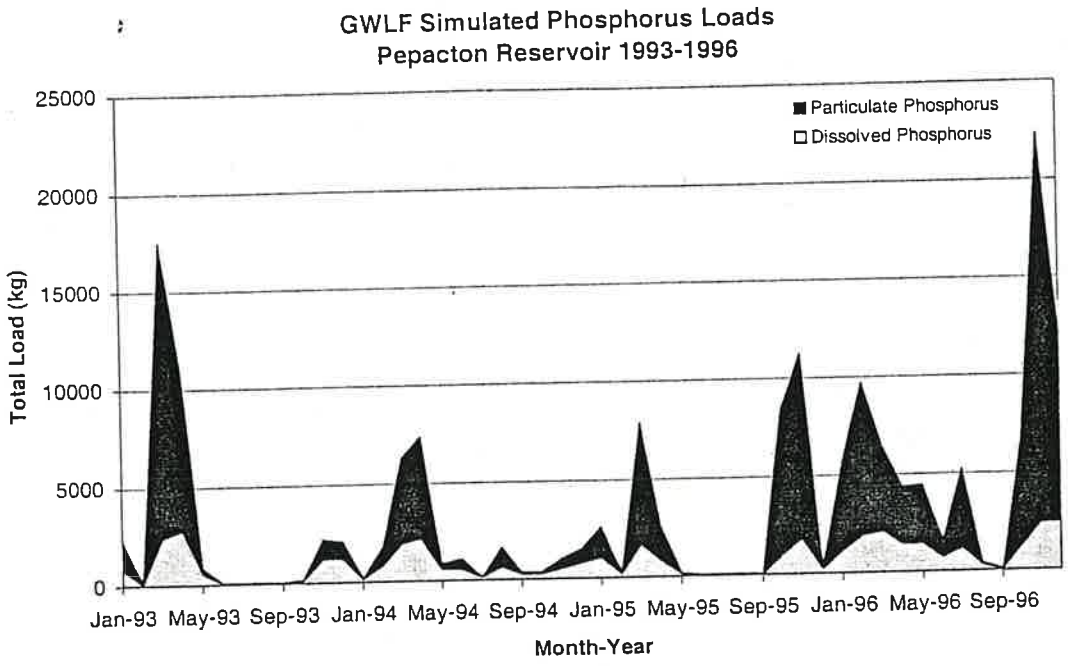


Figure B1. Fraction of positionally unavailable phosphorus versus the ratio of input particulate phosphorus to total phosphorus input for six WOH Reservoirs for 1993-1996.

Appendix C - Monthly Phosphorus Loads from the GWLF Model



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Watershed 13

Alan L. Rosa, Executive Director
Catskill Watershed Corporation

Alan is a native of the Dry Brook Valley near Arkville in Delaware County, where his family has lived for the better part of 200 years, and where he early on developed a love for the outdoors and a penchant for hunting and fly-fishing. He graduated from Margaretville Central School and holds certificates from Cornell University in Business Law, Business Economics and Accounting.

A former accountant and small business owner, Alan was elected supervisor of the Town of Middletown in 1990, and as such became a member of the Delaware County Board of Supervisors.

He helped organize the Coalition of Watershed Towns in 1991 in response to watershed regulations issued by the New York City Department of Environmental Protection which wanted to avoid filtering its daily supply of 1.2 billion gallons of Catskill and Delaware water. The coalition worked for the next six years to negotiate a fair deal for upstate communities faced with potentially suffocating watershed rules.

The struggle led to the landmark New York City Watershed Memorandum of Agreement, signed in January of 1997. The MOA called for the formation of the Catskill Watershed Corporation, a non-profit Local Development Corporation, to direct a number of city-funded environmental protection, economic development and education programs.

The CWC board of directors, which includes 12 elected officials from the 5-county Catskills, along with city, state and environmental representatives, elected Alan its first president in 1997. He became the CWC's acting executive director in December of 1998, a position which became permanent in April, 1999.

Alan manages a staff of 16 professional, technical and support personnel and oversees an annual operation and program budget of 21 million dollars.

He is a member of the Executive Committee of the Watershed Protection and Partnership Council, and assists in an advisory capacity with several partner agencies in the West of Hudson Watershed.

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Watershed 14

CHESTER JOHN STRAUB, JR.

Mr. Straub is the President of the Ulster County Development Corporation (UCDC) having been named to that position on May 15, 2001. He is responsible for the overall operation and management of the UCDC, a private not-for-profit organization that is the lead economic development agency for Ulster County with a mission of creating jobs through the attraction of new business and the retention and expansion of existing business.

In addition Mr. Straub provides financial oversight and general administration of the Development 21 Initiative comprised of the Shovel Ready Fund that provides grants for infrastructure development and the Telecommunications Fund that provides low-cost loans to the fuller utilization of telecommunications and E-commerce technologies. He also oversees the administration of eight regional and local revolving loan funds and all programmatic matters of the Ulster County Industrial Development Agency.

From September 1993 through January 2001, Mr. Straub was associated with the Economic Development Administration (EDA) of the U.S. Department of Commerce, a national economic and community development agency with an annual average budget of approximately $450 million and a 260 person staff. While with EDA he was appointed Acting Assistant Secretary for Economic Development by Secretary of Commerce William Daley on September 10, 1999. He served in this capacity through August 2000 and was the principal advisor to the Secretary of Commerce on domestic economic development issues and administrator of EDA.

Prior to joining the Department of Commerce, Mr. Straub was the Corporate Secretary and Director of Legal Affairs of the Battery Park City Authority (BPCA), a public benefit corporation of the state of New York (1990-1993). The BPCA is responsible for the development and management of the mixed-use 92-acre Battery Park City and World Financial Center community in lower Manhattan in New York City.

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Watershed 15

DRAFT – August 19, 2004

DEPARTMENT OF ENVIRONMENTAL PROTECTION
ADMINISTRATIVE HEARING
THE BELLEAYRE RESORT AT CATSKILL PARK

August 23, 2004

Testimony of
Chester J. Straub, Jr.
President of the Ulster County Development Corporation
(As prepared for delivery)

Good afternoon, I am Chester Straub, President of the Ulster County Development Corporation and on behalf of our Board of Directors I wish to offer comments on The Belleayre Resort At Catskill Park.

My comments will cover two areas:

- The importance of tourism to our region.
- Economic impact.

Importance of Tourism

We in Ulster County recognize our community as one of the most beautiful places on earth. With the historic Hudson River as our front door and the Catskill Mountains as our back yard, we enjoy a quality of life not shared by many.

Just as important, we understand the importance of developing the county's economy as a way to protect and preserve our way of life. This is the key to shaping Ulster County's future.

The coming together of our economy and quality of life can most clearing be seen in our long and proud heritage as a tourism destination. In fact, tourism has become one of the top industries in Ulster County.

In 2000 alone, it is estimated that tourist and visitor spending in the county was approximately $656 million.[1] Furthermore, the direct positive impact of tourism for county residents is quite evident in it's over $100 million in annual wages to approximately 7,300 people. [2]

[1] Office of Tax Policy Analysis, New York State Department of Taxation and Finance.
[2] As of 2001, New York Department of Labor.

Ulster County is one of the top tourism and recreation destinations in New York State. These statistics reflect that fact (ranking the county third highest in hotel/motel sales receipts in the state[3]) and as a result the entire county benefits.

A significant part of Ulster County's and the Catskill Region's tourism heritage has been its resort hotels and multi-seasonal recreation. For many years the region was the destination of choice for outdoor-oriented individuals, but it now also is increasingly the choice of those seeking a retreat from the daily rigors of urban living.

Why do people come to Ulster County?

Because of its location and the activities available at destinations such as: Mohonk Mountain House, Minnewaska Lodge, the Nevele Grande, Hudson Valley Resort, Rocking Horse Ranch, and Emerson Place, Horse Shows in the Sun, the Woodstock Film Festival, Belleayre Mountain, golf courses such as Rondout Golf Club, Apple Greens, and Wiltwyk Golf Club, sky diving in Gardiner, climbing in the Gunks, and fishing and rafting in the Catskills.

Today more than ever, with a greater demand for vacation and recreation options close to home, our viability as a tourism and recreational destination therefore must be maintained.

One of the most effective means of insuring that we remain viable is to building upon our existing offerings. The Belleayre Resort project does just that.

Economic Impact

Beyond the natural appeal of the project to residents of the Hudson Valley and the greater New York City metropolitan region. The Ulster County Development Corporation believes that the economic impact is clear, significant and positive. Both during the anticipated eight-year developmental and construction period and in full operation, The Belleayre Resort project will have significant direct and indirect economic impacts while having minimal impact upon existing public services.

The project proponents have estimated that during its eight-year development and construction phase, The Belleayre Resort will generate direct annual average employment of 264 with wages and salaries of $10.14 million. Indirect wages and salaries are estimated at $8.05 million on average per year. The total economic output (both direct and indirect construction spending) is estimated to be $451 million.[4] This will make this project the single largest endeavor ever in Ulster County in terms of expenditures.

Upon completion, The Belleayre Resort will result in the creation of 542 full-time positions and 330 seasonal positions in the most rural and economically stagnant

[3] Ulster County $67,050,000 Bond Anticipation Notes Official Statement, June 10, 2005.
[4] These estimates are derived through the use of methodologies developed by the Bureau of Economic Analysis of the U.S. Department of Commerce.

locations in Ulster County with a total direct annual payroll of $20.5 million.[5] The projected annual full-time salary of $27,272 compares very favorably to the countywide per capita income of $20,846[6], annual average wages for workers in arts, entertainment and recreation ($17,839[7]) and accommodation and food services ($13,655[8]), and the total for all private sector employment ($25,433[9]).

Equally important is the interconnected nature of the winter employment of the Belleayre Mountain ski facility and The Belleayre Resort. Every year, as the temperature begins to rise and the snow begins to melt as many as three hundred employees find themselves without a job. With the new opportunities being made available at The Belleayre Resort facilities, year-round employment in now possible.

The year-round opportunities presented by complimentary recreational and hospitality facilities will also address another significant issue for local residents, specifically the lack of quality employment in the community. Currently the mean travel time to work for residents of the Town of Shandaken is approximately 32 minutes.[10] With its significant levels of employment, The Belleayre Resort project will provide the opportunity for

Furthermore, the project is anticipated to generate approximately $11.81 million in annual off-site visitor spending in the region and increase local property tax revenues by close to $1.5 million annually and state and county sales tax revenues by approximately $2 million. At a time when county and municipal governments are facing increased financial burdens, new sources of revenues must be identified. Given that local municipal services will not be significantly burdened by the project[11], it will result in positive cash flow for the relevant jurisdictions.

Conclusion

In conclusion, let me say that we all look to the future with hope and optimism. But we must also look to the present with candor and evenness.

The prospects of The Belleayre Resort at Catskill Park must, and should, be thoroughly reviewed by the Department of Environmental Conservation, and each and every one of us with a stack in the future of our community. But the Ulster County Development Corporation anticipates that after that review, you will arrive at the same conclusion as

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[5] Belleayre Resort at Catskill Park Draft Environmental Impact Statement.
[6] U.S. Bureau of the Census, Census 2000.
[7] NAICS Based Industry Employment and Wages -- 2002, New York State Department of Labor.
[8] NAICS Based Industry Employment and Wages – 2002, New York State Department of Labor.
[9] NAICS Based Industry Employment and Wages – 2003, New York State Department of Labor.
[10] U.S. Census Bureau, Census 2000.
[11] It should be noted that municipal and county police representatives, as well as local emergency services (EMT and fire districts) have indicated that current force levels are sufficient to meet anticipated future demand, thus no added expenses will be incurred. Additionally, due to the seasonal and recreational nature of the project, no appreciable additional expenses will be incurred by the local school district.

us, that the Belleayre Resort at Catskill Park is the right project at the right time for Ulster County.

Thank you for this opportunity and we look forward to your review and approval of this important project so that we may move forward in creating a future for our communities that will balance development and preservation and maintain the quality of life that we know and hold dear here in Ulster County.

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Watershed 16

FURLOW LODGE
ARKVILLE, NEW YORK
12406

June 23, 2004

Judge Richard Wissler
New York State D.E.C.
21 South Putt Corner Road
New Paltz, NY 12561

Dear Judge Wissler, Re: State Environmental Quality Review of The Crossroads Environmental Impact Statement

As one of the four incorporators of the Catskill Center for Conservation and Development (formed 35 years ago) I am concerned that the Center in so adamantly opposing the Crossroads proposal has disregarded the fact that facilitating economic development in the Catskill region was as fundamental an objective of its organization as was prosecution of environmental conservation for the Catskills at that time had limited opportunities for gainful employment. That the Catskill economy continues to be depressed cannot be denied.

The Crossroads proposal appears to have potential for substantial job creation both in construction and in permanent employment. Expenditures by the clientele making use of its facilities would follow. Such beneficial impact on the local economy would be especially important to those permanent Catskill residents who depend on making their daily living here.

When I was a boy in the 1930s the Grand Hotel stood across from where Crossroads now proposes new residential structures and I golfed on its course across from where Crossroads would build new golfing facilities. Therefore from my perspective the concept of establishing proximate to the Belleayre Ski area a quality resort destination along the lines of The Homestead or the Greenbriar seems more restoration than novelty.

If the Crossroad's current proposal seems overly ambitious then its production should be phased over specific periods. This way a portion of the project could begin now and the balance started after the initial parts have proved economically beneficial and environmentally benign.

Sincerely,

Kingdon Gould, Jr.

KGJR/md,

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PENGAD-Bayonne, N. J.
Watershed Communities
17
8.26.04

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF NEW YORK

CATSKILL MOUNTAINS CHAPTER OF TROUT UNLIMITED, INC., THEODORE GORDON FLYFISHERS, INC., CATSKILL-DELAWARE NATURAL WATER ALLIANCE, INC., FEDERATED SPORTSMEN'S CLUBS OF ULSTER COUNTY, INC., and RIVERKEEPER, INC.,

Plaintiffs,

v.

THE CITY OF NEW YORK, NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION, and JOEL A. MIELE, SR., COMMISSIONER OF DEPARTMENT OF ENVIRONMENTAL PROTECTION,

Defendants.

1:00-CV-511
(FJS/RFT)

APPEARANCES

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JOHN PAUL, Legal Intern

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HILARY MELTZER, ESQ.
JANET SIEGEL, ESQ.

SCULLIN, Chief Judge

MEMORANDUM-DECISION AND ORDER

I. INTRODUCTION

On November 20, 1998, Plaintiffs served Defendants, the New York State Department of Environmental Conservation ("DEC"), and the Environmental Protection Agency ("EPA") with a Notice of Intent to Sue. On March 31, 2000, Plaintiffs filed their complaint in this action. *See* Dkt. No. 1. On October 6, 2000, this Court dismissed Plaintiffs' turbidity and thermal discharge claims for failure to state a claim. *See* Dkt. No. 19. Thereafter, on October 21, 2001, the Second Circuit reversed in part this Court's decision and remanded this action for further proceedings. *See* Dkt. No. 32.

Subsequently, Plaintiffs filed a motion for partial summary judgment, seeking a declaration that Defendants had violated the Clean Water Act ("CWA"), 33 U.S.C. § 1311(a), by discharging turbidity and suspended solids from the Shandaken Tunnel into the Esopus Creek without a permit, including 347 days between February 1, 1995 and December 30, 1998.[1] *See* Dkt. No. 44. On June 4, 2002, the Court granted Plaintiffs' motion for summary judgment on the issue of liability and directed the parties to contact Magistrate Judge Treece's chambers to discuss how this action could be expedited to ensure that a trial on the issue of damages could be scheduled as soon as possible. *See* Dkt. No. 66.

The Court held a bench trial commencing on January 8, 2003, to determine the amount of civil penalties, if any, that Defendants should be required to pay pursuant to 33 U.S.C. § 1319(d), and what form of injunctive relief, if any, the Court should impose upon Defendants for

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[1] According to Defendants' Exhibit "D-17," the Shandaken Tunnel was in operation on 1,015 days between February 1, 1995 and December 30, 1998.

operating the Shandaken Tunnel without a SPDES permit in violation of the CWA. Pursuant to Rule 52(a) of the Federal Rules of Civil Procedure, the following constitutes the Court's findings of fact and conclusions of law with respect to these issues.

II. DISCUSSION

A. Findings of Fact

Plaintiffs Catskill Mountains Chapter of Trout Unlimited, Inc. ("CMCTU"), Theodore Gordon Flyfishers, Inc. ("TGF"), Catskill-Delaware Natural Water Alliance ("CDNWA"), Federated Sportsmen's Clubs of Ulster County, Inc. ("FSC"), and Riverkeeper, Inc., are not-for-profit corporations organized under the laws of the State of New York. Members of CMCTU, TGF, CDNWA, and FSC live near the Esopus Creek and enjoy the Esopus Creek for numerous activities, including, but not limited to, flyfishing. Riverkeeper, whose mission is to protect the environmental resources of the Hudson River and its tributaries, including the Esopus Creek, has members who fish in the Esopus Creek.

At trial, Bert Darrow, a member of TGF and CMCTU and a professional flyfisherman and licensed flyfishing guide, testified that prior to 1996 he used the Esopus Creek as his primary fishing location for personal as well as business uses. However, since that time, the turbid water in the Esopus Creek has made fishing difficult because the trout cannot see cast lines and flies and dangerous because the fishermen cannot see the bottom of the Creek. As a result, he does not fish in the Esopus Creek very often, and he takes his clients to other streams.

Ron Urban and Bruce Duffy, who are also members of CMCTU, testified that they have observed a significant increase in turbidity in the Esopus Creek below the Shandaken Tunnel and

that they find that the turbidity is visually offensive and creates unsafe conditions for wading. Brother John Farrell, a member of FSC, has fished in the Esopus Creek since the mid-1980s. He testified that since 1996 he has observed that the Esopus Creek below the Shandaken Tunnel has become more turbid, causing it to be unsafe and affecting his aesthetic enjoyment of the Esopus Creek. He also testified that he very seldom fishes below the Shandaken Tunnel, except with an older friend who lives on the Esopus Creek in that area.

Defendant City of New York, by and through Defendant New York City Department of Environmental Protection ("NYCDEP"), is the owner and operator of the largest unfiltered drinking water supply in the United States.[2] Defendants provide high quality water to more than nine million residents of New York State, including eight million people who live in New York City and approximately one million people who live in Westchester, Putnam, and Rockland Counties. Defendant NYCDEP conducts and oversees operation of the Shandaken Tunnel.

The Catskill water supply system provides approximately forty percent of New York City's daily drinking water needs under normal operating conditions. This system consists of two reservoirs, the Ashokan and the Schoharie. The Shandaken Tunnel began operating in 1924. The water in the Schoharie Reservoir is diverted to the Esopus Creek, the main tributary to the Ashokan Reservoir, through the Shandaken Tunnel. The Shandaken Tunnel has a flow capacity of up to 650 million gallons per day. When the Shandaken Tunnel is in operation, water from the Schoharie Reservoir enters the Shandaken Tunnel through an intake channel on or in the bed of the Schoharie Reservoir. The Shandaken Tunnel runs approximately eighteen miles from the intake structure at the Schoharie Reservoir to the portal from which it discharges into the Esopus

[2] Defendant Joel Miele is the Commissioner of NYCDEP.

Creek eleven miles upstream of the Ashokan Reservoir. The Catskill aqueduct, which moves water from the Ashokan Reservoir to New York City's Kensico Reservoir in Westchester County, has a capacity of up to 610 million gallons per day. Two aqueducts bring water from the Kensico Reservoir into New York City.

The Catskill Mountains are characterized by extensive deposits of silts and clays that are continuous for miles in the valleys through which streams tributary to the Catskill reservoirs now flow. The Ashokan Reservoir is designed to provide settling time to minimize the turbidity of Catskill water by the time it enters the Catskill aqueduct on its way to New York City so that the water entering New York City's distribution system meets drinking water standards. The water discharged through the Shandaken Tunnel into the Esopus Creek is frequently substantially, visibly more turbid and higher in suspended solids than the receiving water because of the system design and the geology of the Schoharie drainage basin. The suspended solids present in the Schoharie Reservoir are caused, at least in part, by erosion in the Schoharie Watershed, including erosion resulting from land disturbance from human activities.

The New York State Department of Environmental Conservation ("DEC") has designated the Esopus Creek, between the outlet of the Shandaken Tunnel and the inlet of the Ashokan Reservoir, as a class A(T) stream. The water quality standard for discharges of turbidity to a class A(T) stream is "no increase that will cause a substantial visible contrast to natural conditions." N.Y. Comp. Codes R. & Regs. tit. 6, § 703(2) (2002).

Pursuant to 33 U.S.C. § 1342, the Administrator of the EPA has delegated to the State of New York the authority to issue State Pollutant Discharge Elimination System ("SPDES") permits to dischargers in this State. DEC is the state agency that administers the SPDES program

in New York. Defendants do not have a CWA permit or a SPDES permit for the operation of the Shandaken Tunnel, and, until the Second Circuit's decision on October 21, 2001, they maintain that they believed that they did not need a SPDES permit to operate the Shandaken Tunnel. Defendants operated the Shandaken Tunnel without a permit and, thus, in violation of the CWA on a total of 2,326 days from February 1, 1995 to December 31, 2002. *See* Defendants' Exhibit "D-17;" Letter to Court dated January 23, 2003.[3]

B. Conclusions of Law

1. Standing

An organization has standing to bring an action on behalf of its members if it can establish that "its members would otherwise have standing to sue in their own right, the interests at stake are germane to the organization's purpose, and neither the claim asserted nor the relief requested requires the participation of individual members in the lawsuit." *Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc.*, 528 U.S. 167, 181 (2000) (citation omitted). To establish individual standing a person must show

> (1) [that he/she] has suffered an "injury in fact" that is (a) concrete and particularized and (b) actual or imminent, not conjectural or hypothetical; (2) the injury is fairly traceable to the challenged action of the defendant; and (3) it is likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision.

Id. at 180-81.

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[3] After the trial was completed, the Court requested that Defendants submit a record of the discharges through the Shandaken Tunnel for the calendar year 2002, rather than rely upon an approximation based upon prior history. Defendants responded to the Court's request with the January 23, 2003 letter and attached chart.

In the present case, the testimony of Bert Darrow, Ron Urban, Bruce Duffy, and Brother John Farrow establishes that Plaintiffs have standing to bring this suit on behalf of their members. Each of these individuals testified that, at least since 1996, Defendants' discharge of water through the Shandaken Tunnel into the Esopus Creek has interfered with their enjoyment of the Esopus Creek -- both aesthetically and in their ability to fish safely in the Esopus Creek -- and, in the case of Bert Darrow, has interfered with his business as a flyfishing guide. Such injury is both concrete and particularized as well as fairly traceable to Defendants' actions. In addition, a decision in Plaintiffs' favor – i.e., requiring Defendants to reduce the turbidity of the water that flows through the Shandaken Tunnel into the Esopus Creek – will redress their injuries.

Accordingly, based upon the testimony of Plaintiffs' members, the Court concludes that Plaintiffs have standing to bring suit against Defendants under the citizen-suit provision of the CWA.[4]

2. Civil Penalties

As noted, this Court previously determined, upon remand from the Second Circuit, that Defendants had violated the CWA.[5] Thus, the only remaining issue is the amount of civil

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[4] The Court notes that Defendants have never challenged Plaintiffs' standing. Moreover, at the summary judgment stage, both this Court and the Second Circuit implicitly concluded that Plaintiffs had standing to maintain this suit.

[5] Defendants conceded that, in light of the Second Circuit's October 21, 2001 decision, they were liable for violating the CWA.

penalties and the nature of the injunctive relief that the Court should assess against Defendants.[6] In making its determination, the Court must keep in mind that the purpose of the CWA's penalty provision is "deterrence with respect to both the violator's future conduct (specific deterrence) and the general population regulated by the Act (general deterrence)." *United States v. Mun. Auth. of Union Township*, 929 F. Supp. 800, 806 (M.D. Pa. 1996), *aff'd*, 150 F.3d 259 (3d Cir. 1998) (citation omitted). To attain the goal of deterrence, the penalty must have two components: (1) "it must encompass the economic benefit of noncompliance to ensure that the violator does not profit from its violation of the law" and (2) it "must include a punitive component in the form of a sum in addition to economic benefit which accounts for the degree of seriousness and/or willfulness of the violations." *Id.*

Section 1319 of the CWA sets forth six factors that a court must consider when determining the amount of civil penalties to impose against a defendant:

> [1] the seriousness of the violation or violations, [2] the economic benefit (if any) resulting from the violation, [3] any history of such violations, [4] any good-faith efforts to comply with the applicable requirements, [5] the economic impact of the penalty on the violator, and [6] such other matters as justice may require.

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[6] Several courts have stated that "[c]ivil penalties are mandatory once Clean Water Act violations are found, although the amount to be assessed is wholly within the discretion of the court." *Hawaii's Thousand Friends v. City & County of Honolulu*, 821 F. Supp. 1368, 1394 (D. Haw. 1993) (citing *Atlantic States Legal Foundation v. Tyson Foods, Inc.*, 897 F.2d 1128, 1142 (11th Cir. 1990); *Stoddard v. Western Carolina Regional Sewer Authority*, 784 F.2d 1200, 1208 (4th Cir. 1986)); *see also Piney Run Pres. Ass'n v. County Comm'rs of Carroll County*, 82 F. Supp. 2d 464, 470 (D. Md. 2000), *vacated and remanded on other grounds*, 268 F.3d 255 (4th Cir. 2001) ("The 'highly discretionary calculations necessary to assess penalties [under the CWA] are particularly within the purview of trial judges' and, therefore, are granted wide deference." (quotation omitted)). In addition, some courts have held that the issues of intent and fault are not relevant to the issue of whether the court should impose penalties but are only relevant with respect to the issue of the amount of the penalty. *See, e.g., United States v. Ohio Edison Co.*, 725 F. Supp. 928, 934 (N.D. Ohio 1989) (citations omitted).

33 U.S.C. § 1319(d).

Moreover, when applying these factors to a particular situation, "courts generally employ either a 'top-down' or 'bottom-up' method."[7] *Piney Run Pres. Ass'n v. County Comm'rs of Carroll County,* 82 F. Supp. 2d 464, 470 (D. Md. 2000), *vacated and remanded on other grounds*, 268 F.3d 255 (4th Cir. 2001) (citation omitted); *compare Union Township*, 929 F. Supp. at 806 (finding that "top-down" approach is not appropriate and choosing, instead, to "begin with economic gain and add a sum to that figure guided by the other § 1319(d) factors and the need for punishment and deterrence"); *with Atlantic States Legal Found., Inc. v. Tyson Foods, Inc.*, 897 F.2d 1128, 1137 (11th Cir. 1990) (finding that "top-down" approach is the appropriate methodology for calculating CWA penalties).

If the "top-down" approach is used, the court will "first calculate the maximum penalty based on the $25,000 [$27,500 or $31,500] per day figure,[8] then adjust the figure down, as necessary, to account for the six factors listed in § 1319(d)." *Piney Run*, 82 F. Supp. 2d at 470 (citing [*Smithfield*, 191 F.3d] at 528 n.7); *see* 40 C.F.R. § 19.4. If, on the other hand, the court employs the "bottom up" method, the court will first "determine the economic benefit the defendant derived by violating the [CWA], and then adjust that figure upward or downward using the remaining five factors in § 1319(d)." *Piney Run*, 82 F. Supp. 2d at 470 (citing [*Smithfield*, 191 F.3d at 528]).

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[7] The Second Circuit has not determined whether the "top-down" or the "bottom-up" approach is the appropriate means of calculating civil penalties under the CWA.

[8] The maximum penalty is $25,000 per day for violations occurring on or before January 30, 1997, *see* 33 U.S.C. § 1319(d), $27,500 per day for violations occurring between January 31, 1997 and August 19, 2002, and $31,500 per day for violations occurring thereafter, *see* 40 C.F.R. § 19.4.

For the reasons addressed below in its discussion of the economic benefit factor, based upon the circumstances of this case, the Court concludes that the "top down" approach provides the appropriate manner in which to determine the amount of civil penalties that should be awarded against Defendants for their violations of the CWA.

a. Maximum amount of penalties

Although the parties stipulated that the Shandaken Tunnel discharged water into the Esopus Creek on 1,983 days between February 1, 1995 and December 31, 2001, and approximately 150 days in 2002, the Court reviewed Defendants' Exhibit "D-17" (Bates 15935-15942), plus the additional data for the year 2002, which the Court requested, and determined that the Shandaken Tunnel was in operation for a total of 2,326 days during this period: 308 days (1995) + 185 days (1996) + 247 days (1997) + 275 days (1998) + 320 days (1999) + 280 days (2000) + 349 days (2001) + 362 days (2002).

Using these numbers, the Court then calculated the maximum civil penalties as follows:

Year	Days	Maximum Penalty Per Day	Total
1995	308	$25,000	$ 7,700,000
1996	185	$25,000	$ 4,625,000
1997	3	$25,000	$ 75,000
	244	$27,500	$ 6,710,000
1998	275	$27,500	$ 7,562,500
1999	320	$27,500	$ 8,800,000
2000	280	$27,500	$ 7,700,000
2001	349	$27,500	$ 9,597,500
2002	231	$27,500	$ 6,352,500
	131	$31,500	$ 4,126,500
		TOTAL:	**$63,249,000**

Using this figure as a starting point, the Court will address each of the six factors set forth in § 1319(d) in turn.

b. The seriousness of the violation or violations

To determine the seriousness of a defendant's violations, the court should consider "the frequency and severity of the violations as well as their effect on the environment." *Piney Run*, 82 F. Supp. 2d at 471 (citing *United States v. Smithfield Foods, Inc.*, 972 F. Supp. 338, 343 (E.D. Va. 1997)). Although some courts have acknowledged that "a significant penalty may be appropriate even absent proof of actual negative effect," *id.* (citing ([*Smithfield*, 972 F. Supp.] at 344), other courts have found that the lack of material environmental harm is a significant mitigating factor even though the defendant has violated the CWA a significant number of times. *See Atlantic States Legal Found. Inc. v. Universal Tool & Stamping Co., Inc.*, 786 F. Supp. 743, 747-49 (N.D. Ind. 1992) (finding that, even though the defendant had violated its CWA permit more than 1,900 times during the relevant period, the lack of material environmental harm was a significant mitigating factor).

As noted, Defendants operated the Shandaken Tunnel without a permit, and thus violated the CWA, on 2,326 days between February 1, 1995 and December 31, 2002.[9] While this is a significant number of violations, the Court must also weigh the fact that the turbidity and

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[9] February 1, 1995 is the appropriate starting date for determining the amount of civil penalties to be awarded in this case because "in citizen enforcement actions the five-year statute of limitations period [set forth in 28 U.S.C. § 2462] is tolled sixty days before the filing of the complaint, to accommodate the statutorily-mandated sixty-day notice period." *Sierra Club v. Chevron U.S.A., Inc.*, 834 F.2d 1517, 1524 (9th Cir. 1987). Since Plaintiffs filed their complaint in this action on March 31, 2000, the five-year statute of limitations was tolled on February 1, 1995.

suspended solids which Defendants discharged through the Shandaken Tunnel were not toxic and, at least in part, were the result of the natural conditions of the water that flowed through that Tunnel. Moreover, although there was some evidence at trial that the trout below the Shandaken Tunnel were smaller than the trout above the Shandaken Tunnel, there was no evidence of a significant decrease in the number of trout or of any trout kill as a result of the discharges. In fact, there was evidence that without the discharge of the water through the Shandaken Tunnel, there would have less habitat for trout because of low water levels. Based upon this evidence, the Court considers this element to be a mitigating factor.

c. The economic benefit resulting from the violations

The economic benefit that the violator enjoys as a result of violating the CWA is "[a] critical component of any penalty analysis under the [CWA] . . . ." *United States v. Allegheny Ludlum Corp.*, 187 F. Supp. 2d 426, 436 (W.D. Pa. 2002). "The goal of economic benefit analysis is to prevent a violator from profiting from its wrongdoing." *Id.* (citing *Dean Dairy*, 150 F.3d at 263). Since it is difficult to prove precise economic benefit, "'reasonable approximations . . . will suffice.'" *Piney Run*, 82 F. Supp. 2d at 470 (quoting *Smithfield*, 191 F.3d at 529). In making this determination, "the court must endeavor to reach a "'rational estimate of [the violator's] economic benefit, *resolving uncertainties in favor of a higher estimate.*'"" *Union Township*, 929 F. Supp. at 806 (quotation omitted). "The estimate 'must encompass *every* benefit that defendants received from violation of the law.'" *Id.* (quotation omitted). "It would eviscerate the [CWA] to allow violators to escape civil penalties on the ground that such penalties cannot be calculated with precision." *Id.* at 806-07.

There are two elements to the calculation of economic benefit: "(1) the benefit that the [defendant] received from delayed capital spending (i.e., money saved by delay in issuing and making payments on general obligation bonds to finance the construction of the required pollution control equipment); and (2) the operating and maintenance ("O & M") expenses for the pollution control equipment that the [defendant] avoided operating during the period compliance was delayed." *Hawaii's Thousand Friends*, 821 F. Supp. at 1387.

Plaintiffs did not submit any evidence with respect to the benefit that Defendants received by delaying capital spending. Rather, they focused their proof with respect to economic benefit on the operating and maintenance expenses that Defendants would have incurred had they built a coagulation plant near the Shandaken Tunnel. Dr. Bell testified that, by not building a coagulation plant, Defendants saved $27,083,833 in operational and maintenance costs for the period of February 1, 1995 through December 31, 2001. Although Defendants offered the testimony of David Nickols to rebut Dr. Bell's figures and the feasibility of Dr. Bell's design and his estimates of operational and maintenance costs, they did not present any other figure for the Court's consideration. In fact, based upon Mr. Nickols' testimony, if the Court were to take some of Defendants' arguments into consideration, the potential "economic benefit" to Defendants of not building a coagulation plant would increase.

That being said, however, the Court has some problems with Dr. Bell's testimony as it relates to the economic benefit that Defendants received as a result of their violation of the CWA. First, the Court questions the feasibility of Dr. Bell's plan, both from a design and construction standpoint as well as an operational and maintenance perspective since he did not take into account the environmental impact of his design or the on-going effects on the

environment -- such as the increased traffic -- that the construction of such a plant would have. In addition, Dr. Bell did not take into consideration the time required to design and construct such a facility. Mr. Nickols, however, estimated that it would take several years.

Allowing for several years to construct a coagulation plant of the type Dr. Bell suggested, the Court then must determine the appropriate date from which to measure the economic benefit of not constructing such a facility. If the Court were to measure the operational and maintenance savings from February 1, 1995, as Dr. Bell did, this would require a finding that Defendants should have begun work on the design and construction of a coagulation plant in approximately 1990.[10] If, on the other hand, the Court determines that Defendants should have begun work on the design and construction of a coagulation plant on February 1, 1995 (when the statute of limitations was tolled for purposes of this action), November 20, 1998 (the date on which Plaintiffs served Defendants with their Notice of Intent to Sue), or October 21, 2001 (when the Second Circuit issued its decision), the operational and maintenance costs that Plaintiffs avoided would be far less than the $27,083,833 that Dr. Bell estimated because Defendants would not have incurred such costs until several years after they began construction on the coagulation plant.[11]

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[10] It would be unreasonable for the Court to measure Defendants' economic benefit from this date in light of the Court's finding, *see* discussion *infra* Part II.B.2.d, that it was reasonable for Defendants to believe, prior to October 21, 2001, that they did not need a SPDES permit to operate the Shandaken Tunnel.

[11] Assuming that it would have taken Defendants five years to design and build a coagulation plant, the earliest date that such a plant would have come on line, using February 1, 1995, as a starting date, is approximately February 1, 2000. Applying the numbers in Dr. Bell's Table 5-1, *see* Plaintiffs' Exhibit "P-83," the approximate operational and maintenance costs that Defendants avoided by not having the coagulation plant in operation for the years 2000 through 2002 is roughly **$13,684,759** ($4,198,979 (2000) + $4,551,718 (2001) + $4,934,062 (2002),

Nonetheless, despite the Court's problems with Dr. Bell's opinion regarding the economic benefit that inured to Defendants by not building a coagulation plant, the Court finds that this element is not a mitigating factor.[12]

d. Any history of such violations

In determining the history of a defendant's violations, the court must consider "not only similar violations in the past, but also the duration and continuity of the [defendant's] present violations." *Piney Run*, 82 F. Supp. 2d at 471 (citing *Smithfield Foods*, 972 F. Supp. at 349).

The evidence adduced at trial demonstrated that Defendants recognized the need to address, and have worked to formulate a plan to address, the turbidity problem in the Catskill system since 1993.[13] However, as Dr. Principe testified, Defendants did not believe that they

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assuming that the costs in 2002 increased by 8.4% over 2001. This is a very rough estimate because in Dr. Bell's table all costs are shown in 2001 dollars and the Court's 2002 costs are not.

[12] The Court notes that § 1319(d)'s economic benefit element, the purpose of which is, at least in part, to ensure that a violator does not gain an economic advantage over its competitors, is of limited assistance to a court's determination of the appropriate amount of civil penalties to assess against a municipality which does not compete to provide water to its citizens. Moreover, a court must balance the economic feasibility of any proposed solution against the need of the municipality's citizens for an adequate water supply.

[13] In 1993, a Filtration Avoidance Determination ("FAD") was issued, which addressed the turbidity problems in the Catskill system. *See* Defendants' Exhibit "D-12" - "Short- and Long-term Plans to Reduce Turbidity in Schoharie and Ashokan Reservoirs," dated June 1993; Defendants' Exhibit "D-14" - "Determination on Filtration of New York City's Catskill and Delaware Water Supplies, dated January 19, 1993; Defendants' Exhibit "D-23" - "Short- and Long-term Plans to Reduce Turbidity in Schoharie and Ashokan Reservoirs, 1993 4th Quarter Report," dated January 1994. In addition, the most recent FAD, dated November 2002, included long-term programs to reduce turbidity with time lines. *See* Defendants' Exhibit "D-61" - "New York City Filtration Avoidance Determination," USEPA - November 2002 - "Surface Water Treatment Rule Determiantion for New York City's Catskill/Delaware Water Supply System."

needed a SPDES permit to operate the Shandaken Tunnel until October 21, 2001, when the Second Circuit concluded that such a permit was necessary.

The Court finds that Defendants' belief, prior to October 21, 2001, that they did not need a SPDES permit to operate the Shandaken Tunnel was reasonable. In this regard, the Court notes that, although the EPA and DEC closely monitored the quality of Defendants' water supply pursuant to other statutes and were aware that Defendants discharged water through the Shandaken Tunnel as part of their water system, Dr. Principe testified that neither the EPA nor DEC ever suggested to Defendants that they needed a SPDES permit to operate the Shandaken Tunnel.[14] For these reasons, the Court finds that this element is a mitigating factor.

e. Any good faith efforts to comply with the applicable requirements

Once Defendants were aware that they were required to have a SPDES permit to operate the Shandaken Tunnel (October 21, 2001), they began discussions with DEC to determine what information DEC would need before it could issue Defendants such a permit. Although Defendants and DEC met on only one or two occasions during the year following the Second Circuit's decision, as Dr. Principe noted, at the time Defendants received the Second Circuit's decision, shortly after the terrorist attack on September 11, 2001, they were in the midst of addressing other serious issues, including the safety of New York City's water supply.[15] In

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[14] In fact, on numerous occasions, DEC required Defendants to release water through the Shandaken Tunnel. *See, e.g.* Defendants' Exhibits "D-6," "D-8."

[15] The Court notes that it found Dr. Principe to be a very credible and forthright witness, who readily acknowledged the need to address the turbidity problem in the Catskill water supply system. Moreover, the Court found Dr. Principe's knowledge of Defendants' water supply system and the regulations that govern this system to be very helpful to its analysis.

addition, although somewhat belatedly, Defendants did file a SPDES permit application on December 31, 2002.[16]

Based upon the evidence presented at trial, the Court concludes that Defendants' failure to apply for a SPDES permit until fourteen months after the Second Circuit's decision does not evidence a lack of good faith. When viewed against the backdrop of the September 11, 2001 terrorist attack and Defendants' compelling need to ensure, as their first priority, that New York City's water supply was safe, this delay -- although somewhat extended -- was not undue. Moreover, although Plaintiffs make much of the fact that everything that Defendants have done in the past with respect to the turbidity problem was done because of other statutes, and not in an attempt to comply with the CWA, the Court is not convinced that the particular impetus for Defendants' actions is as important as the fact that Defendants have made efforts to abate the turbidity problem and continue to do so. Accordingly, based upon Defendants' ongoing efforts to address the turbidity issue and the fact that Defendants reasonably believed that they did not need a SPDES permit to operate the Shandaken Tunnel prior to the Second Circuit's decision on October 21, 2001, the Court finds that this element is a significant mitigating factor.[17]

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[16] Dr. Principe acknowledged that at least part of the impetus for filing the permit at that time was the pending trial in this matter.

[17] The Court notes, however, its concern that Defendants provided the Court with very little evidence to explain why they apparently failed to take any affirmative steps to comply with the Second Circuit's October 21, 2001 decision in a more expeditious manner. Had they done so, the Court would have been inclined to find that this element required an even greater mitigation of the maximum penalty allowable under § 1319(d).

f. The economic impact of the penalty on the violator

"The central purpose of CWA penalties is to deter the defendant, and others, from committing future violations." *Piney Run*, 82 F. Supp. 2d at 472 (citation omitted). "A damage award that is limited to economic benefit, therefore, is no deterrent at all because the violator would be no worse off than if it had complied in the first place." *Id.* (citation omitted); *see also Hawaii's Thousand Friends*, 821 F. Supp. at 1396 (finding that the economic impact of the penalty was not a mitigating factor where the penalty would result in only "a slight increase in the monthly rates paid by users of the sewer system").

The only evidence at trial with regard to this element indicates that Defendants could absorb the maximum penalty without serious consequences to their financial well-being. At his deposition, William Kusterbeck, Treasurer of the New York City Water Board, stated that the New York City Water Board maintains a $60,000,000 operations and maintenance reserve fund, equal to one month's operations and maintenance expenses, in part, to pay for unanticipated NYCDEP expenses incurred in water supply or distribution. *See* Transcript of Deposition of William Kusterbeck, dated September 18, 2002, at 28. Moreover, every million dollars in assessed penalties will result in only a one-time $.30 increase in the average water user's annual rate payment. Thus, the Court concludes that this element is not a mitigating factor.

g. Such other matters as justice may require

Assessing a monetary penalty in this case would be tantamount to saying that if you believe in good faith that your activities are not subject to a CWA permit and neither the EPA nor DEC has ever indicated that you needed such a permit, you can be penalized if a citizen suit

is commenced against you and the court finds that you are wrong. *See United States v. Bay-Houston Towing Co., Inc.*, 197 F. Supp. 2d 788, 826 (E. D. Mich. 2002). Thus, the Court finds that this element is a mitigating factor.

h Calculation of civil penalties

As noted, the Court has used the top-down approach to calculate the amount of civil penalties to be assessed against Defendants. Therefore, the Court began its calculation with the maximum civil penalties that could be awarded against Defendants for the period from February 1, 1995 through December 31, 2002, i.e., $63,249,000. Having analyzed the other § 1319 factors, the Court finds that the lack of material environmental harm, Defendants' reasonable belief, prior to October 21, 2001, that they did not need a SPDES permit to operate the Shandaken Tunnel, and Defendants' efforts to address the turbidity problems, both before and after October 21, 2001, are mitigating factors. The Court also finds that, at the time of the Second Circuit's decision, it was reasonable for Defendants to focus much, if not all, of their attention upon the need to protect the water supply from any future terrorist attacks. Thus, their delay in submitting an application for a SPDES permit for at least several months was reasonable. Although the Court finds that the fourteen month delay was somewhat extended, the Court, nonetheless, concludes that an eight month delay, i.e., until June 2002, would not have been unreasonable. Therefore, the Court concludes that no civil penalties should be assessed against Defendants for any violations occurring prior to June 22, 2002. This conclusion requires that the Court subtract $57,500,500 from the maximum allowable penalty to arrive at the final figure of $5,749,000.

3. Injunctive relief

In citizen suit proceedings, district courts are statutorily authorized to enter injunctions. *See* 33 U.S.C. § 1365(a). "The proof of irreparable injury and the inadequacy of legal remedies are prerequisites to the granting of injunctive relief in a CWA case." *Cmty. Ass'n for Restoration of Env't ("CARE") v. Henry Bosma Dairy*, No. CY-98-3011, 2001 WL 1704240, *16 (E.D. Wash. 2001) (citation omitted). "The Court must also balance the competing claims of injury and the public interest." *Id.* (citation omitted); *see also Million Youth March, Inc. v. Safir*, 155 F.3d 124, 126 (2d Cir. 1998) (stating that "when a federal district court crafts an injunction to vindicate a plaintiff's protected rights, it cannot simply order whatever a City is physically capable of doing, without regard to considerations of public health, safety, convenience, and cost.").

"Injunctive relief cannot automatically be granted upon a finding of statutory violation." *Int'l Union, United Auto., Aerospace & Agric. Implement Workers of Am., AFL-CIO v. Amerace Corp., Inc.*, 740 F. Supp. 1072, 1086 (D.N.J. 1990) (citing *Weinberger v. Romero-Barcelo*, 456 U.S. 305, 312, 102 S. Ct. 1798, 1803, 72 L. Ed. 2d 91 (1982)) (other citation omitted). Nor can "irreparable injury . . . be presumed from the mere fact that the Clean Water Act has been violated." *Id.* In determining whether to grant an injunction, "a court must balance the competing claims of injury and must consider the effect on each party of the granting or withholding of the requested relief." *Amoco Prod. Co. v. Vill. of Gambell,* 480 U.S. 531, 542 (1987). Moreover, although the court should give particular regard to the public interest, "'[t]he grant of jurisdiction to ensure compliance with a statute hardly suggests an absolute duty to do so under any and all circumstances, and a federal judge sitting as chancellor is not mechanically

obligated to grant an injunction for every violation of law.'" *Id.* (quoting [*Weinberger v. Romero-Barcelo*, 456 U.S.] at 313, 102 S. Ct., at 1803).

Based upon the circumstances of this case, the Court concludes that it would be an improper use of injunctive relief to enjoin Defendants from operating the Shandaken Tunnel until they obtain a SPDES permit. This does not mean, however, that the Court is without power to fashion some form of injunctive relief which will take into account the injury of both sides of this dispute and, at the same time, to bring the discharges from the Shandaken Tunnel "into 'prompt' compliance with the [CWA]." *United States v. Confederate Acres Sanitary Sewer & Drainage Sys., Inc.*, 767 F. Supp. 834, 837 (W.D. Ky. 1990) (citation omitted).

Fashioning effective injunction relief in this case, however, is complicated by the fact that, resolution of this problem, to some extent, rests with DEC, as it is the only agency with the authority to issue a SPDES permit. Thus, for the Court to order Defendants to obtain a SPDES permit within a certain time frame would be ineffective if DEC failed to cooperate. However, under the All Writs Act,[18] the Court's power "to effectuate the injunction may extend to 'persons who, though not parties to the original action or engaged in wrongdoing, are in a position to frustrate the implementation of a court order or the proper administration of justice.'" *Id.* (quoting *United States v. New York Telephone Company*, 434 U.S. 159, 174, 98 S. Ct. 364, 373, 54 L. Ed. 2d 376 (1977)) (citing *United States v. Wallace*, 218 F. Supp. 290 (N.D. Ala. 1963)).

The testimony at trial indicated that, on average, DEC acts on an application for a SPDES permit within eighteen months. Given this timetable, the Court instructs Defendants that they are

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[18] The All Writs Act provides that "[t]he Supreme Court and all courts established by Act of Congress may issue all writs necessary or appropriate in aid of their respective jurisdictions and agreeable to the usages and principles of law." 28 U.S.C. § 1651(a).

to provide DEC with all of the information that DEC needs to issue Defendants a SPDES permit as soon as practicable after DEC requests any such information. Moreover, pursuant to its authority under the All Writs Act, the Court instructs DEC, who is now a third-party Defendant in this action, to complete the application process and issue a SPDES permit to Defendants within eighteen months of the date of this Order. If, for any reason, DEC believes that it will be unable to complete the process and issue a permit to Defendants within this time frame, DEC is to inform the Court and the parties to this action in writing as to the reason for any delay as soon as DEC realizes that there will be a delay. In addition, the Court instructs Defendants to provide the Court and opposing counsel on the first day of each month, beginning March 1, 2003 and continuing until such time as they obtain a SPDES permit, a written status report as to the progress they have made towards obtaining a SPDES permit and any other measures Defendants have made toward reducing the turbidity of the water that is discharged through the Shandaken Tunnel. Finally, the Court instructs Defendants to notify the Court and opposing counsel in writing when they receive a SPDES permit and are to file a copy of this permit with the Court.

C. Costs and Fees

In addition to civil penalties and injunctive relief, the CWA provides that a court "may award costs of litigation (including reasonable attorney and expert witness fees) to any prevailing or substantially prevailing party, whenever the court determines such award is appropriate." 33 U.S.C. § 1365(d). *See Tyson Foods*, 897 F.2d at 1143 (finding that in a case in which "a citizens group has succeeded on the merits, [the court could not] conceive of any grounds that would justify a denial of fees and costs."). A plaintiff who prevails in the liability phase of a CWA

citizens suit is a prevailing party within the meaning of § 1365(d). *See CARE*, 2001 WL 1704240, at *17. Moreover, "[t]he award should be equal to full compensation comparable to that of a fee-paying client." *Hudson River Fishermen's Ass'n v. Arcuri*, 862 F. Supp. 73, 78 (S.D.N.Y. 1994) (citing *Missouri v. Jenkins*, 491 U.S. 274, 286, 109 S. Ct. 2463, 2470-71, 105 L. Ed. 2d 229 (1989)).

In their complaint, Plaintiffs seek attorneys' fees and costs. Since Plaintiffs prevailed in the liability phase of this action, the Court concludes that they are prevailing parties within the meaning of § 1365(d). As such, they are entitled to an award of reasonable attorneys' fees and costs. Therefore, the Court instructs Plaintiffs to file and serve an application for such an award within ten days of the date of this Order. In calculating the attorneys' fees portion of their application, the Court instructs Plaintiffs that their application must comply with the following rules. First, Plaintiffs must submit contemporaneous time records. Failure to do so will result in the Court substantially reducing the amount of attorneys' fees requested. *See New York v. RAC Holding, Inc.*, 135 F. Supp. 2d 359, 363-65 (N.D.N.Y. 2001). Second, Plaintiffs shall calculate the amount of the fees they are requesting as follows: (1) the hourly rate for work attributable to a law intern is $65.00; (2) the hourly rate for work attributable to Mr. Coplan or any other admitted attorney is $125.00, unless that attorney can demonstrate that he has practiced in the area of environmental law for more than ten years, in which case the appropriate hourly rate is $175.00. *See IBEW Local No. 910 Welfare, Annuity & Pension Funds v. Dexelectrics, Inc.*, 98 F. Supp. 2d 265, 275 (N.D.N.Y. 2000).

Once Plaintiffs have filed and served their application for attorneys' fees and costs, Defendants must file and serve any objections they have to the application no later than fourteen

days after service of the application upon them. Once the Court has received the parties' submissions, it will take the application under advisement and will issue an Order amending the Judgment accordingly.

IV. CONCLUSION

Based upon the evidence adduced at trial and the applicable law and for the reasons stated herein, the Court hereby

ORDERS that Defendants are liable for civil penalties in the amount of **$5,749,000** pursuant to § 1319(d); and the Court further

ORDERS that Defendants are to pay these civil penalties to the United States Treasury pursuant to § 1365(a); and the Court further

ORDERS the following injunctive relief pursuant to § 1365(a) and the All Writs Act: (1) Defendants are to provide DEC with all of the information that DEC needs to issue Defendants a SPDES permit as soon as practicable after DEC requests any such information, (2) DEC is to complete the application process and issue a SPDES permit to Defendants within eighteen months of the date of this Order, (3) if, for any reason, DEC believes that it will be unable to complete the process and issue a SPDES permit to Defendants within this time frame, DEC is to inform the Court and the parties to this action in writing as to the reason for any delay as soon as DEC realizes that there will be a delay, (4) Defendants are to provide the Court and opposing counsel, on the first day of each month, beginning March 1, 2003 and continuing until such time as they obtain a SPDES permit, with a written status report as to the progress they have made towards obtaining a SPDES permit and any other measures Defendants have made toward

reducing the turbidity of the water being discharged through the Shandaken Tunnel, and (5) Defendants are to notify the Court and opposing counsel in writing when they receive a SPDES permit and are to file a copy of this permit with the Court; and the Court further

ORDERS that Plaintiffs are to file and serve their application for attorneys' fees and costs to the Court within ten days of the date of this Order pursuant to § 1365(d); and the Court further

ORDERS that Defendants are to file and serve any objections they have to Plaintiffs' application for attorneys' fees and costs no later than fourteen days after service of the application upon them; and the Court further

ORDERS that the Clerk of the Court is to enter judgment in favor of Plaintiffs and to close this case.

IT IS SO ORDERED.

Dated: February 6, 2003
Syracuse, New York

Frederick J. Scullin, Jr.
Chief United States District Judge

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PENGAD-Bayonne, N.J. Watershed Communities 18 8.26.04

Re: Shandaken Tunnel SPDES Permit
Application ID 3-5150-00420/00001

Dear Mr. Engel:

The New York City Department of Environmental Protection (NYCDEP) submits this comment letter in response to the New York State Department of Environmental Conservation's (DEC) draft State Pollutant Discharge Elimination System (SPDES) permit for discharges from the Shandaken Tunnel, issued for public comment February 18, 2004. NYCDEP owns and operates the Shandaken Tunnel, an 18-mile conduit that conveys water from the Schoharie reservoir to the Esopus Creek which, in turn, feeds into the Ashokan Reservoir. As the notice of the draft permit recognizes, the City relies on the Shandaken Tunnel to provide a significant portion of the City's water supply.[1]

The City presents its detailed comments about specific provisions in the draft permit below. Most fundamentally, the City is concerned that the permit, as drafted, may affect DEP's ability to provide a safe and adequate supply of drinking water to the nine million people who rely on City water. The City agrees with DEC that the Tunnel has significant beneficial effects on the Esopus Creek, and concurs that the Tunnel is essential to sustaining a viable fishery and recreational resource in the Esopus. Therefore, we support DEC's incorporating into the permit the provisions that exempt the City from action levels when the Tunnel is operated as required under 6 NYCRR Part 670 to advance the Tunnel's environmental and recreational benefits in the Esopus Creek. However, the permit must recognize that the Tunnel is, first and foremost, an essential component of the public water supply system that serves half of the State's population. Therefore, the City proposes, in its comments below, specific provisions intended to ensure that the action levels will not prevent the City from

[1] We note that the draft permit states that the Tunnel provides 20% of the water supply; in fact, it provides approximately 40% of the water from the Catskill system, which in turn provides approximately 40% of the City's water on an annual basis.

operating the Tunnel consistent with sound water supply management practices.

Specifically, the City is concerned that the temperature, turbidity and turbidity increase action levels could prevent the prudent management of Schoharie water. Most disturbing is the fact that that based on the only data that exists, there is no accurate way to foresee how frequently the turbidity increase action levels will be exceeded. As drafted, those action levels depend upon the difference between the level of turbidity in the water released from the Tunnel compared to the turbidity in the Esopus Creek upstream of the Tunnel release. While the turbidity in the Tunnel releases has historically been monitored several times per week, on average, upstream turbidity has been monitored less frequently – an average of once every two weeks. Moreover, turbidity was not always measured at both locations on the same day. Thus, it is very difficult to determine, based on the limited number of data points for upstream turbidity (about 26 per year), how often the turbidity increase action level contained in the draft permit would have prevented, and would prevent in the future, the City from operating the Tunnel as necessary to manage its water supply system. Any attempt to make such a calculation would be riddled with inaccuracies.

Notwithstanding these limitations, DEP conducted a preliminary analysis based on the minimal amounts of available data. Although turbidity in the upper Esopus was sampled infrequently, flow was measured daily. Thus, starting from the understanding that turbidity levels in the upper Esopus are generally related to flow – higher flows are generally more turbid – the analysis assigned turbidity levels to the flow data. This analysis, albeit far from perfect, suggests that the turbidity increase action levels, in combination with the temperature and turbidity action levels, could prohibit the City from moving several billion gallons each year from the Schoharie reservoir. Accordingly, the permit, as drafted, could impair the City's ability to provide water.

With respect to the actions contained in the draft permit, the City supports DEC's including a compliance schedule in the permit that recognizes the work the City is undertaking as part of the EPA November 2002 Filtration Avoidance Determination (FAD) to address turbidity in the Schoharie watershed. However, the draft permit proposes an extension and acceleration of certain programs that are required under the FAD. The City respectfully submits that it is ill-advised to alter the carefully crafted process for establishing, evaluating, and prioritizing such programs which resulted from months of negotiations with DEC, among other agencies, in connection with the November 2002 FAD. Under the FAD schedule, the programs that the City is undertaking will be evaluated by EPA and the State Department of Health (DOH), in consultation with DEC, after the City prepares and submits a comprehensive analysis of those programs (among others) in March 2006. The permit should not impose schedules that conflict with those in the FAD, nor should it require the City to extend and expand the programs in a specified manner before their effectiveness, cost-effectiveness, and options for continuations, can be fully evaluated.

As discussed in further detail below, many of the City's comments are related to these two general concerns. In addition, the City has a number of comments relating to specific provisions in the draft permit.

Parameter Action Levels

FLOW

Minimum Flow. The City understands that the 100 MGD minimum combined flow action level contained in the permit is based on anticipated revisions to 6 NYCRR Part 670. However, because the regulation presently in effect requires the City to maintain a minimum combined flow in the Esopus Creek of 160 MGD, the City requests that the permit action level correspond to the existing regulation. 6 NYCRR § 670.3(a). If that regulation is subsequently changed, the permit may be altered accordingly, if DEC concludes that such a revision is appropriate. However, the permit should not include an action level that conflicts with the current regulatory requirement based on a possible revision. Similarly, the SPDES Permit Fact Sheet should not explain the basis of the minimum flow requirement by referring to a regulation that provides for a different volume. (See SPDES Permit Fact Sheet, page 2 of 4.) Accordingly, the City requests that minimum combined flow action level be set at 160 MGD.

Calculation of Flow. Although the permit contains both minimum and, for the period from June through October, maximum monitoring action levels for flow, the permit is unclear as to the intended method for calculating flow for purposes of determining that those levels are achieved. The table on page 2 defines "minimum" as "the minimum level that must be maintained at all instants in time, and "maximum" as "the maximum level that must be maintained at all instants in time." It is not clear whether those definitions of minimum and maximum are intended to apply to flow. Given the fluctuating nature of flow – and particularly of the combined flow required to be measured under this permit, the City requests that the permit explicitly state that flow is to be calculated as a daily mean.

Flow Monitoring. The City requests that the permit include an explicit exemption from flow monitoring requirements when weather and other circumstances beyond the City's control make it impossible to measure flow. In particular, the City relies on the United States Geologic Survey equipment for measuring stream flow upstream of the Portal, and that equipment does not operate when the Esopus Creek freezes. While the City will investigate alternate methods of obtaining flow data when the USGS system is down, no equipment will operate with complete reliability at all times.

TURBIDITY

Continuous Measurement. The draft permit requires continuous measurements of turbidity. However, like the instruments that measure flow, those that measure turbidity cannot function at all times, especially when the Esopus freezes or equipment is washed away or otherwise affected by storms. The City requests that the permit include an exemption from continuous turbidity monitoring when weather and other circumstances beyond the City's control make it impossible to measure turbidity continuously.

Daily Averages. The draft permit requires the City to calculate a daily average of the increase in turbidity caused by the Shandaken Tunnel discharge. The draft permit requires the turbidity sampling frequency to be continuous. However, it is impossible to average a

continuous measurement. Therefore, the City requests that the permit specifically state the sample frequency that will be used to calculate the daily average.

TEMPERATURE

Basis for Action Level. The draft permit sets the action level for the temperature of Tunnel releases between June and October at 65 degrees Fahrenheit. This does not correspond to the State water quality standard for thermal discharges to trout waters. The relevant regulation restricts discharges over 70 degrees Fahrenheit. 6 NYCRR § 704.2(a)(2). Therefore, the City requests that the action level be set at 70 degrees Fahrenheit, to correspond with the applicable water quality standard. For the same reasons, the explanation in the SPDES Permit Fact Sheet of the basis for the temperature action level is inadequate. We are unaware of any authority for DEC to impose a limit based on projected impacts of a release on downstream temperatures. (See SPDES Permit Fact Sheet, page 2 of 4, note 3.)

Applicability During Low Flow Conditions. The last two rows of the table on page 4 of the draft permit, which relate to "Temperature, June – October" and "Temperature, November – May," do not refer to Footnote 1. This appears to be a typographical error, and the City requests that those two rows refer to Footnote 1, which was clearly intended to apply to those parameters, as well as to Footnote 2.

SETTLEABLE SOLIDS/TOTAL SUSPENDED SOLIDS

Total Suspended Solids (TSS). The permit contains a daily monitoring requirement for TSS, which is not currently a pollutant of concern. However, we understand that data regarding TSS may be of interest in assessing pollutant loading to the Esopus Creek. The City currently monitors TSS only twice a month. Because TSS has to be measured from grab samples rather than with automated equipment, the City requests that the monitoring requirement for TSS be no more frequent than twice monthly

Settleable Solids. The permit also contains a daily monitoring requirement for settleable solids. We do not understand the basis for monitoring settleable solids, a parameter typically used to gauge the effectiveness of wastewater treatment, and request that the settleable solids monitoring requirement be deleted from the draft permit. If this monitoring requirement is retained in the permit, because settleable solids, like TSS, must be measured from grab samples, we request that any monitoring requirement be no more frequent than twice monthly.

Exemptions from Action Levels – Footnotes on Page 4

The permit contains, in Footnotes 1 and 2 on page 4, exemptions from the final permit limits and action levels. The City has the following comments pertaining to those exemptions.

Precision of Combined Flow Volumes. Footnote 1 provides that during low stream flow conditions in the Esopus Creek, the quantity of water released shall take precedence over the water quality aspects of the discharge. To that end, the permit provides, "Whenever the combined flow in the Esopus Creek ... is less than 110 MGD (110% of the minimum flow Action Level), this discharge is exempt from the temperature, turbidity and turbidity increase

action levels listed above." Such an exemption is imperative, given that the draft permit requires NYCDEP to maintain a minimum flow of 100 MGD. As DEC acknowledges in this Footnote, it would be inappropriate to hold NYCDEP in violation of the permit for releasing pollutants that it cannot control while the permit requires NYCDEP to continue making the releases.

As drafted, the exemption establishes a permissible band of combined flow between 100 MGD, the minimum allowed under the permit, and 110 MGD, the maximum allowable, when there are issues relating to temperature or turbidity in the releases. This band between the 100 MGD minimum and the 110 MGD maximum is simply too small to be achieved consistently for the combined flow, given the variation in the natural flow in the Esopus Creek.

In order to react to flow conditions in the Esopus, adjustments to the Tunnel flow must be made eighteen miles away from the discharge point, at the Schoharie reservoir intake chamber. The impact of flow adjustments are not realized at the release point for more than 7 hours after the adjustment is made.

In addition, the measurements of combined flow of the Esopus Creek are not accurate enough to allow for the precise control called for in the draft permit. While the degree of accuracy for the USGS records at the Esopus Creek at Allaben are rated "good" for other parameters, meaning that about 95% of the flows are within 10% of the measured levels, the measurements of flow at Allaben are rated "fair," and, under certain conditions, "poor." When the rating is fair, if the flow is measured at Allaben as 100 MGD, the actual flow may actually be as low as 85 MGD or as high as 115 MGD. When the rating is poor, the measured readings are even less accurate.

Accordingly, in order to give effect to the exemption in Footnote 1, the City requests that the band be broadened to 50 MGD. If, in accordance with 6 NYCRR Part 670 as currently written, the permit requires a minimum combined flow of 160 MGD, the exemption in Footnote 1 should be for flows below 210 MGD. To capture the spirit of the exemption as drafted, the City proposes the following amendment to Footnote 1:

> During low stream flow conditions in the Esopus Creek, the quantity of water releases from the Schoharie Reservoir via the Shandaken Tunnel shall take precedence over the water quality aspects of this discharge. When the action levels for temperature, turbidity, and turbidity increase are exceeded, NYCDEP shall use best efforts to limit the flow through the Shandaken Tunnel to the amount necessary to maintain a combined flow as close as practicable to 160 MGD. Whenever the combined flow in the Esopus Creek ... is less than 210 MGD, this discharge is exempt from the temperature, turbidity and turbidity increase action levels listed above.

Timing and Rate of Reduction in Releases. The City requests a clarification that the time it takes for flow adjustments at the Schoharie intake chamber to affect the flow at the Tunnel discharge point will not lead to a second day of exceedances of action levels for turbidity, if a timely and appropriate adjustment is made to flow at the intake point. Because of the 7 hour

travel time through the Tunnel, in the event that an exceedance of an action level is discovered late in the day, or on a weekend or holiday when the response time may be up to four hours longer because of staffing, higher flows may continue onto a second calendar day even if NYCDEP responds promptly. Similarly, 6 NYCRR § 670.3(c) prohibits closing the Shandaken Tunnel at intervals exceeding 20 MGD every hour. The City requests a clarification that this provision of the Release Regulations would govern the closing of the Tunnel in the event of exceedances of action levels.

The permit provides, at page 3, that "If turbidity discharges higher than the Action Levels are confirmed for more than 10 percent of the sampling dates in a given month, the permittee shall investigate the sources of the exceedances and propose measures to reduce turbidity from these sources." For purposes of determining whether this provision is triggered in a given month, it is important to clarify that if the City makes a timely adjustment to react to an exceedance of the turbidity action level by adjusting the flow into the Tunnel, in accordance with 6 NYCRR § 670.3(c), a sustained exceedance will only count as a single "date in a given month."

Scope of Footnote 2. With respect to the overall reach of Footnote 2, the permit states that the "discharge is exempt from the action levels for turbidity and temperature" under the listed circumstances. The City requests that the Footnote explicitly state that the discharge is exempt from action levels for turbidity increase, as well as turbidity and temperature, under the relevant circumstances.

Release Management Strategy. Exemption (d) in Footnote 2 provides that the discharge is exempt from action levels when "the permittee releases water through the Shandaken Tunnel in strict accordance with the provision of the 'Release Management Strategy for the Shandaken Tunnel' which has been executed by both the permittee and the Department." As you are aware, the Release Management Strategy has not been executed, and NYCDEP is continuing to wait for a response to its June 2003 comments on DEC's first draft of the Strategy. While we agree that the Tunnel releases should be exempt from the action levels when they are made in accordance with the Release Management Strategy, the City objects to the reference in the draft permit that suggests that the Strategy has been executed, and notes that we cannot comment on the provision without knowing what that Strategy will ultimately provide.

In addition, the City requests that the following exemptions, which were not included in the draft permit, be incorporated into Footnote 2.

Equipment Down Time. As noted above, the City requests an exemption to monitoring requirements for equipment down time, whether planned or unforeseeable, so long as the City diligently responds to whatever condition caused the disruption.

Work Required by Permit. The City requests an exemption from action levels if the exceedances are caused by work that is required under the compliance schedules in the permit. For example, the permit incorporates the FAD requirement that the City complete dredging of the Schoharie Reservoir intake channel. Draft permit page 5. That work will cause a temporary increase in turbidity in the releases from the Tunnel. Exceedance caused by this work and other required actions should not trigger the action levels so long as such work is

undertaken in accordance with all applicable regulations and approvals (including other permits from DEC), and the SPDES permit should include an explicit exemption for these situations.

Void/Void Situation. The Schoharie reservoir release regulations provide that the City may make releases exceeding the limits that apply from June 1 through October 31 "when the unfilled storage capacity of the Schoharie reservoir is less than five billion gallons and the unfilled storage capacity of Ashokan reservoir is more than five billion gallons." 6 NYCRR § 670.3(b). The City requests that this provision be included as an explicit exemption from the permit's flow, turbidity, turbidity increase and temperature action levels, particularly in light of DEC's stated intention to modify Part 670.

Water Supply Management. The City requests an exemption that will allow prudent management of Catskill water. If the Schoharie reservoir is spilling as the start of Catskill system drawdown – approximately June 1 – approaches, the City must be able to divert water from the Schoharie to the Ashokan reservoir. The ability to fill Ashokan by June 1 is necessary for prudent reservoir system management and drought avoidance. In addition, wasting Schoharie water in the spring could affect the City's ability to manage the Delaware system in accordance with the "current tailwater" release regime, to the detriment of Delaware River fisheries. Accordingly, the City requests adding an additional item in Footnote 2 that provides an exemption when: "NYCDEP, in consultation with the Department, determines that additional releases are reasonably necessary ensure that the Ashokan reservoir is at capacity by June 1."

Drought Avoidance. The City requests that item (a) in Footnote 2, which establishes an exemption from the action levels when "a drought emergency condition has been declared for the New York City water supply," be broadened to encompass reasonable measures to avoid droughts. We are certain that DEC agrees that the declaration of a drought emergency is a dire measure that all parties must strive to avoid.[2] Accordingly, we believe that this exemption must allow for reasonable operation of the Catskill system, always taking water quality into account to the extent possible, to ensure that the City will be able to provide a sufficient amount of safe drinking water to the public.

In particular, we suggest replacing item (a) in Footnote 2 with: "NYCDEP, in consultation with the Department, determines that additional releases are reasonably necessary to avoid drought conditions." Operationally, in wet years, we would not need to invoke this provision at all. In dry years, however, in situations when this SPDES permit would otherwise result in water spilling from the Schoharie reservoir, we would anticipate adjusting operations, taking water quality into account, to ensure that the Ashokan Reservoir is at capacity on June 1 of each year to insure against a drought later in the year.

As noted above, we would expect to take water quality into account in making any such additional releases, and we recognize that DEC may impose some conditions on such releases. For instance, except in emergencies, we could avoid making such additional releases on weekends and holidays during the trout season.

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[2] At a minimum, we urge DEC to refer to drought watches rather than drought emergencies.

We hope and expect that these issues can be addressed in detail in the Release Management Strategy which, of course, would independently allow for an exemption from the Action Levels. Both because that Strategy has not been finalized and because this is an issue of such central importance, we believe that including a separate exemption relating to drought avoidance is appropriate.

ACTION LEVELS – GENERAL PROVISION

The City has a number of concerns related to the overall concept of the action levels as thresholds that trigger compliance requirements, as described on page 3 of the draft permit.

Identifying Sources of Exceedances. The draft permit proposes that when the action levels are exceeded, DEP "shall investigate the sources of the exceedances and propose measures to reduce the turbidity from these sources." Draft permit page 3. However, in reality, it is unlikely that exceedances in discharges from the Tunnel will relate back to a single identifiable source of turbidity in the watershed, such as the failure or collapse of a particular streambank. Rather, turbidity events are more likely to result from a storm, or snow melt that occurred some time prior to the affected discharge, and are unrelated to any particular source that can be located and addressed.

Concept of Addressing Sources of Exceedances. The draft permit states that once the sources of the exceedance are identified, "the identified sources shall be used to prioritize the compliance actions to be taken in the Schedule of Compliance – Action Level Items on page 9 of this Permit." Thus, DEC relies on an underlying assumption that the programs set forth on page 9 – stream restoration, critical area seeding and conservation easements – will actually reduce turbidity in the Schoharie watershed. This underlying assumption has not been established. We believe that these programs provide water quality benefit by, among other things, forestalling new potential sources of turbidity in a watershed that by virtue of its geology and topography is prone to erosion. However, while the programs may lead to localized turbidity reductions during low flow conditions, we do not believe they will significantly reduce turbidity exceedances under the permit, which are more directly related to severe wet weather events. It is these high flow storm events that are likely to lead to the most significant increases in turbidity in the Schoharie Reservoir and the Shandaken Tunnel.[3] For the same reasons, we urge DEC to delete the reference to "the expected ongoing decreases in turbidity from the Shandaken Tunnel" in the SPDES Fact Sheet. (Page 2, Footnote 1.)

As you know, the City has made substantial commitments to stream restoration and conservation easements in connection with its Long-Term Watershed Protection Program, which are components of the November 2002 FAD as well as previous FADs. These commitments reflect substantial efforts on the part of DEP and others to prioritize those programs based on anticipated water quality benefits, among other factors.

[3] We address each program in detail below.

DEP will submit a comprehensive analysis of those programs to EPA, DOH, and DEC in March 2006. This analysis will be the basis for discussions between the agencies and will be used to establish program plans and milestones, starting in 2007, for the next phase of the City's watershed protection efforts. The suggestion that implementation of these programs may be "prioritized" based on identified sources of exceedances of action levels in this permit is inconsistent with the approach to these programs that we, DEC, and other stakeholders have developed over time. The permit's attempt to accelerate the timeline that was established by the EPA, DOH, and DEC, and included in the November 2002 FAD, undermines the process to which the parties agreed and which is a core component of the FAD.

Due Dates. Notwithstanding these fundamental concerns with the actions set forth on page 3 of the draft permit, the City presents the following specific comments. First, the due date for "Submit an approvable report ..." would not allow for adequate investigation of probable sources of the turbidity exceedance, especially if, as is likely, the turbidity was storm-related. Identifying specific sources of storm-related turbidity generally requires study of more than a single storm event. Within 60 days of the DMR submittal, however, DEP could submit a schedule for completing the investigation and submitting a report. Moreover, the due date for "Initiate implementation of the approved turbidity reduction measures" should be "In accordance with approved project schedule" to account for the likelihood that any physical work would not be able to be commenced within 30 days because, for example, necessary permits or easements cannot be obtained, or weather conditions do not permit such work.

Compliance Schedules

ENGINEERING & STRUCTURAL PROJECTS (PER 11/2002 FAD)

As discussed above, the City generally applauds the draft permit's recognition of the City's commitment to undertaking substantial projects as part of the FAD. Therefore, we note from the outset that it is a good policy to include FAD milestones within the permit. However, we have a few specific comments pertaining to the schedule that appears on pages 5-6 of the draft permit.

Due Dates. We request that the due dates for the project be replaced with the following statement: "in accordance with the November 2002 FAD and any duly authorized modifications of that FAD" to avoid inconsistencies in the event of modifications of milestone dates.

Completed Items. The last two items on page 5 ("Develop a plan..." and "Expand the water quality telemetry system...") should be listed as "completed."

"Shoemaker" Project. The "Shoemaker" restoration project, item vii. on page 6, is a Greene County project rather than a DEP project and should not be included as a DEP compliance action. Moreover, its due date should not be "EDP."

MONITORING AND REPORTING, STORM FLOWS, ACTION LEVEL ITEMS

The City strongly urges that extensions and expansions of Catskill Turbidity Control and Stream Management programs in the November 2002 FAD should be considered

within the context of future FADs, with the full participation of EPA and DOH and the benefit of the comprehensive evaluation the City is undertaking of all the FAD programs, rather than established unilaterally in this permit. As discussed in detail below, certain items on pages 7-9 involve projects that may emerge in the course of the 5 year review of the 2002 FAD, based on the results of the comprehensive evaluation of current FAD programs which is due in March 2006. To establish DEP's obligations to undertake such work in advance of that evaluation, without analyzing the costs and benefits of the programs DEP is already implementing, would be imprudent and could adversely affect the City's ability to pursue other water quality initiatives that both the City and State deem important. Moreover, imposing such obligations now, without the full participation of EPA and DOH, undermines the collaborative process that was carefully developed in the course of negotiating the November 2002 FAD.

Comprehensive Engineering Analysis and Implementation Plan. (Page 7, due date 8/1/07.) The November 2002 FAD requires NYCDEP to "Develop a plan, subject to EPA, NYSDOH and NYSDEC approval, with appropriate milestones for implementing any feasible, cost effective measures identified by the comprehensive engineering analysis." This milestone is due on December 31, 2006. While we expect that the first of those milestones will include commencement of design, it is premature and inappropriate to set the date for that milestone in this draft permit. Also, there may be no need to continue modeling after we complete the evaluation in 2006. We request that DEC instead indicate that the milestones to be established in the December 31, 2006 deliverable will be incorporated by reference into this permit.

Annual Monitoring Data Summary. (Page 7.) Please clarify the nature of the summaries DEC is requesting. Depending on the size of the "electronic spreadsheet," it may make sense to submit these reports by email rather than to the address noted.

Schoharie Basin Build-out Model. (Page 8, due date 2/28/05.) We recognize that it may be useful to analyze the potential for development in the Schoharie Basin in connection with Catskill Turbidity Controls, and NYCDEP is willing to explore the parameters for such a study further. The date proposed in the draft permit, however, is unrealistic, even for a much simpler study that would simply delineate lands available for development. Moreover, with existing modeling tools and capability, we do not believe it will be possible to determine the impacts of potential development on stream/streambank stability and erosion problems with enough accuracy to make the study specifically described in this deliverable useful.

Report Evaluating Heightened or More Expansive Implementation of MOA/FAD Programs. (Page 8, due date 4/30/05.) This item directly conflicts with DEP's commitment under the FAD to undertake a comprehensive analysis of these programs by March 2006. The due date should be changed to correspond with that set forth in the FAD, and the description should mirror that in the FAD: "Submit Comprehensive Water Quality/Program Evaluation Report in accordance with outline to be approved by EPA."

Implementation Schedule. (page 8, due date 9/30/05). For the reasons discussed above, the date for this item is inconsistent with the FAD process. Again, we recommend that DEC incorporate future FAD milestones relating to Catskill Turbidity Control by reference.

Commencement of Implementation. (page 8, due date 11/30/05). Like the previous item, this should be replaced with an incorporation of future FAD milestones.

Stream Management, Seeding and Conservation Easement Programs

Like the Catskill Turbidity Control items, the City's substantial commitments to developing stream management plans and implementing certain restoration projects are set forth in the November 2002 FAD. The evaluation of these projects in connection with our current commitments should be the basis for establishing any future obligations with respect to stream management. Moreover, the relationship between the compliance schedule on page 9 and the action items on page 3 is unclear in the permit.

Stream Restoration Program. (Page 9, due date EDP + 6 months.) Even by March 2006, let alone within 6 months of the effective date of this permit, DEP will likely not have sufficient data from the stream restoration projects completed thus far to complete the type of thorough evaluation that should form the basis for future commitments to specific stream restoration work. More fundamentally, stream restoration is one small piece of the City's very complex Stream Management program. Fundamentally, the program involves development of stream management plans, which identify and recommend a range of remedial and preventive actions for problems for stream reaches and on a watershed scale. Stream management plans are living documents, reflecting commitments from local residents as well as from DEP and other governmental organizations, which can be amended over time to reflect changes in conditions and approaches, rather than defining a specific prescription that cannot be adjusted as conditions, priorities or technologies change.

For these reasons, implementation of the stream restoration makes sense only in the context of stream management plans. In some areas, stream restoration makes sense; in others, it does not. While the Batavia Kill stream management plan is complete and has been submitted to EPA, plans for the other two major tributaries to the Schoharie reservoir, West Kill and Schoharie Creek, will not be finished until 2005 and 2007, respectively. Accordingly, to establish a 10-year program with prioritizations, focusing exclusively on stream restoration, at such an early date would be premature.

Finally, as discussed above, while stream restoration may prevent the further exacerbation of turbidity in the Catskill system, it is unproven to date that stream restoration of even a substantial stream area actually reduces turbidity in a measurable way. The effectiveness of stream restoration in addressing turbidity cannot be evaluated until, at a minimum, we have monitoring data from at least one completed restoration project. The first such report, for the Red Falls restoration, is not scheduled to be completed until December 2007. Accordingly, we urge DEC to delete this milestone entirely and instead incorporate by reference the deliverables relating to the Stream Management Program to be established in the 2007 FAD.

Repair of 2,500 Linear Feet of Stream. (Page 9, annual.) As noted above, specific commitments to implement stream restoration projects should be done in the context of completed stream management plans. While DEP is committed to implementation of certain restoration projects based on such plans, it is not clear in advance of completing those plans that repairing stretches of streambanks will be the most cost-effective way to address the issues

identified in those plans. Moreover, it is premature to establish appropriate priorities for such work in advance of development of the stream management plans, which will also allow for public participation. Determination of length, location and type of restoration programs or projects should only be made following completion of stream management plans for Schoharie basin as a whole.

Critical Area Seeding Program. (Page 9, due date EDP + 6 months.) More information is needed to understand the relative contribution of drainage ditches to turbidity, especially in relation to major sources such as streambeds in a glacial clay geologic setting. While we see a potential benefit to seeding ditches in principle, it is premature to undertake prioritization of areas for treatment without adequate assessment. Such questions should be addressed as part of stream management plans.

Conservation Easement Program. (Page 9, annual.) We note that the conservation easement program is not undertaken "in accordance with Catskill Turbidity Control Program" but rather as part of the Land Acquisition Program.

RESPONSIBLE OFFICIAL OR AGENT

Please change the designation of the responsible official at NYCDEP for Discharge Monitoring Report mailing on page 1 of the draft permit to Paul V. Rush, P.E., NYCDEP, P.O. Box 358, Grahamsville, NY 12740.

Thank you for your consideration of these comments. We look forward to discussing these issues further.

Yours truly,

Michael A. Principe

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