New York City
Department of Environmental Protection

Filtration Avoidance Annual Report
For the period January 1 through December 31, 2002

Prepared in accordance with the November 2002 EPA Filtration Avoidance Determination

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1. Introduction

In 2002, New York City continued to make significant strides in implementing a comprehensive watershed protection program to protect and improve the quality of the Catskill/Delaware water supply. The City, primarily through the New York City Department of Environmental Protection (DEP), and its partner agencies and organizations continued to advance the many programs that target present and possible future sources of pollution in the Catskill/Delaware watershed.

Since embarking on an aggressive watershed protection program in the early 1990s, the City has made remarkable progress in assessing the potential sources of water contamination and has designed and implemented programs to address these sources. As part of DEP's source water monitoring program, samples are collected and tests are conducted throughout the watershed. Each year, DEP collects more than 35,000 samples from 300 sites and performs more than 300,000 laboratory analyses. Based upon the information collected through its monitoring and research efforts, DEP designed a comprehensive watershed protection strategy, which focused on implementing both protective (antidegradation) and remedial (specific actions taken to reduce pollution generation from identified sources) initiatives. DEP's assessment efforts pointed to several key potential sources of pollutants: waterfowl on the reservoirs; wastewater treatment plants discharging into watershed streams; failing septic systems; the approximately 350 farms located throughout the watershed; and stormwater runoff from development. DEP has crafted a protection strategy to target those primary pollution sources and a host of secondary ones.

In the context of this long-term commitment, 2002 is yet another year of significant achievements. The City continues to advance efforts in key program areas: land acquisition; regulatory enforcement; implementation of key environmental partnership programs; upgrades of non-City-owned wastewater treatment plants; and water quality monitoring and research. In addition, the City has secured another extension of the filtration waiver for the Catskill/Delaware system from EPA.

1.1 EPA Extends the Filtration Avoidance Determination

Early in 2001, the City began discussions with EPA and the State regarding an extension to the 1997 Filtration Avoidance Determination (FAD), which was set to expire in April 2002. Those discussions led to the publication by the City in December 2001 of a comprehensive long-term watershed protection plan, which detailed certain program commitments by the City. On November 26, 2002, EPA issued a revised FAD for the City's Catskill/Delaware water supply. EPA hosted a press event to announce the release of the new FAD on the 26th at the City's Ashokan Reservoir in Ulster County. Mayor Michael Bloomberg and Commissioner Ward were in attendance to accept the new FAD from EPA Region II Administrator Jane Kenny. The FAD,

which will remain in effect until at least 2007, will allow the City to avoid costly filtration of 90% of the City's water supply, while requiring continued implementation of certain watershed protection programs.

1.2 Land Acquisition

DEP met the 2002 goals for solicitation of owners of watershed lands set forth in the 1997 and 2002 FADs and the Watershed Memorandum of Agreement (MOA). Specifically, in the program year that concluded January 21, 2003, DEP solicited owners of 48,531 acres of watershed lands in designated priority areas. In the first six years of the program, New York City solicited owners of more than 322,224 acres of Catskill and Delaware land.

Through December 2002, DEP had 39,711 acres either acquired or under purchase contract. A number of key parcels are among the acquisitions to date, including:

- Of the 1,038 acres eligible in the Kensico Reservoir basin, the total number of acres acquired or under contract stands at 180 acres, or 17%.
- Of the 4,830 acres eligible in Rondout 1A, the total number of acres acquired or under contract was raised to 2,594 acres (54%).
- Of the 12,645 acres eligible in West Branch 1A and 1B, the total number of acres acquired or under contract was raised to 7,521 acres (59%).

1.3 Environmental and Economic Partnership Programs

West of the Hudson River, many of the partnership programs are being administered by the Catskill Watershed Corporation (CWC), a non-profit corporation formed specifically for that purpose. Together, CWC and DEP continued to implement programs that remediated more than 1,555 failing septics in the Catskill and Delaware watershed since 1997, and funded another round of projects to install stormwater control retrofits.

DEP, in cooperation with the Watershed Agricultural Council (WAC), has helped make the Watershed Farm Program into a national model. The Farm Program has a solid history of achievement: 326 farms have signed up to participate (versus a FAD goal of 297); 251 farms have commenced implementation of Whole Farm Plans; and 124 farms have substantially completed installation of Best Management Practices (BMPs). In addition to continuing to install Best Management Practices on participating farms, WAC has made great strides in forest management, initiating a small farms program, and implementing an expansive research strategy. In addition, the Conservation Reserve Enhancement Program (CREP) continues to be successful at removing environmentally sensitive lands from agricultural production and treating those lands with conservation practices. To date, more than 1,227 acres of riparian buffer lands have been enrolled in CREP, which represents a dramatic increase over traditional rates of enrollment in the Conservation Reserve Program in the watershed region.

When coupled with DEP's own efforts in the areas of stream management, sewer extensions, new infrastructure and land management, 2002 was a year of tremendous activity and water quality protection.

1.4 Wastewater Treatment Plant Upgrades

There are 34 non-City-owned surface-discharging WWTPs in the Catskill/Delaware watershed, which account for approximately 60% of the WWTP flow in the west of Hudson watershed. In 2002, upgrades were completed at facilities that account for more than 83% of non-City-owned Catskill/Delaware WWTP flow. In addition, DEP has completed the upgrades of the six City- owned wastewater treatment facilities that account for 40% of the WWTP flow in the west of Hudson watershed, at a cost of more than $240 million. These upgraded facilities continue to operate well, and effluent quality has improved markedly since completion of the upgrades.

1.5 Water Quality Monitoring

During 2002, DEP continued its comprehensive water quality monitoring efforts. Both in the City distribution system and in the watershed, DEP collects literally thousands of samples each year and conducts millions of analyses. The City's sampling program continues to be much more extensive than is required by federal or State law. More than 45,500 samples were collected in the City and approximately 560,000 analyses were completed. Once again, the results are impressive. The City complied with the Objective Criteria of the Surface Water Treatment Rule. Of the 11,227 in-City Compliance samples collected pursuant to the Total Coliform Rule in 2002, a mere 0.2% were total coliform positive. All resamples, except one, were negative for total coliform. Since November 1994, DEP has collected approximately 89,000 Compliance samples and only four of those samples have tested positive for *E. coli.*

1.6 Water Supply Security

In the wake of the events of September 11, 2001, New York City took a number of steps to enhance the security of the water supply system. Steps taken included increased surveillance at critical facilities upstate and in the City, enhanced water quality monitoring and initiation of a contract to install surveillance and access control measures at key locations. In addition, DEP has increased the number of officers in its Water Supply Police Force, whose duties include (among other things) protection of City water supply facilities. The City continues to place the highest priority on protection of the water supply.

1.7 2002 Annual Report

This report covers the period January 1, 2002, through December 31, 2002, and is compiled to satisfy requirements of the November 2002 FAD, which requires DEP to submit a comprehensive annual report on the status of the watershed protection program. Material in this report is organized to parallel the sections of the November 2002 FAD, which is somewhat different from previous FAD annual reports.

While this report provides a thorough overview of those programs that are directly connected to watershed protection or water quality preservation and enhancement in the City's Catskill and Delaware water supply systems, there is a wide variety of additional information that is compiled and available in other formats. Under the filtration avoidance waivers that have been in effect since December 27, 1991, DEP produces and provides an extensive schedule of other reports, data and documents to EPA and the New York State Department of Health (DOH). Further information on the programs discussed here can be found in the reports submitted pursuant to the May 1997 and November 2002 FADs.

In addition, the DEP web site provides a host of information on watershed protection programs, including recent press releases, reservoir storage status and up-to-date water quality data. Please visit the web site at http://www.nyc.gov/html/dep, and click on the "About DEP" link.

While this report focuses, of necessity, on the efforts of New York City, it is important to note that DEP works in partnership with dozens of agencies and organizations throughout the region to achieve the common goal of water quality protection. Many of those organizations are acknowledged in the body of this report. The other private, governmental and non-profit entities that share a role in this complex effort are too numerous to list. However, DEP gratefully acknowledges their help and support.

2. SWTR Objective Criteria Compliance

During 2002, DEP continued its comprehensive water quality monitoring efforts. Both in the City distribution system and in the watershed, DEP collects literally thousands of samples each year and conducts millions of analyses. The City's sampling program continues to be much more extensive than is required by federal or State law. More than 45,500 samples were collected in the City and approximately 560,000 analyses were completed. Once again, the results are impressive. The City complied with the Objective Criteria of the Surface Water Treatment Rule. Of the 11,227 in-City Compliance samples collected pursuant to the Total Coliform Rule in 2002, a mere 0.2% were total coliform positive, of which one sample was also *E.coli* positive. All resamples, except one, were negative for total coliform. Since November 1994, DEP has collected almost 89,000 Compliance samples and only four of those samples have tested positive for *E.coli.*

On the tenth of every month, DEP provides both EPA and NYSDOH with the results of its enhanced monitoring program, developed to comply with the requirements of the Surface Water Treatment Rule (SWTR), the Total Coliform Rule and other federal regulations that went into effect in 1991. The City, as an unfiltered surface drinking water supplier, must meet these objective criteria. The information provided below demonstrates compliance with all pertinent standards.

2.1 SWTR Monitoring and Reporting

Monthly raw water and entry point monitoring for coliform concentrations, turbidity, disinfection and chlorine residuals complied with all federal water quality requirements, as did quarterly monitoring for trihalomethanes and haloacetic acids. These results indicate the continued maintenance of a high quality water supply.

2.1.1 Raw Water Fecal Coliform Concentrations (40 CFR Section 141.71 (a)(1))

Both the Catskill and Delaware Aqueduct effluent from Kensico Reservoir exhibited fecal coliform concentrations, in water prior to disinfection, at levels less than or equal to 20 CFU/100 mL in at least 90% of the samples collected during the year, for six month running percentages. In fact, the running percentages of samples for the Catskill and Delaware Systems never dipped below 98.91% and 98.37%, respectively.

2.1.2 Raw Water Turbidity (40 CFR Section 141.71(a)(2))

Both the Catskill and Delaware Aqueduct effluent from Kensico Reservoir exhibited turbidity levels less than or equal to 5 Nephelometric Turbidity Units (NTU) in water prior to disinfection, on an ongoing basis, with one exception. That exception occurred in the Catskill System on December 1, between the hours of 6:45 a.m. and 8:25 a.m., with the maximum turbidity value of 18 NTU occurring at 7:30 a.m. The four hour reading, measured at 8 a.m., was 11.7 NTU. This occurrence was reported to the NYSDOH that day and was caused by changes in Catskill and Delaware Operations due to a sewage spill on November 28. This change was an Emergency Precautionary Operation,

resulting in by-pass mode on both systems. Continuous monitoring of source water turbidity was maintained during the year. With that one exception, turbidity values did not exceed 4.7 NTU for the Catskill System and 2.3 NTU for the Delaware System.

2.1.3 Raw Water Disinfection/CT Values (40 CFR Section 141.71(b)(1)(i))

CT values recorded each day during the year for the Catskill and Delaware Systems produced net inactivation ratios greater than or equal to 1.0 at all times. The actual lowest net inactivation ratio was 1.8 for the Catskill System and 1.2 for the Delaware System.

2.1.4 Entry Point Chlorine Residual (40 CFR Section 141.71(b)(1)(iii))

Chlorine residuals were maintained at concentrations at or above 0.20 mg/l at all entry points during the year. The lowest chlorine residual measured at an entry point was 0.41 mg/l.

2.1.5 Distribution System Disinfection Residuals (40 CFR Section 141.72(a)(4))

All chlorine residuals for Compliance samples, measured within the distribution system during the year, were measurable/detectable, the lowest being 0.04 mg/l.

Two Surveillance samples had 0.0 mg/l free chlorine residuals: one sample with a heterotropic plate count (HPC) of <1 CFU/mL and one sample with an HPC of 1 CFU/mL. Surveillance sites are located on mains that do not have direct service connections to consumers and are not used for compliance purposes. Surveillance samples supplement Compliance sites and are collected to gather additional water quality data in the distribution system. Surveillance samples make it possible to optimize process control, assess water quality, facilitate water quality management, and to determine the source and extent of physical and/or biological quality changes, such as high turbidity, color or coliform occurrences. Samples, however, with a 0.0 mg/l chlorine residual and an HPC less than or equal to 500 CFU/mL, are by rule deemed to have a measurable/detectable disinfectant residual.

2.1.6 Trihalomethane Monitoring (40 CFR Section 141.71(b)(6))

The analysis for trihalomethanes, performed on a quarterly basis, resulted in a maximum total trihalomethane (TTHM) level of 51 µg/l. The analysis for haloacetic acids, also performed on a quarterly basis, resulted in a maximum haloacetic acid five (HAA5) level of 58 µg/l.

Under the Stage 1 D/DBP Rule, the System Quarterly Running Average could not be calculated until the fourth quarter of 2002. At that time the TTHM Quarterly Running Average was 31 µg/l for the Catskill/Delaware System, below the regulated level of 80 µg/l. The HAA5 Quarterly Running Average was 34 µg/l for the Catskill/Delaware System, below the regulated level of 60 µg/l.

2.2 Total Coliform Monitoring

2.2.1 Monthly Coliform Monitoring

Within the distribution system, coliform monitoring indicated monthly levels below the 5% maximum of the Total Coliform Rule. The number of Compliance samples collected for total coliform analysis was 11,227. Of the Compliance samples collected, 22 samples were total coliform positive of which one sample was also *E.coli* positive. All resamples, except one, were negative for total coliform. The actual percentage of Compliance samples that were total coliform positive was 0.2%.

2.2.2 Chlorine Residual Maintenance in the Distribution System

During the year DEP continued a number of programs to ensure adequate levels of chlorine throughout the distribution system. These included: 1) maintaining chlorination levels at the distribution system's four entry points, 2) conducting spot flushing when necessary, and 3) providing local chlorination booster stations at remote locations. Three permanent local chlorination booster stations have been continuously operating to improve the chlorine residual levels at the Fort Tilden, Roxbury and Breezy Point areas (Rockaway Peninsula in Queens), City Island in the Bronx and Floyd Bennett Field in Brooklyn.

As a result of these steps taken by DEP, chlorine residuals have been continuously maintained throughout the distribution system. In 2002, in over 11,000 Compliance samples, all samples had a measurable/detectable chlorine residual.

Table 2.1. Monthly average free residual chlorine at system entry points (grab sample readings).

City Tunnel No.1 at BX4/154/15450/10250														
Month	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
JAN	0.61	0.59	0.63	0.69	0.94	1.03	0.95	1.18	0.80	0.73	0.94	0.70	0.71	0.92
FEB	0.57	0.56	0.65	0.65	0.80	1.05	0.88	0.90	0.78	0.73	0.88	0.68	0.67	0.92
MAR	0.58	0.62	0.63	0.68	0.93	1.00	0.92	1.00	0.67	0.72	0.79	0.67	0.64	0.96
APR	0.48	0.56	0.57	0.66	1.00	0.97	1.07	1.04	0.70	0.77	0.85	0.62	0.69	0.92
MAY	0.55	0.60	0.60	0.69	0.91	0.93	1.00	0.89	0.74	0.75	0.78	0.70	0.68	0.93
JUN	0.54	0.64	0.64	0.68	0.90	0.89	1.01	0.83	0.81	0.81	0.86	0.73	0.72	0.93
JUL	0.52	0.63	0.59	0.82	0.94	1.14	1.01	0.95	0.87	0.98	1.01	0.74	0.69	0.92
AUG	0.56	0.57	0.65	0.79	0.99	1.02	1.06	1.14	0.95	1.29	0.96	0.75	0.71	0.96
SEP	0.51	0.63	0.69	0.87	1.14	1.18	1.14	1.16	1.03	1.20	0.88	0.76	0.71	0.87
OCT	0.52	0.61	0.81	0.89	1.16	1.08	1.07	1.02	1.04	1.19	0.83	0.72	0.72	0.92
NOV	0.61	0.58	0.70	0.87	1.16	1.14	1.15	0.90	0.92	1.22	0.78	0.78	0.82	0.95
DEC	0.61	0.74	0.70	0.93	1.12	1.04	1.05	0.87	0.83	1.03	0.80	0.74	0.91	0.94
City Tunnel No.2 at BX5/121/12150														
Month	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
JAN	0.50	0.59	0.64	0.74	0.97	0.99	1.03	1.14	0.89	0.79	0.88	0.83	0.83	1.15
FEB	0.46	0.55	0.66	0.68	0.85	1.11	1.02	0.97	0.80	0.74	0.81	0.76	0.84	1.17
MAR	0.45	0.58	0.65	0.66	0.95	1.10	0.95	1.13	0.74	0.80	0.78	0.77	0.78	1.19
APR	0.50	0.54	0.55	0.68	1.01	1.02	1.04	1.08	0.76	0.87	0.88	0.70	0.83	1.22
MAY	0.73	0.59	0.58	0.71	1.03	1.12	1.01	0.94	0.83	0.95	0.91	0.71	0.82	1.14
JUN	0.65	0.66	0.64	0.69	1.13	1.25	1.05	0.97	1.02	1.00	0.97	0.76	0.79	1.15
JUL	0.69	0.69	0.69	0.83	1.10	1.19	1.06	1.01	1.08	1.13	1.02	0.89	0.82	1.15
AUG	0.75	0.64	0.71	0.87	1.24	1.17	1.11	1.14	1.16	1.25	1.07	0.96	0.92	1.18
SEP	0.68	0.67	0.75	1.02	1.24	1.36	1.16	1.20	1.24	1.28	1.10	0.95	0.93	1.16
OCT	0.62	0.68	0.91	0.91	1.24	1.30	1.09	1.05	1.19	1.23	1.02	0.94	0.94	1.11
NOV	0.61	0.66	0.76	0.88	1.13	1.22	1.15	0.93	0.99	1.14	1.02	0.88	0.98	1.01
DEC	0.63	0.75	0.69	0.94	1.19	1.18	1.12	0.94	0.85	1.01	0.90	0.83	1.05	1.04
City Tunnel No.3 at 15450														
Month	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
JAN											1.11	0.69	0.70	1.00
FEB											0.94	0.70	0.70	0.97
MAR											0.76	0.69	0.67	0.92
APR											0.68	0.65	0.69	0.94
MAY											0.70	0.70	0.74	0.84
JUN											0.79	0.72	0.70	0.80
JUL										1.15	0.90	0.74	0.68	0.83
AUG										0.89	0.94	0.74	0.69	0.84
SEP										0.89	0.85	0.77	0.70	0.86
OCT										0.92	0.82	0.74	0.69	0.87
NOV										1.06	0.78	0.79	0.79	0.88
DEC										1.12	0.78	0.74	0.91	0.96
Note: The unit for free residual chlorine level is ppm.														

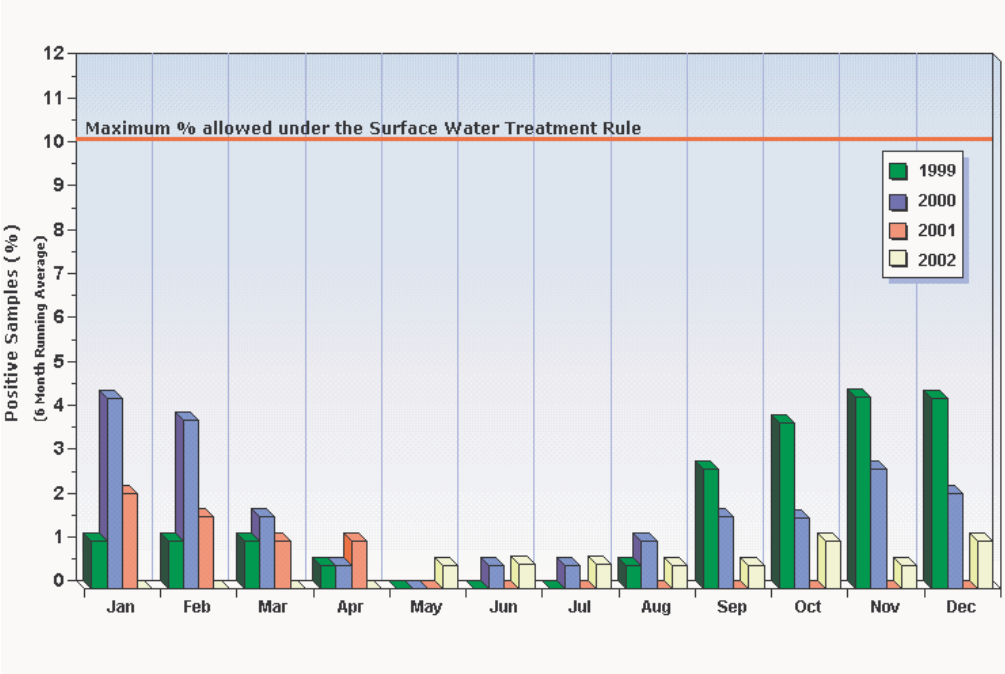

Figure 2.1. Positive fecal coliform samples, Kensico Reservoir, Catskill System, 1999 - 2002

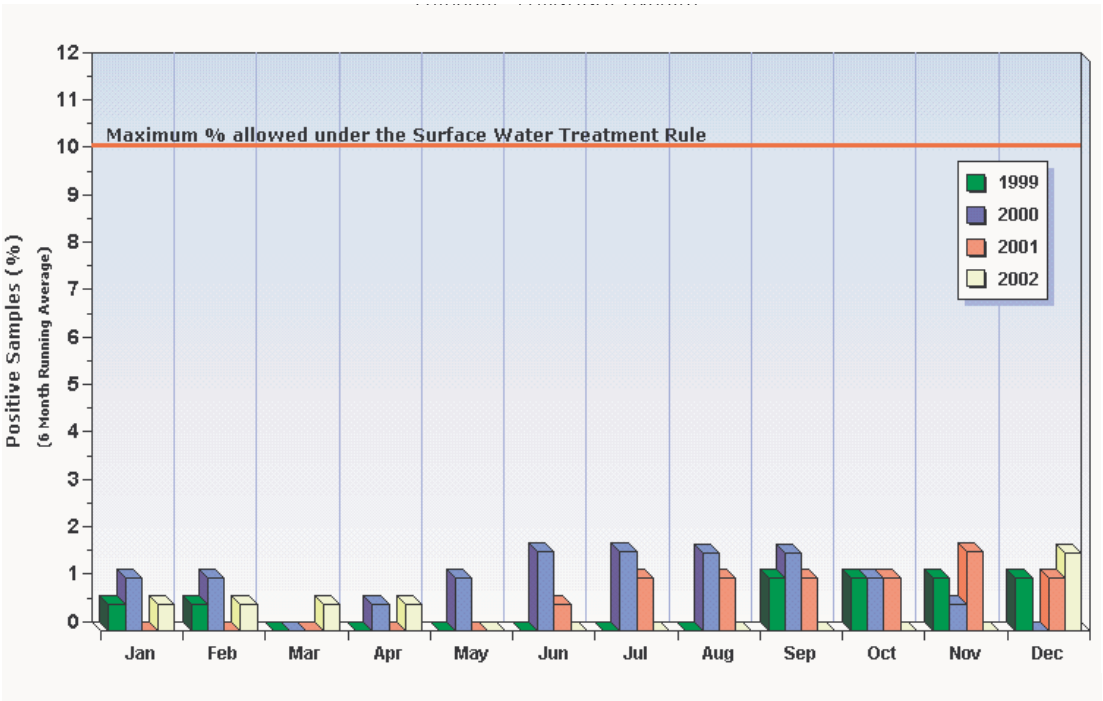

Figure 2.2. Positive fecal coliform samples, Kensico Reservoir, Delaware System, 1999 - 2002.

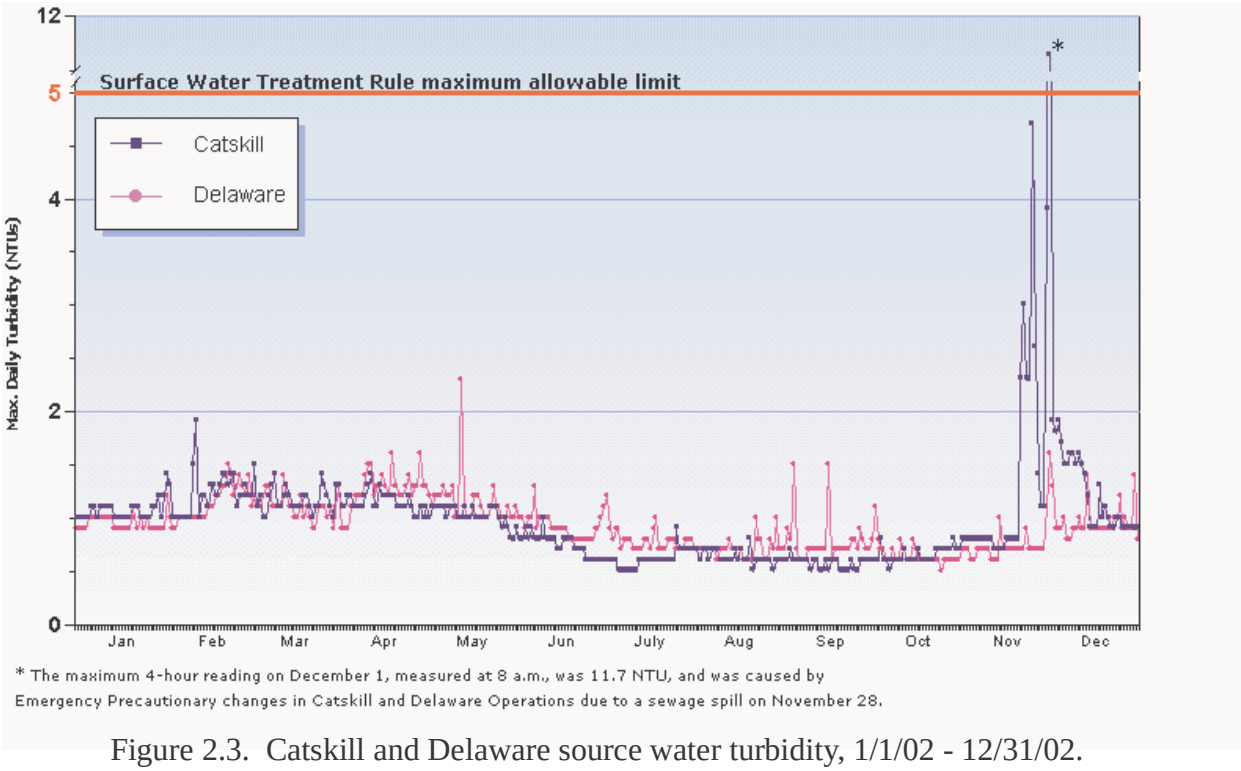

Figure 2.3. Catskill and Delaware source water turbidity, 1/1/02 - 12/31/02.

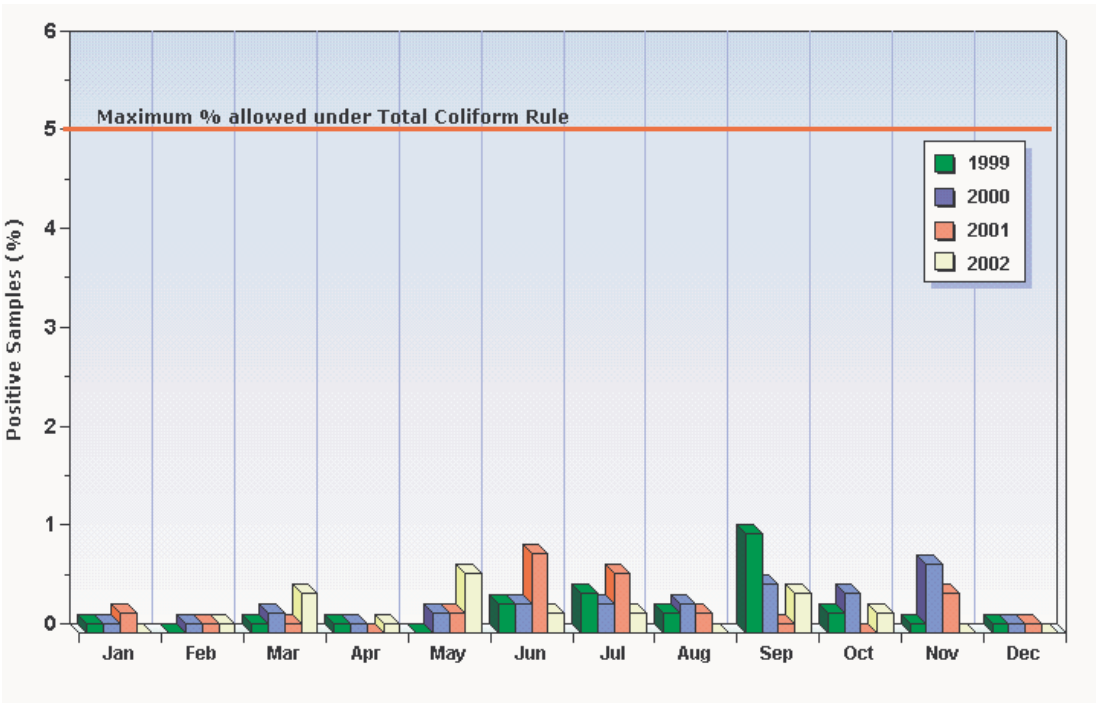

Figure 2.4. Positive total coliform samples in the City's Water Distribution System, 1999 - 2002.

3. Environmental Infrastructure

3.1 Septic and Sewer Programs

3.1.1 Septic System Rehabilitation and Replacement Program

The Septic Rehabilitation Program is a $13.6 million program to rehabilitate failing septic systems serving single family or two-family homes in the WOH watershed.

During 2002, Program Coordinators continued to implement design and construction of repairs and replacements to septic systems identified as failing by DEP prior to January 1, 1999. Septic system failures identified between January 1, 1999 and July 1, 1999, are eligible for CWC funding, but are the responsibility of the homeowner to remediate and are not eligible for inclusion in the Coordinator Program. In 2002, 52 septic system failures identified before July 1, 1999 were remediated.

Beginning July 1, 1999, revised rules redirected program eligibility to properties in the 60-day travel time areas.

Through 2002, CWC solicited interest in the Priority Area program from 1,795 property owners. A total of 316 homeowners have been signed up for the program and CWC has conducted 167 initial site inspections, 125 of which have resulted in the identification of a septic system failure. Sixty-six of these identified failures have been remediated through 2002, while another 24 have approved designs but have yet to be constructed.

Since 1997, a total of 1,557 septic system failures have been addressed through the Septic Rehabilitation and Replacement Program.

The graph on the following page shows the number of septic systems by reservoir basin that have been remediated or have an open violation from the Program's inception in 1997 through December 31, 2002.

As part of DEP's 2002 FAD commitment, DEP is providing an additional $15 million in funding for a Septic II program.

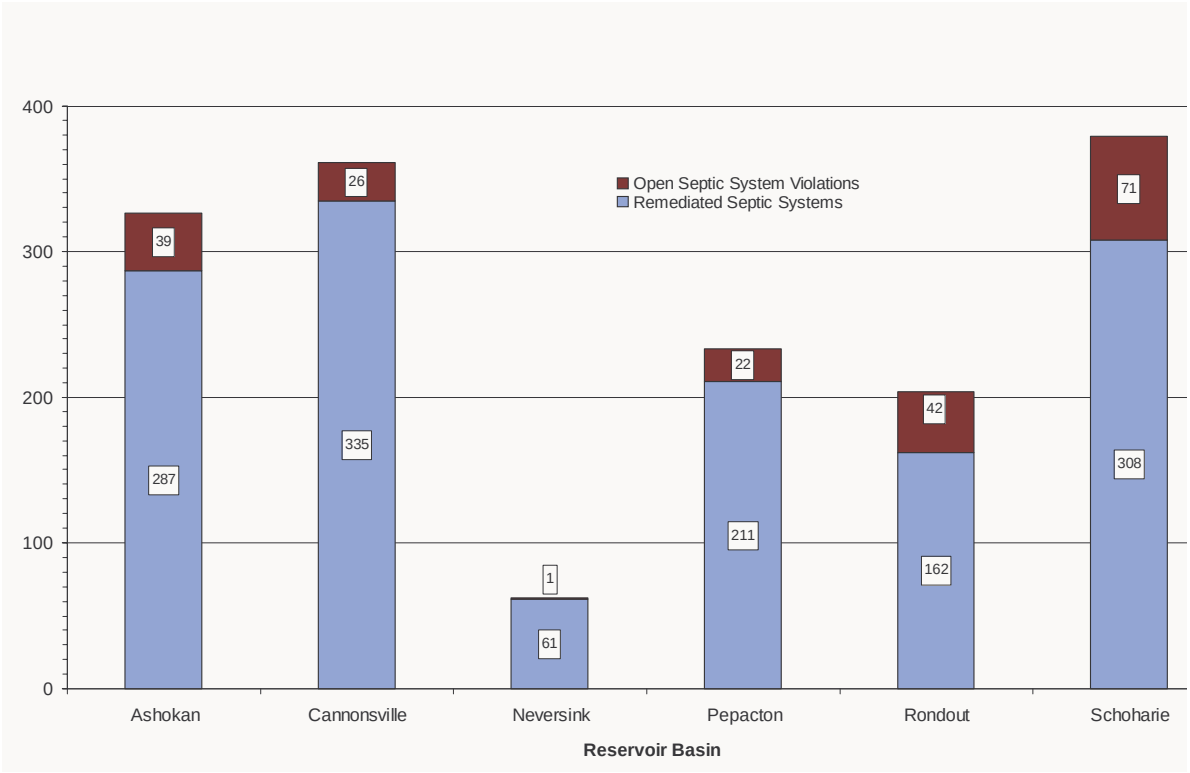

Figure 3.1. Remediated systems/open violations 1/21/97 to 12/31/02.

3.1.2 Alternate Design Septic Systems Program

The Alternate Design Septic Systems Program is a $3 million program to pay for the importation of fill material and/or pumping apparatus for the construction of septics where required solely by DEP or its delegate in order to comply with the Watershed Regulations.

CWC, in consultation with DEP, drafted program rules and standards that were adopted by the CWC Board on February 1, 2000.

CWC paid out $2,935.55 for one eligible system under this program in 2002. No other funding applications were eligible for funding during 2002.

3.1.3 Sewer Extension Program

A number of significant events occurred during the past year in advancing the implementation of the Sewer Extension Program. The most significant activities included the adoption of a new Sewer Use Law by communities participating in the Program, another municipality signing a contract with DEP to implement the Program, the advancement of planning and design activities associated with sewer extensions planned in a few of the involved municipalities, the completion of archeological and environmental site assessment studies, and the initiation of new investigations/studies, in certain communities.

In regard to the fulfillment of community requirements, the Towns of Hunter and Roxbury both adopted new Sewer Use Laws in 2002. In addition to the adoption of a new Sewer Use Law, the Town of Roxbury also signed an Agreement with DEP during the past year to implement the Program.

The Towns of Hunter and Roxbury are moving forward with the planning and design of extensions planned in their communities. In the Town of Roxbury, where DEP is handling the design and construction of the extension selected for funding, preliminary plans have been prepared and the SEQRA environmental review process has been completed. In the first quarter of 2003, DEP is in the process of applying for applicable permits. In the Town of Hunter, where the Town is responsible for managing the design and construction of the planned extensions, they have begun the process of complying with SEQRA and expect to apply for applicable permits in the first few months of 2003.

Three studies were undertaken during the past year in association with complying with SEQRA for the extensions planned in the Towns of Hunter and Roxbury. Two studies were completed in Roxbury including an archeological resources investigation and an environmental site assessment of two properties located along the proposed sewer extension. Also completed in 2002 was an archeological resources investigation in the Town of Hunter. Two additional studies are currently being undertaken. These include compiling a certified list of owners of record (for easement purposes) for properties affected by the sewer extensions and associated laterals planned in the Towns of Roxbury and Middletown, and the Village of Margaretville, and an archeological resources investigation in connection with the sewer extensions planned in the Town of Middletown and Village of Margaretville.

3.2 New Sewage Treatment Infrastructure Program

The New Sewage Treatment Infrastructure Program is described in Paragraph 122 of the MOA. There are 22 communities identified, listed in order of priority, that are eligible to receive funds for the study, design and construction/implementation of wastewater collection, treatment and disposal options. The Program is funded for $75,000,000. The top seven communities have completed extensive studies assessing wastewater needs, service areas, estimates of associated wastewater flows and identifying/proposing the appropriate wastewater collection, treatment, and disposal options. After the extensive studies at each of the top seven communities, allocations of block-grants to complete design and construction, based upon highly scrutinized cost estimations, were agreed upon for the top five communities.

Table 3.1. Top five new infrastructure communities.

Municipality	Maximum Permitted Flow*	Block Grant Award
1. Hunter	244,900 gpd**	$15,300,000
2. Fleischmanns	146,000 gpd	$11,520,000
3. Windham	373,800 gpd	$20,000,000
4. Andes	62,000 gpd	$6,250,000
5. Roxbury	100,000 gpd ***	$8,550,000

* Includes flow from connection of tie-in facilities
** Will be adjusted upward if Liftside (81,000 gpd) is connected
*** Includes Hubbell Corners

As part of DEP's 2002 FAD commitment, DEP is adding $12,150,000 into the New Infrastructure Program to allow block grant allocations to be awarded to Identified Communities 6 & 7. The 2002 FAD also calls for the establishment of a Community Wastewater Management Program to address wastewater needs of priority communities not addressed in the New Infrastructure Program.

The top five communities signed design/construction contracts with the New York State Environmental Facilities Corporation (EFC). In three of these communities – Hunter, Windham and Fleischmanns – a number of existing privately-owned wastewater facilities eligible for funding under the Wastewater Treatment Plant (WWTP) Upgrade Program will be connected to the planned Municipal WWTP. In Hunter, WWTPs at Colonel's Chair, Forester Motor Lodge and Camp Loyaltown are planned for consolidation (Liftside has also agreed to consolidate, but this has not been finalized). In Windham, Ski America, Thompson House and Frog House are planned for consolidation. In Fleischmanns, the Regis Hotel is planned to connect to the municipal plant.

Two of the top five communities, Andes and Roxbury, completed the design phase in 2002. Roxbury awarded construction contracts for its wastewater project (force main from Roxbury to Grand Gorge WWTP) and issued a Notice to Proceed in December 2002. Andes awarded the WWTP construction contract in November 2002. The other communities were still in the design phase at the end of 2002.

Following the completion of the study phase, the Village of Hunter hired a new engineering firm to guide the project through the design and construction phases. An amended facility plan for the Hunter project was prepared that included modifications to the planned wastewater treatment train.

3.2.1 Current Status/Activity

Andes

Notice to Proceed issued on general construction work associated with the WWTP on January 3, 2003. The Sewer collection system construction contract was awarded January 6, 2003. The project is on schedule to be functionally complete by September 2004.

Roxbury

Notice to Proceed issued on all contracts for work associated with the project on December 4, 2002. The date for functional completion is December 31, 2003. The project is on schedule.

Windham

At the end of 2002, 65% design of the WWTP was under review by DEP and DEC. This contract will be bid in early 2003. The Route 23 collection system 90% design is being reviewed by DEP, DEC, and NYSDOT. This contract will be advertised for bids in early 2003. Local roads 90% design will be submitted for review around mid-February. This contract will be advertised for bids by March 15, 2003. The Windham project was on schedule, but in August and September 2002, construction bids on the WWTP and the collection system came in $5 million over budget and the Town dismissed its project engineer and hired another engineering firm to redesign the project and bring it in on budget. The Town expects to break ground in April 2003.

Hunter

WWTP 90% design has been reviewed by DEP and DEC. This contract will be advertised for bids in early 2003. The Route 23A 90% collection system design has been forwarded to DEP, DEC, and NYSDOT. Comments have been received from DEC. The contract will be advertised for bids in early 2003. Local roads 65% design has been completed. This contract will be bid in Spring 2004. The project should be functional by the April 2005.

3.3 Community Wastewater Management Program

The Community Wastewater Management Program is a new effort developed by DEP as part of its watershed protection strategy. Funded for $10,000,000, the Program builds upon experience gained in the New Infrastructure Program to address priority communities not addressed in the New Infrastructure Program. It is expected that communities entering the Program will opt to pursue septic maintenance districts which are likely to include cluster systems for groups of properties where on-site systems are not viable.

In November 2002, DEP provided the Catskill Watershed Corporation with a draft contract. Throughout the remainder of the year 2002, CWC worked with stakeholders to develop comments on the contract. DEP expects CWC to approve the Community Wastewater Management Program contract in the second quarter of 2003.

3.4 WWTP Upgrade Program

As part of the MOA, the City agreed to fund the upgrades of all existing non-City-owned wastewater treatment plants (WWTPs) in the watershed. (As reported in previous annual reports, upgrades of City-owned WWTPs, which account for more than a third of WWTP flow in the Catskill/Delaware watershed, proceeded on a separate track and were completed in 1999.) The upgrades will provide highly advanced treatment of wastewater treatment plant (WWTP) effluent. The task of coordinating these complex projects with the WWTP owners in the Catskill/Delaware watershed is enormous. Many of the owners are restaurateurs, hoteliers, camp operators, school administrators and managers of recreational facilities, not professional WWTP operators and construction specialists. DEP has proceeded diligently with this vast undertaking and provided step-by-step guidance on a host of engineering, operating, contracting and regulatory issues.

DEP has entered into a contract with the New York State Environmental Facilities Corporation (EFC) that identifies a wide range of tasks to be performed by both DEP and EFC to ensure comprehensive management of the overall WWTP Upgrade Program. DEP's and EFC's tasks have included, but are not limited to: program start-up, establishing contracts with each WWTP owner, providing technical assistance to each WWTP owner and their consulting engineer, change order administration, construction oversight, funds management (including invoice review and reconciliation) and extensive project management. DEP and EFC have continued to provide technical and program guidance to each of the owners and their engineers to assist them through the process of upgrading each unique facility.

The upgrade of non-City-owned WWTPs is divided into two distinct programs: Regulatory Upgrades and SPDES Upgrades (West of Hudson only). Although two separate programs, the Upgrade Agreement between EFC and the WWTP owner encompasses both programs.

The Regulatory Upgrade Program is designed to assist WWTPs in meeting requirements imposed solely by the WR&R. Treatment technologies required by the Regulatory Upgrade Program include, but are not limited to: phosphorus removal, sand filtration with redundancy, back up power, back up disinfection, tertiary treatment via microfiltration (or DEP-approved equivalent), effluent flow metering and alarm telemetering.

The SPDES Upgrade Program is designed to assist certain WWTPs in meeting the conditions of their current SPDES permits. Equipment that is unreliable or reaching the end of its useful life is eligible for replacement under this program. Additionally, certain SPDES improvements conducted at a facility after November 2, 1995, are also eligible for reimbursement under this program.

During 2002, important Program milestones continued to be reached as construction was completed on the upgrades for eight WWTPs representing 84.5% of the total WOH SPDES flow and construction commenced on one additional facility. Completion of construction of the 84.5% was accomplished with the aid of bonus incentives and planning for winter construction. Start-Up and Performance Testing (SPT) then commenced. Since August 2002, these newly upgraded facilities, through the monitoring efforts of DEP and EFC, have been engaged in the necessary SPT procedures which will ensure compliance with their new SPDES permitted limits and afford a higher quality of treated effluent than in the past.

Operation and Maintenance (O&M) Agreements were fully executed for the four WOH Villages and SPT amendments providing for payment of SPT were approved for all WWTPs that completed construction.

Of the remaining 15.5% of flow, nearly 8.6% will be addressed by incorporation into the New Infrastructure Program (NIP), 2% has solicited bids and will commence construction in the spring of 2003, while the remainder (4.9% of flow) is in various stages of design.

DEP and EFC also executed two program contract amendments in 2002, with the goal of ensuring completion of the program objectives. Through these amendments, the City allocated approximately $192,000,000 in additional funding for the program, while EFC agreed to provide additional services, some of which include negotiation of operation and maintenance agreements and disbursement of start-up and performance testing payments. The City also added ten additional WWTPs to the Regulatory Upgrade Program as part of these amendments. Currently, the total Regulatory Upgrade funding is $272 million and the SPDES Upgrade funding is $5 million, which includes $400,000 for Infiltration and Inflow (I/I) work.

The ten additional small WWTPs added to the Program have all recently signed contracts committing to the upgrade of their facilities which once implemented will share in the combined efforts of increasing water quality.

During 2002, Liftside at Hunter Mountain was incorporated into the NIP Program bringing the total number of NIP candidates to eight, seven of which signed amendments to design and construct Interim Enhanced UV Disinfection.

3.5 Stormwater Programs

3.5.1 Stormwater Retrofits Program

The Stormwater Retrofit Program is a $7.625 million program to fund the design, permitting, construction, implementation and maintenance of stormwater BMPs to address existing stormwater runoff in concentrated areas of impervious surfaces in the WOH watershed to the extent such stormwater BMPs are necessary to correct or reduce existing erosion and/or pollutant loading. CWC manages the Stormwater Retrofit Program in consultation with DEP.

Throughout 2002, CWC and DEP solicited for program applications, conducted site inspections, completed project evaluations and administered previously funded projects.

Ten applications were received and identified for further review and inspection as a result of the Project solicitation that took place June 1, 2002, through September 3, 2002. Upon completion of the evaluation process, all project applications met the minimum requirements for funding consideration based upon their Site Factor score. Project ranking is based upon a combined Site Factor/Pollutant Removal score, and compliance with Program purposes and goals.

The table below provides information on each Round 4 project. All project evaluations, ranking and suggested funding limits were presented to the CWC Wastewater Committee on January 7, 2003. CWC's Board approved the Round 4 projects at it January 2003 Board meeting. Capital funding for Round 4 is projected to be $667,637.

Table 3.2. Stormwater Retrofit Program projects.

Applicant	Project Area	Project Description	CWC Award
Andes (T)	Town Highway Garage	Stormwater collection, conveyance and treatment	$13,800
Del. Co. DPW	Page Avenue & Del. Co. DPW Facilities	Stormwater collection, conveyance and treatment	$280,500
Greene Co. SWCD	Greene Co. Route 56	Roadside ditch stabilization and stormwater treatment	$9,825
Greene Co. SWCD	Greene Co. Route 40	Roadside ditch stabilization and stormwater treatment	$20,291
Greene Co. SWCD	Hunter (T) Highway Facility	Stormwater collection, conveyance and treatment	$56,100
Jewett (T)	Carr Road	Investigate flood cause-and-effect and identify mitigating actions	$10,000
Margaretville (V)	Margaretville (V) Park	Re-grade commercial access, roadside ditch stabilization and stormwater treatment	$6,878
Margaretville (V)	Swart, Main, Orchard & Walnut Streets (V)	Identification and remediation of household sump pump discharges	$212,243
Middletown (T)	NYS Route 28 & Del. Co. Route 38 Intersection	Stormwater collection, conveyance and treatment	$37,500
Windham (T)	Windham Ventures Parking Lot	Stormwater collection, conveyance and treatment	$20,500

In January 2003, the Catskill Watershed Corporation Board approved amendments to the Stormwater Retrofit Program Rules to include Stormwater emergency provisions for expedited approval of emergency cases.

As a result of the 2002 FAD negotiations, additional funding for the Stormwater Retrofit Program has been committed by DEP and encompassed within a Contract Change Order, including $6.3 million to continue the existing program as currently administered, and $1.25 million to provide for Stormwater infrastructure assessment and planning.

3.5.2 Stormwater BMP Cost Sharing Programs

The West of Hudson Future Stormwater Controls Program is a $31.7 million program to fund the design, construction, implementation and maintenance of new stormwater measures required by the New York City Watershed Rules and Regulations (WR&R) but not otherwise required by federal and/or State law for WOH projects constructed after the effective date of the WR&R. The program is managed by CWC in consultation with DEP.

As a result of the segregation of $1 million for Future Stormwater Operation and Maintenance in October 1999 (Resolution #309), earnings accrued to date total approximately $134,210.11. These earnings are restricted to the funding of approved operation and maintenance costs resulting from eligible stormwater projects. The account is reviewed semi-annually by the CWC Wastewater and Finance Committees to determine its adequacy.

In 2002, CWC processed funding applications for three (3) projects. Applicants, projects, authorizing resolutions, and funding levels are shown in the following table.

Table 3.3. Applications for future stormwater control funding.

Applicant	Project	Approval Date	CWC Funding	NYC 50%
Tannersville (V)	Bike path progress payment	10/22/02	$10,000	
Tannersville (V)	Bike path remediation (not to exceed)	11/26/02	$160,000	
Daniel Pierce Library	Library addition and parking lot	11/26/02	$123,431	

4. Protection and Remediation Programs

4.1 Waterfowl Management Program

Pursuant to the November 2002 FAD, the Waterfowl Management Program will submit a separate annual report on July 31, 2003.

4.2 Land Acquisition

During 2002, DEP met the Year 6 solicitation deliverable set forth in the 2002 Filtration Avoidance Determination (FAD), the 1997 Watershed Memorandum of Agreement (MOA), and the 1997 Water Supply Permit (WSP), with more than 48,531 acres solicited. Specifically, 14,558 acres were solicited during the reporting period in Priority 3 of Cannonsville, 8,840 acres in Priority 4 of Cannonsville, 3,195 acres in Priority 3 of Schoharie, 7,350 acres in Priority 4 of Schoharie, 2,329 acres in Priority 3 of Pepacton, and 12,260 acres in Priority 4 of Pepacton. Since implementation of the 1997 MOA and FAD and counting against the program requirement of 355,050 acres due by January 20, 2007, a total of 322,224 acres (90%) have been solicited watershed- and program-wide to date. Table 4.1 provides an overview of solicitation activities to date while Table 4.2 provides an overview of lands secured by basin and priority area.

Among the significant accomplishments during 2002:

- In Kensico, one additional parcel of 12 acres in Priority 1B was signed to purchase contract, while 18 acres in 1B and 37 acres in 1A were closed. The property in 1A was the southern-most privately held property in the entire watershed and represents roughly 30% of the remaining vacant land in Kensico 1A; it includes a residence, driveway, and septic field that will all be removed. Of the 1,038 acres eligible in the basin, the total number of acres acquired or under contract stands at 180 acres, or 17%.
- Of the 4,830 acres eligible in Rondout 1A, the total number of acres acquired or under contract was raised to 2,594 acres (54%).
- Of the 12,645 acres eligible in West Branch 1A and 1B, the total number of acres acquired or under contract was raised to 7,521 acres (59%).
- For the first time, acres acquired or under contract (39,711) during this Program surpassed the number of non-reservoir acres (36,046) owned by the City prior to 1997.

Note: With this report, DEP is converting to annual reports based on calendar years rather than January 21st cycles. For purposes of consistency, all of January 2002 will be included herein although most of that month was reported with the previous annual report. Thus certain totals may appear skewed when compared with prior reports.

4.2.1 Individual Program Summaries

During 2002, 107 projects comprising 8,149 acres (record highs for the Program) were closed and 89 projects accounting for 5,919 acres were signed to purchase contract. To date, a

total of 566 purchase contracts comprising 39,711 acres were secured by the program (signed to purchase contract or closed). Of these, 397 projects totaling 27,016 acres have been acquired, with the remaining 169 projects totaling 12,696 acres under purchase contract.

During the past six years the number of acres (39,711) secured by the City's Land Acquisition Program surpassed the number of non-reservoir (above water) acres owned by the City in the Catskill/Delaware watershed prior to program implementation (36,046). In Rondout, the City has secured almost five times the number of non-reservoir acres than it owned prior to 1997. The City now controls roughly 35% of all above-water lands in Kensico, 33% of such lands in West Branch / Boyd (up from 2.6%), and almost 8% of the entire watershed (before the program began the City controlled 3.7%).

Table 4.1. Annual solicitation milestones by basin and priority area.

Reservoir Basin	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Actual Acres Solicited thru 2002	Milestone Acres thru 2002	Total Program Milestone
Kensico													
Priority Area 1	570	380									950	1,056	950
West Branch/Boyd's													
Priority Area 1	12,825	1,425									14,250	14,565	14,250
Ashokan													
Priority Area 1	3,230										3,230	3,845	3,230
Priority Area 2	19,035	23,265									42,300	42,385	42,300
Rondout													
Priority Area 1	18,834	10,218									29,052	29,910	29,052
Neversink													
Priority Area 1		161									161	161	161
Priority Area 4		3,825	8,925								12,750	19,482	12,750
Schoharie													
Priority Area 3			7,988	11,183	9,585	3,195					31,950	32,683	31,950
Priority Area 4			7,350	9,188	7,350	7,350		5,513			31,238	31,653	36,750
Pepacton													
Priority Area 1	1,805										1,805	1,873	1,805
Priority Area 3			6,210	3,881	3,105	2,329					15,525	16,146	15,525
Priority Area 4			12,260	12,260	12,260	12,260		12,260			49,040	49,127	61,300
Cannonsville													
Priority Area 1		12,303									12,303	15,488	12,303
Priority Area 3				9,705	9,705	14,558		14,558			33,968	34,098	48,525
Priority Area 4				6,630	13,260	8,840		15,470			28,730	29,752	44,200
Subtotals by Priority	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10			
Priority Area 1	37,264	24,486	0	0	0	0	0	0		0	61,750	66,898	61,750
Priority Area 2	19,035	23,265	0	0	0	0	0	0		0	42,300	42,385	42,300
Priority Area 3	0	0	14,198	24,769	22,395	20,081	0	14,558		0	81,443	82,927	96,000
Priority Area 4	0	3,825	28,535	28,078	32,870	28,450	0	33,243		0	121,758	130,015	155,000
TOTALS	56,299	51,576	42,733	52,846	55,265	48,531	0	47,800		0	307,250	322,224	355,050

Notes: 1) Year 1 begins upon issuance of the DEC Public Water Supply Permit
2) The basin time frames conform to the "Proposed Schedule of Acquisition Planning and Implementation by Basin" distributed June, 1995.
3) All figures are in acres. Acreage estimates are based on NYS E&A data, 1990, using theissen polygons for West-of-Hudson Reservoirs. East-of-Hudson
figures are estimated based on program experience.

Table 4.2. Purchase contracts executed between 1/1/02 and 12/31/02, Catskill / Delaware Systems.

Reservoir Basin	Priority Area	# of Parcels	Acres	Appraised Value
Ashokan	1A	1	39.95	$215,011
Ashokan	1B	1	10.00	$110,000
Ashokan	2	9	516.31	$887,787
Cannonsville	1B	1	5.13	$10,260
Cannonsville	3	6	431.08	$394,652
Cannonsville	4	5	386.89	$289,450
Kensico	1B	1	11.64	$1,360,000
Neversink	4	2	887.83	$511,746
Pepacton	1A	1	6.00	$20,500
Pepacton	3	7	457.74	$415,478
Pepacton	4	12	885.95	$1,145,534
Rondout	1A	3	582.50	$776,816
Rondout	1B	4	20.14	$69,815
Schoharie	3	16	841.14	$1,140,868
Schoharie	4	4	345.75	$532,850
West Branch	1A	8	31.62	$1,010,169
West Branch	1B	8	459.33	$1,602,424
Program Totals:		89	5,919.00	$10,493,360

Despite the Program's continued success, the real estate market has risen significantly, and with higher property values has come increased competition with respect to time-to-close and other contract terms. The City is meeting this challenge by improving and revising program documents, policies, and staffing to be as competitive as possible while still adhering to the requirements of the MOA, FAD, WSP, and City code.

Conservation Easement Program

To date, five easements totaling 754 acres have been acquired and an additional 25 totaling 3,245 acres are under contract. This is a significant jump from two years ago, at which point there were a total of four easements signed. This improvement is in part a result of changes to the model easement document.

Whole Farm Easement Program

The Watershed Agricultural Council (WAC) now holds Farm Easements (FE) on six farms totaling 2,243 acres, and has executed contracts for another 1,128 acres. Purchase offers have just been made for FEs on four more farms totaling approximately 1,000 acres of farmland and associated forestland, and the Program recently received applications from another 30 farm owners interested in enrolling their land.

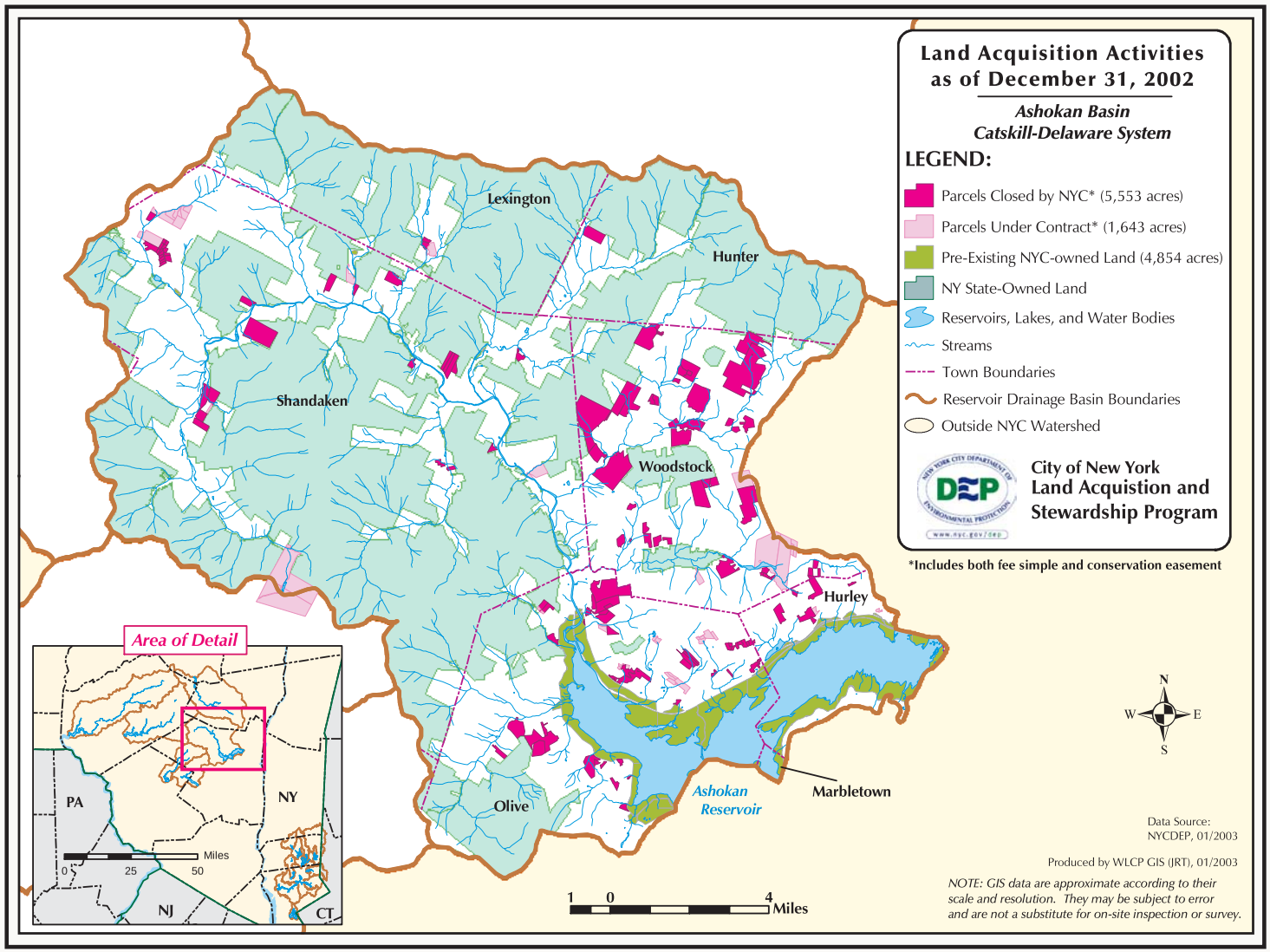

Figure 4.1. Land acquisition activities in the Ashokan Basin as of December 31, 2002.

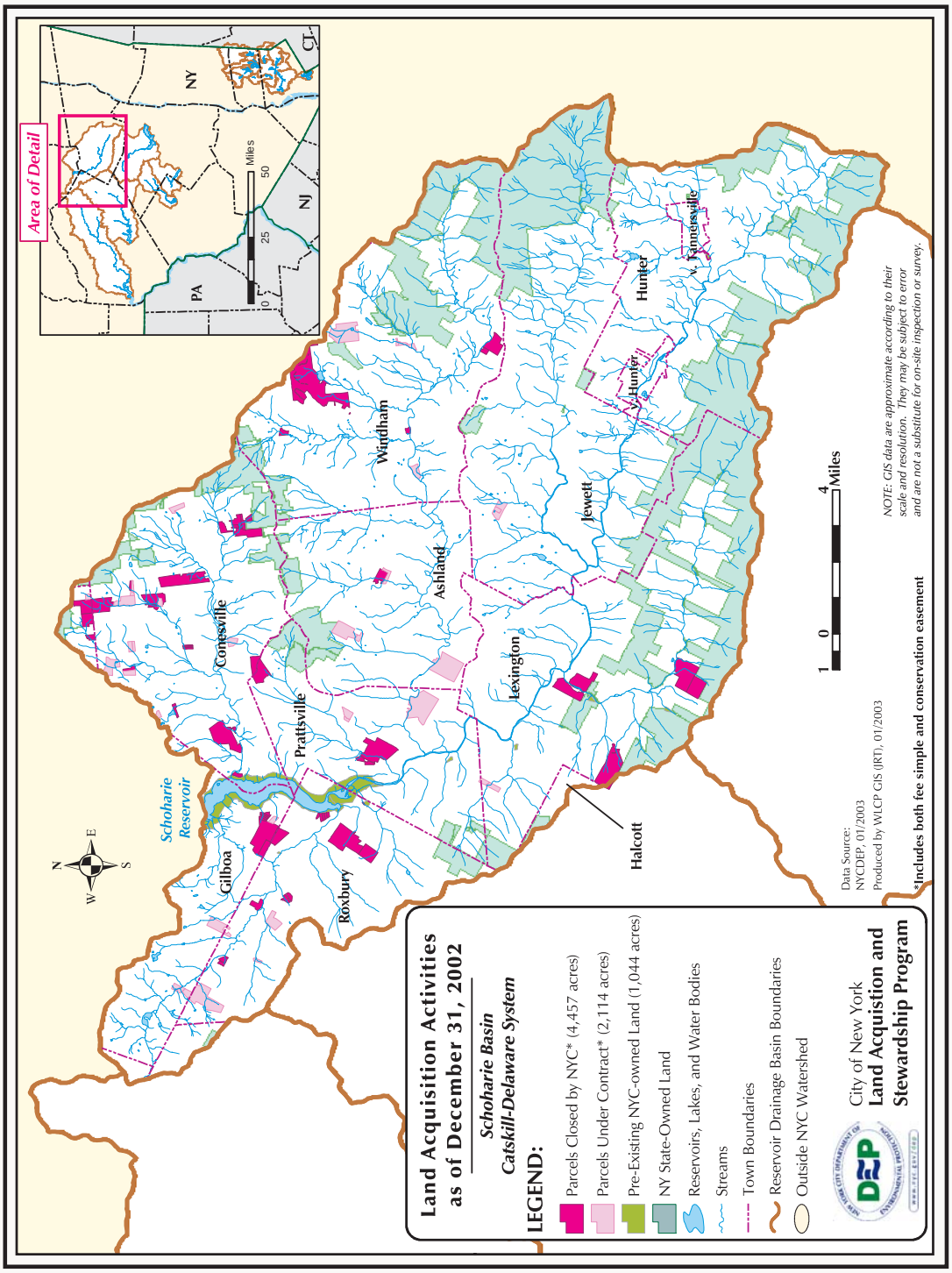

Figure 4.2. Land acquisition activities in the Schoharie Basin as of December 31, 2002.

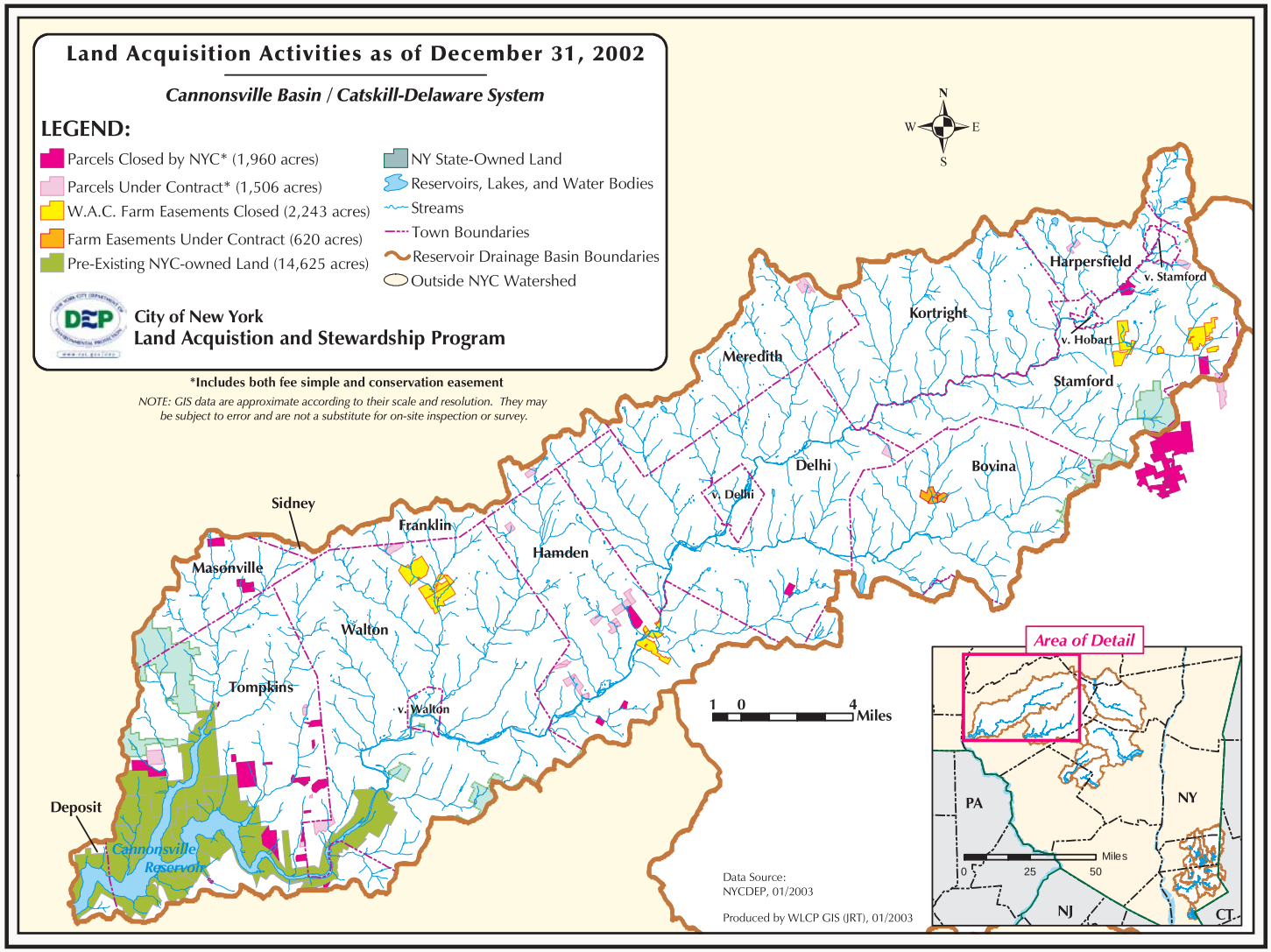

Figure 4.3. Land acquisition activities in the Cannonsville Basin as of December 31, 2002.

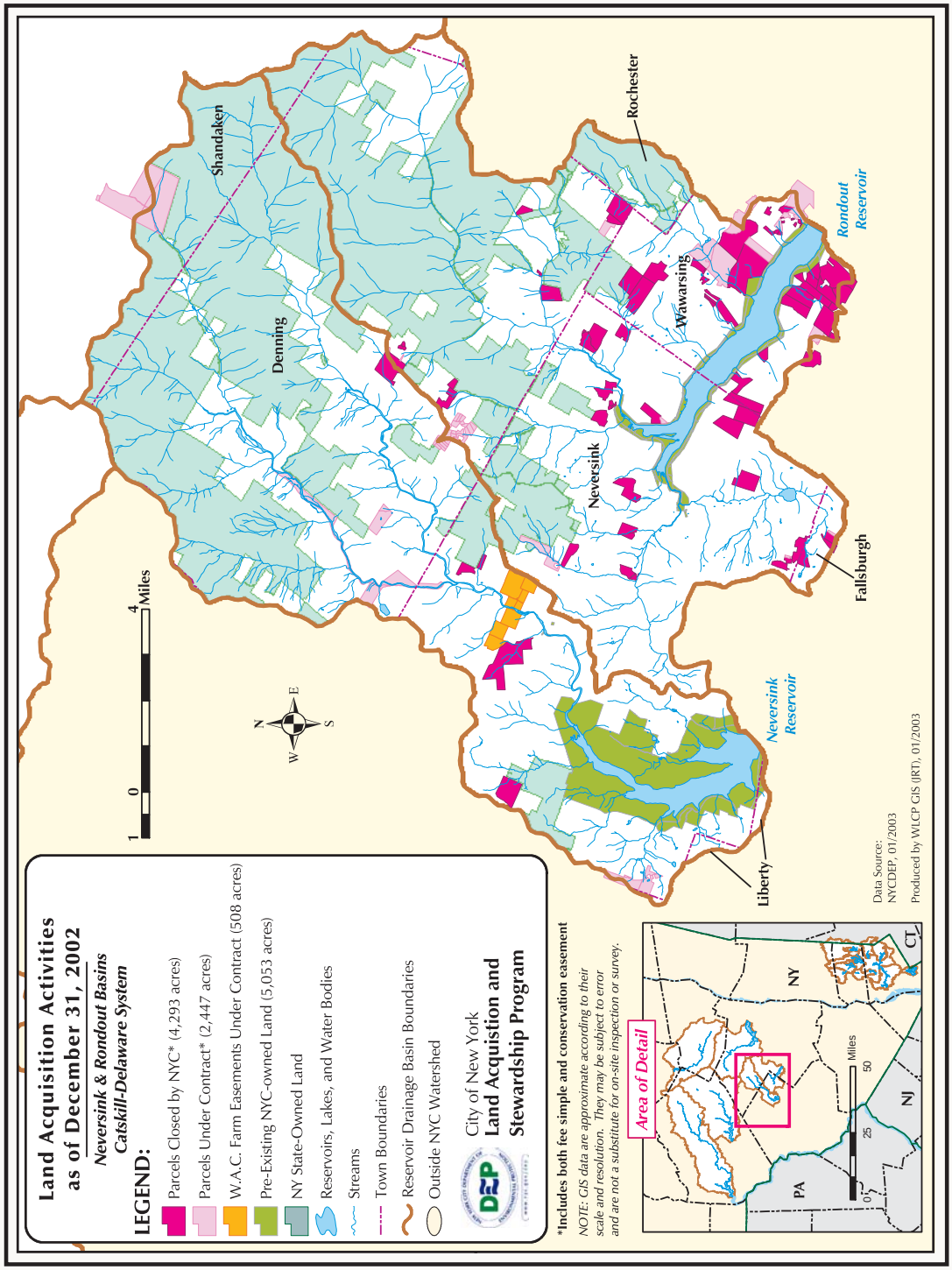

Figure 4.4. Land acquisition activities in the Neversink and Rondout Basins as of December 31, 2002.

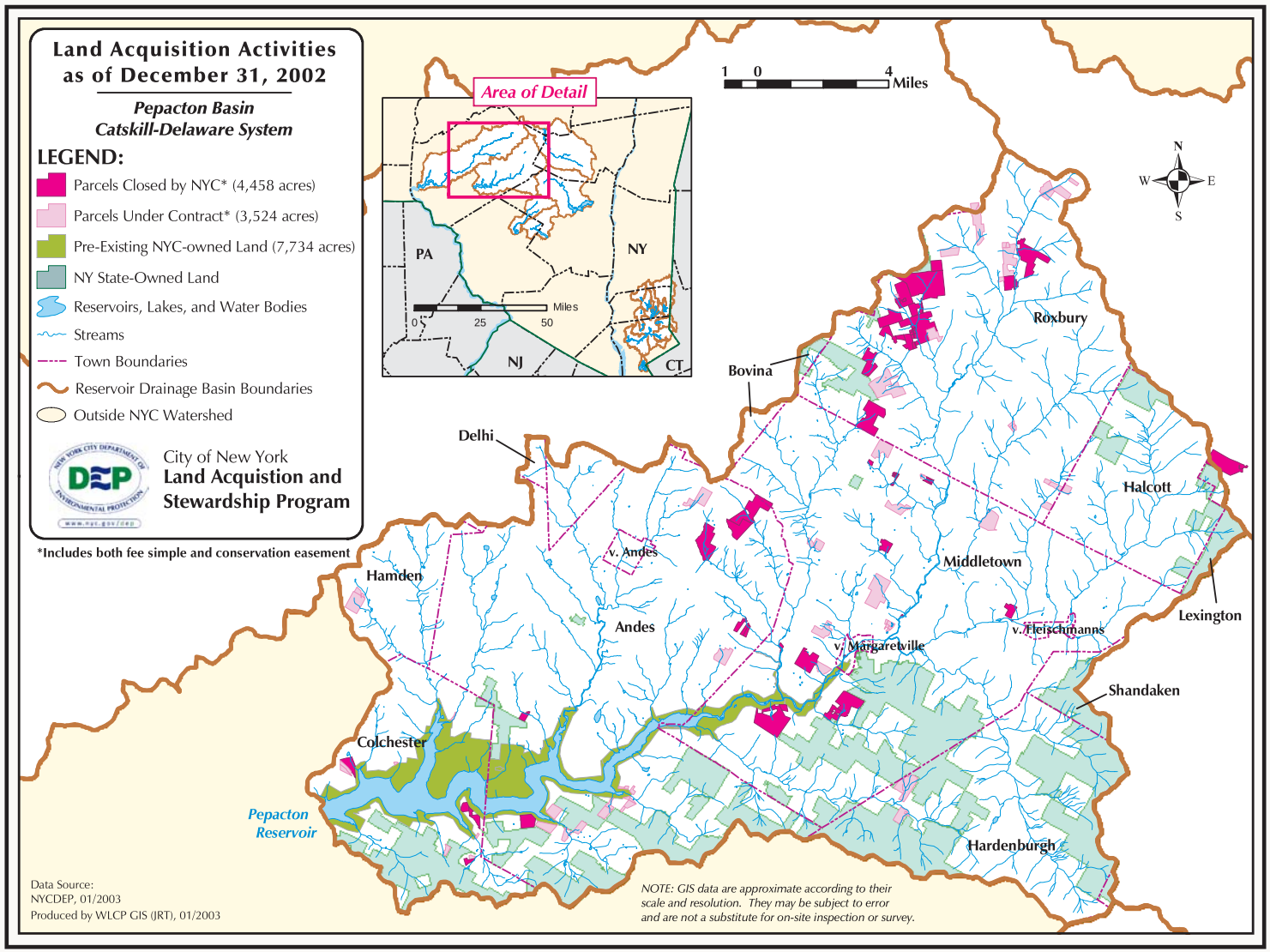

Figure 4.5. Land acquisition activities in the Pepacton Basin as of December 31, 2002.

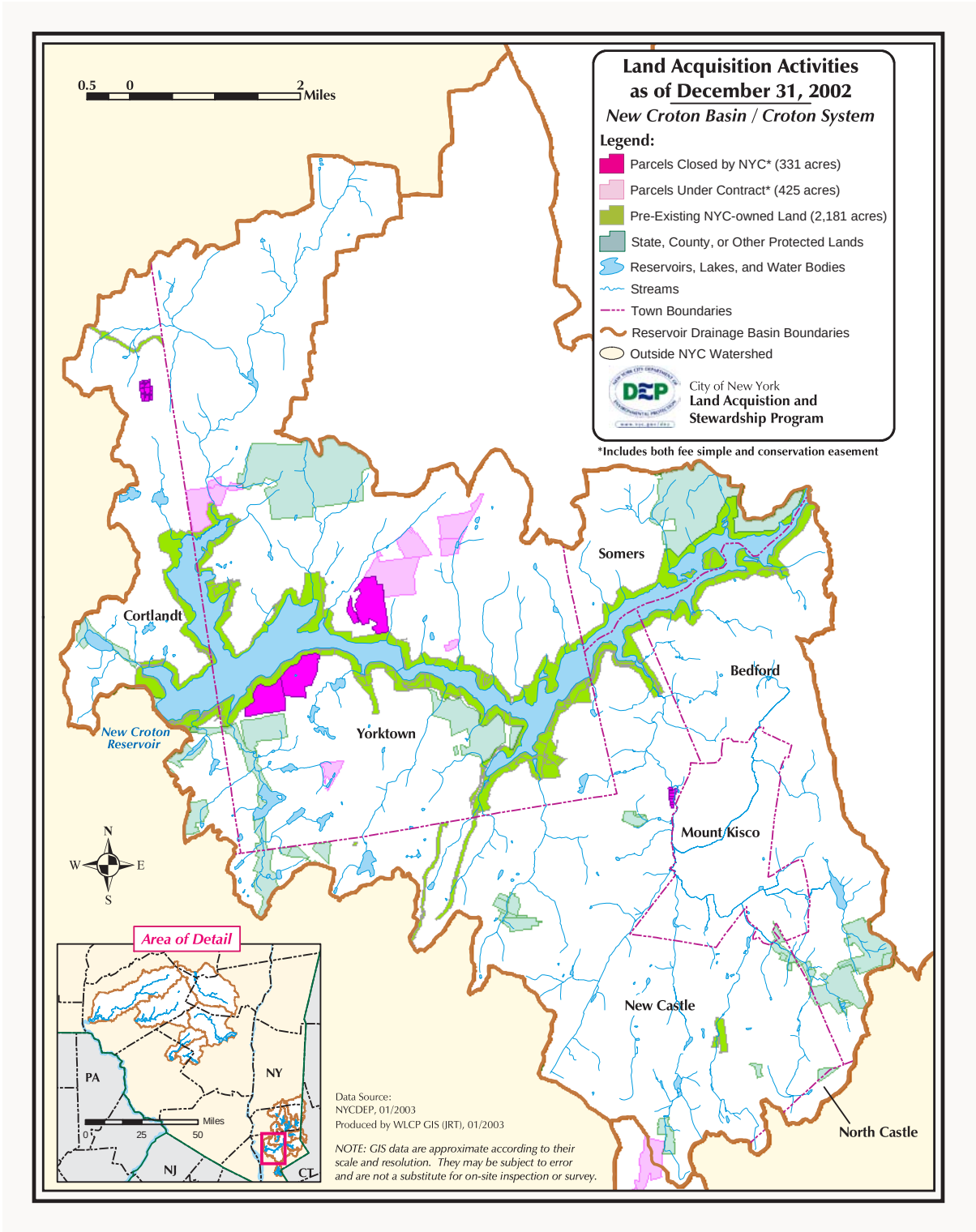

Figure 4.6. Land acquisition activities in the New Croton Basin as of December 31, 2002.

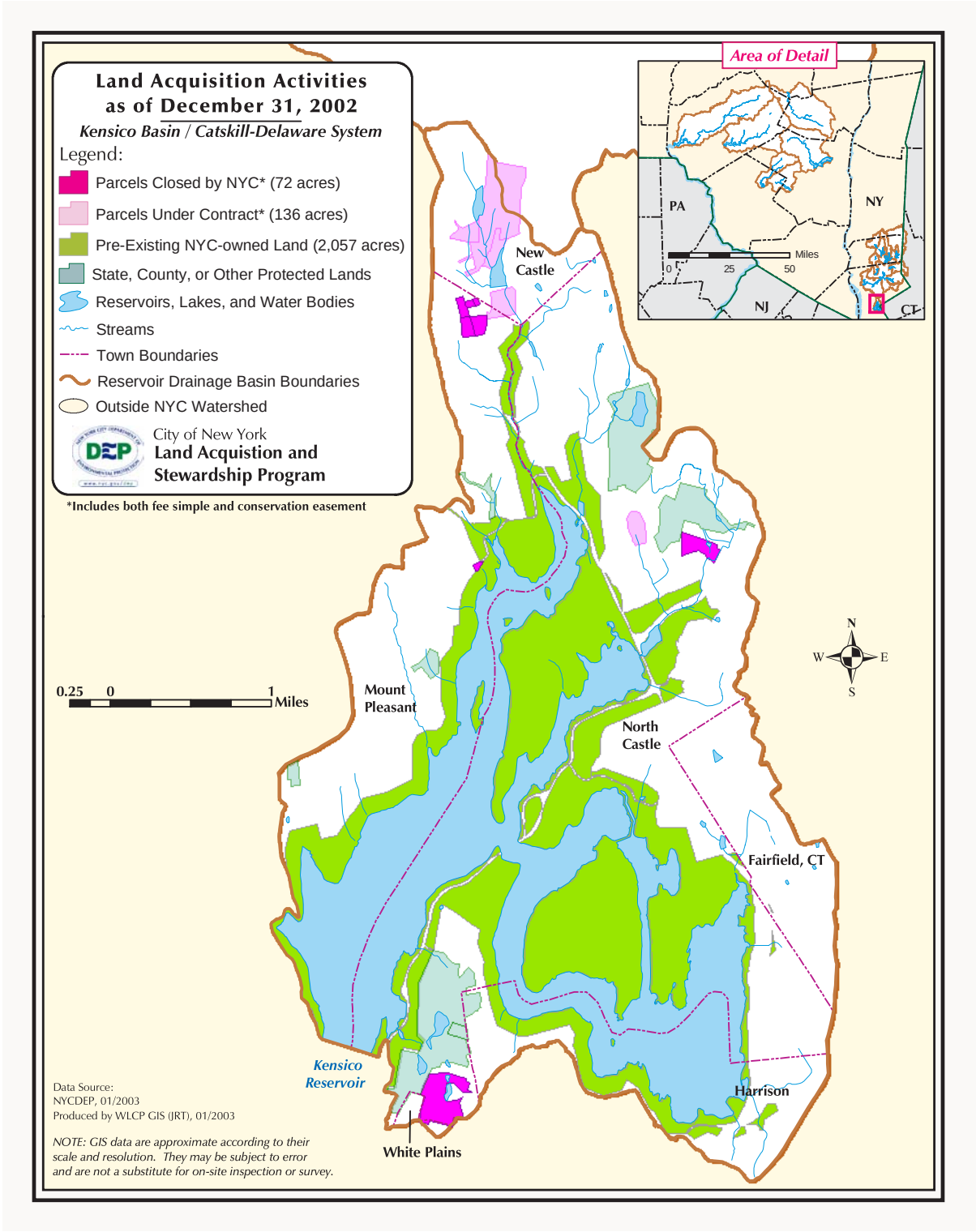

Figure 4.7. Land acquisition activities in the Kensico Basin as of December 31, 2002.

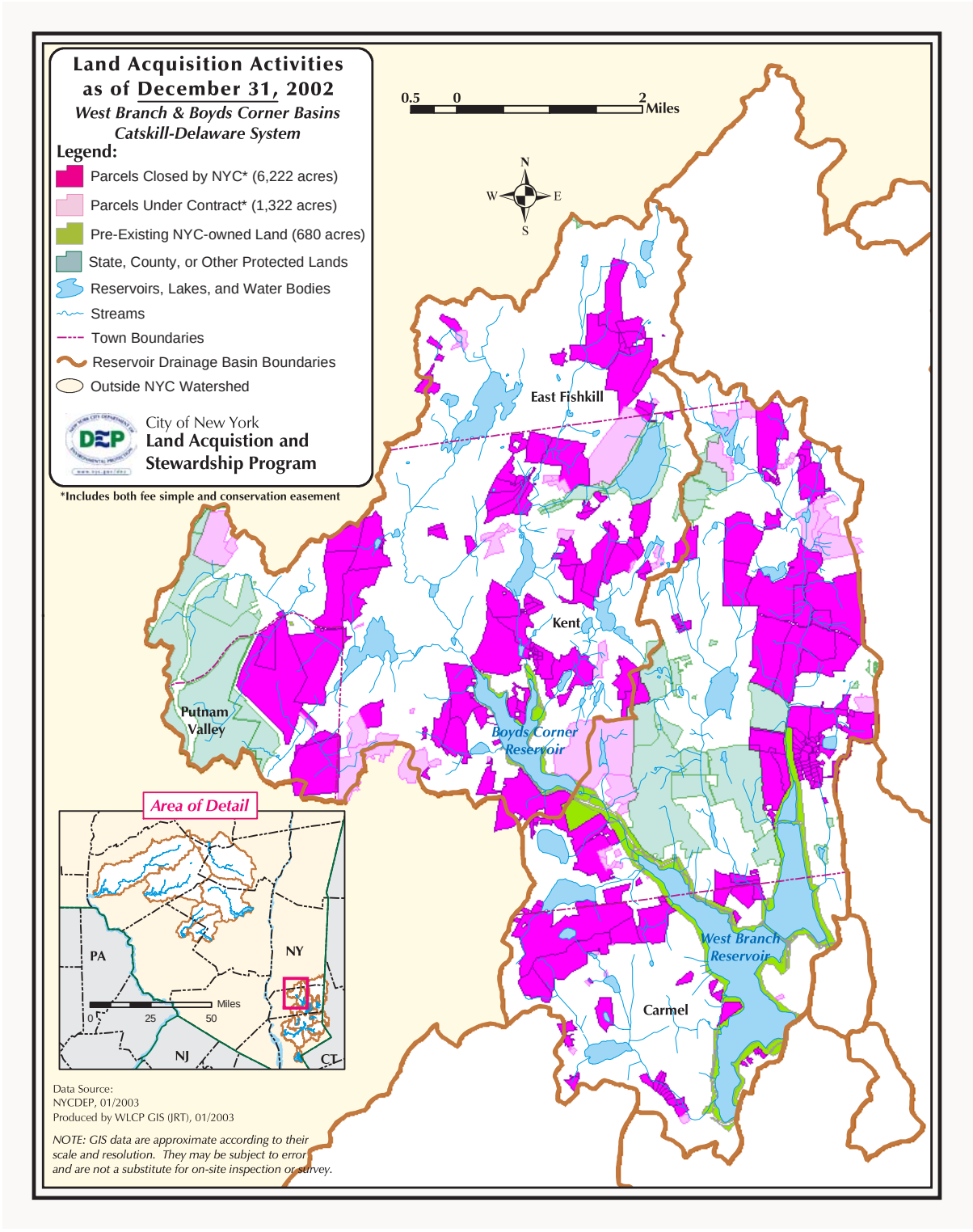

Figure 4.8. Land acquisition activities in the West Branch and Boyd Corners Basins as of December 31, 2002.

4.3 Watershed Agricultural Program

The Watershed Agricultural Program is a comprehensive effort to develop and implement pollution prevention plans on 85% of the commercial farms in the City's Catskill and Delaware watersheds. The program is a voluntary partnership between the City and farmers in the watershed to manage nonpoint sources of agricultural pollution, with particular emphasis on waterborne pathogens, nutrients and sediment. In addition, the program incorporates the economic and business concerns of each farm into the development of its Whole Farm Plan (WFP) in order to fully integrate the principles and goals of pollution prevention into the farm operation.

The Watershed Agricultural Program (WAP) strives to maintain and protect the existing high quality of the New York City water supply system from agricultural nonpoint source pollution through the planning and implementation of Best Management Practices (BMPs) on farms. When possible, the Program uses traditional BMPs that are proven to protect and enhance source water quality, and, if necessary, to evaluate and employ innovative BMPs to increase the number of alternatives available to farmers to address "non-traditional" agricultural water pollution concerns, especially waterborne pathogens.

Fully funded by the City, the Program is administered by the not-for-profit Watershed Agricultural Council, whose board consists of farmers, agri-business representatives and the DEP Commissioner. Over time, the City and WAC have been able to leverage generous financial support from other sources to enhance the Program, particularly the US Department of Agriculture, EPA, and Army Corps of Engineers. Local, State, and Federal agricultural assistance agencies provide planning, technical, educational, engineering, scientific and administrative support for the program under sub-contractual agreements with the Council.

4.3.1 FAD Program Goals

The chart below summarizes the accomplishments to date of the Watershed Agricultural Program in meeting the goals and milestones of the November 2002 FAD. (See attached WAP activity maps, Figure 4.9 and 4.10, to see the extent of the programs accomplishments including: farms signed-up, WFPs approved, commenced plan implementation, farms substantially implemented and plans that had follow-up visits in 2002).

Table 4.3. Watershed Agricultural Program accomplishments.

Task	Farms	Sub-Farms	Total Farms	FAD Goal 12/ 31/02
Farm Sign-ups	285	41	326	Monitor
WFP Implementation Agreements	240	42	282	297
WFPs Commenced Implementation				
Active	195	40	236	
Under Revision	1	1	2	
Inactive	14		13	
Total	210	41	251	250
WFPs Substantially Implemented				
Active	95	7	102	
Under Revision	1	1	2	
Inactive	20		20	
Total	116	8	124	143
WFP Annual Follow-up	119		119	105

As reported in previously, WAP was unable to meet the following two milestones this year.

Whole Farm Plan Implementation Agreements

: The goal was to have signed agreements for 297 farms or all participating farms. However, a number of farms that had signed up are no longer in business or now earn less than $10,000 per year. There were five farms that signed up and are eligible to participate in the program that due to various reasons a WFP agreement was not finalized. On two of those farms the Whole Farm Planning process was completed, but the team was not able to finalize an agreement. The remaining farms were not planned due to either family health issues or the farm failed to respond to meeting requests from the planners. There were, however, nine new whole farm plans developed this year. The planning teams intend to continue working to develop WFPs for all farms that have signed-up, as well as any new eligible farming operations in 2003.

Whole Farm Plans Substantially Implemented

Even though WAP staff had a year of significant BMP implementation they were unable to reach this milestone. This is partly because the implementation staff was focused to a higher degree than normal on implementing riparian buffer BMPs associated with the Conservation Reserve Enhancement Program (CREP). In Federal fiscal year 2002, WAP staff implemented almost $1.5 million of CREP practices, which included 232,445 feet of fencing, 48 alternative watering systems, 15 stream crossings and 309 acres of tree and shrub plantings. It was important for the program staff to give priority to CREP practices, because CREP was scheduled to end on December 31, 2002, and some of the farmers could have lost some of the financial incentives offered by USDA. Fortunately, as a result of the new Farm Bill, the CREP agreement

between the City, NYS Ag. and Markets and USDA has been extended through 2007. This agreement for five more years will reduce the pressure to implement CREP practices immediately and will allow WAP staff to give the WFPs substantially implemented milestone a higher priority in 2003.

In addition, there are approximately 20 farms that would be considered substantially implemented, if the few remaining practices were re-scheduled for implementation in 2003 or 2004. This rescheduling would require that some higher priority BMPs on other farms be postponed until future years. WAP staff has been reluctant to make these scheduling changes.

4.3.2 Whole Farm Planning (WFP)

WAP has approved WFP agreements on 240 (92.6%) of the 259 commercial farms in the watershed. In addition, there are 42 farms that are considered "multiples" or "sub-farms". Sub-farms are the farms that are part of a larger farming operation that due to its size, number of livestock and/or multiple farmsteads requires significantly more staff hours to develop and implement a WFP.

There are only seven farms remaining that have signed up for the program, that still do not have a signed agreement. WAP planning staff will continue developing plans for the few remaining farms, but more of their time can be devoted to helping with BMP implementation and plan follow-up.

In 2003, WAC plans to contact the 12 commercial farms that have still not signed up for the program to inform them of the benefits of participating in the program and encourage them to become a WAP participant.

4.3.3 BMP Implementation

Over the past ten years (1992-2002) WAP has implemented 2,271 BMPs at a cost of $15.8 million on over 210 commercial farms. This past year alone 492 BMPs were implemented at a cost of $2.85 million. The majority of the design and implementation oversight of BMPs is accomplished with WAP staff. However, during this past year, WAC has developed a pre-qualified list of private engineering firms that can be called upon to design and oversee construction of BMPs. This has been very helpful to get more projects implemented with the existing staff.

4.3.4 Conservation Reserve Enhancement Program (CREP)

In the fall of 2002, NYC, NYS Ag & Markets and USDA signed an addendum to the CREP agreement that extends the program through the end of 2007. Prior to the extension program staff were under a great deal of pressure to develop and implement CREP plans before the program and incentives expired. This 5-year extension will allow program staff to continue working with farmers to encourage them to participate in this very successful program.

There are now under contract a total of 1,227.6 acres of riparian forest buffers, which is

equivalent to approximately 341 miles of streams protected by riparian buffers. In addition, there are more than 300 acres of riparian buffers that have been approved by the Council that are in the CREP contract development pipeline. There are a total of 113 contracts of which 79 are complete and have all the associated BMPs implemented. The location of these contracts can be seen on the attached CREP activities map (Figure 4.11).

4.3.5 Farmer Education Program

WAC has made great strides this past year in developing a farmer education program that will provide small classroom settings for farmers to learn about the connection between their whole farm plan and protecting water quality. For example, nutrient management staff has presented six two-day workshops throughout the watershed to help dairy and livestock farmers understand nutrient management issues in the watershed and the factors that control nutrient movement in the landscape. As farmers gain a better understanding of why they are being asked to adopt new manure spreading schedules, which can require more labor and equipment wear, it is anticipated that they will be more willing to make the changes in their operation. Additional workshops are planned for 2003.

WAC is also planning to take advantage of the research being conducted by Delaware County Cornell Cooperative Extension staff on Precision Feeding and Forage Management by contracting with Delaware County Office of Watershed Affairs to administer a project for curriculum development for Precision Forage and Feeding Systems Management. Animal Science experts from Cornell University and Delaware County Cornell Cooperative Extension will develop the curriculum, which will be presented to area farmers in two segments (Levels I and II). This February and March a pilot version of the Level I course will be offered to farmers at four locations throughout the watershed. A final version of the curriculum will be submitted to WAC in October. The farmer participant learning objectives for these workshops are:

- Learn about the importance of lowering phosphorus feeding rates and how this can be accomplished. Learn about the National Research Council's cattle feeding recommendations.
- Strategies to reduce nitrogen and phosphorus imports.
- How to reduce purchased grain supplementation and feed costs.
- How to improve the mass nutrient balance on the farm.
- Learn how to develop and implement a plan to improve forage quality and reduce soil erosion.
- Understand how to evaluate their forage and feeding systems and make modifications.
- Develop a tactical plan to enhance the farms forage system.

The third component of the farmer education program is encouraging more farmers to participate in the New York State Cattle Health Assurance Program (NYSCHAPS). This fall introductory meetings were held to encourage farmers to participate in NYSCHAPS, which is a State sponsored program that brings a farmer and his veterinarian together with State veterinarians to develop a herd health plan that is specific to the individual farm. 15 farmers have agreed

to participate and WAP staff will continue to encourage more farmers to sign on.

4.3.6 Small Farm Program

As of December 2002, WAC has approved 15 Small Farm Whole Farm Plans. Ten of these farms have commenced BMP implementation. The Small Farm Team (SFT) also developed designs and supervised the implementation of 70 BMPs at a cost of $313,087.

The Small Farm Advisory Committee completed an evaluation of the Small Farm Pilot Program based upon the following criteria: Farmer acceptance, technical review of implemented BMPs, adequacy of the cost guideline, role of the Conservation Reserve Enhancement Program and the ability of the program to meet its goals. The Committee findings were positive. The majority of the pilot farmers were very satisfied with the program. In particular, most farmers liked the fact BMPs were implemented relatively quickly after the plan was completed. A technical review of three pilot farms found that there was a good balance achieved in designing practices to be low cost and common sense but also effective in protecting water quality.

In 2003, the SFT has a goal to develop 10 more plans on priority farms and continue to keep the current rate of implementation of BMPs.

4.3.7 Croton Agricultural Program

Croton Agricultural Program has had a great first year of operation as can be seen by its following significant achievements in 2002:

- Four of the ten farms selected for Whole Farm Plan implementation are farms located in reservoir sub-basins that operate as part of the City's Catskill/Delaware water supply system (Boyd Corners and West Branch).
- Implemented a manure storage system on a farm adjacent to the East Branch of the Croton River.
- Completed eight structural designs on four farms, which will be implemented in 2003.
- Conducted multiple outreach events aimed at watershed landowners, citizen volunteer boards, municipal officials and agency staff.
- Developing a series of new Agricultural Environmental Management worksheets for equine operations to be used in assessing potential water quality risks specific to the large number of equine operations located in the Croton watershed.

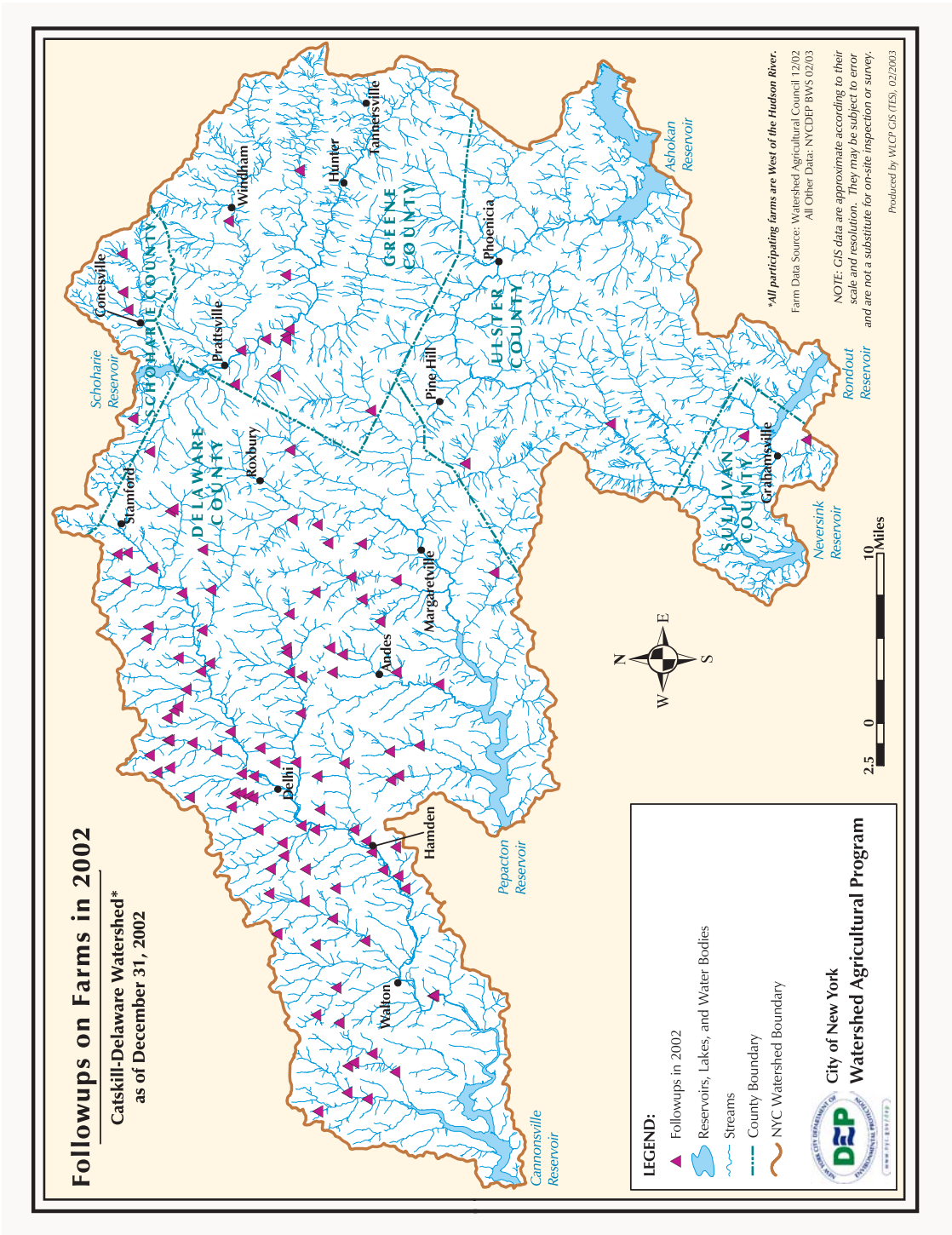

Figure 4.9. Follow ups on farms in the Catskill/Delaware Watershed as of December 31, 2002.

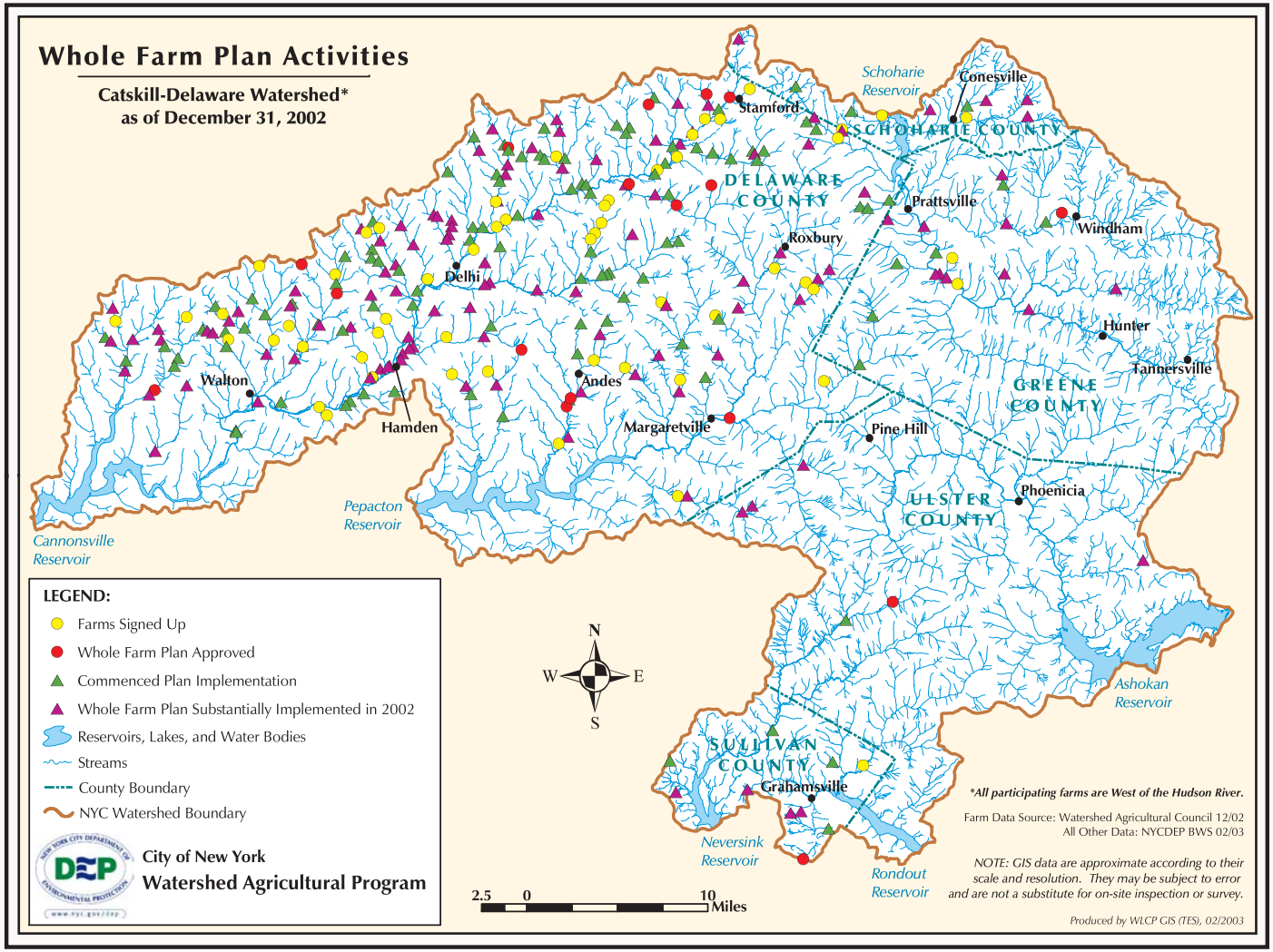

Figure 4.10. Whole Farm Plan activities in the Catskill/Delaware Watershed as of December 31, 2002.

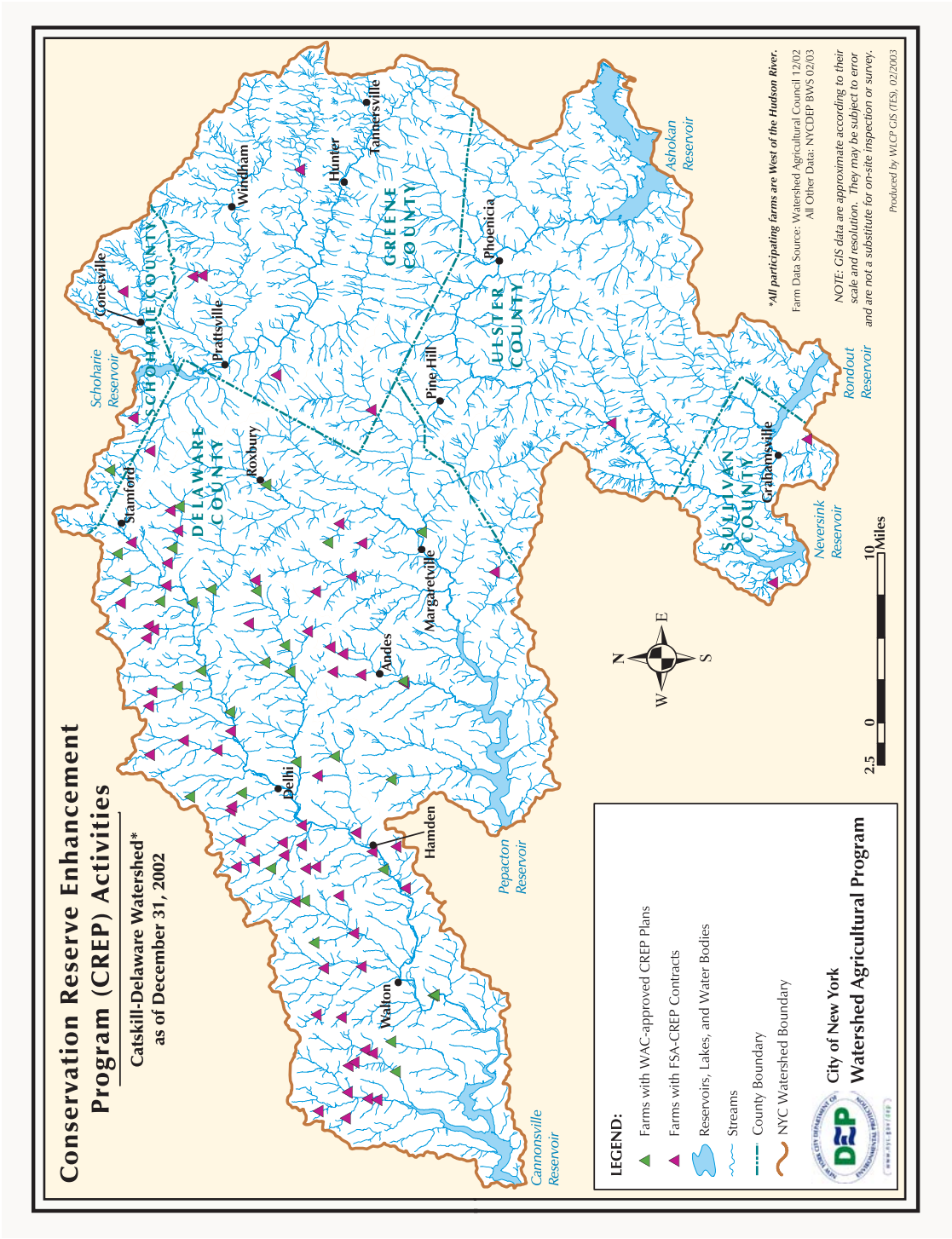

Figure 4.11. Conservation Reserve Enhancement Program (CREP) activities in the Catskill/Delaware Watershed as of December 31, 2002.

4.4 Watershed Forestry Program

4.4.1 Program Summary

The Watershed Forestry Program is a voluntary pollution prevention partnership between New York City and the upstate forestry community that supports and maintains well-managed forests as a beneficial land use for watershed protection. The Forestry Program began as a grass-roots effort during the mid-1990s and was formally established in September 1997, as part of DEP's Nonpoint Source Pollution Control Strategy in accordance with the 1997 Filtration Avoidance Determination (FAD). The Forestry Program is currently a component of DEP's 2001 Long-Term Watershed Protection Program (Section 6.4.4) pursuant to the 2002 FAD.

DEP implements the Forestry Program by contracting with the locally based Watershed Agricultural Council (WAC) to administer four core program tasks:

1. forest management planning,
2. best management practice (BMP) implementation,
3. logger training, and
4. research, demonstration and education.

In addition to the above tasks, the Forestry Program also supports various economic initiatives aimed at strengthening the viability of the watershed forest industry and improving the financial incentives for owning private forest land. Although some City funds are used for certain economic projects (such as taxation policy research), the majority of WAC's forestry economic development programs is funded through the USDA Forest Service.

The City's total funding commitment to the Forestry Program exceeds $3 million for the period September 1997 through September 2003, while the USDA Forest Service has allocated nearly $4.5 million in matching grants to date. DEP is currently negotiating a new contract with WAC to continue funding the Forestry Program through the duration of the 2002 FAD.

4.4.2 2002 Highlights and Accomplishments

This report summarizes the activities and accomplishments of the Watershed Forestry Program during the period January 1 through December 31, 2002. In many ways, this past year was a transitional one for the five-year old Forestry Program, which continued implementing core program tasks while expanding certain efforts to the City's East of Hudson Croton watershed. In January, after two years of unsatisfactory performance, the WAC Forestry Program Manager announced his pending resignation in May. This unfortunate staffing situation caused some disruption in the Forestry Program as WAC and DEP both worked to complete projects left unfinished by the outgoing Program Manager. In June, WAC sponsored the annual Watershed Forestry Task Force dinner for approximately 80 members who were updated about the Forestry Program's accomplishments and solicited for their guidance and feedback. In July, WAC hired a new Forestry Program Manager who quickly established himself as a capable and professional administrator with a solid understanding of New York City watershed issues and the importance of agency partnerships to a voluntary forestry program.

East of Hudson Forestry Program.

During 2002, the Forestry Program began to expand to the City's East of Hudson watershed, where forests cover 60-70% of the total land area. WAC held several planning meetings with local stakeholders to discuss East of Hudson forestry issues and begin developing an outreach strategy for private landowners. These meetings indicated major socioeconomic and land ownership differences between East of Hudson residents and forest landowners in the Catskill/ Delaware watersheds. In 2003, WAC will begin implementing an East of Hudson outreach strategy for educating private landowners and encouraging their participation in the Watershed Forestry Program.

United Nations Croton Forestry Tour

. A major highlight for the Forestry Program this past year involved a United Nations forestry tour of the Croton watershed. In March, at the request of the USDA Forest Service and Society of American Foresters, WAC and DEP hosted a full-day Croton watershed forestry tour for approximately 60 international delegates attending the United Nations Forum on Forests in New York City. The delegates were provided with informational materials, a guided tour of Lasdon Park and Arboretum in Westchester County, and a private property site visit where they learned about conservation easements and forestry BMPs while touring a timber harvest road project.

Figures 4.12 and 4.13 display some of the achievements of the Forestry Program.

4.4.3 Forest Management Planning

The Forestry Program provides cost-sharing to private landowners for developing 10-year forest management plans written by qualified professional foresters trained by WAC. A total of 37 trained foresters are currently approved by WAC to write watershed forestry plans. In 2002, 98 applications were approved and 77 new plans were completed. A total of 261 plans have been completed to date. Three of these plans are updates of non-WAC forestry plans that were upgraded to meet WAC's watershed protection standards. An additional 80 landowners are currently approved for funding and pending completion of a management plan.

Table 4.4. Forest Management Planning accomplishments.

Accomplishments - Forest Management Planning	2002	To Date
Number of landowner applications approved	98	375
Number of forest management plans completed	77	261
Number of riparian plans completed (included above)	6	12
Riparian acres under a completed management plan	1,435	1,495
Forested acres under a completed management plan	13,657	42,185
Total acres under a completed management plan	16,464	52,893

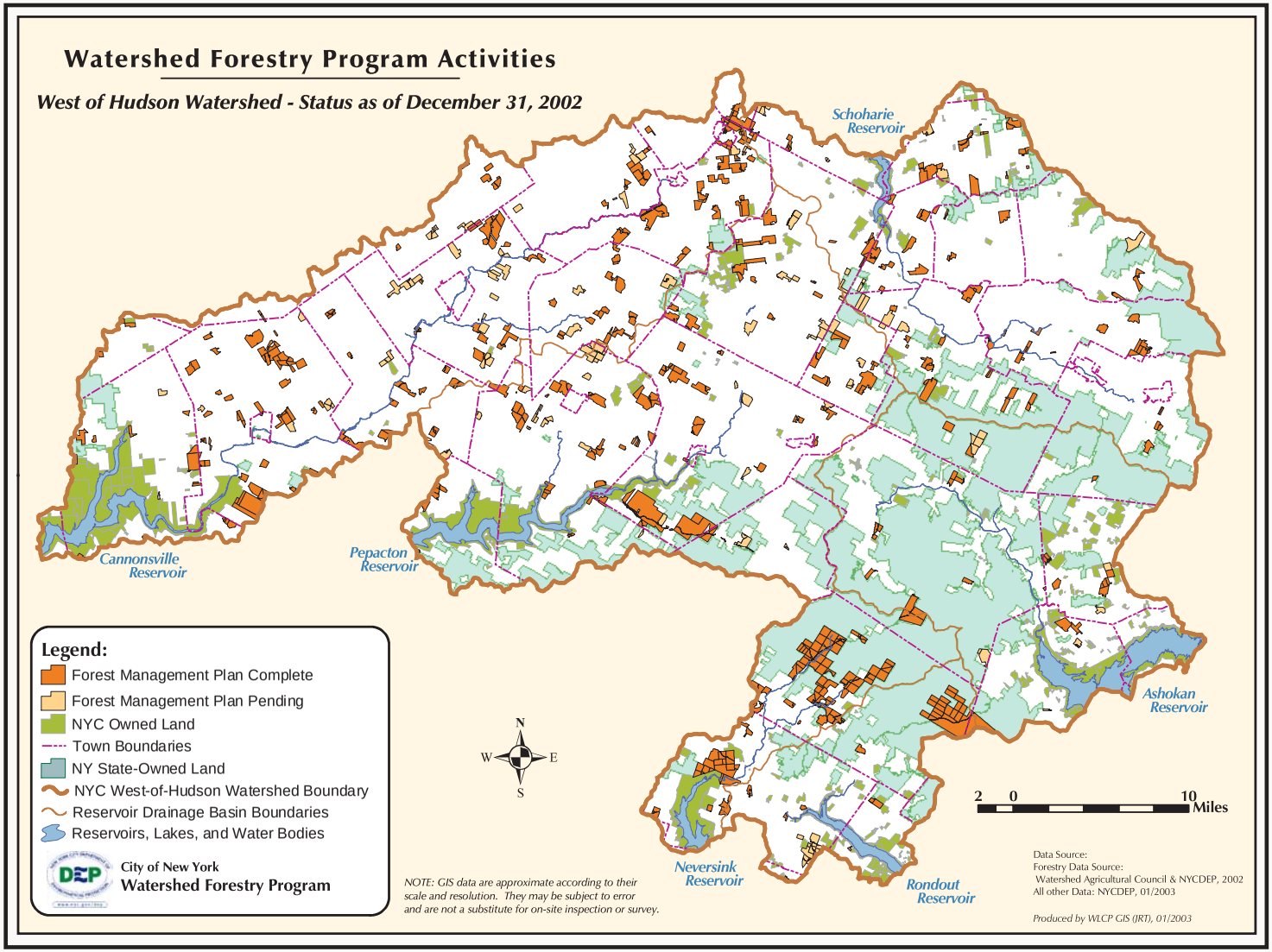

Figure 4.12. Watershed Forestry Program activities, West of Hudson Watershed, status as of December 31, 2002.

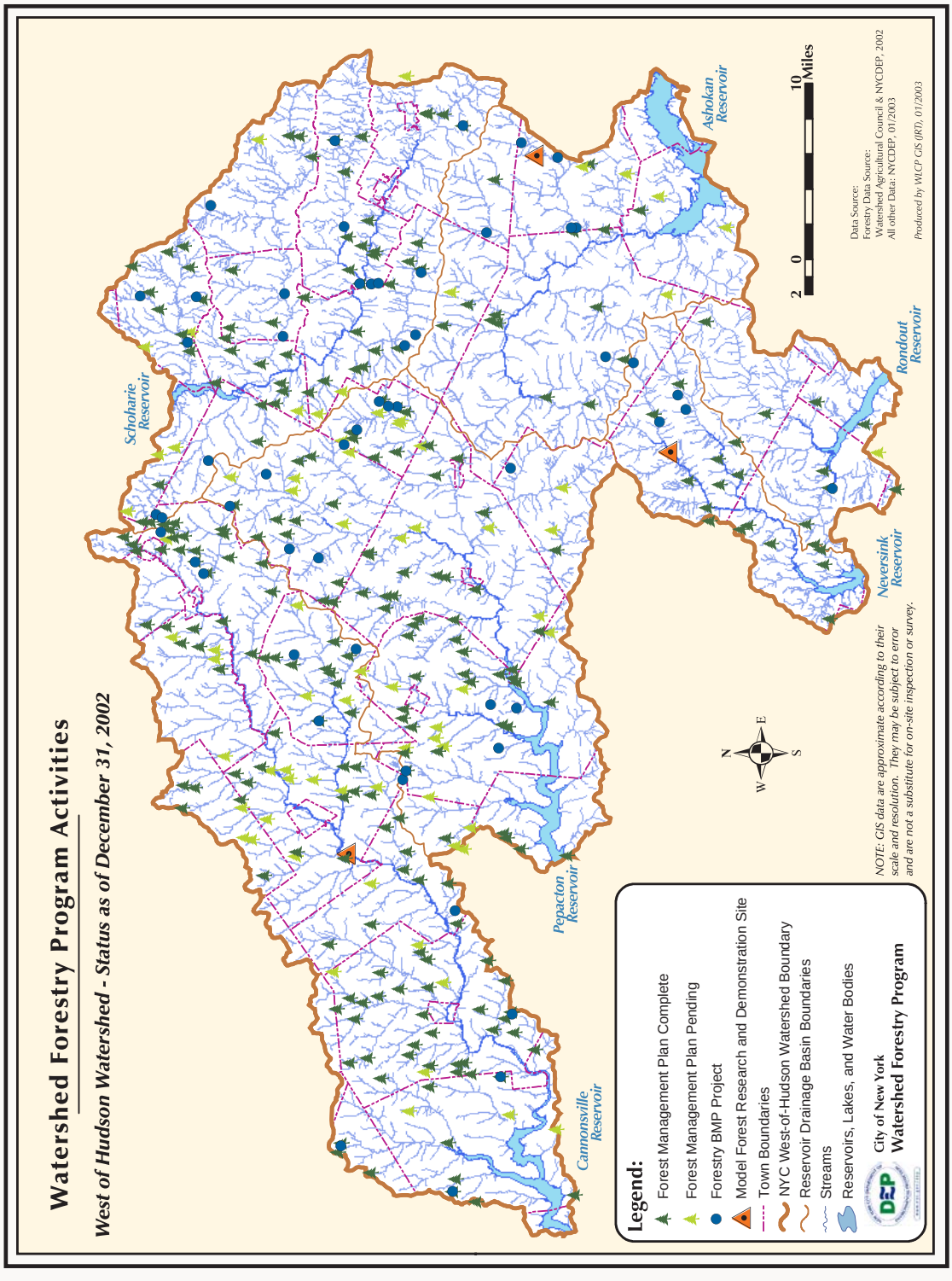

Figure 4.13. Watershed Forestry Program activities, West of Hudson Watershed, status as of December 31, 2002.

Riparian planning

In 2001, the Forestry Program developed a pilot cost-sharing program to encourage foresters writing plans to delineate specific riparian areas with enhanced forest management recommendations. Since then, WAC has worked closely with the USDA Forest Service, DEC and DEP to continue revising and upgrading the watershed forestry plan specifications to improve their focus on water quality and riparian management recommendations. During 2002, the Forestry Program expanded its pilot riparian program by offering two new riparian training workshops and a third sediment control training workshop for interested professional foresters. Eleven foresters are now trained and qualified to develop riparian management recommendations for WAC forestry plans. Twelve approved plans have been completed to date as part of the riparian planning program, and these 12 plans represent 1,495 acres of riparian areas to be managed specifically for water quality and streamside protection. An additional nine plans representing 118 riparian acres are not included in the riparian planning program because they were not developed by qualified foresters who attended a prerequisite riparian training workshop sponsored by WAC.

4.4.4 Best Management Practice (BMP) Implementation

The Forestry Program offers cost sharing, technical assistance and other incentives to watershed loggers and landowners for implementing forestry BMPs, with a particular focus on promoting the use of portable bridges and new erosion control technology. WAC has available more than 100 individual BMP samples representing seven different varieties of erosion control technology (geotextile fabric, silt fencing, traditional pipe culverts, open-topped culverts, organic bar and chain oil, rubber tire land mats, and rubber dam water deflectors), of which 20 free samples have been distributed to loggers as promotional incentives to date.

Portable bridges

WAC owns four short-span skidder bridges and one long-span haul bridge that are available for temporary loan to interested loggers. These bridges have been borrowed and installed at 17 watershed logging sites to date, including permanent installation of a short-span bridge at the Frost Valley Model Forest during 2002. In addition to offering loaner bridges, the Forestry Program has cost-shared the construction of 14 short-span skidder bridges and the rental of one long-span haul bridges to date.

Table 4.5. Portable bridges used at watershed forestry sites.

Accomplishments – Portable Bridges	2002	To Date
Number of portable bridges constructed or rented by watershed loggers and cost-shared by WAC	3	15
Number of watershed logging sites where a portable bridge owned by WAC was loaned and installed	3	17

Road BMP Projects

The Forestry Program cost-shares both the proper installation of new timber harvest roads as well as the remediation of existing forest roads having documented erosion or sedimentation problems. This latter program was initiated on a pilot basis during 2001 and approved for expansion in 2002 following an evaluation of the pilot projects. During 2002, 22 road projects were approved for funding and 14 projects were completed. Ten additional projects are currently underway and scheduled for completion in 2003. A total of 45 road BMP projects have been completed to date. These 45 projects represent 76.5 miles of properly designed access roads containing 1,958 water bars, 163 broad-based dips, 68 traditional pipe culverts, and more than 3,500 linear feet of geotextile road fabric and silt fencing.

Table 4.6. Forestry Program road BMP projects.

Accomplishments – Road BMP Projects	2002	To Date
Number of timber harvest road BMP projects approved	7	26
Number of forest road remediation BMP projects approved	15	29
Total	22	55
Number of timber harvest road BMP projects completed	5	22
Number of forest road remediation BMP projects completed	9	23
Total	14	45

4.4.5 Logger Training

The Forestry Program promotes and encourages voluntary logger participation in the State-wide Trained Logger Certification (TLC) Program administered by New York Logger Training, Inc. (NYLT), as well as other water quality BMP workshops sponsored by WAC or its partner agencies. Since early 1999, the Forestry Program has supported a "watershed qualified" training option whereby loggers who attended at least one Forest Ecology and Silviculture workshop (one of three NYLT workshops required for state-wide certification) or its equivalent BMP training would be eligible to participate in certain WAC cost-sharing programs. This alternate training option resulted in nearly 150 loggers becoming "watershed qualified" over the past few years.

During 2002, the Forestry Program continued to sponsor and support various logger training workshops and events. The Forestry Program participated in both the Deposit and Andes Lumberjacks Festivals (held locally in the watershed), the New York State Woodsmen Field Days, and a Cornell Cooperative Extension "Gentle Logging" satellite teleconference that attracted approximately 40 participants at downlink sites in Delaware and Schoharie counties. The Forestry Program also helped sponsor nearly a dozen individual NYLT workshops, including Game

of Logging (Levels 1-4), First Aid and CPR, and Forest Ecology and Silviculture. As in previous years, the Forestry Program continued offering incentives to loggers for attending these workshops by reimbursing a majority of their workshop fees.

Logger study

In 2002, WAC hired the Empire State Forest Products Association (ESFPA) to compile data on the current number and training levels of all timber harvesters working in the watershed, and to assesses the future need for additional logger training. The ESFPA study revealed 224 active loggers who are independent contractors or have logging crews with multiple employees (this number varies between 200 and 270 depending upon seasonal market conditions), yet only 12% of these loggers are "watershed qualified" and just over 3% have completed full state-wide certification. As a result of these findings, the Forestry Program agreed to merge with the state-wide certification efforts of NYLT and harmonize all logger training activities within the watershed before June 30, 2003. Since there will no longer be a separate "watershed qualified" training option, all watershed loggers will be encouraged to seek full State-wide certification. A complete schedule of NYLT workshops is planned for 2003.

4.4.6 Research, Demonstration and Education

Model Forests

The Forestry Program coordinates and supports four model forests throughout the watershed that integrate forestry and water quality research, BMP and silvicultural demonstrations, public outreach and interpretive education. Since the completion of the first site in 2001, the remaining three sites have existed in various stages of planning and development under the leadership of SUNY College of Environmental Science and Forestry (ESF). When fully completed, each model forest will contain a continuous forest inventory (CFI) plot system based on USDA Forest Health Monitoring protocol, various silvicultural treatment blocks, a demonstration road with BMPs, and numerous outdoor interpretive signs with educational scripts. Three model forests contain water quality monitoring gages to assist DEP, ESF and USGS researchers with measuring the effects of silvicultural treatments and forestry practices on baseline stream flow and water quality. In 2002, the Forestry Program offered a $15,000 USDA Forest Service matching grant to SUNY-ESF to expand the model forest education efforts.

- *Lennox Memorial Forest*. Completed in 2001, this 80-acre site in Delaware County is owned and operated by Cornell Cooperation Extension as part of their 4-H Camp Shankitunk. The Lennox Memorial Forest contains a 2-mile demonstration road highlighting more than a dozen BMPs, 14 silvicultural treatments, 167 permanent CFI plots, more than 20 outdoor interpretive signs, numerous wire fence deer exclosure research units, and an educational kiosk with 8 display panels. During 2002, SUNY-ESF continued monitoring the wire fence exclosures to study the impacts of deer grazing on forest regeneration, while WAC continued to host forestry tours for local and international groups. Also in 2002, the Forestry Program offered a $10,000 USDA Forest Service matching grant to Cornell Cooperative Extension to

help support their model forest education efforts, but this grant was declined.

- *Frost Valley Model Forest*. This 290-acre site is owned and operated by the Frost Valley YMCA in Ulster County. During 2002, construction finally commenced on a 2.6-mile demonstration road, including installation of four (out of six) portable bridges and nearly two dozen erosion control BMPs. Also this past year, SUNY-ESF completed installation of more than 100 CFI plots while conducting a post-harvest inventory of an experimental treatment block where approximately 33% of the basal area was harvested in April. The Frost Valley Model Forest now contains 620 CFI plots distributed over 16 experimental treatment blocks, as well as an experimental research weir installed in 2001, where USGS and SUNY-ESF have continued gathering bi-weekly stream samples. Finally in 2002, the Forestry Program offered a $10,000 USDA Forest Service matching grant to the Frost Valley YMCA to support their model forest education efforts. Frost Valley is currently using this grant to develop interpretive signs, exhibits and educational scripts to be completed in time for a ribbon cutting ceremony planned for September 2003.
- *Ninham Mountain Model Forest*. This 200-acre site in Putnam County is owned and managed by the DEC and is the next site planned for construction following the Frost Valley Model Forest. This site already contains 272 CFI plots that were installed during 2000-2001, as well as an experimental research weir installed in 2001 where SUNY-ESF has continued gathering bi-weekly stream samples. In 2002, ESF and DEC marked an 80-acre experimental watershed in preparation for a 2003 planned timber harvest to remove 40% of the basal area.
- *Mink Hollow Model Forest*. This 260-acre site in Ulster County is owned and managed by DEP and is affiliated with the SUNY New Paltz Field Campus in Ashokan. In 2002, SUNY-ESF completed installation of more than 250 permanent CFI plots as well as a draft forest management plan that was presented to DEP in December. Once approved, this plan will provide a scientific basis for developing silvicultural prescriptions for the still-undecided experimental treatment blocks. The Mink Hollow Model Forest now contains 470 CFI plots, as well as a USGS stream monitoring gage installed by DEP in 2000, for the purpose of gathering five years of baseline data from an undisturbed forest.

Scientific and Technical Advisory Committee (STAC)

During 2001, WAC and DEP began to assemble a Watershed Forest Scientific and Technical Advisory Committee (STAC) that could provide guidance to both agencies regarding long-term forestry research and other scientific issues. Eighteen professionals agreed to participate on the STAC, including experts from SUNY-ESF, Cornell University, Yale School of Forestry and Environmental Studies, Rutgers, Fordham University, Paul Smith's College, University of Massachusetts, MDC Quabbin, Institute for Ecosystem Studies, DEC, USGS and the USDA Forest Service. In January 2002, WAC and DEP hosted the first introductory STAC meeting in Kingston, including an evening dinner reception followed by a full-day of presentations and discussions. Fourteen STAC members and 20 agency staff participated in a facilitated discussion on current forestry research projects and future priorities. A follow-up STAC meeting is planned for 2003.

Watershed Forestry Institute for Teachers

Since 1999, the Forestry Program has partnered with the Catskill Forest Association (CFA) to organize and implement a Watershed Forestry Institute for Teachers. In July 2002, the fourth annual Institute was successfully conducted for 16 downstate and 2 upstate teachers who traveled to the Frost Valley YMCA in Ulster County for five days of interactive learning, field trips and hands-on environmental education. Unlike previous years, the 2002 Institute featured an extra day of instruction and attracted nearly 100 interested applicants (mostly from New York City). A total of 61 teachers have received training and curricula through their participation in the Institute over the past four years, and preparations are already underway for the 2003 Institute.

Green Connections

During 2000-2001, the Forestry Program developed and evaluated a pilot "Green Connections" education program for upstate/downstate teachers and students that utilizes the curricula of the Watershed Forestry Institute. In 2002, WAC hired the Catskill Center for Conservation and Development to implement "Green Connections" during the 2002-2003 school year. WAC published a *Green Connections Project Guide* in April, which the Catskill Center used to promote the program to Institute alumni and other interested teachers. The Catskill Center partnered two teachers from downstate schools (Center School in Manhattan and Mott Haven Village/PS 220 in the Bronx) with two upstate teachers from Ellenville and Walton. The Catskill Center visited all four classrooms to conduct a pre-test of student knowledge, provide educational materials, and teach an introductory lesson about watersheds and water quality. An online discussion forum was established on the WAC website to facilitate communications among all upstate/downstate students. During 2003, "Green Connections" will continue with a one-day field trip to New York City and a two-day overnight field trip to the watershed.

Landowner Education

In 2002, WAC hired Cornell Cooperative Extension of Greene County to continue publishing an informational newsletter for forest landowners, called *Watershed Woodlands*. The first three issues of this newsletter were each mailed to approximately 20,000 forest landowners in both the Catskill/Delaware and Croton watersheds. Beginning with the fourth issue to be published in early 2003, *Watershed Woodlands* will become a targeted newsletter for specific landowner audiences. The fourth issue will focus exclusively on East of Hudson forestry topics and will be mailed to about 9,000 East of Hudson landowners. In 2002, WAC also partnered with the Catskill Forest Association to conduct a series of workshops and informational meetings for landowners in Delaware, Greene, Putnam and Ulster Counties. The first of these events was a one-day forest landowner workshop attended by more than 60 participants. Subsequent informational meetings held in other counties were shorter in nature (1-2 hours) and attended by smaller audiences of six to ten participants.

Downstate Media Outreach

In 2002, WAC hired the Empire State Forest Products Association (ESFPA) to conduct a forestry media outreach campaign for downstate news outlets. As part of this campaign, editorial board meetings were held with *The New York Times* and *Staten Island Advance*, as well as the City Club's Environmental Conservation Committee and several local National Public Radio stations. This downstate media campaign will continue into 2003 with additional editorial board visits and a follow-up forestry bus tour planned for interested members of both the upstate and downstate press.

Forestry Bus Tour Grants

During 2002, the Forestry Program developed a competitive grants program (up to $5,000 per applicant, funded by the USDA Forest Service) to support upstate forestry bus tours for downstate audiences and environmental groups. DEP helped to promote these grants to New York City schools and other downstate members of the Environmental Education Advisory Council. Four grant applications were approved for funding (Council for the Environment in Manhattan, PS 133 in Queens, Community School District 31 in Staten Island, and Rocking the Boat, Inc. in the Bronx). The forestry bus tour grants program will remain active through 2003 pending continued funding from the USDA Forest Service.

Forestry Economic Action Grants

This past year, WAC received a follow-up $800,000 grant from the USDA Forest Service to continue supporting the Economic Action/Rural Development Through Forestry Grants Program. Total available funding for this unique grants program, which has quickly become a national model, now totals $2 million through 2005. During 2002, the Forestry Program reviewed 31 proposals from local forestry businesses and awarded 19 competitive grants totaling more than $400,000. Forty grants have been awarded to date totaling more than $1.5 million, of which 16 grants have been fully completed. The next round of grant applications will be reviewed and selected in early 2003.

Forest Taxation Study

In August 2002, the Forestry Program hired Professor Hugh Canham (SUNY-ESF) to conduct a forest tax study that analyzes and assesses the economic impact of local property tax rates on private forest landowners in the New York City watershed. The final study is scheduled for completion in June 2003.

4.5 Stream Management Program

The mission of the Stream Management Program (SMP) is to protect and/or restore achievable levels of stream system stability and ecological integrity by providing for the long-term stewardship of streams and floodplains through the implementation of stream management

plans and demonstration projects. The SMP employs a multi-objective approach to achieve this overall mission. A more detailed account of the history and mission of the SMP is provided in its Five Year Plan (December 2001).

Five goals support the City's effort to achieve the mission of the SMP. This report will summarize 2002 programmatic achievements towards each of these five goals.

1) Create an approach for stream management in the Catskill Region that is watershed scale, multi-objective, and community-based by promoting and applying the principles of fluvial geomorphology as the scientific basis of the approach.
2) Promote a stream stewardship ethic and develop an informed constituency of regional stream managers and community participants.
3) Prepare and implement Stream Management Plans in priority sub-basins.
4) Implement a range of stream restoration and protection projects demonstrating best management practices (BMPs) in priority sub-basins.
5) Develop and distribute regional stream morphology databases to support stream management decisions, stream design specifications, and program evaluation.

For the purposes of this report, Goals 1 and 2 are reported on together as they are closely related and progress towards the first also supports progress toward the second.

Goals 1 and 2: Create an approach for stream management in the Catskill Region that is watershed scale, multi-objective, and community-based by promoting and applying the principles of fluvial geomorphology as the scientific basis of the approach. Promote a stream stewardship ethic and develop an informed constituency of regional stream managers and community participants.

SMP Advisory Board

Since its inception, the SMP has worked to overcome the departmentalization of stream management practices by the many different agencies, organizations and individuals who manage stream corridors throughout the watershed. To promote a coordinated, multi-objective approach, SMP is attempting to integrate the many scientific disciplines that study stream dynamics and bring their understanding to guide the development of sound stream management practices. Toward this end, in 2002 the SMP established an Advisory Board to guide and evaluate the activities of the program and its partnering SWCDs. The Advisory Board, consisting of 16 professionals from diverse fields such as fluvial geomorphology, sediment transport, civil engineering, community planning, landscape ecology, conservation biology, and fisheries biology, was first convened in May 2002. DEP contracted the services of Cornell Cooperative Extension of Ulster County to facilitate the formation of the Advisory Board and the organization of the meetings.

At the first meeting in May, the Board received presentations describing the NYC water supply system, the Watershed Partnership Programs, the SMP and its joint planning and restoration projects with the SWCDs, its research efforts supporting natural channel design and BMP (restoration project) monitoring. A second meeting in December enabled the Board and SWCDs to carefully review a draft program evaluation strategy and offer suggestions for a more expanded and comprehensive strategy.

Regional Meetings

The SMP was invited to participate in several noteworthy meetings to deliver presentations throughout the year. These conferences provide an important opportunity to present DEP's stream management approach as a model for multi-objective management to professionals from across the country and to obtain constructive input that will help the SMP refine its current methodologies. The SMP presentation, entitled "A Fluvial Geomorphic Approach to Stream Management in New York City's Water Supply Watershed," provided a comprehensive summary of the DEP SMP program.

- "Stream, Floodplain and Wetland Restoration: Improving Effectiveness through Watershed and Source Water Protection Programs," Bear Mountain, New York - DEP Commissioner Ward addressed a plenary session of 200 participants at the Association of State Wetland Managers Workshop held at Bear Mountain on November 12-14, 2002. SMP presented "Watershed Approaches to Stream Restoration" to the plenary session which focused on the history leading to SMPs current partnerships with the local SWCDs to produce Stream Management Plans.
- USGS Stream Restoration Workshop Urbana, Illinois - In the spring of 2002, the City was invited to present its Stream Management Program to a United States Geological Survey (USGS) Stream Restoration Workshop in Urbana, Illinois as part of continuing collaboration between the GCSWCD and the USGS to develop and refine watershed assessment, restoration and monitoring technologies.
- New York State Wetlands Forum - In 2002, SMP continued to participate on the Governing Board of the New York State Wetlands Forum, and attended the 2002 Annual meeting held in Syracuse, NY. SMP moderated a session on local government initiatives to protect wetlands. The annual meeting provides an excellent venue for SMP to receive updated information on the ever-changing scope of state and federal wetlands regulations and new developments in case law and continue the dialogue with wetland managers to better link stream and wetlands protection.

Project Advisory Committees

One of the primary vehicles for achieving Goal 2 is the Project Advisory Committee (PAC), formed at the outset of the development of each Stream Management Plan for discussion of stream issues and to guide the planning process. The PACs are comprised of local government officials, watershed landowners and various agency resource managers. In 2002, the PACs proved

to be a key venue in the promotion of stream stewardship through increased institutional coordination, and for creating opportunities for educational programming around stream resource values and best management practices.

The process for PAC and public review of a draft Stream Management plan was designed and piloted in 2002 on the Broadstreet Hollow. Each step in the process represented an opportunity for education and coordination among the participants, and will serve as a model for fostering commitment to the implementation of the plans that are being developed throughout the WOH watershed in the coming years. PAC meetings were also held for the Stony Clove, Chestnut Creek and West Branch Delaware Projects.

Landowner Associations

Community interest in forming watershed and landowner associations is an indication of local commitment to long-term stewardship. In the past year, private landowners living in both the Stony Clove and Broadstreet Hollow watersheds pursued the early stages of forming landowner associations and began to take a proactive role in working with the partnering agencies that are developing Stream Management plans. In each case, interested landowners elected representatives to these groups following discussions initiated at public meetings. These representatives then took lead roles in organizing mailings and agendas for meetings that were co-sponsored with the partner agencies.

Educational Programming in 2002

In order to promote a stewardship ethic, a variety of educational activities and materials have been developed to facilitate better communication with the community.

- Workshops - In July, Francis Groeters from the Catskill Native Nursery, and John Dickerson of the Natural Resources Conservation Service (NRCS) presented "Streamside Landscaping for Bank Stabilization and Ecosystem Enhancement" to about 45 participants including Broadstreet Hollow and Stony Clove riparian landowners, interested Catskill community members, stream management and other resource agency staff. The workshop resulted in increased demand for restoration of riparian vegetation.
- In September, the landowner associations co-sponsored an invitation by the Broadstreet Hollow and Stony Clove Stream Management project teams to Robin Ulmer, Executive Director of the Boquet River Association in the Adirondack Region of NY, to discuss "What a Small, Mostly Rural Watershed Association Can Do." The workshop presented the accomplishments of the Boquet Association and techniques for developing a watershed association locally.
- As mentioned above, in fall 2002, the Delaware County SWCD hosted a day-long meeting describing the ongoing stream assessment and restoration activities of the Project staff to over 20 of the major farmers managing land along the West Branch. The key speaker at the meeting, Dale Bentz of Gleim Environmental Group, described the implementation of similar geomorphic stream restoration projects in agricultural areas of Pennsylvania.
- In May 2002, the SMP assisted education staff from the Catskill Center for Conservation and Development with the field component of the StreamWatch program for 30 students from Tri-

Valley Central High School on a tributary of the Chestnut Creek. This resulted in Chestnut Creek Project staff receiving an invitation from the Catskill Forestry Association to introduce the Stream Management Plan to a group of 15 teachers participating in the Watershed Forestry Institute in July 2002.

- Also in May, the SMP and AmeriCorps assisted an organized riparian planting of 600 seedlings on the Little Delaware River at Delaware Academy Park in Delhi with three upstate high schools; Margaretville, Downsville, and South Kortright, and a NYC high school; Dewitt Clinton.
- In October, the Stony Clove team and AmeriCorps continued the partnership with CENYC's Training Student Organizers (TSO) Program by organizing a streambank planting on the lower Stony Clove Creek.
- In 2002, DEP began to work with the Catskill Center for Conservation and Development to develop a program tailored specifically for schools within each SMP priority sub-basin that will incorporate field based stream studies and appropriate stream stewardship techniques.
- The West Branch Project team prepared and distributed a questionnaire for use in identifying public perceptions about streams and soliciting public input to the stream management plan. Surveys are an important vehicle for initiating two-way communication with a large, rural, decentralized population.
- 2002 was the third year that SMP partnered with the federal AmeriCorps program through a cooperative agreement with the GCSWCD and the Youth Resource Development Corporation (YRDC), a non-profit community organization based in Poughkeepsie, NY. There have been twelve AmeriCorps members to-date. Throughout the year, SMP and SWCD staff provided in-house training to eight AmeriCorps members stationed at three Soil and Water District offices and the DEP office in Kingston.
- In 2002, the SMP hosted the seventh year of a Watershed Conservation Corps through a partnership with Ulster County Community College. This year the focus of the group's fieldwork was collecting the data needed to support the SMP's SDWA funded evaluation of stream restoration-demonstration project performance.

Goal 3: Prepare and implement Stream Management Plans in priority sub-basins.

SMP made considerable progress in its priority subbasins in 2002. The advances in the assessments are described first, followed by brief updates on the most important milestones.

Stream and Watershed Geomorphic Assessments

Progress towards the achievement of this goal requires continued development and application of the emerging science of river morphology in the Catskill region, including assessments that are appropriate to different watershed scales. As part of the process of assisting the SWCDs to understand stream processes and identify stream related problems, in the summers of 2000 and 2001 the SMP and SWCDs prepared, tested, and utilized a protocol for a Rosgen Level II and III stream geomorphic assessment on the Broadstreet Hollow, Stony Clove and Chestnut Creeks. This was an intensive data collection and analysis effort well suited for use on smaller watersheds.

However, this protocol required a level of effort and resources which are unavailable for large watersheds like the West Branch of the Delaware River (WBDR), East Branch of the Delaware River, (EBDR), Esopus, and Schoharie Creeks.

Biological Assessments

Riparian Vegetation - As an allied investigation to the geomorphic assessment, in 2002, the SMP and the GCSWCD developed a protocol to describe the condition and biological function of a stream's riparian vegetation and to identify sites where vegetation management might restore or protect stream stability. The assessment protocol consists of three tasks: using remotely sensed data to classify riparian ecological communities, assessing the functional condition of the vegetation and identifying potential vegetation management sites by comparing the findings of the vegetation assessment with geomorphic assessments. The protocol is being piloted and evaluated on two sub-basins: Broadstreet Hollow and Stony Clove Creek.

Stream Management Plans

Stream management plans will comprehensively identify and prioritize problem areas and provide a schedule for attaining long-term management goals for the stream corridor at the sub-basin scale. Each component of a stream management plan will directly or indirectly address water quality concerns. These components include full or assisted stream channel stability restoration to address bed and bank erosion, flood mitigation including stormwater management and ongoing stream maintenance, and fisheries habitat enhancement. The process of developing the plan and its recommendations involves outreach to the community at all levels, from the PAC members who are local agency representatives, to the broader community through support of the formation of local landowner/watershed associations, to funding stream educational programs in the schools and promoting stewardship activities for the general public. The status of the DEP's stream management planning efforts and demonstration project implementation is depicted in Figure 4.14.

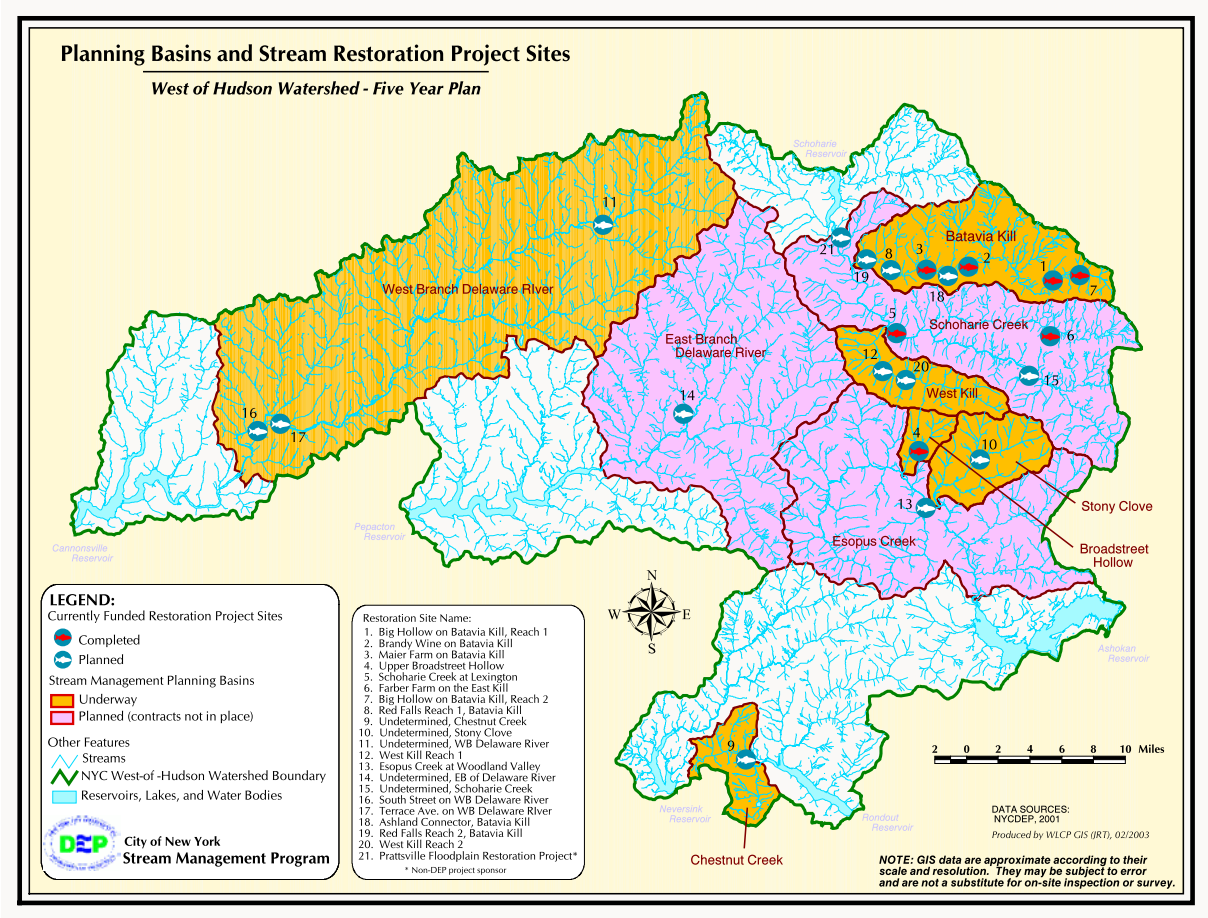

Figure 4.14. Planning basins and Stream Restoration Project sites.

The following are highlights of the development of each Stream Management Plan in 2002.

Batavia Kill Stream Management Pilot Project

This project, administered by the GCSWCD, is a principal part of the DEP's program to identify the overall effectiveness of stream channel stability restoration as a strategy for reducing turbidity and total suspended solids. The sub-basin furnished multiple demonstration project reaches over the course of the Project, which monitored at the watershed scale over time, will best demonstrate whether whole stream restoration in this geologic setting can reduce turbidity in a measurable way. The Batavia Kill is also the first sub-basin for completion of a draft stream management plan, accomplished on January 14, 2003, and is available on GCSWCD's web site, gcswcd.com.

This six-year project was initiated in 1996, marking the first partnership between the City and a SWCD for the purposes of comprehensive stream management assessment, planning and restoration. During 2002, Phase I of the Batavia Kill Project came to a close, and a Phase II contract (2003-2007) was negotiated and registered. While negotiating the Phase II contract, GCSWCD and SMP had the opportunity to undertake a comprehensive evaluation of progress over the past six years.

Broadstreet Hollow Stream Management Plan

Ulster County SWCD requested an extension of their December 31, 2002 deadline for submission of their first draft stream management plan. DEP agreed to this request, with an extension provided until April 1, 2003 for submittal of a first draft stream management plan. A final plan is due to EPA on June 1, 2003.

The 3.5 assessed miles of the Broadstreet Hollow (BSH) mainstem have been divided into 19 separate Management Units (MUs) for summary of current conditions, preliminary recommendations, and prioritization for the management plan, using the stream assessment survey data in combination with tax parcel data and aerial photo overlay. Draft summary MU Descriptions (MUDs) and complete workbooks and maps were prepared for all units.

Additional sections of the management plan were also drafted, including a summary of Broadstreet Hollow geology and its applications, a description of DEC stream activity permitting requirements, DEP water quality summary and a history section submitted by the chairwoman of the Broadstreet Hollow Watershed Landowners Association and PAC representative.

Stony Clove Stream Management Plan

The Stony Clove Creek Stream Management Plan team, comprised of DEP and GCSWCD staff, had a very productive 2002. Two meetings with the PAC in the first half of the year established concurrence on the location for the stream restoration demonstration project to be constructed during 2003, as well as the recommended prioritization of remediation of bank erosion sites. The chosen demonstration project site in Lanesville was topographically surveyed, and the conceptual design for the project was completed. Stream assessment data was analyzed at both reach and watershed scale to identify the endpoints of the management units that will be used to organize information presented in the Plan.

Meetings were held with highway managers from the two towns, counties and the NYSDOT to discuss road/stream issues, both historical and ongoing. A meeting was held with DEC staff that resulted in a commitment to complete the remapping of the floodplain in the sub-basin. Riparian vegetation in a 300 ft. stream buffer was mapped from aerial photography, and with this a protocol was developed to integrate this with data from the stream morphology mapping completed in 2001, to support recommendations for a watershed-wide “Streamside Landscaping”

project designed to improve the functionality of the riparian ecosystem. A newsletter distributed to streamside landowners in late summer kept the project and its progress in the public eye (See Appendix 1).

Chestnut Creek Stream Management Plan

In 2002, the Chestnut Creek Stream Management Project Team hired a geomorphic consultant, Integrated Rivers Solutions, to assist the Project Team with quality control for the geomorphic stream data that had been collected in Summer 2001. In addition, IRS was contracted to recommend a procedure for prioritizing and completing additional fieldwork, and to assist with the prioritization of potential stream demonstration project sites. Preparation for this data review involved processing and graphing geomorphic data for the entire 5 mile Chestnut Creek mainstem. Also in summer 2002, the field team performed a reconnaissance of two of the five major tributaries to Chestnut Creek, Pepacton Hollow and Red Brook, and added GPS mapping and photo-documentation of infrastructure and eroding stream banks throughout the mainstem.

This data compilation enabled the team to produce maps of Management Units as referred to above, that divide the stream into distinct sections based on stream classification, geographic location and other relevant factors such as infrastructure and bank erosion. At the close of the year, Project staff had drafted a Table of Contents for the Management Plan and will delegate appropriate portions to PAC and other community members, thus attempting to promote community support for multi-objective planning throughout the process.

West Branch Delaware River Stream Management Plan

DCSWCD conducted a Rosgen Level I and limited Rosgen Level II assessment of the West Branch main stem between Stamford and Delhi during the summer 2002. This GPS-based "walkover" survey of approximately 25 miles of river enabled the team to develop detailed maps of stream alignments and stream features, locations and extent of erosion and deposition, location of revetments, as well as many other features related to stream health and function. Classification cross-section surveys were initiated at 16 sites with approximately 50 sites to be completed in the summer 2003. The walkover will continue between Delhi and Walton during the summer 2003.

As agreed upon with DEP in May 2002, DCSWCD has cancelled its obligation with the landowner of the Hamden stream restoration project site and received permission from DEC to transfer the NYS Environmental Bond Act funds to another site. The project was cancelled due to the scale and complexity of the restoration effort required to address the problems found at this reach. Stream protection at this site will be implemented by the DCSWCD and the Watershed Agricultural Program/CREP. DCSWCD is currently considering alternative sites for a demonstration restoration project from the results of the 2002 assessment on the upper portions of the watershed.

West Kill Stream Management Plan

The DEP contract with GCSWCD for the West Kill Stream Management Plan was registered on November 6, 2002. The commencement date for work to begin on this project is January 1, 2003. The West Kill is a stream characterized by extensive incision into glacial lake clays and hence is one of the primary contributors of suspended sediments into the Schoharie Reservoir. The scope of work for the contract includes the implementation of a watershed assessment, development of a stream management plan for the West Kill basin and two stream restoration projects.

Goal 4: Implement a range of stream restoration and protection projects demonstrating best management practices (BMPs) in priority sub-basins.

Goal 4 is a new programmatic goal drafted at the end of 2002 during the process of finalizing the program evaluation strategy. Previously, stream restoration, which is a highly visible component of the SMP, was the only BMP to be demonstrated in the priority sub-basins. Emphasis had been placed on full stream restoration using natural channel design practices rather than applying traditional hydraulic engineering solutions to degraded stream reaches. Examples of this include the projects designed and implemented by GCSWCD in the Batavia Kill and Broadstreet Hollow watersheds. Following the recommendations of the Advisory Board, SMP expanded the Stream Management Plan demonstration project category to include "assisted" and "passive" non-construction activities, including riparian corridor restoration and riparian corridor easements as means of preventative measures to protect stream reach stability.

The status of the DEP's demonstration project implementation is depicted on Figure 4.14.

Japanese Knotweed Study

Through the Batavia Kill Stream Management Plan, SMP commissioned a study of Japanese knotweed (*Fallopia japonica*), an invasive plant that is colonizing large stretches of stream bank in the West of Hudson watersheds and may be a source of bank instability. GCSWCD partnered with Hudsonia, a non-profit scientific research and education institute, to conduct a literature review of the current research on knotweed, observe and document its occurrence on the Batavia Kill and outline for a plan for acquiring the additional information needed to manage the invasive plant. The draft study is currently being reviewed and will provide the information needed to educate the public about the plant and its habits. Recommendations for the monitoring and possible control of knotweed in riparian environments will be produced for all stream management plans.

Broadstreet Hollow Restoration/Demonstration Project

The Broadstreet Hollow Restoration Project was constructed in 2000, and amended in 2001, by GCSWCD through agreements with DEP, UCSWCD and USACOE. The project site, characterized by a tremendous amount of thick, soft glacially deposited clay comprising the bed, banks and surrounding valley walls, typifies conditions found naturally throughout the Esopus

and Schoharie Creek watersheds. This project represents an important opportunity to pilot restoration methods at a small scale, and to evaluate performance for use at a larger scale in similar glacially influenced settings throughout the watershed and the Catskill region.

The restoration project on the Broadstreet Hollow included a full scale channel reconstruction, returning nearly 1,100 feet of over-widened and badly eroding stream to a stable, naturally functioning step-pool channel more suitable to the narrow valley and geologic setting. Project inspection in 2002 under a moderate flow and subsequent falling stage conditions showed the project successfully returned the design channel to a more stable and sustainable form. Design specifications developed through this project and the staged construction process will be invaluable for design, construction and monitoring of other projects in the Esopus and Schoharie basins, where glacial lake clays are common. A monitoring survey was completed in 2002 that included extensive photographic documentation.

The bioengineering component of the project was particularly problematic in this setting, primarily due to the difficult access conditions, the soil structure and moisture conditions due to the clay materials, health and condition of plant materials used, and logistical problems with irrigation scheduling and equipment. Several phases of vegetative seeding and planting were required to begin to establish functional riparian vegetation, and ongoing monitoring shows this component of stream restoration will require more time and effort to ensure success in this and other projects. During 2002, attention was focused on enhancing the riparian vegetation component to address this concern, but as stated, more will be needed.

Big Hollow Restoration Project on the Batavia Kill

During the reporting period, GCSWCD completed the Big Hollow Demonstration Project that was initiated in 2001 as part of the Batavia Kill Stream Management Pilot Project. The full description of this 5,310 foot project is included in a report submitted to EPA on December 31, 2002, “Big Hollow Stream Restoration Demonstration Project.”

The restoration of the Big Hollow project reach was the third “full” restoration effort implemented in the Batavia Kill stream corridor. It was identified as a reach contributing a disproportionately to total suspended sediment and turbidity in the early years of GCSWCD’s assessment, 1997-1999.

A “full” restoration approach was chosen by GCSWCD and DEP in order to address the water quality goal. For Big Hollow restoration, GCSWCD the natural channel design restoration strategy included:

- Develop a stable stream planform with a meander pattern appropriate for the available belt width, slope and other valley features using a reference reach experience. The restoration designs provide for a C4 stream type to be constructed. Figure 4.15 depicts the designed channel overlaying an aerial photograph of the existing stream planform condition, conveying

a “pre” and “post” construction image.

- Develop appropriate channel dimensions (width, depth and cross sectional area) for a C stream type such that the channel effectively conveys its sediment supply.
- Develop a stable stream channel profile (bedform), with a riffle-pool complex appropriate for a C stream type.
- Where possible recreate meanders away from the high terrace, and where they run close to its toe, install “bankfull stage benches” to provide some floodplain relief and reduction in shear stress along the bank.
- Reduce streambank erosion using a combination of geomorphic structures, bioengineering techniques and vegetation to reduce near bank stresses. Reduce streambed erosion by using in-stream rock structures to provide grade control at the head of the riffles throughout the profile.
- Use extensive woody and herbaceous planting on the streambanks and floodplain to provide for long-term stability.

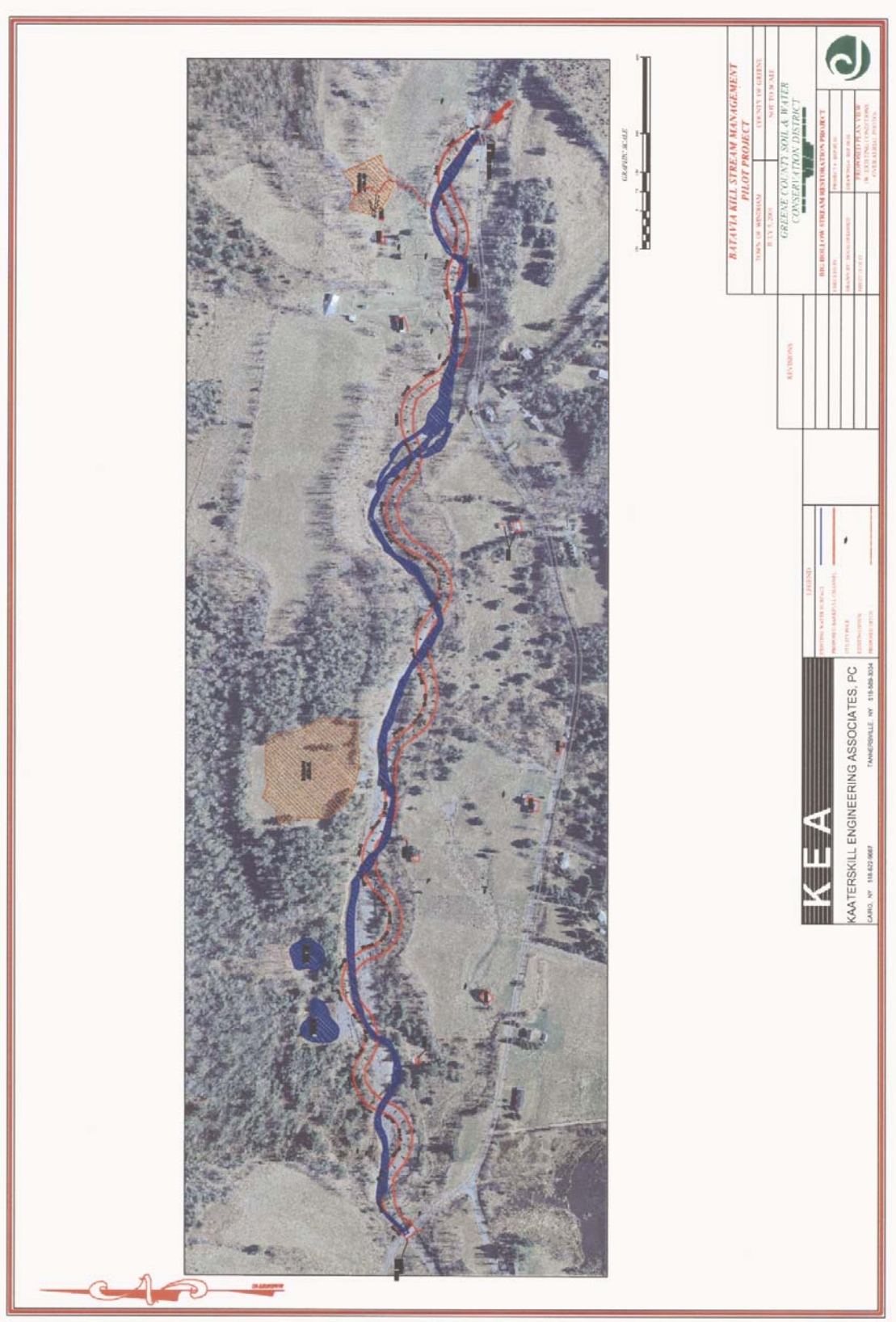

Figure 4.15. Batavia Kill Stream Management Pilot Project.

To determine if the primary project goals and the restoration approach is succeeding, GCSWCD, DEP and USGS are conducting post-construction inspection and monitoring of the project reach. The monitoring phase will focus on two principle measures, including physical morphology and erosion rates, and structural components (stability). Separately, USGS and DEP are studying the response of the fish community and alterations in fisheries habitat under the DEP's SDWA funded research effort to evaluate the effectiveness of a set of three restoration projects.

Goal 5: Develop and distribute regional stream morphology databases to support stream management decisions, stream design specifications, and program evaluation.

SMP continued the multi-year effort to develop and distribute regional stream morphology databases to support stream management decisions, stream design specifications, and program evaluation. This collection of studies is a coordinated set of projects, funded in part by SDWA grants, to a) identify channel forming flows and associated hydraulic geometry at USGS stream gages in order to improve the accuracy of regional relationships of bankfull discharge/hydraulic geometry to drainage area, b) develop design geometry and fluvial processes data for up to 15 reference stream reaches and monitor biological and aquatic habitat, c) monitor the effectiveness of stream restoration demonstration projects installed on three unstable stream reaches, and to monitor six control sites (three stable and three unstable sites), over a five year period, and d) monitor rates of streambank erosion and stream bed scour at up to 11 stream reaches.

The hydrologic and biologic components of the projects are performed by the United States Geological Survey (USGS). DEP personnel are responsible for performing the geomorphic components of the research projects. This information will ultimately guide DEP's stream management activities by development of stream assessment and restoration tools and databases as well as evaluating the effectiveness of the Stream Management Program's stream restoration projects. The status of the SMP research projects will be discussed in detail in the FAD report on DEP Research Objectives due in May 2003.

4.6 Wetlands Protection Program

In 1996, DEP developed and began implementation of an interdisciplinary Wetlands Protection Strategy consisting of regulatory and non-regulatory elements designed to protect and preserve the water quality function of wetlands in the watershed. In September 2001, DEP completed an enhanced Wetland Protection Strategy that, like the previous strategy, includes regulatory and non-regulatory components. However, the September 2001 strategy includes important additions to DEP's approach to protecting wetlands in the watershed, and their water quality protection and improvement functions.

The enhanced wetlands protection strategy includes, among other things, provisions to review land use and development proposals before federal, State and municipal agencies that regulate wetlands. Further, the strategy includes administration of the WR&R, the review of federal, State and municipal legislation that may affect wetlands in the watershed, and inter-agency coordination of enforcement, science, research and mapping programs of value to DEP in implementing the regulatory component of the strategy. Data collected in the non-regulatory programs will assist DEP in assessing the potential impacts on the water quality functions of wetlands anticipated from proposed land use and development projects and by helping to substantiate conclusions DEP draws in those assessments.

4.6.1 Regulatory Programs

DEP continued to implement the regulatory components of its Wetlands Protection Strategy (Strategy) throughout the 2002 reporting period. The regulatory components, consisting of project review and enforcement, review of legislation affecting wetlands, and additional wetlands mapping, aim to help protect and improve the quality of the water supply by preserving the water quality function of certain wetlands in the watershed. DEP also relies upon inter-and-intra-agency coordination to assess the impacts on wetland from land use and development proposals, pursue enforcement actions and conduct wetland mapping programs.

Project Reviews

In 2002, DEP continued to review applications to conduct activities governed by federal, State and municipal regulations, as well as those subject to the WR&Rs. Reviewing proposals before federal, State, City and municipal wetland agencies allows DEP to evaluate land use proposals that may require approval from only one agency. These reviews focus on a project's compliance with applicable wetland regulations, its potential impact on the water quality protection function of on-site or neighboring wetlands, and to identify measures to avoid, minimize, and mitigate impacts on the water quality function of wetlands.

During the reporting period, DEP formalized arrangements to review permit applications with the United States Army Corps of Engineers (Corps), DEC and certain watershed municipalities in the watershed that have adopted wetland protection legislation. No municipalities West of Hudson have enacted such legislation.

To aid DEP in conducting consistent and thorough reviews of wetland permit applications, DEP completed a regulatory guide in 2001, that includes a compilation of Corps, DEC, and the municipal regulations in effect in the watershed. The guide, amended during the 2002 reporting period, includes an extensive database of wetland literature, and technical memoranda exploring a variety of wetland and related water quality issues. In all, DEP reviewed more than 840 land use proposals to first determine whether they were subject federal, State, municipal and/or City wetland regulations, and if they were, to assess their compliance with applicable regulations and their potential to impact the water quality function of wetlands in the City's watershed.

United States Army Corps of Engineers Applications

The Corps forwards certain Pre Construction Notifications (PCNs), Individual Permit Applications, and other notices for actions affecting wetlands in the watershed to DEP for review and comment. DEP reviews PCNs to confirm that the proposed activity is properly licensed by a Nationwide Permit and that it does not trigger the need for an Individual Permit Application. Note that the federal wetland regulations were amended in 2002, to require an individual permit application for projects that impact 0.10, or more, acres of wetlands in the City's EOH watershed. DEP's reviews Individual Permit Applications to assess a project's compliance with the Corps Regulations. During the reporting period DEP reviewed nine proposals regulated by the Corps.

New York State Department of Environmental Conservation Wetland Permit Applications

Under the terms of a Memorandum of Understanding (MOU) with DEC, DEC Regions 3 and 4 forward "Major" stream disturbance permit applications, meeting certain criteria, to DEP for review to ensure compliance with New York's Protection of Waters Regulations and to ensure that the proposal does not threaten water quality. Under the terms of a 2002 agreement, DEC also forwards applications for State wetlands permits to DEP for review. Comments issued by DEP identify instances of noncompliance, potential impacts on water quality, and measures that could be incorporated into a proposal to avoid, minimize and mitigate the water quality impacts anticipated from the activity.

In 2002, DEP and DEC met to discuss, among permitting issues, wetland permitting and enforcement activity in the watershed. These meetings allow for the exchange of information that assists each agency in administering their regulatory wetland programs.

State Wetland Mapping

At DEP's request, DEC is currently examining existing data sources and conducting field work to revise the NYS Freshwater Maps for the EOH watersheds. Specifically, DEC is verifying the boundaries of existing regulatory wetlands, locating additional wetlands that meet the regulatory threshold of 12.4 acres, and identifying smaller wetlands of Unusual Local Importance (ULIs) that are adjacent to the reservoirs.

In 2002, DEP received and reviewed DEC's summary of the draft modifications to the NYS Freshwater Wetlands maps for portions of the watershed in Westchester County. DEC contractors identified approximately 2,302 acres of wetlands for amendment to the State's regulatory maps. Through field checks, DEP identified an additional 91 acres. The proposed amendments include 74 ULIs (~ 230 acres), 28 new 12.4-acre or larger wetlands (~ 676 acres), and boundary modifications of 54 existing 12.4 acre wetlands (~1,487 acres). These proposed amendments will be subject to public hearings later this year. If adopted, the acreage of wetlands subject to both DEC regulations and the WR&R would increase from 5,338 acres to 7,731 acres in Westchester County alone. Field work for Putnam county map revisions is scheduled for the 2003 growing season.

401 Water Quality Certifications

In response to DEP's request, DEC also agreed to also forward 401 Water Quality Certification requests for projects in the watershed to DEP's wetlands unit for review. DEC's issuance of a 401 Water Quality Certification is required before certain projects, including those that require a Corps Individual Permit, may proceed. The 401 certifications, which indicate that the State has determined that its water quality standards will not be contravened by the proposed action, provide DEP and the public with an additional opportunity to evaluate a proposal's potential impact on the quality of the City's drinking water supply.

To expedite DEP's review of applications for certifications, DEP completed a standard review form in 2002, that is based upon the State's criteria for issuance of the 401 certifications. The form will be used to objectively and consistently gauge a project's compliance with the State standards for issuance of the certification.

State Environmental Quality Review Act (SEQRA)

During the past year, DEP continued to involve itself early in State and municipal evaluations of projects undergoing SEQRA environmental reviews. During the SEQRA scoping stage, DEP identified potential wetlands impacts that had to be addressed if a positive declaration were issued and an Environmental Impact Statement prepared. If no formal scoping is conducted, or no EIS prepared, DEP identified potential impacts on the water quality functions of wetlands that a project may have and project alternatives that would avoid, minimize, or mitigate the potential impacts, in response to a SEQRA Environmental Assessment Form.

Municipal Wetland Permit Applications

In addition to its role in SEQRA, DEP reviews proposals before municipal regulatory bodies concentrating on a proposal's compliance with the municipal wetland regulations and the threat that a proposal poses to wetlands and their water quality function.

During the reporting period, DEP continued its dialogue with watershed communities that administer wetland regulations, and to review applications before municipal agencies. Based upon the specifics of an application, DEP has advocated denial of wetland permit applications under consideration at the municipal level, or modification of the project to avoid, minimize or mitigate the impacts.

DEP Wetland Tracking System

DEP continued to track various land use and development projects in the watershed during the reporting period. Using its specialized database, DEP tracked wetland disturbance and loss, and managed other information associated with wetlands activities in the watershed. Data entered into the system included a description of a proposed activity, the project or site location(s), and the level of permitting required. Fields in the database also include: the agency(ies) with regulatory jurisdiction (Corps, State, or municipally designated wetlands); wetland permits required

(Corps, State, municipal); project acreages (total acres of the project); total acres of site disturbance; total acres of on-site wetlands and on-site wetland acreage disturbed and created, and any regulated buffer area disturbed.

DEP Legislative Reviews

During 2002, DEP continued its legislative review function by tracking and evaluating changes in federal, State and municipal legislation that may affect wetland protection in the City's watershed. During the reporting period, DEP reviewed changes to the Corps Nationwide Permitting Program, New York State's proposed Phase II Stormwater Regulations and municipal Master Plan and Zoning Regulation amendments.

DEP also reviewed the Corps' January 15, 2002 Final Notice of the Issuance of Nationwide Permits (NWPs), which included General Condition No. 25 for Designated Critical Resource Waters. Critical Resource Waters include, among other things, "waters officially designated by States as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment". During the reporting period the State also designated all water bodies and wetlands in the East-of-Hudson portion of New York City's drinking water supply watershed as Critical Resource Waters. This designation was specifically applied to the wetlands in the EoH watershed to provide a greater level of wetland protection.

DEP expects the designation will benefit the water quality of the New York City water supply, and supported the State's designation of all water bodies and wetlands in the East-of-Hudson portion of the New York City water supply watershed as Critical Resource Waters. Accordingly, DEP endorsed the Corps intent to concur with the State designation and to issue a new Regional Condition on to the NWP's

Regulatory Enforcement

During the reporting period, DEP continued its role in the detection and restoration of wetlands subjected to unauthorized disturbances. In addition to enforcing the provisions of the WR&Rs relating to wetlands, the regulatory component of the Strategy includes providing technical assistance to other regulatory agencies with common wetland protection goals.

In 2002, DEP provided EPA with information concerning the filling of a wetland in the Town of Southeast. That matter was resolved in 2002 with EPA issuing a directive to the property owner prohibiting any further disturbance of the wetland.

Further, through enforcement of DEP's WR&Rs, the City has addressed numerous illicit discharges of turbid stormwater into wetlands in watershed. Using the State's standard wetland violation form, DEP documented these wetland violations and issued orders to abate them.

Wetland Creation/Enhancement

DEP received approval for a NYSDEC Safe Drinking Water Act (SDWA) grant and a Water Resources Development Act (WRDA) grant to implement two stormwater management/ wetland creation and enhancement projects in the City's water supply reservoir watershed. These projects will reduce non-point source discharges of turbidity, and other pollutants, into the public drinking water supply through the use of created and enhanced wetlands. The grant funds will be used to construct and monitor stormwater entering, and discharging from, the wetlands to determine their pollutant removal efficiency. In the spring of 2002 DEP completed the designs for the facilities, which remained under review by the Corps at the end of the reporting period.

4.6.2 Wetland Mapping and Research

DEP continued to implement and expand its Wetland Mapping and Research Programs. Plans were begun to update the west of Hudson National Wetlands Inventory Maps (NWI) and to continue analysis of East of Hudson wetlands trends. Progress was also made in expanding the wetland monitoring and functional assessment programs to the entire watershed. These wetland mapping and research projects are designed to support both the regulatory and non-regulatory aspects of the Wetlands Protection Strategy.

National Wetland Inventory (NWI) Map and EOH Trends Update

An agreement with the USFWS was drafted to update the National Wetland Inventory (NWI) GIS data for the entire NYC watershed and continue the analysis of wetland trends in the EOH watershed. Spring 2003 color infrared (CIR) photography, to be acquired under a separate contract, will be used for both mapping projects. The first NWI was completed in the mid-1990s and was based on the best existing aerial photography (1982-1987 NAPP CIR). The first EOH wetland trend analysis was completed in 1999, and summarized trends from 1968-1984, and 1984-1994.

Wetland Functional Assessment

DEP's Wetland Functional Assessment Program combines the USFWS Watershed-based Wetland Characterization and Preliminary Assessment of Wetland Functions (W-PAWF) with a reference wetlands monitoring program to determine baseline characteristics and water quality functions of wetlands among various hydrogeomorphic settings. For the W-PAWF, the USFWS attaches hydrogeomorphic modifiers to each wetland polygon in the NWI database to support preliminary, basin-wide assessments of eight wetland functions. DEP is conducting a monitoring program to verify the hydrogeomorphic classifications and preliminary functional assessments and to provide additional measures of ecological and water quality conditions for reference wetlands.

DEP continued to expand the W-PAWF by completing work under an existing contract with USFWS for the Cannonsville and Neversink Basins, and by commencing work on a new contract with USFWS for the remainder of the Croton, Catskill and Delaware Watersheds. In

September 2002, the USFWS completed a report entitled Wetland Characterization and Preliminary Assessment of Wetland Functions for the Neversink and Cannonsville Reservoir Basins (Tiner et. al. 2002). This final report was produced after thorough review of preliminary wetland hydrogeomorphic classifications and functional assessment protocols by DEP. By working jointly with DEP, the USFWS improved its differentiation of floodplain, flat, basin, island, and fringing landforms in these reservoir basins. DEP also provided USFWS with additional stream data to improve the assignment of hydrogeomorphic modifiers, particularly to locate outflow streams in wetlands classified as isolated on the draft maps. DEP also made recommendations on classification methods for ponds and slope wetlands and suggested criteria to improve the designation of stream orders and headwater wetlands

Methodological improvements gained from work in Cannonsville and Neversink, and from previous work in the Boyd Corners and West Branch basins, will benefit the current project to complete a W-PAWF for the remainder of the Catskill, Croton and Delaware Watersheds. Work commenced on this project in March 2002. In late 2002, DEP received from USFWS draft wetland characterization maps for the entire Catskill, Delaware and Croton Watersheds. DEP will review and comment on the draft maps in 2003. Complete reports with functional assessments for each reservoir basin are expected from USFWS in 2004.

Water quality sampling was completed in April 2002, for the two-year pilot reference wetland monitoring program in the West Branch and Boyd Corners basins. From April 2000 through 2002, routine samples were collected from 8 sites on 63 dates for a total of 504 water quality samples. Each sample was analyzed for TP, TDP, TOC, DOC, TSS, and Color. All analytical results were received from the contract laboratory in 2002, and validated by DEP. In addition, 46 discharge measurements were collected to complete rating curves for the 6 of the 8 sampling points (two sites had discharge data available at the onset of the study). Data collected at reference wetlands will be analyzed to compare water quality functions of terrene and lotic wetlands and to assess the results of the WPAWF upon its completion in 2004.

Fieldwork was conducted to expand the reference wetland monitoring program to the Catskill and Delaware watersheds. During the 2002 growing season, approximately 50 wetland sites were visited throughout the Catskill and Delaware watersheds and assessed for inclusion in the monitoring program. Approximately 50 additional sites will be visited early in the 2003 growing season. Of these candidate sites, 22 will be selected that occupy a gradient of terrene and lotic landscape positions with minimal evidence of disturbance both onsite and in their respective catchment areas. Monitoring of these sites will commence upon registration of an agreement with State University of New York College of Environmental Science and Forestry (SUNYESF). Water quality samples will be collected from the outflows of the 22 wetland study sites for at least one year and analyzed for dissolved major cations, pH, specific conductance, total alkalinity, Cl, TN, TP, and DOC. Storm and groundwater sampling will be conducted at a subset of the study sites in order to develop rudimentary mass balances.

DEP will continue to analyze data collected from reference wetlands in conjunction with the hydrogeomorphic data generated through the W-PAWF in order to characterize the distribution, composition, and functions of watershed wetlands. This approach will provide a means of identifying wetlands for strengthened protection based on their landscape positions and associated water quality functions.

Wetland Scientific Support

In addition to conducting the above wetland mapping and research projects, wetland scientists provided technical support in the review of wetland-related aspects of storm water pollution prevention plans, environmental impact statements, and USACOE and town wetland permit applications. DEP's wetland scientists also conducted field work with DEC's contractors and reviewed their draft revisions to the Freshwater Wetlands Maps. In addition, DEP gave a poster presentation of the Wetlands Protection Strategy at the Society of Wetland Scientists annual meeting in Lake Placid, New York and continued its participation in meetings of the New York State Wetlands Interagency committee.

4.7 East of Hudson Non-point Source Pollution Strategy

DEP has developed a comprehensive strategy to address potential non-point pollution sources in the Catskill/Delaware basins east of the Hudson River. This strategy includes continued implementation of several ongoing efforts, most notably the Watershed Rules and Regulations; expansion of several successful west of Hudson programs to the east of Hudson watershed (e.g., the farm and forestry programs); completion of an assessment of potential sources of contamination; and development and implementation of a non-point source plan. Updates on the various efforts follow or, in some cases, can be found elsewhere in this report.

4.7.1 Croton Watershed Strategy Project

In March 2003, DEP will complete the Croton Watershed Strategy project. This project is a two-year effort to develop an integrated watershed management plan for the Croton System. The primary goal of this project is to allow DEP to optimize management efforts and focus limited resources on critical areas to achieve maximum water quality benefit.

For the Croton Watershed Strategy, DEP retained the services of Malcolm Pirnie, HydroQual and LimnoTech to:

- Conduct a watershed assessment to identify a subbasin's potential to impair water quality using four critical indicator variables: total phosphorus, total suspended solids, pathogens, and toxic chemicals;
- Implement the methodology in a Decision Support Tool to allow DEP to continue to update the watershed assessment; and
- Recommend watershed management alternatives for DEP's consideration.

For this analysis, the twelve Croton reservoir basins were divided into 74 smaller subbasins. The watershed assessment examined both existing conditions in the watershed and potential future impacts to water quality associated with further development of the watershed. A separate assessment methodology was developed for each water quality variable based on available data and current understanding of the watershed sources. The methodology focuses on impairment from terrestrial sources; it does not consider in-reservoir sources or contributions from upstream basins and aqueduct discharges. The assessment was not intended to predict actual levels or concentrations of water quality variables in the reservoirs and does not include any actual monitoring data. Instead, the analysis identifies each subbasin's relative potential to impair water quality compared to other subbasins.

Individual reports will be developed for each of the reservoir basins. The Basin Reports provide: potential point and nonpoint water quality impairment sources for each variable ("Areas of Concern"); subbasin scores that indicate the relative potential for water quality impairment from each source and each subbasin; and basin-specific management alternatives. Background information on the physical, environmental, and demographic characteristics of each basin are also included in the reports.

A final watershed-wide analysis also will be conducted as part of the project. The analysis compares subbasin scores and Areas of Concern across the watershed objectively, prioritizing the management alternative based on several factors including: reservoir operations, 60-day travel time, phosphorus restricted basins, trout streams, and wetlands/sensitive environments. Management recommendations will be grouped into five general areas: wastewater, stormwater, open space preservation, road drainage improvement and agricultural.

The Croton Watershed Strategy project will provide a more detailed and comprehensive watershed analysis than was previously available. This will be valuable in a wide variety of DEP activities. The Decision Support Tool will also allow DEP to update this analysis as new data is developed.

Additional work is planned for the Croton Watershed Strategy project in 2003. This work includes the development of a Tracking Tool which will track implementation of projects by basin, estimate reductions of phosphorus based on existing or proposed implementation projects, estimate increases of phosphorus based on new development, and generate basin status reports. Additional critical watershed analyses, field verification and outreach efforts are also planned during the coming year.

4.7.2 Non-point Source Management Plan

DEP will use the results from the Croton Strategy project and other available information to develop a comprehensive non-point source management plan for Catskill/Delaware basins EOH. DEP completed reviewing the Draft Croton Strategy Reports during 2002. During the year, DEP also reviewed the results of impervious surfaces mapping and analysis, sections of

Westchester and Putnam County's Croton Plans, and other information relevant to the development of a non-point pollution plan in the West Branch, Boyd Corners, Croton Falls, Cross River, and Kensico watersheds.

As DEP analyzed the information noted above, staff was also creating an outline for a comprehensive non-point plan and developing specifications for the mapping of stormwater and sanitary sewer systems in the West Branch, Boyd Corners, Croton Falls, and Cross River watersheds, and the video inspection of certain areas identified in the Croton Strategy and Croton Plan as potential sources of non-point pollution. DEP expects to complete the specifications for the two contracts early 2003, and to issue them to DEP's contracting unit for processing shortly thereafter.

4.7.3 Stormwater Management

DEP has identified a site in the West Branch Reservoir Basin that is currently eroding and discharging turbid runoff into the reservoir. DEP has completed detailed designs and specifications for measures that will eliminate the pollution and will hire a contractor and complete the remediation during 2003.

Small Stormwater Remediation Sites

During 2002, DEP identified numerous sites that appear to meet the criteria for inclusion in the Small Stormwater Remediation Site Program. The sites, identified by use of DEP's GIS coverages and aerial photographs, are located in the West Branch, Boyd Corners, Croton Falls, and Cross River Reservoir Watersheds. During the reporting period DEP also began conducting field evaluations of each site. However, snow cover, and otherwise poor weather conditions, prevented staff from completing detailed site assessments or preliminary remediation design work. As conditions permit in the spring, DEP will complete its field assessments, and begin the design phase of the projects selected for repair in the first year of the program. DEP will also conduct additional investigations in the Kensico Watershed as weather and ground cover conditions permit.

In 2002, DEP also began developing specifications for a design and construction contract that will be used to remediate the sites that DEP determines meet the Small Stormwater Remediation Site criteria previously submitted to EPA.

4.7.4 Impervious Surfaces Mapping, Tracking and Analysis

During 2002, DEP's GIS staff obtained impervious surface land cover data from an automated classification of 0.3 meter resolution color-infrared aerial imagery by a contractor (PAR). Resulting data were reviewed, QA/QC-ed and converted to a polygon coverage by GIS staff for ease of analysis. An overlay analysis with basin and sub-basin data was performed in order to derive statistics of percent impervious land cover by basin and sub-basin.

Prior to receiving the impervious surfaces data, DEP engaged a contractor to address the question of whether, as expressed in certain literature, exceeding a ten percent impervious surface threshold in a watershed results in irreparable harm to water quality. The contractor's analysis, conducted by a recognized authority in the field, concluded that based upon the literature, water quality data in the watershed, and statistical analysis, no single impervious surface threshold exists.

4.8 Kensico Water Quality Control Program

In 2002, DEP made significant progress developing and implementing its programs to protect the Kensico Reservoir and its 13 square mile watershed. DEP continued to enhance its Kensico Watershed Management Plan by adding programs to further identify and eliminate potential sources of pollution. To advance the enhanced plan, DEP conducted detailed watershed assessments, field reconnaissance and mapping efforts, evaluated wastewater and stormwater infrastructure, and implemented other programs discussed below.

4.8.1 Stormwater Management Practices (BMPs)

The initial stormwater management component of DEP's Kensico Watershed Management Plan included the installation, operation and maintenance of 44 stormwater best management practices (BMPs) in three municipalities in the Kensico watershed. The BMPs were designed to eliminate sources of turbidity, to remove fecal coliform and suspended solids from stormwater before it enters entering the reservoir, and to reduce stream bed and bank erosion by controlling the peak rates of stormwater discharge in selected reservoir tributaries. By the end of 2002, 42 of the 44 BMPs had been completed.

Stormwater Facilities 58 and 59, Subbasin N12

In response to the Town of Mt. Pleasant's request, DEP redesign two facilities (58 and 59) associated with the sand filter (facility 57) to address altered conditions after the road was repaved and the drainage altered. The new design for the parking area and road drainage improvements added two catch basins, 240 linear feet of concrete pipe, 1,200 linear feet of concrete curbing, and repaired a severely eroded section of road directly adjacent to the reservoir. After several revisions, the Town approved a design that significantly improved road conditions, safety and performance of the sand filter. Construction of the facilities began in May 2002, and was completed in the summer of 2002.

Stormwater Facilities 74 and 75, Subbasin E11

Two facilities planned for the E11 subbasin could not be constructed in accordance with the approved construction schedule due to the presence of a Verizon fiber optic cable in the work zone that had not been detected by DEP's design consultants. Following negotiations with Verizon, the company relocated the cable in August 2002. However, as of the date of this report, Ver-

izon continues to experience considerable difficulties bringing the cable into service. As a result of these delays, the contractor engaged to construct all but one of the 44 BMPs in the, filed a claim of "substantial completion" and was not required to construct the last two practices.

To avoid further delays, DEP has taken steps to re-bid and, if necessary, redesign the BMPs. Anticipating that Verizon may not have completed its cable relocation by the time the project is bid, DEP has completed a second design for the practices that avoids the cable. If the cable has not been relocated at the time of the pre-bid meeting, DEP will substitute the amended plan for the original one, and proceed with the contracting and construction process. While this approach may require DEP to modify the practices in the future, it will allow for the construction of the primary controls by the autumn of 2003.

Stormwater Facility 68A

Based upon DEP's inspections, stormwater monitoring, BMP maintenance, and the stormwater infrastructure mapping and video inspection programs, DEP determined in the winter of 2002 that an additional stormwater practice is required to eliminate stream bank erosion in the E9 subbasin of the Kensico watershed. The site, which includes the stream banks adjacent to the outlet of a box culvert that carries flow under Route 120 into the Reservoir, is subject to accelerated erosion and is discharging suspended solids into the reservoir during significant rainfall events. Prior to the close of the reporting period, DEP collected baseline data and completed the design of the BMP. Construction plans and specifications will be added to those for BMPs 74 and 75 to expedite the implementation of BMP 68A.

4.8.2 Con Ed Right of Way

Eighteen of the BMPs discussed above are located adjacent to an unpaved road that Consolidated Edison (Con Ed) uses to maintain its power lines along the western shore of the reservoir. In the course of implementing its programs in the Kensico Watershed, DEP identified sections of that road that are eroding and discharging sediment in the vicinity of the reservoir. While lengthy sections of the road were stabilized by DEP during construction of the BMPs, DEP views the repair of certain sections of road as the sole responsibility of Con Ed. Accordingly, in 2002, DEP continued negotiations with Con Ed over the company's use of the City-owned road, and ultimately secured a commitment from the company, which became a condition of its revocable permit, to repair the specified sections of the road in 2003. DEP and Con Ed also agreed to jointly repair other eroding sections of the road. To facilitate the repairs, DEP prepared, and provided Con Edison with, engineering plans for the project.

4.8.3 BMP Maintenance

In April 2000, DEP finalized the Stormwater BMP Operation and Maintenance Manual for the BMPs, and began implementing provisions of the manual with in house staff. Based upon observations made during the stormwater infrastructure mapping, and other field reconnaissance, DEP revised the manual in 2002, and advertised specifications to engage a contractor conduct the

specified maintenance during the same year. DEP will maintain responsibility for inspecting and maintaining the facilities until such time as a contractor is engaged to complete all maintenance activities, which are estimated to cost $50,000.00 annually.

4.8.4 Stormwater Infrastructure Mapping

Beginning in 1999, DEP began digitally mapping infrastructure in the Kensico Reservoir watershed to augment the overall stormwater management plan for the watershed. However, complete stormwater infrastructure mapping and inspection data was necessary to complete a comprehensive Kensico watershed stormwater inventory.

DEP finished mapping the infrastructure in the portion of the watershed that is not served by sanitary sewers (approximately 2/3 of the 13 square mile of the watershed) in August 2001. In the spring of 2002, DEP engaged a contractor who completed, and quality controlled DEP's mapping, and who inspected the entire stormwater infrastructure in the watershed during the reporting period. This effort included infrastructure in sewered and non-sewered areas.

As part of the mapping and inspection effort, DEP reviewed the video inspection and mapping information, which included an analysis of pipe, catch basin and outlet condition, size and material. DEP determined, based upon its review of the information, that diversion of stormwater to points outside the watershed is not feasible.

4.8.5 Stormwater Infrastructure Inspection

DEP devised a stormwater infrastructure inspection program to locate any illicit connections of wastewater to the stormwater system. During 2002, DEP's contractor who completed the infrastructure mapping was engaged to conduct video inspections and identify illicit connections.

The video inspection program, which included more than 30,000 linear feet of drainage pipe and 260 structures such as catch basins and manholes, revealed no evidence of any illicit connections that might contribute wastewater to the system. However, the inspections did reveal the presence of animals, which may be a source of fecal coliform bacteria in stormwater entering the reservoir, living in the stormwater system. DEP will review the recommendations in the contractor's final report, and work with the municipalities that own the infrastructure to implement the appropriate measures.

4.8.6 Sewer System Protocol

In accordance with DEP's 2001 Long-term Watershed Protection Plan, DEP developed an Operations and Maintenance Protocol for Westchester County-owned sewers in the Kensico basin during the reporting period. During this effort DEP engaged in frequent discussions with the Westchester County Department of Environmental Facilities (WCDEF). The protocol DEP developed and submitted to the County commits DEP and the WCDEF to inspect and maintain the sewer system in the Kensico watershed and to take other such action as necessary to prevent wastewater discharges to the reservoir.

After final review by County staff in 2002, the protocol was approved. However, following a wastewater discharge to the Kensico Reservoir, caused by an obstruction in an adjacent County sewer line, the County submitted a modified protocol that remained under DEP review at the close of the reporting period.

4.8.7 House to House Septic System Survey

In 2001, DEP supplemented its program to identify and remediate failing septic systems in the Kensico Watershed by initiating a house-to-house septic survey. The survey, which would update data collected during the first such survey conducted in 1991, targeted approximately 795 homes in the four watershed towns (New Castle, Mount Pleasant, Harrison and North Castle). The remaining homes in the watershed were excluded from the survey after confirming, by examining municipal records and 1991 survey data, that they are served by sanitary sewers. The house-to-house septic system survey involved mailing a letter to property owners explaining the program's purpose and requesting that they participate in the program by completing and returning a survey form (enclosed with the letter) and allowing DEP to inspect their systems.

The survey form requested confirmation that the residence is served by a septic system and asks for the approximate date of the system's construction, the date it was last inspected, and whether the system was functioning properly. In the event the system was not working properly, the residents were asked to identify the malfunction and any remedial action taken to correct the problem.

Since DEP enjoys excellent relationships with the supervisors of North Castle and Mount Pleasant, where the vast majority of the systems are located, the two supervisors signed and mailed the introductory letter and survey to their constituents. Mailing of the Harrison and New Castle letters was not scheduled until February 2002, to allow DEP time to complete the survey process in Mount Pleasant and North Castle. Since DEP attempts to speak with all residents with septic systems, (whether or not a survey was returned) and inspect the systems, the process is time consuming.

The survey, completed in 2002, revealed four possible septic failures, two of which were confirmed by introducing dye into the interior plumbing of the residences. By October 2002, the two systems had been repaired. No additional septic system failures were detected between October and the close of the reporting period.

4.8.8 Turbidity Curtain/Spill Containment Facilities

In August 2002, DEP issued a "Notice to Commence Work" to a contractor to install the Kensico turbidity curtain/spill containment facilities. While DEP anticipated that the project would begin shortly after issuance of the notice, the contractor notified DEP that fabrication of the 850 ft. long turbidity curtain and the spill containment facilities for the twenty-six stormwater out-

falls from Interstate 684 would take longer than anticipated, thereby delaying the start of installation. Furthermore, because of the nature of the work, the firm would be required to prepare a Health and Safety Plan and secure DEP approval for that plan.

Fabrication of the turbidity curtain was completed and the curtain delivered to the site for deployment by the close of the reporting period. Fabrication of the all of the spill containment measures was near completion at the end of 2002, and expected to be finished before spring.

The contractor submitted a Health and Safety Plan for DEP's review at the end of the reporting period. DEP's review identified numerous deficiencies in the plan, which was returned to the contractor for revisions after a January 2003 meeting with DEP Health and Safety and Engineering staff. The contractor has committed to begin installation of the measures immediately upon DEP's approval of the plan and appropriate weather conditions.

4.8.9 Enhanced Spill Containment Plan

In December 2002, DEP completed the plans and specifications for the Enhanced Spill Containment Plan that will contain spills from Routes 22 and Nannyhagen Road which abut the reservoir. The plans and specifications have been forwarded to DEP's contracting unit in anticipation of deploying the measures in the autumn of 2003.

4.8.10 Kensico Watershed Improvement Committee (KWIC)

By researching assessor records, and through discussions with municipal officials in New Castle, Mount Pleasant, and Harrison, DEP identified corporations, institutions and other entities in the Kensico Watershed that may impact water quality in the reservoir. DEP completed an inventory of these entities to identify potential members of the Kensico Watershed Improvement Committee KWIC). Entities in the towns of Harrison and Mount Pleasant were considered to be possible members of the committee with the sole purpose of protecting water quality in the Kensico Reservoir. DEP identified no such facilities in the Town of New Castle.

DEP is continuing its efforts to schedule meetings with potential committee members. DEP has agreed to make a presentation at those meetings to assist in establishing membership in the committees.

Note that in November 2002, the KWIC held an annual committee meeting. Discussions at the well-attended meeting did not identify any significant issues concerning implementation of the King Street (Route 120) Corridor Management Plan, or the need for amendments to the plan.

4.8.11 Route 120/22

During 2002, the New York State Department of Transportation (DOT) continued to develop highway improvement plans for Route 120/22 and exits 2 and 3 on Interstate 684. DOT also further developed the conceptual Stormwater Pollution Prevention Plan (SPPP) for the project. Representatives of EPA, DOT, DEC, NYSDOH, the Watershed Inspector General,

Westchester County, Riverkeeper, Croton Watershed Clean Water Coalition, Sierra Club, and NRDC continued to participate on a committee charged with developing a plan that satisfies the issues of each entity.

DEP continued to attend the meetings and provide technical and regulatory compliance input given that approval of the SPPP from DEP must be secured before work on the project may proceed.

4.8.12 Computer Assisted Facilities Management Program

DEP has engaged the services of a software consulting firm to develop an integrated operations tracking system to manage the components of the Kensico Watershed Management Program. The system, which will be linked to DEP's GIS, will notify its users that certain operations, inspection, maintenance, monitoring, evaluation and reporting tasks are required. It shall monitor, track and ensure compliance with the provisions in the *Operation and Maintenance Guidelines for the Kensico Reservoir Watershed Stormwater Management Program*, and the monitoring, evaluation and reporting provisions of Kensico Water Quality Control Program, the FAD and DEP's Long-Term Plan. The program will also prepare reports from the compiled inspection, maintenance, monitoring, and evaluation data concerning stormwater BMPs, septic and sewer systems, and other program components.

4.9 Catskill Turbidity Control

Due to the nature of the underlying geology, the Catskill system is prone to elevated levels of turbidity in streams and reservoirs. High turbidity levels are mostly associated with high flow events, which mobilize the streambeds and suspend the glacial clays that underlie the streambed armor. The Catskill system was designed with the local geology in mind, and provides for settling within Schoharie, Ashokan West Basin, Ashokan East Basin and the upper reaches of Kensico Reservoir. Under normal circumstances this extended detention time in the reservoirs is sufficient to allow turbidity to settle out, and the system easily meets turbidity standards at the Kensico effluents. Periodically, however, the City has had to use chemical treatment to control high turbidities.

DEP is engaged in numerous projects and studies designed to reduce turbidity in the waters of the Catskill system. A summary of the major projects and studies that are underway is below. There are also several efforts planned (e.g., dredging of the Schoharie intake channel) which will not begin until future years.

Analysis of Engineering Alternatives

DEP is undertaking a comprehensive analysis of engineering and structural alternatives to reduce turbidity levels entering Esopus Creek. DEP will engage a consulting firm to conduct the engineering analysis. In addition, DEP has already hired the Upstate Freshwater Institute (UFI) to enhance the existing Schoharie Reservoir model to allow for full assessment of the effectiveness of potential engineering alternatives in reducing turbidity.

UFI began work in summer 2002, with initial efforts focused on deployment of data collection equipment:

- Reservoir Remote Underwater Sampling Station (RUSS) units – RUSS units will be placed on the reservoir to allow for continuous data collection at key locations throughout the waterbody. A single RUSS unit was tested in 2002 near the intake. Two other units are expected to be deployed in spring 2003 (after ice-melt), one near the dam and one approximately mid-way between the intake and the dam.
- Stream sampling units (Robohuts) – Specially fabricated for this effort, Robohuts will be placed along streams to collect continuous stream data for a host of constituents. A Robohut that will be placed on Schoharie Creek has been constructed and is expected to be fully operational by the end of March 2003, assuming that weather conditions allow for the installation of a water intake from the Creek. Robohut locations for two other sites have been determined. One hut is expected to go near where the Esopus Creek enters Ashokan Reservoir, and DEP expects construction to start in spring 2003. The other Robohut will go downstream of the Shandaken Tunnel portal. Progress with this Robohut is expected to be slower for several reasons, including that the land at the proposed site is not owned by DEP.

While UFI has begun its work, DEP has been developing a scope of work for engineering services. A scope of work was completed by the end of 2002, and DEP had secured approval for the necessary funding.

Expand Water Quality Telemetry System

Expansion of DEP's existing telemetry system to the Schoharie Reservoir and the Shandaken tunnel will provide DEP with better access to timely water quality information. The RUSS units and Robohuts discussed above are a part of this effort. In addition, DEP will be installing new water quality instruments at the Schoharie Intake Chamber, and connecting those instruments to the existing Delaware Telemetry System in spring 2003. The building that will allow for a similar connection at the Shandaken Tunnel Portal is in place, and the water quality pumps and instrumentation at this site are being installed.

Coordination with New York State

DEP has agreed to work with the State on several efforts related to turbidity control. In particular, DEP has been meeting with DEC to develop a release management strategy, along with an implementation schedule, for water from Schoharie Reservoir. DEP and DEC met during fall

2002, to discuss the release management strategy. DEC is currently revising a draft strategy it developed in 1994. DEP hopes to receive the revised draft in time to pilot test a new release strategy this spring.

DEP also discussed two other collaborative efforts with DEC during 2002: development of a sediment transport model for the Schoharie and Esopus basins, and providing technical support to DEC in DEC's development of a suspended sediment TMDL for the Schoharie and Esopus basins. DEP understands that DEC is evaluating options for development of a sediment transport model and anticipates working with DEC on this effort in 2003. Regarding development of a sediment TMDL, DEP stands ready to provide assistance to the State when requested.

5. Watershed Monitoring, Modeling and GIS

5.1 Watershed Monitoring Program

The 2002 FAD required submission of DEP's revised Watershed Monitoring Program Plan. This was duly done after a draft document was reviewed by EPA and NYSDOH. Comments from these organizations were accommodated in the FAD deliverable entitled "Integrated Monitoring Report" in October 2002.

The deliverable presents reviews of three of DEP's three key upstate water quality monitoring programs: Hydrology, Limnology, and Pathogens. These reviews were designed to meet the expanding scope of DEP's data uses including requirements for watershed and reservoir models, mandates, and regulations, as well as fulfilling data needs to ensure that management requirements are adequately addressed. The programs are designed to meet the current and future data requirements of DEP including the long-term evaluation of watershed protection programs.

The overall goal of the framework is to establish an objective-based, water quality monitoring network, which provides scientifically defensible information regarding the understanding, protection, and management of the New York City water supply. The information needs required to achieve this goal are compiled as objectives, each of which is clearly defined (in statistical terms if possible). The list of objectives for each program was derived by compiling the information needs of existing and prospective DEP programs, and the review of legally binding mandates, agreements, and/or documents which pertain to New York City's Watershed Water Quality Monitoring Program. The definition of objectives was the starting point for this comprehensive review because, ultimately, the objectives define the temporal, spatial, and analytical requirements of the programs. Statistical features of the historical database were used to guide the sampling design.

To ensure the most efficient gathering of data, the monitoring programs are integrated with each other through common data requirements. Several data collection programs, e.g., Hydrology and Limnology, may contribute to a single objective, e.g., Reservoir Modeling, so it is essential that data from each collection program be coordinated.

Pursuant to the City's Long-Term Watershed Protection Program, DEP now produces a Watershed Water Quality Annual Report which is submitted to EPA (as a FAD deliverable) in July of each year. This document contains chapters discussing issues, including water quantity (e.g., the effects of droughts during the reporting period); water quality of streams and reservoirs; watershed management; and water quality models (terrestrial and reservoir). For 2002, the limnology and hydrology components of the document will draw largely on information obtained from approximately 270 reservoir and stream routinely-sampled sites resulting in about 8,000

samples and almost 100,000 analyses. For the pathogens component, there were 48 routine sample sites (including keypoints) resulting in 627 samples for *Cryptosporidium* and *Giardia* spp. analysis and 248 samples for virus analysis in 2002.

5.2 Multi-Tiered Water Quality Modeling Program

DEP's Multi-tiered Water Quality Modeling Program is based on an integrated set of terrestrial and reservoir modeling tools to support both long-term watershed management and short-term operational strategies for maintaining high quality drinking water. In 2002, DEP continued development of a predictive Nutrient Management Eutrophication Modeling System to support watershed management and reservoir operations for the control of eutrophication in Catskill/Delaware reservoirs. Progress in the major elements of the program is reported in five sections:

5.2.1 Data acquisition and analysis;
5.2.2 Model calibration, verification, and testing;
5.2.3 Model improvement;
5.2.4 Model integration and software development; and
5.2.5 Model applications for watershed /reservoir management.

5.2.1 Data Acquisition and Analysis

Ongoing efforts to acquire new and better data for modeling are a critical component of the modeling program. Terrestrial model output is very sensitive to meteorological data input as forcing functions. GIS data on watershed land use, soils, topography, and on reservoir morphometry are used to determine model parameters. Stream flow, water chemistry, and reservoir stage data are used for model calibration and verification. Updated and improved data are required for continued model development and testing.

In 2002, DEP continued to acquire and develop data to support terrestrial and reservoir model development, testing and applications. Necessary time series data for model input and testing has been updated as more recent data becomes available. Terrestrial time series data included meteorology, stream flow and water quality monitoring, and point source loads. Reservoir time series data includes hourly meteorology, stream flow and quality, aqueduct flow and quality, reservoir storage and quality, and reservoir operations. Analysis of reservoir time series data was performed to develop reservoir water budgets and loads. A monitoring plan to support modeling was developed and submitted to EPA and is underway. The plan provides for reservoir, aqueduct, and stream monitoring, including storm event monitoring, of the major tributaries to Catskill/Delaware System reservoirs. These monitoring data are used for continued model testing and improvement.

Development of updated and improved land use data for the Catskill/Delaware System Watersheds is underway as part of task 1 of the SDWA project with PAR Technology on Watershed Data Management and Software Tool Development (PAR SDWA project). The updated land use/land cover map will be based on recent satellite imagery with ground-truthing, and will incorporate ancillary data including tax parcel data. See the GIS section of the annual report for more details.

Work was completed on projecting the entire GIS spatial data library, including those components crucial to terrestrial and reservoir modeling, from the NAD27 datum to the NAD83 datum (UTM projection). This effort is one part of a larger endeavor to evolve the GIS/Modeling system to an object-oriented geodatabase implementation in Oracle. The shift to the NAD83 datum keeps DEP current with collaborating agencies that have already made such a change and facilitates immediate use of new data products developed in the NAD83 datum.

The second version of a CDROM of spatial data relevant to ongoing research efforts in the Town Brook sub-basin (Cannonsville Reservoir watershed) was compiled and forwarded to principal collaborators at USDA-ARS (University Park, PA), USGS (Troy, NY), and Cornell University (Ithaca, NY). This CDROM of information serves as a common foundation of GIS data supporting Town Brook research

5.2.2 Model Calibration, Verification and Testing

The hydrology and water quality modules of Generalized Watershed Loading Function (GWLF) have been extensively calibrated and verified for the Cannonsville watershed. The hydrology module has been calibrated and verified for the other Catskill/Delaware system watersheds consisting of the Pepacton, Neversink, Rondout, Schoharie, Ashokan and West Branch watersheds. During 2002, DEP set forth a schedule for the completion of the calibration and verification of the GWLF water quality modules for the remaining Catskill/Delaware System watersheds (NYC DEP, 2002a). The timetable is based on the modeling data needs outlined in NYC DEP (2002b) and the proposed schedule for continued storm event water quality monitoring in these watersheds. The schedule calls for completion of Pepacton, Ashokan and West Branch by 2006; and Neversink, Rondout and Schoharie watersheds by 2007. As part of this schedule, water quality calibration for the Pepacton watershed was updated using monitoring data collected through 2000.

The Catskill/Delaware reservoir models have been developed for eight reservoirs: Cannonsville, Pepacton, Neversink, Rondout, Schoharie, Ashokan's West basin, Ashokan's East basin, and West Branch. Calibration, verification, and documentation of 1- and 2-dimensional (2-D) reservoir water quality models have been finalized for each reservoir.

5.2.3 Model Improvement

Model improvement is an ongoing process as better data and new research results become available. A number of updates were made to the current GWLF model to improve the integration of GWLF with the reservoir management models. The GWLF model for Cannonsville watershed was updated to simulate total dissolved nitrogen, instead of dissolved inorganic nitrogen. Existing monitoring data was further analyzed to develop a relationship between total dissolved nitrogen versus the dissolved inorganic nitrogen, thus enabling the updated GWLF model calibration and application. Dissolved organic carbon simulation was also added to the Catskill/Delaware System GWLF models.

DEP has begun developing a GWLF model application for the Town Brook watershed. Application of GWLF to Town Brook, an agricultural sub-basin of Cannonsville watershed that the Watershed Agricultural Council has designated as a research watershed, will provide a testing ground for improving agricultural phosphorus loading coefficients and refining runoff generation mechanisms for GWLF terrestrial model applications. During 2002, DEP began efforts on calibrating GWLF for the Town Brook watershed. The calibration process focused on refining meteorological inputs to obtain more realistic forcing data for this local watershed application.

During 2002, a paper by the DEP modeling group entitled “Modeling the Hydrochemistry of the Cannonsville Watershed with GWLF” was published in the October 2002 issue of the Journal of the American Water Resources Association. (Schneiderman et al., 2002). The paper documents the model changes that DEP has made to the original GWLF model, calibration and verification methods, parameter sensitivity analyses, and the application of the revised and calibrated model to the Cannonsville watershed.

DEP has developed and tested (and continues to test) mechanistic nutrient-phytoplankton water quality models for the Catskill/Delaware reservoirs. It has been established that the reservoirs of the Catskill/Delaware Systems have unusually high levels of inanimate particles (tripton) relative to concentrations of phytoplankton. Presently, the effects of tripton and resuspension are not predicted in these models. The Cannonsville sediment resuspension study was designed to assess the potential impact of incorporating tripton into the Catskill/Delaware water quality models. This study involves extensive field and laboratory analytical programs, including data collected by remote field instrumentation (RUSS units, sediment traps and wave gages), in addition to other data acquisition and analysis (see 5.2.1). Wind fetches and bioavailability of tripton were determined. The 1-D and 2-D hydrothermal reservoir model codes were revised to accommodate a wave submodel, a bottom shear stress submodel, and resuspension of total suspended solids (TSS). Wind fetches and integrated into the wave sub-model. Model input files were developed, and preliminary simulations of TSS were performed in both 1-D and 2-D models.

In accordance with the FAD deliverable to "incorporate a mechanistic sub-model for THM precursors into the existing Cannonsville eutrophication model framework," DEP and the American Water Works Association Research Foundation (AWWARF) co-sponsored an extensive study of THM precursors in lakes and reservoirs. This work produced a mechanistic model for predicting THM precursors in lakes and reservoirs. A manuscript entitled: "*Origins, behavior, and a mechanistic model for THM precursors in lakes and reservoirs*" will be published by AWWARF. The most relevant sections of this manuscript were submitted to EPA, as the December 2002 FAD deliverable.

5.2.4 Model Integration and Software Development

Terrestrial GWLF models have been functionally linked with reservoir models, and with supporting GIS and time-series databases, to permit the models to be run in an integrated application. This integrated modeling system is designed to perform quantitative evaluation of reservoir trophic state as a function of reservoir and watershed characteristics, meteorological conditions, watershed management and reservoir operations. Work is underway to improve this integration with enhanced software tools.

DEP is developing a modeling software interface through an SDWA funded contract with Par Government Systems Corporation. The software consists of two main sub-programs: the Modeling Support Tool System (MSTS) and the Scenario Support Tool System (SSTS). The MSTS will combine tools for terrestrial and reservoir models with data, calibration/verification, and visualization tools in an integrated software package. The SSTS will link the MSTS with a database of watershed management program implementation and effectiveness measures to provide support for evaluating the effectiveness of watershed management and BMPs in maintaining reservoir water quality. During 2002, progress was made on the specification of model software requirements and software programming began.

The *Catskill/Delaware Management Model* was finalized. This model links and integrates the eight individual 1-D reservoir models (see 5.2.2) into an integrated multiple-reservoir management tool. *LINKRES* was also finalized, and integrates the eight individual 2-D reservoir models into a single management tool, but was produced without a user-friendly graphical user interface (GUI). A second version of *LINKRES* was developed, which incorporates a Kensico reservoir 2-D hydrothermal model (without nutrient-phytoplankton calibration) into the *LINKRES* framework, and also includes a GUI. This second version of *LINKRES* is currently undergoing DEP final review.

5.2.5 Model Applications for Watershed /Reservoir Management

The modeling system has been used to evaluate the effectiveness of watershed management programs to control eutrophication in the Cannonsville and Pepacton Reservoirs (NYC 2001 Watershed Protection Summary, Assessment, and Long-term Plan 12/01). This application

involves analyses of long-term scenarios, and will be revisited, using updated and improved data and research results, in the next five-year Comprehensive Water Quality/Program Evaluation Report due March 31, 2006.

In accordance with the FAD, DEP submitted to EPA a proposed procedure and schedule for utilizing multi-tiered water quality models to assess the implications of Phase II TMDLs for watershed management purposes. The analysis procedure will be applied to Cannonsville Reservoir first. Upon completion of Cannonsville analysis, the other Catskill/Delaware reservoirs will be investigated. Cannonsville is scheduled completion at the end of 2003, while the other reservoirs are scheduled for the end of 2004.

DEP staff continued use of individual reservoir models to address reservoir specific issues. A preliminary simulation of a recent (11/30/02) sewage spill, within the Kensico watershed was performed using the 2-D model. The Schoharie 2-D model was used to address potential turbidity and temperature releases into the Esopus Creek, for various Shandaken Tunnel withdrawal scenarios. As part of a *LINKRES* evaluation, DEP simulated a tracer study for the entire Catskill-Delaware system. This study simulated two separate intense one-day stream loads, one into Cannonsville reservoir and one into Schoharie reservoir. Travel times and dilutions of the two tracer loads were tracked throughout the system, until reaching the Kensico reservoir outlets.

5.3 Geographic Information System

DEP staff continued to develop the upstate Geographic Information System (GIS) and to use it in support of FAD and MOA programs. The GIS was used for hardcopy mapping, geographic analysis, spatial data development, visualization and analysis of remotely sensed imagery, and water quality modeling.

The GIS system includes networked Windows and UNIX workstations at laboratories in Kingston and Valhalla, and on individual desktops. Each GIS lab has hardware capabilities for scanning documents, digitizing data, and producing hardcopy maps on a variety of small- and large-format output devices. Users access spatial data stored in data libraries on central servers. ESRI (ArcGIS, ArcInfo, ArcView) and ERDAS (Imagine) are the GIS software packages of choice. The Grahamsville and Shokan sites have Windows workstations for on-site GIS work. Global Positioning System (GPS) technology is used for field data collection.

Significant accomplishments in 2002 include expanded use of the GIS to support MOA and FAD programs, datum conversion of the spatial data library from NAD 27 to NAD 83, preliminary installation and testing of an ArcSDE/Oracle prototype geodatabase, and extensive hardware upgrades.

5.3.1 Utilizing GIS for Watershed Management Applications

Throughout the reporting period DEP staff utilized the upstate GIS to support FAD and MOA program planning and implementation. Semi-annual progress reports to EPA in July 2002 and January 2003 described the scope of these projects, providing detailed lists of the numerous map products that were produced and description of individual projects in which GIS resources were utilized.

As a general characterization, it is noted that hundreds of maps were produced to support the programmatic needs of groups throughout the Bureau, and beyond. A partial list includes maps created for the Land Acquisition Program (basin status, community review, gap analysis), the DEP police (overviews for presentation and public display, radio communications, crime investigation), Watershed Management Studies (Croton Watershed Strategy, Kirk Lake), the Stewardship Program (recreational use, conservation easements), the Pathogen Group (program review, early warning system), the Wildlife Studies Group (bird harassment program, wildlife surveys), the Water Quality Impacts Assessment Group (biomonitoring program sample locations, pesticides, Kensico wells, Greenwich American WWTP dye injection points and probe locations), and the Stream Management Program (conference presentation, sub-basin and restoration site program planning).

Additionally, maps were produced for: Shandaken Tunnel litigation; EOH lab operations; post-9/11 security concerns; Putnam Valley town master plan; EOH non-point FAD program; watershed regulations; septic survey program; stormwater facility designs; permit applications; project locations and constraints; project reviews; partnership protection program activities; sewer service areas; reservoir kiosks; forestry management; impervious surface; designated main street areas. Maps were created for other agencies in satisfaction of regulatory requirements, for information, and for review. The agencies included DEC (stream reclassification, Endangered Species Unit eagle observation points), Putnam County (towns, monitoring stations), supervisors of towns of the Boyd Corners and West Branch basins, and NYSDOH, among others.

Map products not only assisted Bureau staff with routine watershed monitoring and management tasks but also contributed to emergency response, planning efforts, and reports. GIS staff continued to refine interactive software routines that automate recurring mapping tasks performed by real estate specialists and stewardship program specialists.

In conjunction with these mapping efforts the GIS was used extensively to provide technical support, query and analysis for BWS projects. A short list of such projects includes the Wetland Protection Program, Forest Research, Pathogen Field Program, Terrestrial Modeling and application of the GWLF water quality loading model, Town Brook Phosphorus Loss research, Reservoir Modeling, Office of Engineering Project Locations and Project Site Constraints, Kensico Stormwater Conveyance System, Kensico Residential Survey and Identification of Failing Septic Systems, Kensico Watershed Improvement Committee, Designated Main Streets, DEC/

NYSDOT permit and project reviews, Intermediate Sized Sewage Treatment Systems, Impervious Surface Mapping/Tracking/Analysis, Baseline Documentation of Conservation Easements, Forest Stand Mapping and Research, Land Acquisition Program Tracking System, Stewardship Baseline Documentation, Land Acquisition Re-solicitation, Stream Management of Erosion and Instability, Sewer Extension, Community Planning, Whole Farm Easements, and the Watershed Land Information System (WaLIS). As noted, more detailed information about these programs, and additional ones, was included in the July 2002 and January 2003 semi-annual reports.

As the quantity and quality of available spatial data expands and as more users access the system by way of ArcView and ArcGIS software, use of the GIS as a resource for programs of watershed management continues to increase. The GIS was used to develop criteria and constraints for implementation of FAD and MOA programs; to establish baseline documentation of City-owned lands, easements, and initial conditions of other programs; to plan new, extended, or upgraded infrastructure for water supply, wastewater treatment, and stormwater management facilities; and to assist with planning for emergency response, whether terrorist attack or accidental spill. The GIS continued to play an instrumental role in supporting ongoing research into sources and processes of water quality degradation; it was used to plan for and to evaluate best management processes (BMP) and other remediation activities.

5.3.2 Data Development, Management, and Dissemination

Recognizing the importance of a high-quality spatial data library as a fundamental component of the GIS, staff continued to upgrade, create, and obtain data products. Designated GIS staff at each site managed and updated the data libraries. These efforts promoted use of a common foundation of up-to-date and accurate spatial data for Bureau GIS activity.

During 2002, work was completed on converting the datum of the entire GIS spatial data library (UTM projection), including components important for terrestrial and reservoir modeling, from the NAD 27 to the NAD 83, adopted as the legal horizontal datum for the United States. The work included automated processes for projecting both coverages and grids, automated processes for updating metadata, and extensive effort to redefine projection information for existing imagery. Such an upgrade keeps DEP current with collaborating agencies that have already made such a change and facilitates immediate use of new data products. At the close of the year the NAD 83 library had been fully tested and implemented in Kingston, with duplication to Valhalla soon to follow.

New data placed in the library after appropriate QA/QC review included: EOH land use derived from thematic layers for Westchester, Putnam, and Dutchess Counties, and relevant Connecticut towns; 1-foot resolution CIR EMERGE ortho imagery for the Cannonsville basin and EOH watershed; EOH impervious surface derived from the EMERGE imagery using a texture-mapping artificial intelligence image classifier (PAR); EOH and WOH protected open space, derived primarily from tax parcel data; a series of Landsat Thematic Mapper (TM) scenes cover-

ing the years 1984-1999; the bounds of hamlets recognized under the MOA Community Wastewater Management Program for proposed septic maintenance or community septic districts; NYS-owned lands in the East of Hudson watershed; slope grids derived from 10-meter DEMs; and locations of additional meteorological monitoring stations.

Examples of library data that were updated and reviewed for QA/QC included: DEP stream monitoring sites; newly-acquired lands (as of 6/02 and 12/02); annual updates of county tax parcel data; DEP pathogen monitoring sites; DEP meteorological stations; USGS stream gage sites; and MOA designated areas.

Throughout the reporting period DEP GIS staff provided substantial guidance and support to PAR staff working on Task 1 (Remotely Sensed Data Acquisition and Analysis) and Task 2 (Data Mining and Database Development) of this SDWA contract. DEP provided PAR with image acquisition parameters (lidar, satellite and thermal infrared imagery) to ensure that data of acceptable quality and suitability for analysis are delivered. Much DEP staff time was devoted to the development of a land cover/land use classification system suitable for multiple watershed protection programs. Support in the collection of agricultural ground truth data was provided. Interim and final data quality checks were performed. DEP staff played an integral role in guiding and supporting the direction of development for programs in the other Tasks of this SDWA project as well.

In accordance with data sharing policies developed in cooperation with DEP counsel, GIS staff responded to external requests for GIS data from representatives of watershed communities, other local/state/federal agencies, and designated consultants. In lieu of not having a data dissemination internet site due to security concerns, staff reviewed requests, forwarded those for data deemed "sensitive" to appropriate upper management or security personnel, and responded by forwarding data deemed shareable via email or CDROM. Prior to this reporting period, the BWS MIS group published a GIS data dissemination CD for the most commonly requested GIS data layers, one available to the public upon request.

A CDROM of spatial data relevant to research studies in the Town Brook sub-basin was updated and forwarded to collaborators (USDA-ARS, USGS, Cornell University). Other recipients of spatial data included Rutgers University (time-series of Landsat Thematic Mapper images for use in a US Forest Service-funded project to map hemlock forest stand location and condition, pre- and post-hemlock-wooly adelgid infestation), DEP Bureau of Environmental Engineering (ortho imagery, multiple layers), Watershed Agricultural Council (ortho imagery), ARMYCE (multiple layers for use in post-9/11 security projects), and OEPA subcontractors (multiple layers for use in the waterfowl management EIS).

Under the SDWA contract, PAR began prototyping and testing a secure "intranet" data dissemination site at their Rome, NY location, one utilizing ESRI ArcIMS technology. Once DEP has procured and set up a suitable web-server, and installed ArcIMS, development of a DEP

data sharing site can continue throughout 2003-2004. Methods for access to such a "data" dissemination site would be available to stakeholder agencies using a secure methodology or external server for selected GIS data.

5.3.3 Infrastructure

Staff accomplished significant hardware and software upgrades during the reporting period, actions necessary for maintaining an enterprise GIS of the highest caliber and for providing essential support for the diverse requirements of DEP watershed management programs.

The upstate BWS GIS was comprehensively upgraded to ESRI ArcGIS as the primary software tool for mapping and spatial analysis. ArcGIS is available at workstations in the Kingston and Valhalla GIS labs, on individual desktops at those sites, and on selected workstations at Grahamsville and Shokan. Approximately 50 staff members have received on-site, ESRI instructor-led training in ArcGIS. Two people attended ArcGIS II training. Individuals are at various stages in making the transition to ArcGIS from ArcInfo/ArcView, software that remains on the system, in part because customized tools require its use.

ArcGIS was released in conjunction with the ESRI geodatabase model, a third-generation, object-oriented data model for representing geographic information, one that replaces second-generation coverage and shapefile formats. DEP decided to implement the geodatabase within Oracle using ArcSDE, an ESRI software product that serves as a gateway for managing spatial data in a relational database management system.

The ArcGIS/ArcSDE/Oracle implementation continued to require additional expertise and support, obtained by way of SDWA funding and contractual arrangements with the New York State Department of Environmental Conservation (DEC) and PAR Government Systems Corporation (PAR) of Rome, NY.

DEP continued to test the ArcSDE/Oracle installation, and expanded the prototype geodatabase in Oracle, including data sets crucial to deployment of the Watershed Lands Information System (WaLIS) and recently-acquired, 1-foot resolution ortho imagery as seamless mosaics. Work began on reviewing the entire spatial data library and importing components to the geodatabase. DEP also provided technical assistance for the UNIX and Windows 2000 issues arising from an increased number of GIS users and workstations.

As noted, GIS server technology was upgraded with the addition of four SUN V880 Unix servers. Of the three servers in Kingston, one is a UNIX account server, the second is a GIS data library server with Oracle and ArcSDE installed, and the third is a server of remotely sensed imagery, with ERDAS Imagine installed. The new Valhalla Unix server is identical to the Kingston library server. When this equipment is fully configured, the existing coverage library and the geodatabase will be duplicated/replicated across the network from Kingston to Valhalla using UNIX and Oracle utilities.

During 2002, twelve dual-processor Xeon Windows 2000 GIS workstations were installed for "power" GIS users in Kingston, at their desktops. Four similar workstations were installed in the Kingston GIS Lab. These serve as public workstations, in combination with four UNIX machines already in place. Each station has an ATEN Masterview CPU switch that allows 2 CPUs (one UNIX, one Windows) to share a common monitor, mouse, and keyboard. Three workstations were procured for the Grahamsville (1) and Shokan (2) sites.

Additional upgrades included: new GPS firmware for two older Kingston GPS units, enabling each to utilize the same navigation tools that newer units are running; additional RAM and Windows 2000 software for 20 EOH Engineering Project Review, Regulatory Compliance and Project Management computers, also allowing for use of ArcGIS; ten COMPAQ iPAQ H3670s, Trimble GPS Pathfinder Pocket Receivers, with ArcPAD software, distributed to EOH Engineering Project Review, Regulatory Compliance and Project Management, and WOH Project Review staff; and a large-format, color map scanner at Valhalla.

GIS staff members continued their involvement in training experiences, conferences, and user groups. Staff at each site attended 2-day "Introduction to ArcGIS" training sessions offered by ESRI instructors. Two people attended the first annual NYS Remote Sensing Symposium (Albany), one participated in the annual NYS GIS Conference (Syracuse), and two attended the Northeast Arc Users Group Conference (Bretton Woods, NH). Personnel attended meetings of the Capital District Arc Users Group and the Catskill GIS Users Group. Several people participated in on-line ArcGIS/ArcSDE/Geodatabase seminars offered monthly by ESRI.

6. Regulatory Programs

6.1 Watershed Rules and Regulations and Other Enforcement/Project Review

6.1.1 Regulatory Review and Enforcement

Watershed Regulations

A primary component of DEP's overall watershed protection strategy is the enforcement of applicable environmental regulations, which include the revised Watershed Rules and Regulations (WR&R), also promulgated as State law, the federal Clean Water Act, SEQRA and others. Of these, the primary mechanism for protection of the water supply is the WR&R. DEP's enforcement efforts are focused on three major areas: review and approval of projects within the watershed; regulatory compliance and inspection; and environmental enforcement.

Project Review

Because DEP has specific review and approval authority granted by State and City law, it is considered an "Involved Agency" under SEQRA for these projects where a DEP approval is required, and must review and issue findings statements regarding projects that have potential environmental impacts in the watershed. Comments or questions raised by DEP during the SEQRA process must be addressed by the project applicant to the satisfaction of both DEP and the lead agency.

Each project proposed in the watershed, including those designed or sponsored by DEP, is reviewed to ensure compliance with the WR&R, as well as federal, State and local laws. Projects that require DEP review and approval include all wastewater treatment facilities, including the installation and maintenance of subsurface sewage treatment systems (SSTSs), preparation of stormwater pollution prevention plans (SPPPs) and the construction of certain impervious surfaces. In addition, DEP reviews and issues permits for individual residential stormwater plans (IRSPs) and for impervious surfaces associated with stream diversions or pipings. DEP also ensures that during and after construction, projects that require SPPPs or IRSPs have the necessary BMPs and that erosion controls are properly installed and maintained. In addition, DEP also reviews applications that have been sent to DEC for special permits involving mining operations, timber harvesting, stream crossings and wetland issues. These applications are forwarded to DEP for review and comment as provided for in the DEP/DEC MOU.

In June of 2002, revisions to the WR&R were promulgated that instituted the previously documented findings of the EPA mandated Galley Study. The WR&R were modified to include a definition of "galley systems," and language that prohibited the use of this type of system for subsurface treatment in the watershed.

Tables 6.1 and 6.2 list project applications received in the Boyd Corners, West Branch and Kensico Reservoir basins for the 1st, 2nd and 3rd quarters of 2002. The Croton Falls and Cross River Basins were added in the 4th quarter 2002, as these two reservoirs have the potential to feed the Delaware system.

Table 6.1. Boyd Corners, West Branch, Croton Falls, Cross River and Kensico Reservoirs new projects for 2002.

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/02
Boyd Corners	Marc Breslav/Cook Pond Dredging	Kent	CPDP	Approved
Cross River	Konetchy Lot #3	Lewisboro	IRSP	Approved
Cross River	The Harvey School	Bedford	SPPP	Approved
Croton Falls	Putnam County Courthouse	Carmel	SPPP	Approved
Croton Falls	Shear Hill Estates	Carmel	SPPP	Incomplete
Kensico	Morgan Manhattan	North Castle	SEQRA	No Application
Kensico	White Willow Subdivision	North Castle	SEQRA	No Application
Kensico	Kensico Flow Control Modification	Mt. Pleasant	SPPP	Incomplete
Kensico	Arden Site Plan	North Castle	SEQRA	No Application
West Branch	Beman Subdivision Lot 4 A	Kent	Variance	Denied
West Branch	Beman Subdivision Lot 6A	Kent	Variance	Incomplete
West Branch	Fox Valley Estates Lot 5	Kent	Variance	Approved
West Branch	Daffodil Hill Subdivision Lot 6/ Rogers	Kent	IRSP	New
West Branch	Young/Weise Lot 602/42 Upper Ninham	Kent	Variance	New

Table 6.2. Boyd Corners, West Branch, Croton Falls, Cross River and Kensico Reservoirs individual SSTSs for 2002.

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals
Boyd Corners	East Fishkill	N/A	3	0	4
Boyd Corners	Kent	N/A	1	0	9
Boyd Corners	Putnam Valley	N/A	0	0	0
Cross River	Bedford	4	3	0	10
Cross River	Lewisboro	1	2	0	6
Croton Falls	Carmel	0	2	0	2

Table 6.2. Boyd Corners, West Branch, Croton Falls, Cross River and Kensico Reservoirs individual SSTSs for 2002.

Reservoir	Town	# of Delegated Septics	# of New Septics	# of Septic Repairs	# of Approvals
Kensico	Harrison	N/A	0	0	0
Kensico	Greenwich, Ct.	N/A	0	0	0
Kensico	Mount Pleasant	N/A	0	0	0
Kensico	New Castle	N/A	1	0	3
Kensico	North Castle	N/A	0	0	0
West Branch	Carmel	N/A	1	0	5
West Branch	East Fishkill	N/A	1	0	0
West Branch	Kent	N/A	3	0	9
Totals		**5**	**17**	**0**	**48**

All new individual septic system applications in Kensico, West Branch and Boyd Corners basins are subject to joint review by DEP and the Putnam County Health Department. Table 6.3 lists all projects received in 2002 in the Cannonsville, Pepacton, Rondout, Neversink, Schoharie and Ashokan Reservoirs in the Delaware and Catskill systems. The "Other" projects consist of DOT projects, wetland, stream disturbances and mining applications from DEC, timber harvests and Stormwater Retrofit projects. The septic projects listed below are new or repaired commercial, institutional or multi-family septics. The new, delegated and remediated individual septic systems are listed in Tables 6.4 and 6.5.

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schohaire Reservoirs new projects for 2002

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/02
Ashokan	Communications Network Facility	Olive	SEQRA	No Application
Ashokan	Chinese Restaurant @ Singer Denman	Olive	Comm. SSTS Repl.	Approved
Ashokan	OWSL #4200N	Woodstock	SEQRA	No Application
Ashokan	Helen Pappas Apartments	Hurley	New Comm. SSTS	Withdrawn
Ashokan	NYSDOT Rt. 28 Over Esopus/Birch Creeks	Shandaken	Other	No Application
Ashokan	Murray, Paul	Woodstock	Variance	Approved
Ashokan	Coc Studio	Woodstock	SPPP	Approved
Ashokan	Savage Subdivision	Shandaken	New Comm. SSTS	Incomplete
Cannonsville	Mountain Brook Inn	Bovina	Comm. SSTS Repl.	Approved

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schohaire Reservoirs new projects for 2002

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/02
Cannonsville	Route 10 Gravel Bank	Walton	Other	No Application
Cannonsville	Wright, Candice	Kortright	Variance	Approved
Cannonsville	C&D Debris Landfill Expansion	Walton	Other	No Application
Cannonsville/ Pepacton	DCDPW Jet/Vacuum Truck	All	Other	No Application
Cannonsville	Sunrise Heating Fuels, Inc.	Stanford (V)	New Comm. SSTS	Approved
Cannonsville	Burton F. Clark Sand & Gravel	Stamford (V)	Other	No Application
Cannonsville	DeLancey House Restaurant	Hamden	New Comm. SSTS	Approved
Cannonsville	V/Walton Stormwater Retrofit	Walton (V)	SPPP	Complete
Cannonsville	Church of Jesus Christ of Latter Day Saints	Delhi (V)	Sewer Connection	Approved
Cannonsville	Morningstar Foods, Phase I	Delhi	SPPP	Approved
Cannonsville	Cobane, Timothy & Nancy	Walton	CPDP	Approved
Cannonsville	Pines Brook Trailer Park	Walton	Comm. SSTS Repl.	Approved
Cannonsville	Village Seafood	Kortright	Comm. SSTS Repl.	Approved
Cannonsville	CR 14 Bridge & Highway	Delhi	Other	No Application
Cannonsville	Walton Mined Land	Walton	Other	No Application
Cannonsville	CORE Values	Stamford (V)	SPPP	Approved
Cannonsville	Rama Property	Delhi	Stream Disturbance	No Application
Cannonsville	Inman Property	Bovina	Stream Disturbance	No Application
Cannonsville	Department of Emergency Services	Hamden	New Comm. SSTS	Approved
Cannonsville	Weiland, Gary	Stamford (V)	Variance	Approved
Neversink	CTS of Neversink	Neversink	New Comm. SSTS	Approved
Neversink	Grahamsville Police Precinct #1	Neversink	New Comm. SSTS/ SPPP	Approved
Neversink	Grahamsville Police Precinct #2	Neversink	New Comm. SSTS/ SPPP	Approved
Neversink	Grahamsville Deli	Neversink	Other	No Application

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schohaire Reservoirs new projects for 2002

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/02
Pepacton	Roxbury Stormwater Retrofit	Roxbury	Other	No Application
Pepacton	Halcott Stormwater Retrofit	Halcott	Other	No Application
Pepacton	OWSL #4196N	Middletown	SEQRA	No Application
Pepacton	Marchetto, Dean	Andes	IRSP	Approved
Pepacton	Josh Construction Sand & Gravel Bank	Middletown	Other	No Application
Pepacton	OWSL #4145N	Middletown	SEQRA	No Application
Pepacton	Vigliarolo, Frank	Roxbury	Variance	Approved
Pepacton	Cassese, John	Colchester	IRSP	Approved
Pepacton	Bauer Stream Disturbance	Middletown	Stream Disturbance	No Application
Pepacton	Schuman Stream Disturbance	Roxbury	Stream Disturbance	No Application
Pepacton	Cumming & Phillipou SSTS	Roxbury	New Comm. SSTS	Approved
Pepacton	Busciglio Stream Disturbance	Middletown	Stream Disturbance	No Application
Pepacton	Szerko/Greissel Property	Middletown	Stream Disturbance	No Application
Pepacton	Donarummo, Fred	Roxbury	Variance	Approved
Pepacton	Tatka, Bartek & Arthur	Middletown	Variance	Complete
Pepacton	Miljevic, Hasim	Colchester	Variance	Approved
Pepacton	Vigliarolo, Frank	Roxbury	Variance	Approved
Pepacton	McArdle, Frances	Roxbury	Comm. SSTS Repl.	Complete
Pepacton	Jenkins Gravel removal	Middletown	Stream Disturbance	No Application
Pepacton	Gladys Fairbairn Property	Andes	Stream Disturbance	No Application
Rondout	Slutsky Timber Harvest	Wawarsing	Timber Harvest	No Application
Rondout	Terwilliger Timber Harvest	Wawarsing	Timber Harvest	No Application
Rondout	OWSL #4214	Wawarsing	SEQRA	No Application
Rondout	Purcaro Timber Harvest	Wawarsing	Timber Harvest	No Application
Schoharie	Ashland Sand & Gravel	Ashland	Other	No Application

Table 6.3. Ashokan, Cannonsville, Neversink, Pepacton, Rondout, Schohaire Reservoirs new projects for 2002

Reservoir Basin	Project Name	Town	DEP Approval Required	Project Status as of 12/31/02
Schoharie	NYSDOT Culvert Repair and Replacement	Hunter/Lexington/ Windham	Other	No Application
Schoharie	Westkill Flood Management	Lexington	Stream Disturbance	No Application
Schoharie	Mountaintop Arboretum	Hunter	New Comm. SSTS	Approved
Schoharie	Gelber & Diamond Properties SSTS	Hunter (V)	Comm. SSTS Repl.	Approved
Schoharie	Grand Gorge Firehouse	Roxbury	Sewer Connection	Approved
Schoharie	Dolans Lake Streambank Stabilization	Hunter (V)	Stream Disturbance	No Application
Schoharie	Windham NIP-Town Sewer (South Street)	Windham	SPPP/Sewer Collection	Incomplete
Schoharie	Windham NIP-DOT Route 23	Windham	SPPP/Sewer Collection	Incomplete
Schoharie	NYSDOT Route 23 Over Batavia Kill	Windham	Other	No Application
Schoharie	NYSDOT Concrete Repairs	Jewett	Other	No Application
Schoharie	Tytla, Bohdanna	Lexington	Variance	Approved
Schoharie	Fromm, Robert	Windham	CPDP	Approved
Schoharie	Hutchinson, Richard A.	Lexington	CPDP	Approved
Schoharie	Boyle, James	Lexington	CPDP	Approved
Schoharie	Okonsky, Adam – Lots #1 & #2	Windham	New Comm. SSTS/ SPPP	Approved
Schoharie	Mill Race Stormwater Retrofit	Windham	Other	No Application
Schoharie	T/Hunter Sewer Extension	Hunter	SEQRA	No Application
Schoharie	Windham/Ashland/ Jewett CSD	Windham	SEQRA	No Application
Schoharie	Dimaio Property	Jewett	Stream Disturbance	No Application
Schoharie	Ostrander Property	Hunter	Stream Disturbance	No Application
Schoharie	Tompkins Property	Ashland	Stream Disturbance	No Application
Schoharie	Dahlberg, Eric	Conesville	IRSP	Approved

Table 6.4. Ashokan and Schohaire Reservoirs individual SSTSs for 2002.

Reservoir	Town	# of Delegated Septics*	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Ashokan	Hurley	5	N/A	4	17	10
Ashokan	Olive	18	N/A	13	35	27
Ashokan	Shandaken	19	N/A	16	26	13
Ashokan	Woodstock	12	N/A	8	16	8
Schoharie	Ashland	N/A	16	2	23	13
Schoharie	Conesville	N/A	6	1	8	3
Schoharie	Gilboa	N/A	1	3	5	1
Schoharie	Hunter	N/A	8	3	16	11
Schoharie	Hunter (V)	N/A	0	0	0	0
Schoharie	Jewett	N/A	17	1	25	11
Schoharie	Lexington	N/A	11	6	19	16
Schoharie	Prattsville	N/A	11	3	12	6
Schoharie	Roxbury	N/A	1	3	5	4
Schoharie	Stamford	N/A	0	0	0	0
Schoharie	Tannersville (V)	N/A	0	0	0	0
Schoharie	Windham	N/A	23	6	27	12
Totals		**54**	**94**	**69**	**234**	**135**

* DEP has an agreement with Ulster County to review new individual SSTS applications.

Table 6.5. Cannonsville, Pepacton, Rondout, Neversink Reservoirs individual SSTSs for 2002.

Reservoir	Town	# of Delegated Septics*	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Cannonsville	Bovina	N/A	8	2	8	3
Cannonsville	Delhi	N/A	12	6	18	13
Cannonsville	Franklin	N/A	1	0	1	1
Cannonsville	Hamden	N/A	6	2	11	6
Cannonsville	Harpersfield	N/A	3	1	5	3
Cannonsville	Hobart (V)	N/A	1	0	1	0
Cannonsville	Jefferson	N/A	0	0	0	0
Cannonsville	Kortright	N/A	2	3	7	8
Cannonsville	Masonville	N/A	0	0	0	0
Cannonsville	Meredith	N/A	5	0	6	7
Cannonsville	Sidney	N/A	0	0	0	1

Table 6.5. Cannonsville, Pepacton, Rondout, Neversink Reservoirs individual SSTSs for 2002.

Reservoir	Town	# of Delegated Septics*	# of New Septics	# of Septic Repairs	# of Approvals	# of Constructions
Cannonsville	Stamford (V)	N/A	7	1	8	3
Cannonsville	Tompkins	N/A	5	1	7	4
Cannonsville	Walton	N/A	15	8	22	12
Neversink	Denning	2	N/A	2	4	1
Neversink	Hardenburgh	N/A	0	0	0	0
Neversink	Neversink	N/A	2	5	7	2
Pepacton	Andes	N/A	15	5	19	20
Pepacton	Bovina	N/A	0	0	0	0
Pepacton	Colchester	N/A	2	1	8	3
Pepacton	Fleischmann's	N/A	1	0	1	1
Pepacton	Halcott	N/A	3	0	4	2
Pepacton	Hamden	N/A	0	2	2	2
Pepacton	Hardenburgh	2	N/A	0	5	2
Pepacton	Margaretville (V)	N/A	0	0	0	0
Pepacton	Middletown	N/A	20	3	25	13
Pepacton	Roxbury	N/A	7	9	21	7
Pepacton	Wawarsing	0	N/A	0	0	0
Rondout	Denning	1	N/A	1	4	1
Rondout	Fallsburg	N/A	0	0	0	0
Rondout	Hardenburg	0	N/A	0	0	0
Rondout	Neversink	N/A	18	20	27	21
Rondout	Rochester	1	N/A	0	0	0
Rondout	Wawarsing	0	N/A	3	3	2
Totals		**6**	**133**	**75**	**224**	**138**

* DEP has an agreement with Ulster County to review new individual SSTS applications.

Wastewater Treatment Facility Compliance Inspection Program

Wastewater treatment plants in the Catskill and Delaware watersheds continue to show improvement in compliance with their State Pollutant Discharge Elimination System (SPDES) permits over the past year, in large part due to DEP's Wastewater Treatment Facility Compliance Inspection Program. Facilities showing notable improvement in compliance records in 2002 include Hunter Highlands, Harriman Lodge, Ski Windham, (V) Hobart, (V) Walton, and (V) Stamford. Past problematic facilities such as Mountainside Restaurant, Camp Nubar and Whistle-tree Development have shown marked improvement for the 2002 year over the prior year.

Another facility, Regis Hotel, was subject to pump-outs during part of the year, due to the work of inspection program staff. Because these pump-outs did not positively affect effluent quality, DEP and the facility have instituted additional structural measures. The facility installed a holding tank after the septic tank and prior to dosing in an attempt to reduce organic and hydraulic loadings to the undersized sand filter beds. Pumpouts from the holding tank occurred on a near daily basis. This measure did not cause the facility to meet its SPDES permit consistently; subsequently, a compliance assistance conference was held with facility representatives and the NYSDOH. Currently, DEP and the facility are exploring the use of a mobile treatment unit for the 2003 operating season.

Latvian Church Camp, which is permitted for a surface discharge, continued to be subject to restricted subsurface discharge to avoid non-compliant surface discharges. The facility is currently being converted to a subsurface disposal system under the DEP's upgrade program; work is approximately 90% completed and will be fully functional by the commencement of the 2003 season.

Camp L'Man Achai was also subject to a "no surface discharge" requirement for its entire 2002 operating season. As a result, the camp had to hold and haul its entire WWTP flow. Drainage and piping problems created a surface breakout of untreated gray water from the facility's kitchen. This discharge was immediately collected and pumped to the septic tank. A Notice-of-Violation was issued in October 2002, for this illegal discharge. The camp will again be required to operate under the hold and haul requirement for the 2003 operating season. It is anticipated that the facility will commence full upgrade construction during the summer of 2003.

Notification by the inspection program staff, and in one case directly by DEP sampling staff, caused several facilities to take immediate corrective action during specific incidents of acute operational or equipment failures. This resulted in avoidance or elimination of non-compliant discharges. These facilities included Thompson House, Ski Windham, Mountain View Estates, Mountainside Restaurant, Whistletree Development and Forester Motor Lodge.

At each surface discharging wastewater facility that operates on a year-round basis, DEP conducts four inspections, one for each calendar quarter. At seasonal surface discharging facilities, a minimum of two inspections per year are conducted during the facility's operating season. Similarly, at least two inspections per year are conducted at non-contact cooling water discharges to surface waters. Treated industrial waste discharges to groundwater, via ground surface application, are inspected four times per year.

A total of 41 WOH wastewater treatment facilities were inspected on a regular schedule. Of those, 30 facilities are permitted for year-round discharge and 11 are permitted for seasonal discharge. Of this overall total, three are wastewater treatment facilities permitted to discharge to groundwater. Two other discharges are industrial non-contact cooling water discharges. The total number of regularly scheduled inspections of WWTPs in the Catskill/Delaware watershed in

2002 was 258. Approximately 80 of these inspections were related to the DEP's upgrade construction work for the following facilities: (V) Walton, (V) Delhi, (V) Stamford, (V) Hobart, Mountainside Farms, Hunter Highlands, Latvian Church Camp, Harriman Lodge and Allen Residential Center. Two of these facilities, Allen Residential Center and Harriman Lodge are no longer WWTPs. Allen Residential Center is now being pumped via a 3.5 mile long force main to the (V) Hobart WWTP. This work was completed during late summer of 2002. Harriman Lodge has been fully converted to subsurface discharge as of July 2002. These facilities have had their respective SPDES permit terminated by the DEC; therefore, they will no longer be inspected on a regular basis by the DEP and have been taken off the DEP's inspection schedule. However, DEP may conduct follow-up site visits during the 2003 season.

In addition to regular inspections, DEP conducts follow-up inspections when necessary. If it is determined at the initial inspection that non-complying conditions exist and corrective action is necessary, a follow-up inspection is scheduled to ensure that corrective actions are implemented and that an effort is being made to return the facility to compliance or to correct operational deficiencies. Also, following an enforcement initiative, staff may periodically conduct a follow-up unannounced visit to ensure that the facility is continuing in its efforts to remain in compliance. Approximately 20 follow-up inspections were made at various facilities throughout the year.

Several facilities had construction remediation or improvements made in response to compliance actions initiated by DEP. During and after construction work on any facility, DEP will visit the facility to observe the work and to ensure the construction is in accordance with approved plans. Approximately 15 non-upgrade program construction inspections were performed in 2002.

DEP also visits facilities to meet with owners and/or operators to address special problems and to offer operating suggestions. In addition, DEP labs conduct special analyses to help identify reasons for actual or potential violations by determining if the collection of special samples in the treatment process train is needed. DEP conducted approximately 10 such visits in 2002.

In 2002, two Compliance Assistance Conferences were held between DEP and facility owners. There was one NOV issued. There were two referrals to the NYSDOH for assistance in implementing enforcement actions.

In addition, DEP coordinates enforcement activities with DEC through the quarterly Watershed Enforcement Coordination Committee (WECC) meetings. At these meetings the status of watershed WWTPs is discussed and steps are taken to ensure that adequate enforcement activities are pursued. Staff from EPA and DOH also participate in the WECC meetings.

6.1.2 Sampling of Wastewater Treatment Plant Effluents

Sampling of wastewater treatment plant (WWTP) effluents is conducted by DEP's District Laboratories: Grahamsville Lab in the Delaware District and Ben Nesin Lab in the Catskill District. Non-City-owned surface-discharging WWTPs are sampled twice monthly and City-owned

WWTPs are sampled at least weekly. Sampling data are shared regularly with DEP's Facilities Compliance Section for the purpose of tracking compliance with SPDES-permitted effluent limits.

The City-owned WWTPs are sampled in accordance with the monitoring requirements of their State Pollutant Discharge Elimination System (SPDES) permits, and grab-samples are taken at non-City-owned facilities. Once a year, a composite sample is collected from those non-City-owned WWTPs that have composite sampling monitoring requirements on their permits. In the Catskill District in 2002, composite samples were collected from Snowtime, Hunter Highlands, Liftside, Onteora Central School, and Colonel's Chair Estates, and from the City-owned WWTPs at Tannersville, Grand Gorge, and Pine Hill. In the Delaware District, composite samples were collected from Village of Walton, Village of Stamford, Village of Hobart, Mountainside Farms, Ultradairy, and Village of Delhi, from the City-owned WWTPs at Margaretville and Grahamsville, and from the non-contact cooling water discharge at Kraft. Effluent total phosphorus concentration data are collected from all facilities regardless of whether or not this parameter is permitted so that the data can be used to develop point-source phosphorus loads. In 2002, the Ben Nesin Laboratory conducted 3,963 analyses on 798 effluent samples and the Grahamsville Laboratory conducted 4,435 analyses on 489 effluent samples from WWTPs (and non-contact cooling water discharges) discharging within the water-supply watershed only.

To monitor the effluent quality of WWTPs that receive high weekend usage during the ski season, weekend samples were collected on the holiday weekends of New Years, Martin Luther King Day, and Washington's Birthday, at Whistle Tree, Snowtime, Mountain View Estates, Mountain View Homeowners Association, Liftside, Hunter Highlands, and Forester Motor Lodge. In general, these samples contained slightly more exceedances of SPDES-permitted parameters than standard weekday samples collected during the ski season.

6.1.3 Protection Activities

During 2002, the Protection Section performed routine patrols of City-owned reservoirs, aqueducts, and the watershed area; performed discovery and confirmation, issued Notices of Violation, and pursued enforcement actions on failed subsurface sewage treatment systems; reviewed residential building sites from the testing phase through the completion of construction for subsurface sewage treatment systems; referred other potential WR&R violations to the Engineering Section; referred criminal activity to the DEP Police; performed supplemental SPPP inspections; issued Fishing and Boating Permits and enforced Fishing and Boating Regulations; documented and pursued removal of encroachments on water supply lands; and performed numerous other activities to protect the water supply. Additionally, these activities are coordinated with DEP and Corporation Counsels, local County Health Departments, local building inspectors, and the Catskill Watershed Corporation in the MOA program areas. Protection staff also performed a house-to-house survey of the Kensico watershed.

In 2002, Protection accomplished the following (the East of Hudson figures are watershed wide, and include both the Boyd Corners/West Branch, Kensico, and all Croton System Reservoirs, aqueducts, and watershed areas):

Table 6.6. 2002 Protection Section activities.

	East of Hudson	Catskill	Delaware
Workload Item Description			
New, Remdeiated or Delegated Onsite SSTS's Construction Approved	N/A	64	120
New, Remdeiated or Delegated Onsite SSTSs Design Approved	48	234	224
Public Access Permits Checked	4458	800	1732
Boating Permits Checked	212	174	144
Sectors Patrolled	160.5	0	1
Aqueduct Patrols	36.75	25.5	48
Individuals Removed from City Property	1260	454	83
Police Referrals	0	10	4
Complaints Received	0	23	4
Spills Responded To	N/A	N/A	N/A
NOVs/NOFs Issued	12	107	38
Fishing And Boating Permits			
Public Access Permits Issued/Renewed	5875	N/A	N/A
Boat Permits Issued/Renewed	698	352	865
Boat Permits Validated	3828	1,265	3173
Boats Steam Cleaned	556	121	188
Other Reported Items			
Miles Traveled	208752	145,138	340970
Onsite SSTSs Pending Construction		261	148

Note: In January 2003, the Protection Section was reorganized.

Over the course of the past decade, New York City's comprehensive watershed protection program has evolved dramatically. DEP has used the results of scientific and engineering studies to focus protection efforts. DEP also now has extensive contracts for watershed protection programs with organizations such as the Watershed Agricultural Council and the Catskill Watershed Corporation, which has changed the way the City protects the watershed. As the program has evolved, DEP's organizational structure has changed to better focus watershed protection resources. In 1996, the Bureau of Water Supply (BWS) was formed, as was the Division of Watershed Lands and Community Planning (WLCP). Then in 1997, enhanced Watershed Rules and Regulations (WR&R) went into effect and the Engineering Section expanded its role in the review of proposed watershed projects. Throughout this period, the Protection Section was reor-

ganized itself becoming a single unit (previously part of Districts). More recently, DEP has significantly increased the size of the DEP Police force to provide enhanced security at water supply facilities and throughout the watershed, and formed the Division of Regulatory Compliance and Facilities Remediation, which addresses spills in the watershed as part of its mission.

In light of these changes, BWS re-evaluated the functions performed by the Protection Section, and determined that those functions could be carried out more efficiently and effectively if Protection staff was reallocated to other existing units. The reallocation will not lead to a diminishment of the functions served by Protection. Quite the contrary, DEP believes that the watershed protection effort will be improved by combining Protection staff with staff in other units who are performing similar, complimentary functions. In addition, the reorganization will clarify the roles and responsibilities of the various involved units.

The 2003 FAD report will contain more information on the reorganization.

6.1.4 DEP Police Activities

DEP Police are responsible for the security of water supply facilities and enforcement of environmental laws. DEP Police patrol the City's watershed on a daily basis with emphasis on critical water supply structures, such as chambers, dams and aqueducts. These patrols include sector patrols as well as aerial and surface water surveillance. Officers help track new developments, construction, or other activities that may affect water quality, and refer all relevant information to the appropriate group within DEP for follow-up. The DEP Police also provide support services to other DEP divisions as well as to local community enforcement offices.

Since the events of September 11, the DEP Police have increased their focus on protection of critical water supply facilities, and supplemented their force with State Department of Corrections personnel. In addition, DEP is working with ACOE to assess facilities and design and install certain access control and surveillance measures

The following table summarizes the enforcement activity of the DEP Police in 2002.

Table 6.7. 2002 DEP Police activity.

Description	Summons/Arrests	NOWs
Penal Law Trespass	487	54
Environmental Conservation Trespass	5	0
Hazardous Material Release	0	0
Hazardous Material Spill	4	0
Discharge to Stream	0	0
Dumping	7	1
Solid Waste to Environment	5	0
Turbidity/Contravention	4	1
Working in Stream without Permit	2	0

Table 6.7. 2002 DEP Police activity.

Description	Summons/Arrests	NOWs
Fishing without License	36	1
Failure to Carry a License	2	0
Depositing Noisome Substance	8	0
Fishing Other Than Angling/Fishing with more than 2 lines	2	0
Failure to Contain Waste	0	0
Hazardous Substance to River	1	0
Hunting with Artificial Light	0	0
Taking Game from Highway	1	0
Taking Undersize Fish	0	0
Taking Fish out of Season	2	0
Penal Law (Other than Trespass)	43	0
V&T	751	1
All Other	39	13
No Covering Device	6	0
Removal of Trees	3	0
Unattended Poles	2	0
Improper Tagging	3	0
Firearm in Vehicle	2	0
Unclassified ECL	4	0
Failure to Report	1	0
Total	1,420	71

6.1.5 Delegation Agreements

Westchester, Putnam and Ulster County Health Departments continued to perform reviews of septic systems in accordance with the Delegation Agreements. We received documentation concerning the review of 65 delegated systems in the Catskill and Delaware systems in the East and West of the Hudson during the calendar year 2002. The total number of delegated systems reviewed in the entire watershed is 272 during the calendar year 2002.

6.1.6 Winter Road Deicer Policy and Program Development

In June 1998, the Delaware County Department of Transportation asked DEP if there might be any water quality concerns with the use of a new winter road maintenance product made of grain distilling by-products and sodium chloride. Laboratory analysis and subsequent biostimulation experiments found the particular product in question to have large concentrations of bioavailable phosphorus. As DEC had already issued a Beneficial Use Determination to the manufacturers of the particular product in question, DEP had no regulatory recourse to prevent its use. However, DEP issued results of the analyses to several government agencies, and the issue of high phosphorus concentrations in this new wave of winter road maintenance products became known to State and local Departments of Transportation.

As many of the local governments within the water supply watershed are aware of DEP's efforts to protect water quality, including efforts to reduce phosphorus loads in the watersheds, some local governments accepted DEP's position on the new deicing agents which incorporated industrial by-products and refrained from using them. However, in discussions with staff from the Watershed Inspector General's (WIG) office of the NYS Attorney General, a consensus developed regarding the value of a stated policy on total phosphorus content in deicing products. Over the course of five months in 2001-2002, staff from DEC, NYSDOT, DOH, WIG, and DEP gathered data on the total phosphorus concentrations in various products being offered on the market and developed a policy statement on acceptable total phosphorus concentrations in these products. That policy was finalized and placed on the WIG's website in April 2002 (http://www.oag.state.ny.us/environment/deicer.html). The primary goal of the policy was to establish and promote the following categories of total phosphorus concentrations in road deicers:

- Endorsed: products that contain 50 parts per million total phosphorus (ppm) or less;
- Discouraged: liquid products that contain more than 100 ppm (particularly in Delaware, Putnam, and Westchester Counties), and
- Avoid: Any deicer that contains greater than 250 ppm should not be used or applied within the Watershed.

When the policy was finalized, WIG staff also mailed it out to Town and County government offices in the water supply watershed with a survey requesting information on the quantity and type of deicing products used by local DOTs. In the course of developing the policy, it was discovered that most roads within the watershed are maintained by local DOTs rather than NYSDOT. Completed surveys were to be forwarded to DEP for tracking. However, over the last year only three survey forms have been returned. DEP also set up an analytical contract to enable testing of new products as they became available so that the total phosphorus concentrations of new products could be known and compared to the policy.

DEP plans to re-issue the survey form and follow up with local DOTs on winter road maintenance practices. Also, samples of winter road maintenance materials stockpiled at DOTs will be collected to help inform the current policy. By tracking the quantities being used and the total phosphorus concentrations (as well as other analytes such as biochemical oxygen demand and heavy metals) of material being used for winter road maintenance, DEP expects to continue to develop and promote an informed policy on this practice.

6.1.7 Pilot Stormwater/Permit Review Agreement

Following lengthy discussions with the Town of North Castle during 2002, the town and DEP agreed to implement a Pilot Stormwater Enforcement Program. Under the provisions of the pilot program, DEP and North Castle will coordinate permitting review and enforcement actions to effectively prevent Stormwater Pollution Plan failures, and other non-permitted activities that result in turbidity violations. As part of the program, North Castle agreed to involve DEP in the earliest stages of the environmental review of projects subject to SEQRA, and to forward all

applications governed by the Town's wetlands regulations to DEP. During the reporting period North Castle forwarded two large development proposals, one of which was MBIA, to DEP for review and comment.

6.1.8 Applicant's Guides

During the reporting period, DEP completed revisions to its applicant's guides and forwarded them to the Watershed Protection and Partnership Council (WPPC). The guides, which were developed prior to promulgation of the WR&Rs in May 1997, were amended to clarify the permitting process for applicants and to reflect developments in regulatory policies since 1997.

DEP amended the guides in response to comments from the New York State Department of Health, EPA, and the Riverkeeper. No other members of the WPPC commented on the guides.

During 2002, DEP established a working group to collect stormwater BMP pollutant removal efficiency data, and other related information, necessary to develop appropriate revisions to the Applicant's Guide to SPPPs. DEP will utilize the information to revise the guide, by June 2004, to provide performance based benchmarks, highlight the importance of non-structural BMPs, and to promote innovative site designs that minimize the area of new impervious surfaces.

7. Catskill/Delaware Filtration/UV Disinfection Facilities

This summarizes the work performed by DEP and their consultants, the Joint Venture of Hazen and Sawyer/Camp Dresser & McKee (the Joint Venture) on the Catskill/Delaware Water Treatment Projects, namely Filtration and Ultraviolet (UV) Disinfection. During this year, the primary focus has been on the development of plans for Ultraviolet Disinfection Facilities and a means for validating UV reactors.

In addition, DEP and the Joint Venture have stayed current on technology and site-related issues that would affect the Preliminary Designs for filtration facilities, which were last submitted in 2001. To maintain the time-neutral dual-track approach outlined in the FAD, DEP will be submitting biennial updates of these designs.

Two deliverables were due during this period, 1) Complete Conceptual Designs for UV Disinfection Facility and 2) Initiate Preliminary Design of UV Disinfection Facilities. In accordance with these requirements, DEP submitted Conceptual Designs in May and issued a letter in August indicating that these designs would be advanced.

7.1 Ultraviolet Disinfection

7.1.1 Conceptual Designs

Building upon the work presented in the December 2001 Feasibility Study, DEP and the Joint Venture developed designs for UV disinfection facilities for the Catskill and Delaware Supplies at Kensico Reservoir in the Town of Mount Pleasant. As outlined in the Feasibility Study, these facilities would provide for a combined treatment capacity of 2,200 million gallons per day (MGD) – an 800 MGD facility for the Catskill Water Supply and a separate 1,400 MGD facility for the Delaware Water Supply, each sited in the corresponding aeration basins at the Kensico complex.

Conceptual Designs for these facilities were completed in May 2002, and submitted for review by EPA and DOH. In light of the fact that the federal and State regulations governing this project are still being developed, DEP and the Joint Venture have employed conservative design factors at this stage of the project. As an example, 20% reactor redundancy, previously cited in the feasibility study, has been repeated for the Conceptual Designs. Other areas where a conservative approach has been applied include, but are not limited to, back-up power supply and design dose. DEP intends to reevaluate these parameters in future stages of design and will maintain compliance with the LT2 regulations.

Two types of UV lamps are currently used in the water industry -- low-pressure, more notably low pressure/high output, and medium-pressure lamps. These designations refer to the operating pressure of the mercury within each lamp. At the direction of DEP, the Joint Venture

has been evaluating both through literature searches, vendor presentations and operator dialogue. While there are differences in their properties, each delivers light within the germicidal wavelength of 230-300 nanometers (nm).

- Low-pressure/high output (LPHO) lamps deliver nearly monochromatic light with peak wavelengths at 185 nm and 253.75 nm. Due to the natural absorbance of water (up to 220nm), only the peak at 253.7 nm will be applicable for the disinfection of microorganisms in drinking water. These lamps operate at a higher intensity than the low-pressure lamps that were more widely used in past decades, leading to a reduction in the number of lamps or reactors that would need to be installed, compared to their predecessor.
- Medium-pressure (MP) lamps deliver polychromatic light with wavelengths within and beyond the germicidal range. Operating at a higher pressure than the LPHO lamps, these lamps exhibit higher operating temperatures. As a result, their use within a reactor is limited to horizontal configurations that provide uniform flow and reduces the chance for lamp and sleeve breakage. Like the LPHO lamps, these lamps also provide for smaller footprints than the traditional low-pressure systems of recent history. Due to the increased light intensity above LPHO equipment, these lamps better lend themselves to larger capacity installations by reducing the size of the overall facility footprint. More frequent replacement cycles and higher operating energy requirements are characteristic of these lamps.

In addition, the construction and operating costs for facilities using each type of lamp are also being developed and evaluated. These costs, as well as several non-economic factors including ease of operation, likelihood of technological improvement and availability of manufacturers, will also be taken into account before DEP identifies the type of lamps and reactors that will be specified for the project.

7.1.2 Reactor Validation through Modeling

Coincident with the evaluation of the advantages and disadvantages of LPHO and MP reactors, DEP has been continuing the effort to ensure that the UV reactors will provide an appropriate level of disinfection. This is to be accomplished by validating the reactors for a range of operating parameters. To attain the previously referenced design-flows in a cost-effective and space-efficient manner, DEP is proposing the use of reactors that are sized larger than those traditionally installed or currently validated.

DEP and the Joint Venture have been exchanging dialogue with the manufacturers listed below to determine the likelihood of having large-scale (>20 MGD) reactors fabricated and validated for use on the Catskill and Delaware water supplies. These vendors currently represent the leading UV manufacturers within the North American market.

- Calgon Carbon Corporation
- Severn-Trent Services
- Trojan Technologies
- Wedeco-Ideal Horizons

To date, full-scale validation facilities are not available for reactors with capacities greater than 20 mgd. DEP has therefore been pursuing validation with computer modeling methods rather than traditional bioassay testing methods. Using biodosimetry test results from smaller scale reactors and correlated computer based light intensity and fluid dynamic models, the Joint Venture has been developing the means to use similar models to predict the performance of larger reactors.

To assist in this effort, the services of Bolton PhotoSciences, Inc. and Fluent, Inc. have been engaged and a Peer Review Panel has been established. Bolton PhotoSciences, Inc has been providing the expertise to develop light intensity distribution (LID) models using while Fluent, Inc. has been supporting the development of computational fluid dynamic (CFD) models. By integrating these two models, the radiation and hydrodynamic characteristics of the reactor can be captured in a format that can be used to predict a reactor's inactivation capability. This in turn can be used to develop reactor-specific operating parameters to achieve a prescribed delivered dose.

During a meeting at EPA's Manhattan offices on April 17, staff from DEP and the Joint Venture offered a presentation outlining various elements of the project. In addition to a recapitulation of the Feasibility Study, a status report on the pending Conceptual Designs was offered. In anticipation of the forthcoming release of draft protocol for computer based reactor validation, the agenda also included a presentation on the objectives and modeling approaches that would be employed for this effort. Preliminary findings were shared and discussed.

A Peer Review Panel was convened early in the year to review and, where necessary, revise the draft protocol document. The members of the Peer Review Panel are:

- Karl Linden, Ph.D. an Associate Professor at Duke University
- Joel Ducoste, Ph.D. an Associate Professor at North Carolina State University
- Harold Wright, A Research Scientist with Carollo Engineers
- Alex Mofidi, Team Leader: Water Quality-Process Development of Metropolitan Water District of Southern California

The members of the panel met on May 6 to provide their comments and guidance for improving the modeling protocol. Later in the month, copies of the updated protocol document were distributed to EPA and DOH for review and comment. Subsequently, invitations to meet with representatives of the Peer Review panel were extended to EPA and DOH staff. This meeting was held on August 1. Comments received at or before this meeting were incorporated into the protocol. A revised document was later circulated to the meeting attendees.

Using available information for the Wedeco K3000 medium pressure reactor, an integrated CFD/LID model was developed and compared directly against biodosimetry data collected during full-scale reactor validation at the DVGW testing facility. The modeling runs and validation testing were performed using several operating flows, and varied lamp power conditions to simulate a range of operating conditions that could occur during the life of a UV lamp. With the

exception of flawed data-points, the comparison of certification points between the data sets shows promising results. This work has been discussed in-depth on several occasions during the year.

No additional modeling runs have been performed. Both Trojan Technologies and Calgon Corporation have been working with the Joint Venture to establish a basis for information exchange that is consistent with corporate policies to ensure the protection of any proprietary elements of their respective products. Although Wedeco has indicated a willingness to provide information for one of their low-pressure reactors, modeling work for this equipment has not been initiated.

7.1.3 Investigation into Full-Scale Reactor Validation

To conduct traditional validation methods using biodosimetry, a number of requirements must be met. These include:

- A suitable supply of source water (+/- 1.5 MG per run of water with appropriate water quality characteristics)
- The infrastructure to deliver, spike, treat, test and dispose of the water used in testing at a flow rate no less than 40 MGD
- Challenge microbes (or suitable surrogate) in volumes to support multiple runs
- Ability to achieve or simulate a range of UV transmittance conditions
- Superstructure to house testing equipment and support facilities (i.e., electrical equipment and storage space)

Since the largest internationally available validation facility is limited by its ability to deliver no more than 20MGD to a reactor for evaluation, DEP has been investigating opportunities to meet the requirements noted above so that full-scale bio-assay testing can be performed on reactors with a design flow greater than or equal to 40 MGD. To this end, DEP has opened dialogue with several vendors, evaluated several City-owned siting opportunities and received proposals from several entities that have expressed some interest in developing a testing facility.

DEP and the Joint Venture have evaluated three City-owned sites – Kensico Reservoir, Jerome Park Reservoir, and Spring Creek Combined Sewer Overflow Facility – to see if any would be suitable for a full-scale validation facility. For each site, the availability of source water volumes, storage facilities, drainage infrastructure and suitable space for a testing structure was determined. Cost estimates for providing site-specific supplemental facilities were established. Other non-economic factors were also taken into account.

Based on these evaluations, DEP does not believe it will be feasible to perform full-scale validation within a time frame consistent with the design schedule for this project.

DEP is in the process of evaluating the possibility of conducting validation testing at water treatment facilities outside of New York State. Each proposal provides for a host-facility and cooperation by vendors and utilities that represent a cross-section of the industry. While these proposals look promising, no further information can be released at this time due to the confidential nature of these proposals.

7.1.4 Fouling Study

To better understand the operation and maintenance of the UV disinfection reactors, DEP intends to conduct a pilot study focused on lamp-sleeve fouling. The protocol for this study is under development. DEP and the Joint Venture are also defining the space needs and site-support requirement that will be necessary to perform this study. As currently conceived, the pilot will allow for parallel testing of LPHO and MP lamp units. For each type of lamp being tested, two units will be installed so that side-by-side runs to assess varying operating conditions can be performed.

The research plan will also incorporate an assessment of the potential impact of the visible light emitted by UV lamps on algae growth as well as any impacts to taste and odor that may result from UV disinfection. Mechanical and chemical cleaning methods will both be used during this study. Information that may be helpful to future operators will be noted and incorporated in the training and documentation delivered during start-up of the Catskill/Delaware UV Disinfection facilities.

7.2 Filtration Design Updates

Since the completion of the first preliminary design update issued in 2001, DEP has been evaluating the use of a portion of the Eastview site for a water treatment facility for the Croton water supply. To prepare for the possibility of sharing the Eastview site, DEP and the Joint Venture have been developing staging concepts for a number of projects at this site.

DEP and the Joint Venture have used literature searches, interactions at conferences and seminars and similar means to remain current on advances in water treatment technologies. At this time no major modifications to the 2001 Preliminary Design Update are anticipated.

To provide a timely update, DEP intends to review water-use data in 2003. If necessary, the design capacity for the Catskill/Delaware Water Filtration Facilities will be modified to reflect updated demand projections.

7.3 American Water Works Association Research Foundation Activities

7.3.1 Membrane Filtration of Filter Backwash Water

This project originated during earlier stages of the filtration planning process. The goal of this study was to assess the use of membrane filtration to treat filter backwash water to meet drinking water quality standards sufficient to support direct reuse. This flow is traditionally recir-

culated in water filtration facilities. With a facility the size of the proposed Catskill/Delaware Water treatment facility successful application of membrane treatment would allow DEP to recapture substantial flows (~ 60 MGD) and reduce the size of the facility's overall footprint.

As previously reported, this work has suffered delays due to hazardous materials remediation efforts at the proposed pilot site(s) and more recently due to complications with procuring and constructing adequate power supply facilities at the Delaware Shaft 17 complex.

Research partners for this work include New York State Energy Research and Development Authority and New York Power Authority.

7.3.2 Integrating UV Disinfection Into Existing Water Treatment Plants

DEP has agreed to participate in a research effort designed to address the challenges and benefits associated with integrating UV disinfection into Existing Water Treatment Plants. Though New York City does not currently operate any water filtration facilities, this research should provide useful information for better understanding how UV will affect the current treatment regime for disinfection, fluoridation and corrosion control.

7.3.3 Optimization of UV Reactor Validation

In October 2002, DEP agreed to champion a proposal for an AWWARF Tailored Collaboration project entitled "Optimization of UV Reactor Validation". Carollo Engineers, Clancy Environmental, Inc. and the Optical Laboratory of the Institute of Medical Physics and Biostatistics of the University of Veterinary Medicine of Vienna, Austria developed the research plan for this study. The cities of Phoenix, Arizona and Tacoma, Washington have agreed to co-sponsor this work.

This work is intended to address three primary issues associated with UV reactor validation. The research will evaluate a promising new surrogate challenge microbe, assess the ability of a UV-absorbing compound to better simulate the physical and chemical properties of source waters and study lamp & sleeve fouling to provide useful data regarding dose delivery by aged units. The results of this study are intended to optimize reactor validation methods, limit the uncertainties in design and ultimately reduce the costs of implementation for full-scale UV installations.

The American Water Works Association Research Foundation is currently considering this proposal for co-funding and related approvals.

8. In-City Programs

8.1 Waterborne Disease Risk Assessment Program

The Waterborne Disease Risk Assessment Program will submit a separate annual report for 2003 by May 31, 2003, in accordance with the conditions of the FAD.

8.2 Cross Connection Control Program

The Cross Connection Control Program has as its primary objective the avoidance of any potential for backflow from within premises to the public water supply system. To accomplish this objective, property owners are required to install backflow prevention containment devices in water service lines for premises that pose a potential hazard. After installation, backflow prevention containment devices are required to be tested by a certified tester at least once a year. Installation of containment devices, or a review leading to an exemption from installation of such a device, is initiated due to one of the following reasons:

- Complaints to DEP indicating that there may be a potential for a backflow to the public water supply system.
- Construction of new premises or renovation of existing premises which require installation of a tap or wet connection in a size two (2) inches or larger.
- Premises that appear to be at "high hazard" for contamination of the public water supply in the event of a backflow.

Construction of new premises and/or renovation of existing premises that involves installation of a two inch tap or a larger connection frequently involves a potentially hazardous occupancy. Such construction/renovation requires a mandatory cross connection control review. This review may result in installation of a containment device as part of the construction/renovation, or an exemption from installation of such a device.

Enforcement efforts were accelerated by DEP during 2002, and a significant increase was seen in property owners' willingness to comply with cross connection control requirements.

The major tool used by DEP during 2002, which had not been used in prior years, was the issuance of Notices of Violation to non-compliant property owners. A property owner who receives a Notice of Violation is required to appear at an Environmental Control Board hearing where a monetary fine of up to $1,000 may be imposed. Any property owner who fails to appear at a hearing receives a default fine of $1,000.

Notices of Violation were issued to property owners for failure to install backflow preventers and also for failure to test backflow preventers at least once a year. During 2002, DEP issued 691 NOVs either for failure to submit an annual test report or failure to install a backflow preven-

ter. The real estate industry, which had opposed issuance of Notices of Violation in prior years, did not object to such issuance in 2002. In addition, DEP issued six Cease and Desist Orders in 2002.

As property owners became aware that DEP was serious about issuance of Notices of Violation for non-compliance, compliance began to increase. Even letters to property owners requesting the status of proposed backflow preventer installations (with no mention of Notices of Violation) received more attention by property owners who wanted to avoid possible issuance of Notices of Violation.

Through issuance of Notices of Violation, followed in a few cases by issuance of Cease of Desist Orders, DEP was able to achieve a significant increase in compliance without the need for termination of water service. This increase in compliance was achieved without any significant staffing increase.

9. Education and Outreach

Public education and outreach efforts have been a component of the City's watershed protection strategy since the expansion of the protection program in the early 1990s. DEP's activities are built on the principle that an informed base of watershed residents and water consumers facilitate development and implementation of protection strategies. An effective outreach program enhances consumer confidence in the safety and quality of the water supply, while teaching watershed residents and consumers alike the importance of watershed protection.

DEP's efforts have included, and will continue to include, both program-specific education efforts and broad-based outreach. In many cases, program-specific outreach efforts are conducted in coordination with DEP partner agencies and organizations – the Catskill Watershed Corporation, the Watershed Agricultural Council, KEEP and the watershed counties, to name a few. It is important to acknowledge the contributions of these locally-based groups in spreading the word about the links between land use activities and water quality.

9.1 Program-specific Education Efforts

Many of the individual watershed protection programs have incorporated outreach since their inception. In many cases, that outreach is designed to reach a target group of involved or interested parties. For instance, the Farm Program focuses efforts on reaching farmers and the Stream Program has held a number of training sessions for agencies and contractors who work in streams. In addition, these programs have a more general educational component to disseminate basic information to a wider audience.

DEP has collaborated with WAC, CWC and other partner organizations on a variety of programs, including the Farm Program, the Forestry Program, the Stream Management Program, Partnership Programs run by CWC and Croton Planning.

Details on some of these targeted outreach efforts can be found in the specific program write-ups in this report, including the Stream Management Program section, the Watershed Agricultural Program section and the Watershed Forestry Program section.

9.2 Other Outreach and Education Programs

Watershed Museum

The proposed Catskill Watershed Museum dominated the Catskill Watershed Corporation's public education agenda for 2002. CWC's Public Education Advisory Committee (PEAG) met in early January to review the "Exhibit Plan for Catskill Watershed Museum" developed by designer Leonard Levitan. While PEAG reacted critically to the proposed exhibit plan, and had numerous comments on specific aspects of the plan, their recommendation to the CWC Board was to support the development of the proposed museum exhibits with modifications. DEP like-

wise submitted comments to CWC in January. Overall, DEP suggested that the exhibits, as proposed, were too focused on the development and construction of the water supply system, and should place greater emphasis on water quality, watershed protection and stewardship.

The items required for a CWC "commitment" of funds for museum exhibits were not fulfilled by the January 21, 2002 deadline established by the MOA and program contract. Due to the progress made to-date and the Museum's good-faith efforts, DEP and CWC agreed on parameters for granting an extension of time for CWC to make any such "commitment." The CWC Board adopted a resolution agreeing to an extension, conditioned on strict adherence by the Museum to a schedule of deliverables, which would be determined by CWC and DEP. A list of conditions and deliverables necessary for the extension was developed and agreed to by DEP, CWC and the Watershed Partnership Museum. The extension was granted until September 2003.

As the first deliverable under the extension, a museum business plan was prepared, defining the expected audience (market) and attendance, and projecting annual revenues and expenses. Throughout the summer drafts of the business plan were submitted to CWC and DEP, and comments were reviewed with representatives of Watershed Museum. Additional analysis was recommended to clearly define a financial operation that would be viable. Areas of particular concern included: development of multi-year cash-flow analysis (including start-up) and levels of endowment and "operating reserve funds." While significant improvements have been made to the plan, DEP continues its skepticism that the finances would break even during the first few years.

In June the location of the museum was proposed to be shifted from Shandaken to the Town of Middletown. The museum negotiated with the Town of Middletown to acquire property owned by the Town at the site of the industrial park in Arkville. In addition to developing 10 acres for the museum proper, 34 adjoining acres along the East Branch of the Delaware River would be acquired for passive recreation and interpretation. The CWC adopted a resolution at their June Board meeting endorsing this location.

Grants and Projects

Applications for Round 5 of the CWC Public Education Grants were due on February 1. Sixty applicants requested nearly $500,000 from the $150,000 made available. The CWC PEAG met in March and recommended $149,840 in funding to 30 public education projects directed to K-12 audiences. Following CWC Board approval, DEP sent a letter on May 2, 2002 to CWC approving the grants.

Under CWC supervision, six commemorative kiosks were constructed at WOH reservoirs. Dedication ceremonies took place at the Schoharie, Rondout, Neversink, Cannonsville, Pepacton and Ashokan reservoirs.

Household Hazardous Waste

DEP provided funding to assist Putnam County in hosting a HHW cleanup event, where homeowners could properly dispose of household waste at a convenient location. The cleanup events have helped to build community awareness of hazardous materials in the home and the need for proper disposal. During an event held in the spring 2002, the project provided educational material on how to use, store, and reduce hazardous materials in the home, including information about alternatives to the use of such products. DEP funding helped Putnam County collect 42 fifty-five gallon drums of waste from the approximately 170 county residents that participated.

East-of-Hudson Lawn Care Programs

In 2002, DEP provided funding to Putnam Cornell Cooperative Extension (CCE) to promote and present lawn care outreach programs that educate watershed residents on the impacts of non-point source pollution from residential sources.

- Lawn Ranger Volunteer Program – CCE presented the Lawn Ranger slide set and script to targeted audiences to show how lawn care practices can affect water quality. The targeted audience was first-time homeowners in the Croton Watershed with limited knowledge of proper environmental stewardship of their newly acquired investments.
- The Homeowner's Lawn Care and Water Quality Almanac – CCE promoted an innovative homeowners guide to proper maintenance of residential lawns. Of particular concern are non-point sources of pollution, such as fertilizers and pesticides, which can be carried to the water supply by stormwater runoff. DEP is working with CCE to promote the Almanac in the watershed and has provided funding to advertise the availability of the Almanac on the CCE web site. DEP funding allowed CCE to position educational material in over 80% of the garden centers in Putnam County.

East-of-Hudson Golf Course Management Project

In an effort to minimize the potential water quality impacts from golf courses, DEP, in cooperation with Westchester CCE, held a workshop to educate golf course superintendents and promote the implementation of the best management practices developed by Audubon International. Audubon International has acknowledged the potential for golf courses to serve as a beneficial land use through their Cooperative Sanctuary Certification Program. To encourage participation in the Audubon International Program, the workshop guided golf course superintendents through the initial step of the Audubon Certification process – the Site Assessment and Environmental Plan. Following the workshop, superintendents who complete the initial requirements of the Audubon International Program will have the initial Audubon membership fee paid for by DEP and receive the book A Guide to Environmental Stewardship on Your Golf Course, created by Audubon International. The workshop took place in fall 2002 and included representatives from approximately half the golf courses in the watershed.

Regulatory Outreach

Following adoption of the revised Watershed Rules and Regulations, DEP conducted a series of workshops for municipal land use officials, town engineers, design professionals, and potential applicants. The workshops included an overview of the Watershed Regulations and a detailed discussion of the stormwater provisions, acceptable stormwater management practices and design standards, and DEP's review and approval and enforcement protocols. DEP conducted a similar workshop that focused on its Pilot Phosphorous Offset Program. During 2002, DEP scheduled similar sessions; the first sessions were held west of Hudson in early 2003.

To maintain the relationships that DEP project review staff have built with municipal Planning Boards, DEP routinely attends planning board meetings in the more than 70 municipalities in the watershed. Attendance at these meetings allows DEP to be aware of land use proposals under municipal consideration and to provide testimony concerning a proposal's potential impact on the City's water supply, and its compliance with the Watershed Regulations. DEP will continue to participate in Planning Board meetings in the future.

10. Miscellaneous Reporting Provisions

10.1 Water Conservation

Water demand in the City of New York had been increasing at a rate of more than 1% per year through the 1950s, 1960s, 1970s and early 1980s. Since the late 1960s the City's water consumption has been beyond the "dependable yield" of the reservoir system. Three drought warnings or emergencies occurred during the 1980s. At the same time, wastewater flows to the Wards Island, Newtown Creek, North River and Coney Island wastewater treatment plants either exceeded or approached permit levels. Avoiding the capital cost of expanding the water supply and wastewater treatment infrastructure and the costs incurred as a result of droughts led New York City to develop a lower cost plan for providing water/sewer services.

The best proof of the success of these programs is the drop in New York City's water consumption. From an average of 1450 - 1500 million gallons per day (MGD) in 1990 - 1991, consumption has dropped continuously in the 1990s to under 1250 MGD since 1996 and under 1200 MGD for 1997, 1998 and 2001, even through some of the hottest summers on record. Wastewater flows have been decreasing consistently every year since the early 1990s.

Highlights of DEP's ongoing water efficiency program include:

Leak Detection

DEP has undertaken an aggressive sonar leak detection program, which surveys approximately 1 million linear feet of water mains each year. One-third of the city's water mains are scanned for leaks every nine months while the remainder are scanned at least once every three years. Leak reduction also includes regular inspection of system blow-off valves and hydrant locks. The ultrasonic leak detection program is estimated to have significantly reduced supply systems losses since the mid-1980s, with system-wide savings of at least 30- 50 MGD in the early years and 5-20,000 gpd in recent years.

DEP will continue a program of leak detection and street repairs. DEP estimates that the largest benefits of this program accrued in the early years. Going forward, DEP anticipates that the program will maintain equilibrium, rather than yield significant further reductions in leakage.

Water Metering

New York has substantially completed its Universal Metering Program. A metered rate structure provides customers with a long-term incentive for leak repair and efficient use. Quarterly billing for metered customers began regularly in 1995. Some multifamily buildings are being offered the option to continue to be billed on a per-apartment fixed charge if they meter and undertake a number of water efficiency measures. The City is now 94% metered.

Incentive Programs

From March 1994 through April 1996, the New York City Toilet Rebate Program (TRP) accepted applications from more than 120,000 property owners seeking to replace 1.6 million old toilets with water-saving models. More than 1.3 toilets were replaced in 110,000 properties through June 1997, reducing consumption by 70 - 90 MGD. Tracking of actual savings at several score apartment buildings participating in the Program found that the average reduction in water consumption was 29%.

Now that regulations require installation of low flow fixtures, normal turnover of fixtures should lead to further savings. If 1% of existing old toilets are replaced each year in the course of bathroom renovations or equipment reaching the end of its useful life, that provides a new saving of 1.2 - 2.5 MGD each year which will continue for another 10-20 years.

DEP will be initiating a second phase of the Toilet Rebate Program next year and anticipates replacing up to 240,000 toilets over the next two years, resulting in a saving of approximately 7 - 15 MGD. This overlaps the savings indicated for "normal market turnover" above.

In addition, the New York City Housing Authority (NYCHA) has been replacing tens of thousands of old toilets over the last decade and is about 80-90% complete in performing such work at their properties located in consent decree drainage areas.

Education Programs

DEP conducts educational programs, which include publications and videotapes, teaching training and curriculum efforts, training for apartment building superintendents, an annual Water Art and Poetry Contest, internships and tours. DEP staff speak at hundreds of community meetings each year on the subjects of water efficiency and water quality.

General Water Use and Drought Regulations

DEP enforces standard regulations prohibiting certain outdoor water uses during peak hours of the day, requirements for evaporative cooling towers for all but the smallest air conditioning and refrigeration units and penalties for significant leak and waste violations. During drought periods, the City can implement a three-stage series of increasing restrictions on water use including outdoor water use, air conditioning and commercial water use, increased hydrant patrols and other measures.

Federal Clothes Washer Efficiency Standards

Beginning in 2004, the Department of Energy will implement minimum efficiency standards for new clothes washers, which will, over 15 years or so, provide significant savings as people replace their old washers. The standard becomes a bit tighter in 2007.

A specific savings estimate for New York City has not been completed, but a very conservative one would look only at one- and two-family homes. There are approximately 775,000 one- or two-family homes in the City. Assuming there are two people per property, DEP estimates a saving of about 9 gallons per person per day, or about 14 MGD.

The one- and two-family home analysis excludes a NYSERDA program which is providing incentives to "route operators" to replace the machines in apartment building laundry rooms and our agreement with NYCHA wherein they will be replacing the machines in theirs. Perhaps 20-25% of apartment buildings will be required to replace older equipment with newer, more efficient units.

DEP estimates that these programs will lead to a total savings of up to 10-20 MGD in the next five years and another 30-55 MGD over the following 15 years as the existing stock of clothes washers is replaced.

10.2 Updates to Drought Management Plan

During 2001 and 2002, New York City and the region suffered a significant drought event. As the drought continued to worsen, DEP took a number of steps to preserve water resources, including implementation of the City's Drought Management Plan and regulations.

The Drought Management Plan has three phases - Drought Watch, Drought Warning and Drought Emergency - that are invoked sequentially as conditions dictate. The Drought Emergency phase is further subdivided into four stages with increasingly severe mandated use restrictions. Guidelines have been established to identify when a Drought Watch, Warning or Emergency should be declared and when the appropriate responses should be implemented. These guidelines are based on factors such as prevalent hydrological and meteorological conditions, as well as certain operational considerations. In some cases, other circumstances may influence the timing of drought declarations.

- Drought Watch – Drought Watch is declared when there is less than a 50% probability that either of the two largest reservoir systems, the Delaware (Cannonsville, Neversink, Pepacton, and Rondout Reservoirs) or the Catskill (Ashokan, and Schoharie Reservoirs), will fill by June 1 - the start of the water-year.
- Drought Warning – A Drought Warning is declared when there is less than a 33% probability that either the Catskill or Delaware Systems will fill by June 1.
- Drought Emergency – A Drought Emergency is declared when there is a reasonable probability that, without the implementation of stringent measures to reduce consumption, a protracted dry period would cause the City's reservoirs to be drained. This probability is estimated during dry periods in consultation with the New York State Drought Management Task Force and the New York State Disaster Preparedness Commission. The estimation is based on analyses of the historical record, the pattern of the dry period months, water quality, subsystem storage balances, delivery system status, system construction, maintenance operations, snow cover, precipitation patterns, use forecasts, and other factors. Because no two droughts have identical

characteristics, no single probability profile can be identified in advance that would generally apply to the declaration of a drought emergency.

On December 23, 2001, the City entered Drought Watch, with reservoirs at 44% of capacity, which was more than 30% below normal for that time of year. Drought Warning came approximately one month later, as reservoir storage dropped to nearly 40% below normal. On April 1, 2002, the City declared a Stage I Drought and implemented mandated restrictions, including: 15% reductions of consumption for non-residential users; restrictions on lawn watering; prohibition on washing sidewalks; and restrictions on use of ornamental fountains.

In June 2002, precipitation levels rose above normal for the month for the first time in over a year. July and August were relatively dry, but beginning in September, and continuing throughout the fall, the watersheds saw above normal precipitation and runoff. Due to improved storage and hydrologic conditions, DEP backed down to Drought Watch on November 1, 2002, and completely ended the drought on January 3, 2003.

DEP continues to encourage consumers to conserve water and to observe the City's year-round water use restrictions, which remain in effect. These restrictions include a prohibition on watering sidewalks and lawns between November 1st and March 31st and illegally opening fire hydrants. During 2003, DEP will reevaluate the Drought Management Plan to see if any changes are warranted.

10.3 Delaware Aqueduct Leak

Efforts to evaluate the condition of, and to develop dewatering and repair plans for the Rondout-West Branch Tunnel (RWBT) continue in 2002 and involve the following components:

- Hydraulic Investigations of the RWBT
- Water Supply Dependability Analysis
- Autonomous Underwater Vehicle (AUV) Inspection of the RWBT
- Remote Operated Vehicle (ROV) Inspection of the RWBT

The following is a description of the activities on these projects during 2002.

10.3.1 Hydraulic Investigations of the RWBT

A Horizontal Boring Program was begun at a suspected leak area of the tunnel in Orange County, near the Town of Roseton, between Shafts 5A and 6. A directional drill subcontractor was employed to take core samples, perform geophysical testing, and determine water pressure in a region approximately forty feet from the tunnel, in an area where known leaks and faults are located. The drilling subcontractor drilled diagonally from the surface to a depth near the tunnel. Drilling was continued approximately 1,900 feet horizontally, parallel to the tunnel and was completed in early 2003.

This data will be useful in determining the nature of the rock surrounding the tunnel and will allow DEP to further refine the tunnel repair program. Data gathering and analysis will be completed in Spring 2003.

GEOD Survey

Aerial Surveys of the areas over the RWBT have been evaluated to locate and map expressions of possible leakage from the tunnel. This survey was also useful to selecting areas of concentration for the drilling program. In addition GPS coordinates of tunnel route and shaft locations developed from this survey will be used in the navigation of the Autonomous Underwater Vehicle (AUV, see below).

Risk Analysis Program

A risk analysis of Tunnel failure was developed in 2001, based on existing information such as original contract drawings, prior tunnel inspection logs and former personnel interviews. This risk analysis is continually revised based on new data gathered from ongoing investigations such as the Drilling Program. Further data from the Drilling Program and the AUV inspections will further refine the Risk Analysis.

Shaft 6 Dewatering System for the RWBT

In 2002, DEP continued development of facility plans for the dewatering of the RWBT tunnel. In order to perform a tunnel repair, it is necessary to unwater the tunnel. Several pumping configurations and shaft modifications are being evaluated with the goal of dewatering the tunnel as reliably and quickly as possible.

10.3.2 Water Supply Dependability Analysis

In 2002, DEP continued its evaluation of the dependability needs for the water supply system. The RWBT was identified as a critical element of the System needed to meet the City's annual average demand and water needs for portions of the upstate community.

Several projects were identified that, individually or in combination, could enable the System to meet demand during a planned or emergency repair of the RWBT. These projects include alternative means of increasing system conveyance and storage; providing additional supply through expansion of existing sources, or development of other sources; and implementing demand management and reduction measures. The feasibility of these potential projects has been considered based on a preliminary analysis of their effectiveness and implementability. The projects will be further investigated and developed in 2003, with additional consideration to their degree of dependability. Alternative combinations of projects will be evaluated that could provide the water supply dependability needed during repair of the RWBT.

10.3.3 Autonomous Underwater Vehicle (AUV) Inspection of the RWBT

Woods Hole Oceanographic Institute (WHOI) has designed and built an AUV that will be capable of photographing the entire 45-mile run of the RWBT. In 2002, the AUV and a launch frame was designed, built and partially tested. The testing of the AUV included: camera focus and overlap tests, pressure tests, directional stability tests, crash tests, acoustic tracking tests, launch and recovery tests, and battery tests.

DEP plans to conduct the tunnel inspections in spring 2003. This operation will provide photographic coverage of the tunnel, hydrophone data (which will record sound data, that may indicate areas where water is exiting the tunnel), and pressure data (which is another form of energy loss that may be indicative of a leak), over the 45-mile length of the tunnel. The gathered data will be useful to evaluate the tunnel condition and to locate areas that require further investigation by using an ROV (see below).

10.3.4 Remote Operated Vehicle (ROV) Inspection of the RWBT

DEP has evaluated options for procuring a contract for ROV Inspections of the tunnel. DEP has planned to use a negotiated acquisition with its consultant to procure ROV development services to inspect the tunnel. Development of an ROV to inspect this tunnel will require the contractor to develop new technologies for a tethered vehicle, longer than any other tethered ROV built to date. DEP believes that advances in state-of-the-art fiber optics will make such an effort possible.

Data gathered from the drilling and AUV projects will be used to determine the locations that require additional investigation using the ROV. Use of an ROV will allow capture of real time tunnel data, and provide the ability to perform detailed, close-up investigations of problem areas.

Appendix I. Stony Clove Creek Newsletter

The Stony Clove Creek
Stream Management Project
Demonstrating Multiple-Objective Stream Management

2002 Newsletter

Stream Management Plan Update:
Inventories, Assessments and Recommendations

The Greene County Soil and Water Conservation District (GCSWCD) and New York City Department of Environmental Protection (NYCDEP) have been working with the Towns of Hunter and Shandaken, the NYS Department of Environmental Conservation, the Ulster County Soil and Water District and other partners to develop a long term, multiple objective management plan for Stony Clove Creek. This plan will document current and historical conditions in the stream and offer recommendations for improving the Stony Clove's stability, fisheries, and water quality, as well as reducing flood damage.

In order to make sound recommendations in the management plan, the Stony Clove field crew has conducted a series of inventories and assessments. The reports below describe the types of information collected, and how they will be useful for making recommendations in the management plan.

Stream Feature Inventory Completed

An inventory of stream features has been completed for the mainstem and three tributaries (Warner Creek, Hollow Tree Brook, Ox Clove) of the Stony Clove Creek. The inventory began in the headwaters, just south of the Devil's Tombstone Day Use Area, and encompassed the full length of the mainstem, ending at its confluence with the Esopus River in Phoenicia.

When a stream is functioning well, it carries water and sediment off the landscape without significantly building up or cutting down the channel bed under normal flows, and the stream ecosystem supports diverse and abundant fish and wildlife. This inventory is intended to locate and characterize stream features that may impact healthy stream function, and which need to be considered in the decisions regarding stream management. The features that were inventoried included tributary confluences bank erosion, bedrock, clay exposures, rip-rap, berms, rock walls, sheet piling, bridges, culverts, and channel patterns. Photographs were also taken at each feature to document current conditions. so that when problems arise, resource managers can identify the location, local conditions and respond quickly with management interventions. A summary of these features is given on page 3.

This inventory was organized into a geographic information system (GIS) database, a computer-based map that allows the user to rapidly compare many different kinds of map information, in different combinations. By displaying stream features together with maps of roads, soils, vegetation on the banks and floodplains, and topography, the information from the stream inventory can be analyzed in the context of a complex landscape. The information can also be considered with respect to many different management concerns, such as minimizing threats to private and public property, and protection of water quality and fish habitat.

Assessments, cont.

Stream Geometry Data Collection Completed

In order to understand whether any particular reach of the stream is tending toward stability or instability, the Stony Clove field crew surveyed the full length of the stream to characterize its form, or ***stream morphology***. Stream morphology is dewcribed in terms of width, depth, slope, sinuosity (curviness) and the size of the material that makes up the streambed. This geometry determines how effectively water and sediment will move through the different sections during different storm events, and whether the stream will tend,over time, to downcut or erode its banks. The Stony Clove survey information was used to categorize 199 individual reaches of the creek using the Rosgen Stream Classification System. Each stream type in this classification scheme exhibits a unique behavior pattern. Knowing the stream type allows us to answer questions like, How sensitive is this reach to disturbances? How important is streambank vegetation on this reach for maintaining bank stability?

Reliable answers to these kinds of questions will allow landowners and resource managers to use the Management Plan to choose the most effective management practice for each reach, and to target stream restoration work.

Bank Erosion Hazard Indexing

Addressing stream bank erosion is one of the central goals of the Stony Clove Creek Stream Management Plan. Bank erosion means property loss to landowners, expensive road maintenance for highway crews, as well as water quality and fish habitat degradation. The stream feature inventory identified twenty-seven sites demonstrating a significant degree of bank erosion. On these sites a detailed assessment of the of the eroding stream banks was conducted, identifying the channel dimensions, soil structure, vegetation, and stress of stream flow against the banks. The findings of these assessments will be used to quantify erosion hazards, rank the severity of threat at each location, and to recommend the priority of remediation. The erosion sites will be monitored over the next several years to track the rate at which bank loss is occurring.

What's Next?

The Stony Clove field crew is in the process of analyzing the information that has been collected. After the stream reaches have been ranked according to their channel and bank stability, one of the first steps will be to identify those unstable reaches that might be stabilized through improvements in bank and floodplain vegetation, including bioengineering practices (see article in this issue on "*Streamside Landscaping*"), and without extensive restoration of channel morphology.

Once this is completed, a series of smaller meetings will be held to discuss the findings of the inventories and assessments with landowners who live each management unit. Those of you who live, work, and recreate in the watershed know the history of the stream most intimately; we need your knowledge, ideas and involvement to shape the recommendations for your section of the Stony Clove if the plan is going to be useful, and not simply sit on a shelf.

Over the Spring and Summer of 2003, the Stony Clove team will compile all of these comments and recommendations into a comprehensive draft stream management plan. The draft will be distributed all streamside landowners and discussed at a public forum. This will provide you with a another chance to contribute input before the management plan is finalized.

Fish Habitat Assessment

An essential part of any multi-objective stream management plan is an assessment of aquatic habitat. The Stony Clove project team chose to use an approach developed at Cornell University called Meso-HABSIM. This assessment will identify habitat-related limits on fish productivity and will help in the development to address those limitations.

In the MesoHABSIM approach, ***hydro-morphological units*** — riffles, pools, runs, etc.— are mapped during a field survey. Because the amount and distribution of fish habitat change with the amount of water flowing in the stream at any time, habitat mapping has been conducted at three different flow levels.
In addition to describing the size and type of habitat unit, the extent of cover, substrate, and other habitat characteristics are recorded. Velocity measurements are also taken within each habitat unit. The results illustrate variation in the spatial distribution of ***mesohabitats*** and provide key information on habitat quantity corresponding to alterations in flow and channel structure.

The use of these different types of habitat by different species of fish is then assessed using field population surveys (electro-fishing) in each habitat type. Piotr Parasiewicz, a research associate from Cornell, will analyze the data and provide habitat characterizations for each of the Stony Clove Creek management units using the data collected by the field crew. These recommendations will be incorporated into the Stony Clove Stream management plan.

On the left, GCSWCD AmeriCorp member Ashley Brown collects velocity measurement using a dipping bar. On the right, Amy DeGaetano from GCSWCD collects habitat data on a hand held computer.

Developing A Successful Watershed Association Workshop

On Sunday, September 22nd, at the Phoenicia Elementary School, Robin Ulmer, Executive Director of the Boquet River Association in Essex County New York, presented a talk on, "What a Small, Mostly Rural Watershed Organization Can Do!". The talk was sponsored by the Stony Clove Creek Landowner Association and Broad Street Hollow Landowner Association.

Ms. Ulmer emphasized that a watershed association can develop programs or projects around any issue of interest to the members — from fishing, to birdwatching, to bank stabilization — and described the benefits of trying to understand environmental concerns in the context of watersheds. Ms. Ulmer prompted those attending to begin the process by asking each person to identify two watershed issues of interest to them, and then to list a resource person and services that could help them investigate each of their interests.

The Boquet River Association (BRASS) a small, 200-member, grass-roots non-profit organization dedicated to enhancing the quality of water and life in the Boquet watershed. Formed in 1984, it discusses and acts upon issues related to land uses, point and non-point source pollution, in-stream and riparian species and habitats, recreation, and the economy. BRASS membership is primarily local landowners, and its Board is composed of appointees from the five watershed towns and elected representatives. For more information on the many projects the organization is involved in, see their website: www.boquetriver.org BRASS is known for its dedication to river quality and for mitigating conflicting river interests. It also has a reputation for accomplishing projects through education and by coordinating skills and services of volunteers, businesses, county and town governments, and state agencies.

The success of the Boquet River Association inspired several Stony Clove landowners to reach out to their neighbors in efforts to strengthen the Stony Clove landowners association. Kyla Marion will be hosting an informal lunch gathering in her Phoenicia backyard for Stony Clove area neighbors to meet, share history, concerns, and ideas. Come enjoy a bowlful of hot chili on a cool day. You can park in the Phoenicia Elementary School lot and walk across the Route 214 to the white cottage #123 to the left of the fence. All are welcome to join in the festivities.

Mark Your Calendar for a Stony Clove Creek Watershed Neighborhood Gathering
Saturday • October 26th 1-3 p.m. **(raindate October 27th)**
Please R.S.V.P. to: Kyla Marion (845) 688-2273 or Meredith Altman (845) 688-7293

Stony Clove Creek Stream Management Project
Greene County Soil & Water Conservation District
907 County Office Building • Cairo, NY 12413
Phone (518) 622-3620 • Fax (518) 622-0344
Website: www.gcswcd.com

Non-Profit
Organization

Permit #2
South Cairo, NY

Streamside Landscaping Workshop

On Saturday, July 27th, The Stony Clove Creek Landowners Association and the Broadstreet Hollow Landowners Association, in conjunction with The Greene and Ulster County Soil and Water Conservation Districts and The NYCDEP Stream Management Program, jointly sponsored a streamside landscaping workshop.

Francis Groeters, Ph.D., from the Catskill Native Nursery in Kerhonkson, described the role of plants in the ecology of streamsides and floodplains and suitable stream bank plant species. Mr. Groeters stressed the importance of using native plants in landscaping. Native plants are those that naturally grow in a region and were not introduced by humans. Native plant species have numerous benefits including, aesthetics, ease of cultivation, wildlife food and habitat, and conservation. For more information about all The Catskill Native Nursery has to offer visit www.catskillnativenursery.com

John Dickerson, Regional Plant Materials Specialist with the USDA Natural Resources Conservation Service, described techniques that can be used to stabilize stream banks with plant materials. Woody plant materials, usually dormant shrub branches, are placed into the soil in ways which provide an immediate degree of stability to the slope. As the branches take root and produce shoots, the stream bank slope becomes much more resistant to erosion and failure. Mr. Dickerson showed slides of successful bank stabilization projects from across the state. These projects used various planting techniques such as cuttings, rooted cuttings, live fascines, brush mattressing, brush layering, live staking, and wattle flow deflectors. He has agreed to return in the Spring to lead a field-based workshop for landowners

John Schwartz, NYCDEP Project Manager, described resources available through the Watershed Forestry Program for funding streamside plantings.

To receive handouts from these presentations, or if you are interested in revegetating your streambanks and floodplains, contact Amy at Greene County Soil & Water Conservation District (518-622-3620).

Project Team Contacts

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