EXECUTIVE SUMMARY

WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS
AND
DEPARTMENT OF PLANNING

CROTON WATERSHED WASTEWATER DIVERSION STUDY

DECEMBER 1998

SAVIN ENGINEERS, P.C.
TARRYTOWN, NY

in Association with

HAZEN & SAWYER, P.C.

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WESTCHESTER COUNTY, NEW YORK
DEPARTMENT OF PUBLIC WORKS
AND
DEPARTMENT OF PLANNING

CROTON WATERSHED WASTEWATER DIVERSION STUDY

Report Organization

The Croton Watershed Diversion Study Report consists of an **EXECUTIVE SUMMARY** which provides an overview of all the work undertaken in the study and outlines the study's findings and of a series of **STUDY MEMORANDA** which provide the detailed, technical backup on specific topics. The Executive Summary and Study Memoranda are each bound separately as follows:

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Study Memorandum No. 1 – Work Plan

Study Memorandum No. 2 – Data Acquisition

Study Memorandum No. 3 – Wastewater Capacity Needs

Study Memorandum No. 4 – Existing Facilities Evaluation

Study Memorandum No. 5 – Alternatives Development

Study Memorandum No. 6 – Expansion of Existing Facilities

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Study Memorandum No. 8 – Environmental and Institutional Considerations

Study Memorandum No. 9 – Draft Report Revisions

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Volume II - December 1997 through April 1998

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

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DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
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Town of Yorktown

FINDINGS

Westchester County and New York City Department of Environmental Protection (NYCDEP) have contractually agreed to undertake a Wastewater Diversion Study to determine the feasibility of diverting wastewater, generated in the Croton and Kensico watersheds, to wastewater treatment plants off the watershed for treatment. NYCDEP funded the study as part of the watershed Memorandum of Agreement.

The Findings of the Westchester County Croton Watershed Wastewater Study are as follows:

- A total of 30 local wastewater treatment plants (WWTPs) have been identified within the Croton Watershed in Westchester County with a total average daily flow of approximately 4.7 million gallons per day (mgd).

- A total of 31 Focus Areas (areas currently not sewered or served by WWTPs) have been identified with a total average daily flow of approximately 2.1 mgd. Focus Areas of greatest concern because of a history of septic system failure are Yeshiva YFS (No. 48), Stanwood (No's. 41 and 49), Peach Lake (No. 52) and Quarry Heights (No. 50).

- The total flow considered for diversion is approximately 6.8 mgd.

- Seven feasible diversion alternatives have been identified. The alternatives are divided into two broad categories:

  In-Basin Treatment and Diversion

  Alternatives 1, 2, 3 and 7 involve the construction of one or two new regional secondary wastewater treatment plants, centrally located in the watershed. All local WWTPs and focus areas are diverted to the new plant(s) for treatment and the effluent is discharged to the Hudson River. Refer to Figures ES-3, ES-4, ES-5 and ES-9 for a conceptual layout of these alternatives.

  Alternative No. 3 is a joint Westchester County/Putnam County project and resulted directly from the coordination meetings held between the Counties during the study phase. It envisages one joint wastewater treatment plant located in either County adjacent to the border. Following review of the Draft Report, Alternative No. 3 was eliminated, since it involved crossing the reservoir. Alternative No. 7 was developed in its place and includes a joint Westchester/Putnam project but includes Westchester flow from the northern side of the reservoir only.

  Diversion and Out-of-Basin Treatment

  Alternatives 4, 5 and 6 involve diversion off the watershed of raw sewage for treatment at one or more of the existing county-owned WWTPs, located in

Peekskill, Ossining or Yonkers. Refer to Figures ES-6, ES-7 and ES-8 for a conceptual layout of these alternatives.

Alternative 4 requires the expansion of the Peekskill WWTP from the existing 10 mgd to 14.4 mgd. Approximately 2.3 mgd would be diverted to Yonkers Joint Treatment Plant for treatment but no expansion of the plant is contemplated since additional treatment capacity is available at the Yonkers plant.

Alternative 5 requires the expansion of the Peekskill WWTP from the existing 10 mgd to 14.4 mgd and the expansion of the Ossining WWTP from the existing 7 mgd to 9.3 mgd.

Alternative 6 requires the expansion of the Peekskill WWTP from the existing 10 mgd to 16.7 mgd.

- Generally, an alternative involves the construction of approximately 85 miles of local collector sewers, 65 miles of interceptor sewers, 88 pumping stations (38 interceptor pumping stations, 20 Focus Area pumping stations and 30 WWTP pumping stations) and either the construction of new WWTPs or the expansion of existing county owned WWTPs.

- The estimated project cost estimates for the seven alternatives (in 1998 $) ranges from a low of $400 million (Alternative No. 4) to a high of $474 million (Alternative No. 1). ($450 million to $533 million in 2001 $)

- The estimated annual operation and maintenance costs (in 1998 $) ranges from a low of $4.4 million per year to a high of $5.9 million per year. ($5.0 million to $6.6 million in 2001 $).

- Implementation of any of the diversion alternatives will result in a reduction in the phosphorous loading of an estimated 1,145 kg/year.

- Wastewater diversion from the Croton Watershed to the Hudson River following secondary treatment will not have a significant impact on pollutant load to the Hudson River.

- There are a number of institutional frameworks that can be established for each of the alternatives outlined, depending on ownership – Westchester, joint Westchester/ Putnam or New York City. However, it is not New York City's intention to construct, own or operate any of the facilities.

- NYCDEP is currently on record as not in support of crossing the reservoir on bridges with piped diversion flow. Therefore, Alternatives 2, 3 and 6 were not sequenced in this final report and Alternative 7 was created to allow for an alternative involving Putnam without crossing the reservoir.

- The diversion of the local WWTPs from the watershed ranges in cost from $190 to $288 (Alternatives No. 1, 4, 5, & 7).

- Each of the four surviving alternatives can be constructed in phased sequences. The initial phases of the Out-of-Basin alternatives (Alternatives No. 4 and No. 5) are significantly less expensive than the In-Basin alternatives (Alternatives No. 1 and No. 7). If complete diversion occurs, if the diversion project is phased over a number of years or if only partial diversion occurs, Alternative No. 4 is the most economic alternative.

- In the Northern Sector (north of the reservoir system) diversion of Yorktown Heights WWTP flow to Peekskill WWTP (No. 17) is the least expensive at $17 per gallon of flow diverted. In the Southern Sector, diversion of Riverwoods WWTP (No. 13)/Yeshiva YFS (No. 48) is the least expensive at $48 per gallon of flow diverted.

- Among the WWTPs, Yorktown Heights, with a future flow of 2.5 mgd is the largest WWTP in the watershed. Its diversion is not only the most economic but would also eliminate 53% of the total WWTP flow from the watershed.

- Among the Focus Areas, diversion of the Riverwoods WWTP/Yeshiva YFS would eliminate one of the Focus Areas of greatest concern and would also enable another focus area, Stanwood (Nos. 41 and 49), to be diverted.

CONCLUSIONS

Under the terms of the MOA, Westchester County has received $38 million (the East of Hudson funds) to be utilized to fund WWTP diversion or any other approved environmental projects within the watershed. In addition, the MOA commits NYCDEP to add to the East of Hudson funds the cost of upgrading any WWTP that is diverted off the watershed. There is currently no funding available for the diversion of Focus Areas. The implementation of the findings of this study will be subject to funding provided by NYCDEP for capital and operation & maintenance costs.

The conclusions of the Croton Watershed Wastewater Diversion Study are as follows:

- It is feasible to divert wastewater from WWTPs and Focus Areas in the Croton and Kensico watersheds to WWTPs off the watershed (out-of-basin alternatives) or to new WWTPs on the watershed with the effluent from these plants being discharged off the watershed (in-basin alternatives).

- There are four viable alternatives, 2 out-of-basin alternatives (Alternatives No. 4 and No. 5) and 2 in-basin alternatives (Alternatives No. 1 and No. 7).

- The out-of-basin alternatives have a capital cost of $400 and $421 million while the in-basin alternatives cost $474 and $469 million.

- If the diversion project is phased or only partial diversion occurs, the out-of-basin alternatives are even more economical.

- Of the two out-of-basin alternatives, Alternative No. 4 (diverting wastewater to Peekskill and YJTP) is lower in cost.

- Within Alternative No. 4, the most cost effective projects are the diversion of Yorktown Heights WWTP in the Northern Sector to Peekskill WWTP and Riverwoods WWTP/Yeshiva YFS in the Southern Sector to Yonkers Joint Treatment Plant.

- If diversion does not occur, further evaluation should be undertaken to provide a treatment solution for all of the Focus Areas. Solutions could include a new Focus Area WWTP, new or upgraded septic system(s) or diversion to one of the existing local, watershed WWTPs (where upgrading and expansion may be required). In particular, the four Focus Areas of greatest concern could be addressed by the following solutions.

    - Yeshiva YFS: connection to Riverwoods WWTP, and expansion and upgrading of Riverwoods Treatment Plant to AWT.

    - Stanwood: connection to Riverwoods WWTP, expansion and upgrading of Riverwoods WWTP to AWT.

- Peach Lake: evaluation of a joint Westchester/Putnam solution which would divert the development to Brewster WWTP or provide a local treatment plant.

- Quarry Heights: the economic alternative for Quarry Heights is diversion to Mamaroneck WWTP.

- Each alternative can be implemented in a sequence of phases to remove wastewater from the watershed over a period of time. If the diversion project is phased or only partial diversion is chosen, the out-of-basin alternatives are far more attractive than in-basin options.

- Westchester County's adoption of the recommendations of this study will be based on the timing and the extent of the commitment of funds by the NYCDEP to construct and operate the facilities described in the various diversion projects.

EXECUTIVE SUMMARY

1. General

The Croton Watershed Wastewater Diversion Study consists of this **Executive Summary** and ten **Study Memoranda.** The Executive Summary provides an overview of all the work undertaken in the study and outlines the study's findings. The study memoranda provide the detailed, technical backup on specific topics. The ten memoranda, listed in the Table of Contents, are each bound separately.

Throughout the Executive Summary, the appropriate Study Memorandum is referenced for the reader who requires more detailed information on a specific topic.

Study Memorandum No. 9 – Draft Report Revisions details the revisions made to the draft report including the addition of an additional alternative.

2. Project Scope

Westchester County and New York City Department of Environmental Protection (NYCDEP) have contractually agreed to undertake a Wastewater Diversion Study to determine the feasibility of diverting wastewater, generated in the Croton and Kensico watersheds, to wastewater treatment plants off the watershed for treatment.

The goal of the study is to determine the technical, economic and environmental feasibility of diverting off the Croton and Kensico watersheds sewage generated by:

(I) Wastewater Treatment Plants (WWTPs) currently discharging into the watersheds; and

(II) "Focus Areas" or areas currently not sewered or served by WWTPs.

The parameters for determining Focus Areas were:

- Areas within each municipality in the watersheds which are currently experiencing septic system failures.
- Areas within each municipality which because of existing dense development may require sewers.
- Areas within each municipality which because of planned development may require sewers.

A more detailed scope of work and the work plan prepared to execute that scope of work are contained in ***Study Memorandum No. 1 – Work Plan.***

3. Study Area

The Study Area encompasses the portion of the Croton Reservoir Watershed within Westchester County and the Kensico Reservoir Watershed. Refer to Figure ES-1 Base Map, bound herein.

The Study Area encompasses all or a portion of the following 12 municipalities:

1. Town of Bedford
2. Town of Cortlandt
3. Town of Harrison
4. Town of Lewisboro
5. Town/Village of Mount Kisco
6. Town of Mount Pleasant
7. Town of New Castle
8. Town of North Castle
9. Town of North Salem
10. Town of Pound Ridge
11. Town of Somers
12. Town of Yorktown

4. Diversion Study Context

This sewage diversion study represents one element of an overall watershed program being undertaken by NYCDEP to protect and improve water quality within the watershed to comply with the new New York City Watershed Regulations.

It should be noted that absent diversion, all of the existing WWTPs within the watershed will require upgrading to Advanced Wastewater Treatment (AWT), in accordance with the new Watershed Regulations. As of the date of this study, new Draft SPDES permits have been issued by NYSDEC for the WWTPs requiring future compliance with new discharge limitations which can only be achieved by upgrading to AWT. Based on the results of this study, as compared with upgrading all the WWTPs to AWT, a decision may be made as to which is the more appropriate solution to sewage discharges within the watershed – diversion or upgrading to AWT of each plant. It is conceivable that a hybrid solution could be concluded – the diversion of some WWTPs and the upgrading to AWT of others. That decision and the evaluation of the upgrading of the existing WWTPs to AWT are outside the scope of this study. ***Study Memorandum No. 10 – Phasing of Alternatives*** outlines some possible hybrid solutions.

If diversion is not the chosen solution, the treatment of Focus Area sewage will be further examined during the development of the Comprehensive Croton System Water Quality Protection Plan where alternative sewage treatment options will be developed. Treatment solutions, other than diversion, available to the Focus Areas could involve the construction of new WWTP's with AWT or the connection of the areas to existing WWTPs which would likely require expansion of the plants and upgrading to AWT. This could involve the construction of 31 additional AWT WWTP's on the watershed. If diversion of Focus Areas is not undertaken, it is

recommended that further study be undertaken to develop potential solutions for their sewage treatment needs.

5. Putnam County Study

The Croton Watershed encompasses portions of both Westchester County and Putnam County. Concurrent with the Westchester County Diversion Study, a similar study is being undertaken in Putnam County. During the course of this study, three meetings were held with Putnam County to coordinate activities, exchange information and evaluate joint diversion options.

The coordination resulted in the development of one joint Westchester/Putnam diversion alternative, outlined later in this report.

6. Data Acquisition

The data acquisition phase of the study involved gathering pertinent background data for the study – previous reports and studies, relevant maps and drawings for the existing collection system and wastewater treatment plants. Meetings were held with the Westchester County Department of Public Works, (WCDPW) Planning, (WCDOP) Environmental Facilities (WCDEF) and Health (WCDOH); NYCDEP; and the New York State Department of Environmental Conservation (NYSDEC).

In addition, several meetings were held with the Supervisors and the technical representatives of each of the watershed municipalities to gain an understanding of their diversion needs and to define the Focus Areas in each municipality

Copies of the State Pollutant Discharge Elimination System (SPDES) permit for each WWTP in the watershed were obtained from the NYSDEC. Monthly performance reports for each plant for the previous year were obtained from the WCDOH. Site visits were made to the Ossining, Peekskill and Yonkers WWTPs (the three County owned plants on the Hudson River).

A schedule of meetings held, the minutes of those meetings, a bibliography of reports, studies and drawings acquired during the Data Acquisition phase of the project plus additional pertinent information are all contained in ***Study Memorandum No. 2 – Data Acquisition***.

7. Wastewater Treatment Plants

A total of 30 wastewater treatment plants within the Croton Watershed in Westchester County have been identified as having SPDES permits issued by NYSDEC. The names and locations of these plants are shown on Figure ES-2, Key Map. The total average daily flow estimated from all these WWTP's is 4,691,000 gallons per day (gpd). Table ES-1 contains a listing of the WWTP's and the associated average daily flows. Refer to ***Study Memorandum No. 3 – Wastewater Capacity Needs*** for additional details on the development of the WWTP flows.

8. Focus Areas

The designation of every Focus Area within a particular municipality was based on information supplied by WCDOH, NYSDEC, NYCDEP and the municipality itself at the data acquisition meetings. It was imperative that the Focus Areas reflect the planning goals and be consistent with the Master Plan of the municipalities. Once the Focus Areas were defined, they were reviewed and agreed to by the municipalities and the regulatory agencies.

A total of 31 Focus Areas were defined in the Croton and Kensico Watershed with a total average daily flow of 2,069,000 gpd. A listing of the Focus Area are shown in Table ES-2 and their locations are shown in Figure ES-2, Key Map. Extensive background data on the development of the Focus Areas and their flows are contained in ***Study Memorandum No. 3 – Wastewater Capacity Needs.***

There are a number of Focus Areas that have a history of septic system failures and ground contamination. Based on conversations with the WCDOH, NYSDEC and NYCDEP the following four areas are of greatest concern

- Yeshiva YFS (Focus Area No. 48)
- Stanwood (Focus Areas No. 41 and 49)
- Peach Lake (Focus Area No. 52)
- Quarry Heights (Focus Area No. 50)

9. Town Maps

Individual maps for each of the 12 municipalities were prepared showing the location of the WWTP's and the Focus Areas. These maps have been extensively reviewed and agreed to by the municipalities. The maps are bound in a separate section at the end of the Executive Summary.

10. Total Diversion Flow

The total flow from the WWTP's and the Focus Areas in the watersheds to be evaluated for diversion is 6,760,000 gpd. Of that amount 6,740,000 gpd is from the Croton Watershed and 20,000 gpd is from the Kensico Basin. Table ES-3 contains this flow summary.

The individual contribution of each municipality is shown in Table ES-4.

11. Diversion Alternatives

Diversion and treatment alternatives were divided into two broad categories:

(I) In-Basin-Treatment and Diversion

This concept involves the construction of one or more new, central secondary WWTP(s) within the watershed basin and the subsequent diversion of the effluent outside the basin to the Hudson River. The

diversion of the effluent to the Hudson is advantageous, because the treatment level required at the new central WWTP(s) would only appropriately be secondary treatment. The discharge of any effluent within the basin would require AWT which is considerably more expensive than secondary treatment.

(II) Diversion and Out-of-Basin Treatment

This concept involves the diversion of raw sewage from the WWTPs and the focus areas to out of basin, secondary WWTPs for treatment. The existing WWTPs would be abandoned and converted to pumping stations. Evaluation of existing WWTPs capable of treating diverted sewage indicated that there are three county owned WWTPs on the Hudson River – Peekskill, Ossining, and Yonkers Joint Treatment Plant (YJTP). The possibility of diverting sewage eastwards into Connecticut to either an existing plant or a new plant was also considered. Existing adjacent Connecticut plants are too small and would require significant expansion. The institutional issue of inter State sewage treatment further compounded the problem. This alternative was not considered further.

Seven alternatives were developed, four in-basin treatment alternatives and three out-of-basin treatment alternatives. The four in-basin alternatives are:

(I) IN-BASIN ALTERNATIVES

Alternative No. 1 Using the reservoir system as a dividing line, the watershed is divided into a northern sector and a southern sector. All WWTP's and focus areas in the north are diverted to a new central, secondary WWTP located either at the existing Yorktown Heights WWTP or at a generic, undefined location. Total flow to the new plant is approximately 4.0 million gallons per day (mgd). The effluent from the plant is diverted off the watershed to the existing outfall at the Peekskill WWTP.

Similarly, the WWTPs and the Focus Areas in the south are directed to a new, central secondary WWTP located either at the existing WWTP at the Bedford Hills Correctional Facility or a generic, undefined location. Total flow to the plant is 2.3 mgd. The effluent is diverted to the existing outfall at the Ossining WWTP.

Alternative No. 1 is shown schematically in Figure ES-3.

Alternative No. 2 All of the WWTPs and Focus Areas in the watershed are diverted to one new central secondary WWTP located in the northern sector at either the existing Yorktown Heights plant or at generic, undefined location. Total flow to the plant is 6.3 mgd. The effluent is diverted to the outfall at the Peekskill WWTP. Alternative No. 2 is shown in Figure ES-4.

Alternative No. 3 This alternative is a joint solution with Putnam County. All the WWTPs and the Focus Areas are diverted to the north to one new, large WWTP located on the Westchester/Putnam border. The actual location could be in either

County. The plant would be sized at 14.2 mgd. 6.2 mgd from Westchester and 8.0 mgd from Putnam (at the time of writing). The effluent would be diverted to the Hudson River and would require a new outfall to the Hudson River.
Alternative No. 3 is shown schematically in Figure ES-5.

Alternative No. 7 This alternative is also a joint solution with Putnam County. However, it does not involve crossing of the reservoir with piped diversion flow. The northern Westchester flow would be diverted to the joint Westchester/Putnam WWTP and the southern Westchester flow would go to a new, central secondary WWTP as in Alternative No. 1.

Alternative No. 7 is shown schematically in Figure ES-9.

(II) OUT-OF-BASIN ALTERNATIVES

Alternative No. 4 Similar to Alternative No. 1, the reservoir system is used as a dividing line in the watershed. All WWTPs and Focus Areas, a total flow of 4.4 mgd, in the northern sector are diverted to the Peekskill WWTP for treatment. The southern WWTPs and Focus Areas, a total flow of 2.3 mgd, are diverted to the YJTP for treatment. This alternative requires the expansion of the Peekskill WWTP.

Alternative No. 4 is shown schematically in Figure ES-6.

Alternative No. 5 The northern portion of this alternative is exactly the same as Alternative No. 4, with the northern WWTPs and Focus Areas being treated at Peekskill. For the southern portion, instead of treatment at YJTP, the flow is diverted to Ossining WWTP for treatment. This alternative requires the expansion of the Peekskill and Ossining WWTPs.

Alternative No. 5 is shown schematically in Figure ES-7.

Alternative No. 6 The WWTPs and Focus Areas in the watershed are diverted to the north for treatment at the Peekskill WWTP. Total flow is 6.7 mgd. This alternative requires the expansion of the Peekskill WWTP.

Alternative No. 6 is shown schematically in Figure ES-8.

A more detailed discussion of Alternatives 1-6 is outlined in ***Study Memorandum No. 5 – Alternatives Development.*** Alternative 7 is outlined in ***Study Memorandum No. 9 – Draft Report Revisions.***

12. Existing Facilities

In order to determine the capability of the existing conveyance and treatment facilities to deal with the diverted sewage, it was necessary to evaluate these facilities. The results of the evaluation are as follows:

Peekskill Sewer District

The Peekskill WWTP has a design capacity of 10 mgd. It currently treats approximately 7 mgd. Currently, the available treatment capacity of 3 mgd is reserved for future growth within the Peekskill Sewer District. Absent any information about future needs within the existing district, any diversion flow would require an expansion of the plant.

The northern interceptor has two pumping stations, Shrub Oak and Highland Ave. Both were designed to be expandable to convey additional flow. Shrub Oak can be expanded from the current 6 mgd to 8 mgd. Highland Ave. can be expanded from 14 mgd to 28.6 mgd.

The interceptor sewer line was evaluated to determine its hydraulic capacity. A comparison of existing flows in the interceptor (obtained from the 1993 Sewer System Evaluation Survey) with this capacity determined the available capacity for diversion flows.

Ossining Sewer District

The Ossining WWTP has a design capacity of 7 mgd and currently treats approximately 6.5 mgd. The remaining capacity of 0.5 mgd is reserved for expansion within the existing sewer district.

There are no east/west sewer interceptors in the Ossining Sewer District, so any diversion flow would require a new interceptor system to the plant.

Saw Mill Sewer District

The Saw Mill Sewer District is serviced by the Yonkers Joint Treatment Plant (YJTP). YJTP has a design capacity of 92 mgd and a SPDES Permit for flow of either 120 mgd or 145 mgd, depending on the time of year. Over the last three years, the average daily flow to YJTP has been 85 mgd, so there is existing treatment capacity available at the plant.

The Town/Village of Mt. Kisco is the most northerly portion of the sewer districts served by YJTP and is a key element in Alternative No. 4, conveying sewage from the watershed south to YJTP through the existing Mt. Kisco Pumping Station. Very little conveyance capacity is available at this station. The station is vintage 1960's and the equipment is approaching the end of its useful life. If Alternative No. 4 is the chosen diversion alternative, the Mt. Kisco pumping station will require expansion and complete upgrading.

A portion of the existing downstream conveyance system will also require upgrading. A new force main will need to be installed paralleling the existing dual force main. Approximately 1000 feet of the Saw Mill Interceptor will also need be enhanced. A hydraulic evaluation of the balance of the Saw Mill Interceptor indicates that sufficient capacity exists to convey any contemplated diversion flow.

For additional detailed information on the existing facilities, refer to ***Study Memorandum No. 4 – Existing Facilities Evaluation.***

13. Diversion Study Terminology

The following terminology is used in the development of the diversion alternatives.

Collector Sewers

Collector sewers are small sized (8" or 12") sanitary sewer lines located in the Focus Areas. In most cases, Focus Areas will require a pumping station within the local area to convey sewage from the collector sewers to the Interceptors.

Trunk Sewers

Trunk sewers are the lines which convey sewage from either Focus Areas or WWTP's to the Interceptors.

Interceptor Sewer

The interceptor sewers are the main sewer lines, which convey sewage for diversion to the treatment plant or outfalls.

14. Alternatives Development

Each of the seven alternatives was developed to determine the physical elements required – interceptors, pumping stations, collector sewers, wastewater treatment plants, etc. Interceptor routings were determined and plan and profile were prepared for each interceptor. Based on the wastewater needs of WWTPs and the Focus Areas, interceptors, pumping stations and force mains were sized. Each alternative was developed in detail to determine the physical needs. Interceptor routes were laid out to pick up all WWTPs and to allow Focus Areas to be connected with a minimum of interconnecting trunk sewers. Vertical profiles of each interceptor were developed to determine the location of required pump stations. All interceptors are within existing Rights-of-Way (ROWs). It should be noted that while the interceptor routes chosen represent the optimum solution at this planning stage, significant additional work will be undertaken during preliminary design to determine actual routes and their location is subject to change. In general, each alternative consists of 65 miles of interceptor sewers, 38 interceptor pumping stations, 85 miles of local collector sewers, 20 collector sewer pumping stations and 30 WWTP pumping stations. The detailed development of Alternatives 1-6 is outlined in ***Study Memorandum No. 5 – Alternatives Development***, and Alternative 7 is outlined in ***Study Memorandum No. 9 – Draft Report Revisions.***

Alternatives No. 4, 5 & 6 involve the utilization of existing county WWTPs and interceptors. The proposed expansion of existing facilities is generally as follows:

Peekskill Sewer District

Under Alternatives 4 & 5 it is proposed to expand Peekskill WWTP by 4.4 mgd, while under Alternative 6 the plant would be expanded by 6.7 mgd within the existing plant property. Westchester County planning documents from 1970 envisaged a future expansion of the plant.

Under all three alternatives, the northern interceptor and the two pumping stations will need to be expanded. The extent of the expansion depends on the specific alternative.

Ossining Sewer District

Under Alternative 5, the Ossining WWTP will need to be expanded by 2.3 mgd which can be accommodated within the existing county owned property. This expansion was planned in the original 1975 planning reports.

Saw Mill Sewer District

Under Alternative 4, a total of 2.3 mgd will be diverted to YJTP. Sufficient treatment capacity exists to treat this flow, and therefore no expansion of YJTP is

contemplated. However, a cost allocation equivalent to a 2.3 mgd expansion is included in Alternative No. 4 construction cost estimate.

Also, under Alternative No. 4, the Mt. Kisco pumping station will be upgraded and expanded, a third force main will be added and approximately 1000 feet of the Saw Mill Interceptor will be upgraded.

Significant additional detail on the expansion of existing facilities is included in ***Study Memorandum No. 6 – Expansion of Existing Facilities.***

15. Common Alternative Elements

There are several WWTPs and Focus Areas which are common to all alternatives and whose diversion location does not change. These are as follows:

Town of North Castle: It is recommended that the Quarry Heights area (Focus Area No. 50) be diverted to a recently installed low pressure force main on Orchard Street and through the existing sewer system to the Mamaroneck WWTP for treatment.

Town of Mount Pleasant: It is recommended that Focus Area No. 62, Usonia Road be connected into the existing sewer system in the Saw Mill Sewer district and then to YJTP for treatment.

Town/Village of Mt. Kisco: Focus Area No. 70, Parkview Place in the Town/Village of Mt. Kisco should be connected to the existing Village sewer system and conveyed south by the Mt. Kisco pumping station for treatment at YJTP.

Town of Yorktown/New Castle: The IBM Watson Center is currently served by a pumping station at Hudson Hills which conveys sewage to the Ossining WWTP for treatment. It is recommended that Focus Areas No. 30, Yeshiva YKY and No. 61, Saw Mill River Road at Dell Ave. and WWTP No. 12, Random Farms be connected into this system and diverted off the watershed for treatment at Ossining WWTP. An alternative routing, which connects these areas to the Mt. Kisco system, has also been costed.

Town of Yorktown/Cortlandt: Diversion of the existing Lakeside Village WWTP (No. 7) to the Peekskill Interceptor for treatment at Peekskill WWTPs is currently underway. It is recommended that the Hunterbrook Expansion (No. 64), Parkway Colony/Quarry Acres (No. 63) and WWTP No. 29, Walter Panas High School be connected to the Lakeside Village pumping station for diversion to Peekskill WWTP. Baldwin Place (No. 1) could be diverted to the Peekskill WWTP through the proposed line from Stephens Green.

The project cost estimates for the seven alternatives include the costs of these common elements.

16. Project Cost Estimates

Based on the project development undertaken in Study Memorandum No. 5 – Alternatives Development and Study Memorandum No. 6 – Expansion of Existing Facilities, detailed quantity takeoff's were made, including: length, size and depth of Interceptors; length, size and depth of collector and trunk sewers; number and size of pumping stations; new WWTPs and upgrades to existing WWTPs; upgrades to existing interceptors and pumping stations; and length and size of new outfall pipelines. Unit costs were developed for each of these elements and applied to each alternative. A standard construction cost contingency of 15% was included. Engineering design, construction administration, legal and administrative costs were taken as 25% of construction costs.

The project cost estimates in June 1998 dollars and June 2001 dollars are as follows:

	June 1998 $ (in Millions)	June 2001 $ (in Millions)
Alternative No. 1	$474	$533
Alternative No. 2	467	525
Alternative No. 3	450	507
Alternative No. 4	400	450
Alternative No. 5	421	474
Alternative No. 6	404	455
Alternative No. 7	469	527

An additional project cost estimate, Alternative No. 4A has also been prepared. This is the same as Alternative No. 4, except that it assumes that the Town/Village of Mt. Kisco does not wish to participate in the diversion project. In that instance, a new pumping station would be constructed to handle only diversion flow and

convey it to the Saw Mill Interceptor. The existing Mt. Kisco pumping station would remain as is, handling only Mt. Kisco sewage. The total project cost for Alternative 4A is $400.5 million in June 1998 dollars and $451 million in June 2001 dollars.

The project costs of the common alternative elements outlined in paragraph 15 are included in the above alternative costs. The project costs of these individual, common elements are as follows:

	June 1998 $ (in Millions)	June 2001 $ (in Millions)
• North Castle: Quarry Heights	$3.1	$3.5
• Mount Pleasant: Usonia Road	6.8	7.7
• Town/Village Mt. Kisco: Parkview Place	2.0	2.3
• Town of Yorktown/New Castle/Cortlandt		
(I) Yeshiva YKY, Saw Mill River Rd. At Dell Ave., Random Farms	5.9	6.7
(II) Hunterbrook Expansion, Parkway Colony/Quarry Acres, Walter Panas H.S., Baldwin Place	14.8	16.6

Finally, if the diversion choice in the Town of Yorktown for Yeshiva YKY (Focus Area No. 30) Saw Mill River Road (Focus Area No. 61) and Random Farms (WWTP No. 12) is towards the Mt. Kisco system rather than treatment at Ossining WWTP, this would add $3.3 million (1998 $) to all alternatives. ($3.7 million 2001 $)

Detailed back-up for these project cost estimates for Alternatives 1-6 is included in ***Study Memorandum No. 7 – Project Cost Estimates.*** Backup for Alternative 7 is in ***Study Memorandum No. 9 – Draft Report Revisions.***

17. Operation and Maintenance Cost Estimates

The estimated annual operation and maintenance costs of each alternative, in 1998 $ is as follows:

	June 1998 $ (in Millions)	June 2001 $ (in Millions)
Alternative 1	$5.7	$6.4
Alternative 2	5.9	6.6
Alternative 3	5.7	6.4
Alternative 4	4.4	5.0
Alternative 5	5.5	6.2
Alternative 6	5.5	6.2
Alternative 7	5.7	6.4

For additional information, refer to ***Study Memorandum No. 7 – Project Cost Estimates*** and ***Study Memorandum No. 9 – Draft Report Revisions.***

18. Environmental Considerations

Generic environmental impacts as a result of the implementation of any of the diversion alternatives were evaluated.

Removal of pollutants from the Watershed as a result of the implementation of diversion results in the following:

- Average annual phosphorus loading in the watershed will be reduced by an estimated 1,145 kg/year.

Under the various diversion alternatives, an average of 6.8 mgd of wastewater will be discharged to the Hudson River. This diverted flow will receive treatment to secondary levels before discharge to the Hudson. The additional load to the Hudson River is small in comparison to discharges to the Hudson in this reach.

All the interceptors are located in existing, public rights-of-way. All diversion alternatives would bring short term construction impacts including potential traffic impacts, construction noise, sediment runoff and construction dust. These impacts can be significantly mitigated with proper sequencing and construction procedures. These impacts are short term. Once flow diversion is implemented, there would be no long term significant adverse impacts associated with construction.

More in-depth discussion of these environmental impacts is contained in ***Study Memorandum No. 8 – Environmental and Institutional Considerations.***

It should be rated that this study does not include a detailed Environmental Impact Statement. If diversion proceeds, it is recommended that detailed environmental studies should proceed.

19. Institutional Considerations

There are a number of institutional frameworks within which one of the diversion alternatives could be implemented. Options vary with the project selected.

A. Institutional options for diversion alternatives within Westchester County include:

- Creation of new sewer district(s)
- Expansion of existing sewer district(s)
- Service contracts between new service area(s) and existing sewer district(s)

B. Institutional options for a joint Westchester/Putnam County diversion (Alternative No. 3) include:

- Creation of new sewer district(s)
- Creation of a new bi-County sewer district
- Creation of a new bi-County sewer authority

C. As part of the Watershed Agreement, NYCDEP gave Westchester County $38 million to establish the East of Hudson Water Quality Fund. These monies can be used, at the discretion of the County and the Municipalities, to advance all or portions of the diversion project.

D. In all instances, another alternative would be for New York City to construct, own and operate the facilities. It should be noted that while it is not New York City's intention to construct, own or operate any of the facilities, there is no legal impediment to this alternative.

A more detailed discussion of institutional issue is included in ***Study Memorandum No. 8 – Environmental and Institutional Considerations.***

20. Draft Report Revisions

Westchester County submitted the draft Croton Watershed Wastewater Diversion Study to NYCDEP on June 1, 1998. NYCDEP submitted written comments to the County, to which the County gave a detailed response. The NYCDEP's comments, the County's response and the subsequent revisions to the Report are outlined in detail in ***Study Memorandum No. 9 – Draft Report Revisions.***

The major revisions to the report are as follows:

- NYCDEP expressed its opposition to any alternatives which involved crossing the reservoir system with sewage pipes. As a result, Alternatives 2, 3 and 6 have been eliminated from further consideration. Since Alternative No. 3 was the only alternative involving a joint Westchester/Putnam diversion solution, a new alternative, Alternative No. 7 was developed. Details of this alternative are outlined in ***Study Memorandum No. 9 – Draft Report Revisions*** and shown in Figure ES-9.

- NYCDEP requested that the phasing of alternatives be evaluated and included in the final report.

21. Phasing of Alternatives

A sequenced phasing was developed for each of the four remaining alternatives, Alternatives No. 1, 4, 5 and 7. The phasing of each alternative is outlined in detail in ***Study Memorandum No. 10 – Phasing of Alternatives*** and shown graphically in Figures ES-10, ES-11, ES-12 and ES-13.

Each alternative was divided into a Northern Sector and a Southern Sector. The interceptor in each sector was then divided into manageable phases of construction in each sector. It should be noted that, in general, the phases must proceed in sequence, however, the Northern and Southern sectors can proceed independently.

The estimated cost to divert each phase for all of the diversion flow (WWTPs and Focus Areas) is shown in Table ES-6. The cost to divert just the WWTPs is shown in Table ES-7. The cost per gallon of flow diverted is shown in Table ES-8.

The following conclusions can be drawn from this economic phasing of alternatives.

- The initial phases of the In-Basin Alternatives (No. 1 and No. 7) are significantly more expensive than those for the Out-of-Basin Alternatives (No. 4 and No. 5). This is because a new outfall and a portion of the new WWTP (likely not less than 25%) must first be constructed for the in-basin alternatives before any diversion can take place. For example Phase 1N costs $43 million for the Out-of-Basin Alternatives but $86 and $101 million for the in-basin alternatives. Consequently, if the diversion project is to be phased over a number of years or only partial diversion occurs, the Out-of-Basin Alternatives (No. 4 and No. 5) are the most economic and are the least expensive in the initial phases.

- In the Out-of-Basin Alternatives, the phases of the northern sector (the portion of the alternative north of the reservoir system) are the same. In the southern sector, however, flow is diverted to either YJTP (Alternative No. 4) or Ossining WWTP (Alternative No. 5). The YJTP alternative utilizes the existing interceptor system, while the Ossining solution requires a new East-West interceptor from Mt. Kisco to Ossining WWTP. This results in a cost for Phase1S ranging from $13 million (Alternative No. 4) to $40 million (Alternative No. 5) as shown in Table ES-6.

  If the diversion project is phased over a number of years or only partial diversion occurs, Alternative No. 4 is the most economic alternative.

- Table ES-7 shows the cost of diverting only the local WWTPs, without the focus areas included. The cost of diversion now ranges from $190 to $288 million, as opposed to $400 to $474 million when the Focus Areas are included. This illustrates that the Focus Areas, which account for 30% of the overall diversion flow, cost in excess of 50% of the construction cost (Alternative No. 4).

- Table ES-8 illustrates the cost per gallon of flow diverted for each phase of each alternative. In terms of the northern sector, the diversion of Yorktown Heights WWTP (No. 17) represents the best value at $17 per gallon diverted (Alternative No. 4). In terms of the southern sector, the diversion of Riverwoods/(No. 13)/Yeshiva YFS (No. 48) is the most economic at $48 per gallon.

  The diversion of Yorktown Heights WWTP would divert 2.5 mgd off the watershed out of a total WWTP flow of 4.7 mgd. This solution would represent 53% of the total flow.

  In the southern sector, the diversion of Yeshiva YFS (No. 48) would solve one of the four Focus Areas of greatest concern. In addition, this solution would also allow Stanwood (No.'s 41 and 49), another of the four areas, to connect into the diversion.

TABLES

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 1

WASTEWATER TREATMENT PLANT FLOWS

NO.	WASTEWATER TREATMENT PLANT	AVERAGE DAILY FLOW (GPD)
1	BALDWIN PLACE SHOPPING CENTER	26,000
2	BEDFORD CORRECTIONAL FACILITY	500,000
3	BEDFORD LAKE ESTATES	20,000
4	HERITAGE HILLS	702,000
5	IBM - SOMERS	105,000
6	YESHIVA KAK - BEDFORD	50,000
7	LAKESIDE VILLAGE	—
8	LINCOLN HALL	50,000
9	MEADOWS	59,000
10	MICHELLE ESTATES	60,000
11	PEPSICO	40,000
12	RANDOM FARMS	42,000
13	RIVERWOODS	80,000
14	SOMERS MANOR	60,000
15	WATERVIEW HILLS	32,000
16	WILD OAKS	60,000
17	YORKTOWN HEIGHTS	2,500,000
18	ROUTE 22 OFFICE COMPLEX	23,000
19	KENILWORTH	38,000
20	BEDFORD PARK APARTMENTS	20,000
21	FOX LANE HIGH SCHOOL	20,000
22	INCREASE MILLER SCHOOL	10,000
23	LEWISBORO ELEMENTARY SCHOOL	10,000
24	NORTH SALEM MIDDLE SCHOOL	12,000
25	ST. MARY'S OF ASSUMPTION	63,000
26	SOMERS INTERMEDIATE SCHOOL	21,000
27	SOMERS HIGH SCHOOL	31,000
28	WACCABUC COUNTRY CLUB	8,000
29	WALTER PANAS HIGH SCHOOL	40,000
30	YESHIVA YKY - YORKTOWN	9,000
	TOTAL	**4,691,000**

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNIN
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 2

WATERSHED FOCUS AREA FLOWS

NO.	FOCUS AREA	AVERAGE DAILY FLOW (GPD)
CROTON BASIN		
40	BEDFORD HILLS/KATONAH (1)	665,000
41	STANWOOD - BEDFORD (1)	19,000
42	GOLDENS BRIDGE COLONY (1)	23,000
43	LAKE KATONAH (1)	20,000
44	OLD GOLDENS BRIDGE (1)	17,000
45	TRI-LAKES (1)	61,000
46	LAKE TRUESDALE (1)	46,000
47	LAKE KITCHAWAN (1)	44,000
48	YESHIVA YFS - NEW CASTLE (1)	200,000
49	STANWOOD - NEW CASTLE (1)	19,000
51	CROTON FALLS (1)	17,000
52	PEACH LAKE (1)	73,000
53	AMAWALK HEIGHTS (1)	17,000
54	GRANITE SPRINGS (1)	6,000
55	SHENOROCK (1)	168,000
56	HORTON ESTATES (1)	20,000
57	LAKE LINCOLNDALE (1)	78,000
58	LAKE PURDY (1)	62,000
59	DYKEER (1)	34,000
60	HAYES DRIVE AREA (1)	10,000
61	SAW MILL RIVER ROAD AT DELL AVENUE (1)	2,000
63	PARKWAY COLONY/QUARRY ACRES (2)	65,000
64	HUNTERBROOK EXPANSION (3)	268,000
65	KISCO PARK (1)	56,000
66	DEER RIDGE (1)	9,000
67	WEST PATENT SCHOOL (2)	9,000
68	SOMERS ELEMENTARY SCHOOL (2)	15,000
69	SOMERS MIDDLE SCHOOL (2)	16,000
70	PARKVIEW PLACE (1)	10,000
	TOTAL - CROTON BASIN	**2,049,000**
KENSICO BASIN		
50	QUARRY HEIGHTS (1)	12,000
62	USONIA ROAD (1)	8,000
	TOTAL - KENSICO BASIN	**20,000**
	TOTAL	**2,069,000**

(1) Septic System failure.

(2) Unsewered dense development.

(3) Planned development.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 3

TOTAL DIVERSION FLOW SUMMARY

NO.	WWTP / FOCUS AREA	AVERAGE DAILY FLOW (GPD)
1	BALDWIN PLACE SHOPPING CENTER	26,000
2	BEDFORD CORRECTIONAL FACILITY	500,000
3	BEDFORD LAKE ESTATES	20,000
4	HERITAGE HILLS	702,000
5	IBM - SOMERS	105,000
6	YESHIVA KAK - BEDFORD	50,000
7	LAKESIDE VILLAGE	—
8	LINCOLN HALL	50,000
9	MEADOWS	59,000
10	MICHELLE ESTATES	60,000
11	PEPSICO	40,000
12	RANDOM FARMS	42,000
13	RIVERWOODS	80,000
14	SOMERS MANOR	60,000
15	WATERVIEW HILLS	32,000
16	WILD OAKS	60,000
17	YORKTOWN HEIGHTS	2,500,000
18	ROUTE 22 OFFICE COMPLEX	23,000
19	KENILWORTH	38,000
20	BEDFORD PARK APARTMENTS	20,000
21	FOX LANE HIGH SCHOOL	20,000
22	INCREASE MILLER SCHOOL	10,000
23	LEWISBORO ELEMENTARY SCHOOL	10,000
24	NORTH SALEM MIDDLE SCHOOL	12,000
25	ST. MARY'S OF ASSUMPTION	63,000
26	SOMERS INTERMEDIATE SCHOOL	21,000
27	SOMERS HIGH SCHOOL	31,000
28	WACCABUC COUNTRY CLUB	8,000
29	WALTER PANAS HIGH SCHOOL	40,000
30	YESHIVA YKY - YORKTOWN	9,000
40	BEDFORD HILLS / KATONAH	665,000
41	STANWOOD - BEDFORD	19,000
42	GOLDENS BRIDGE COLONY	23,000
43	LAKE KATONAH	20,000
44	OLD GOLDENS BRIDGE	17,000
45	TRI-LAKES	61,000
46	LAKE TRUESDALE	46,000
47	LAKE KITCHAWAN	44,000
48	YESHIVA YFS - NEW CASTLE	200,000
49	STANWOOD - NEW CASTLE	19,000
50	QUARRY HEIGHTS	12,000
51	CROTON FALLS	17,000
52	PEACH LAKE	73,000
53	AMAWALK HEIGHTS	17,000
54	GRANITE SPRINGS	6,000
55	SHENOROCK	168,000
56	HORTON ESTATES	20,000
57	LAKE LINCOLNDALE	78,000
58	LAKE PURDY	62,000
59	DYKEER	34,000
60	HAYES DRIVE AREA	10,000
61	SAW MILL RIVER RD AT DELL AVENUE	2,000
62	USONIA ROAD	8,000
63	PARKWAY COLONY/QUARRY ACRES	65,000
64	HUNTERBROOK EXPANSION	268,000
65	KISCO PARK	56,000
66	DEER RIDGE	9,000
67	WEST PATENT SCHOOL	9,000
68	SOMERS ELEMENTARY SCHOOL	15,000
69	SOMERS MIDDLE SCHOOL	16,000
70	PARKVIEW PLACE	10,000
	TOTAL	**6,760,000**

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 4

FLOW SUMMARY BY TOWN

NO.	MUNICIPALITY	AVERAGE DAILY FLOW (GPD)
1	TOWN OF CORTLANDT	105,000
2	TOWN OF YORKTOWN	2,790,000
3	TOWN OF SOMERS	1,489,000
4	TOWN OF NORTH SALEM	134,000
5	TOWN OF LEWISBORO	442,000
6	TOWN OF BEDFORD	1,373,000
7	TOWN OF NEW CASTLE	397,000
8	TOWN OF MOUNT PLEASANT	8,000
9	TOWN OF NORTH CASTLE	12,000
10	TOWN / VILLAGE OF MOUNT KISCO	10,000
11	TOWN OF HARRISON	----
12	TOWN OF POUND RIDGE	----
	TOTAL	**6,760,000**

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 5

COST ESTIMATE SUMMARY
(IN MILLIONS)

	Alternative No. 1	Alternative No. 2 (1)	Alternative No. 3 (1)	Alternative No. 4 (2)	Alternative No. 5	Alternative No. 6 (1)	Alternative No. 7
1. Focus Areas (Collection & Trunk Sewers)	$165	$165	$165	$165	$165	$165	$165
2. Local WWTPs (Conversion to PSs & Trunk Sewers)	$26	$26	$26	$26	$26	$26	$26
3. Interceptor Sewers	$98	$127	$125	$94	$125	$100	$104
4. Secondary Wastewater Treatment Plants	$90	$90	$90	$0	$0	$0	$90
5. Outfalls	$86	$47	$38	$0	$0	$0	$77
6. Augment County Interceptors	$0	$0	$0	$20	$18	$26	$0
7. Expand Mt. Kisco PS	$0	$0	$0	$8	$0	$0	$0
8. Expand CountyTP/Outfall Use	$9	$11	$6	$87	$87	$87	$6
TOTAL - 1998 DOLLARS (3)	**$474**	**$467**	**$450**	**$400**	**$421**	**$404**	**$469**
TOTAL - 2001 DOLLARS (4)	**$533**	**$525**	**$507**	**$450**	**$474**	**$455**	**$527**

(1) Alternatives 2, 3 and 6 are not acceptable to the NYCDEP because they involve crossing the reservoir.
(2) Alternative No. 4 includes $30 million for improvements at YJTP. No expansion of the YJTP is proposed.
(3) Based on ENR Construction Cost Index of 5875.44
(4) Based on a 4% increase per year through 2001

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 6

COST TO DIVERT LOCAL WWTPs & FOCUS AREAS BY PHASE
(IN MILLIONS)

		Out-of-Basin Alternatives		In-Basin Alternatives	
Phase	Description	Alternative No. 4	Alternative No. 5	Alternative No. 1	Alternative No. 7
1N	Yorktown Hts	$43	$43	$86	$101
2N	Hunterbrook	$3	$3	$3	$3
3N	Hayes Drive Area (1)	$4	$4	$4	$4
4N	Cortlandt	$11	$11	$11	$11
5N	Baldwin Place	$1	$1	$1	$1
6N	Somers - IBM Line	$104	$104	$98	$86
7N	Somers - PepsiCo Line (2)	$9	$9	$7	$7
8N	Peach Lake	-	-	-	$7
9N	No. Salem - Other (3)	-	-	-	$19
TOTAL		**$175**	**$175**	**$209**	**$239**
1S	Riverwoods/YFS	$13	$40	$82	$80
2S	Stanwood (4)	$5	$5	$5	$5
3S	Kisco Park (4)	$8	$8	$7	$7
4S	Bedford - Main (4)	$67	$61	$46	$46
5S	Bedford - Other (5)	$5	$5	$5	$5
6S	Lewisboro (5)	$75	$75	$70	$70
7S	No. Salem - Main (6)	$22	$22	$21	-
8S	Peach Lake (7)	$12	$12	$11	-
9S	Parkview Place	$2	$2	$2	$2
10S	Random Farms Line	$6	$6	$6	$6
11S	Kensico Basin	$10	$10	$10	$10
TOTAL		**$225**	**$246**	**$265**	**$230**
GRAND TOTAL		**$400**	**$421**	**$474**	**$469**

(1) Costs are based on the assumption that Phase 1N is completed before this phase.
(2) Costs are based on the assumption that Phase 6N is completed before this phase.
(3) Cost is based on the assumption that Phase 8N is completed before this phase.
(4) Costs are based on the assumption that Phase 1S is completed before this phase.
(5) Costs are based on the assumption that Phases 1S & 4S are completed before this phase.
(6) Costs are based on the assumption that Phases 1S, 4S & 6S are completed before this phase.
(7) Costs are based on the assumption that Phases 1S, 4S, 6S &7S are completed before this phase.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 7

COST TO DIVERT LOCAL WWTPs BY PHASE
(IN MILLIONS)

		Out-of-Basin Alternatives		In-Basin Alternatives	
Phase	Description	Alternative No. 4	Alternative No. 5	Alternative No. 1	Alternative No. 7
1N	Yorktown Hts	$43	$43	$86	$101
2N	Hunterbrook	$0	$0	$0	$0
3N	Hayes Drive Area (1)	$0	$0	$0	$0
4N	Cortlandt	$2	$2	$2	$2
5N	Baldwin Place	$1	$1	$1	$1
6N	Somers - IBM Line	$43	$43	$44	$32
7N	Somers - PepsiCo Line (2)	$8	$8	$6	$6
8N	Peach Lake	-	-	-	$0
9N	No. Salem - Other (3)	-	-	-	$9
TOTAL		**$96**	**$96**	**$138**	**$151**
1S	Riverwoods/YFS	$10	$37	$82	$79
2S	Stanwood (4)	$0	$0	$0	$0
3S	Kisco Park (4)	$0	$0	$0	$0
4S	Bedford - Main (4)	$33	$27	$20	$20
5S	Bedford - Other (5)	$5	$5	$4	$4
6S	Lewisboro (5)	$29	$29	$26	$26
7S	No. Salem - Main (6)	$11	$11	$11	-
8S	Peach Lake (7)	$0	$0	$0	-
9S	Parkview Place	$0	$0	$0	$0
10S	Random Farms Line	$6	$6	$6	$6
11S	Kensico Basin	$0	$0	$0	$0
TOTAL		**$94**	**$115**	**$150**	**$136**
GRAND TOTAL		**$190**	**$211**	**$288**	**$287**

(1) Costs are based on the assumption that Phase 1N is completed before this phase.
(2) Costs are based on the assumption that Phase 6N is completed before this phase.
(3) Cost is based on the assumption that Phase 8N is completed before this phase.
(4) Costs are based on the assumption that Phase 1S is completed before this phase.
(5) Costs are based on the assumption that Phases 1S & 4S are completed before this phase.
(6) Costs are based on the assumption that Phases 1S, 4S & 6S are completed before this phase.
(7) Costs are based on the assumption that Phases 1S, 4S, 6S &7S are completed before this phase.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NEW YORK

TABLE ES - 8

COST PER GALLON OF DIVERSION FLOW

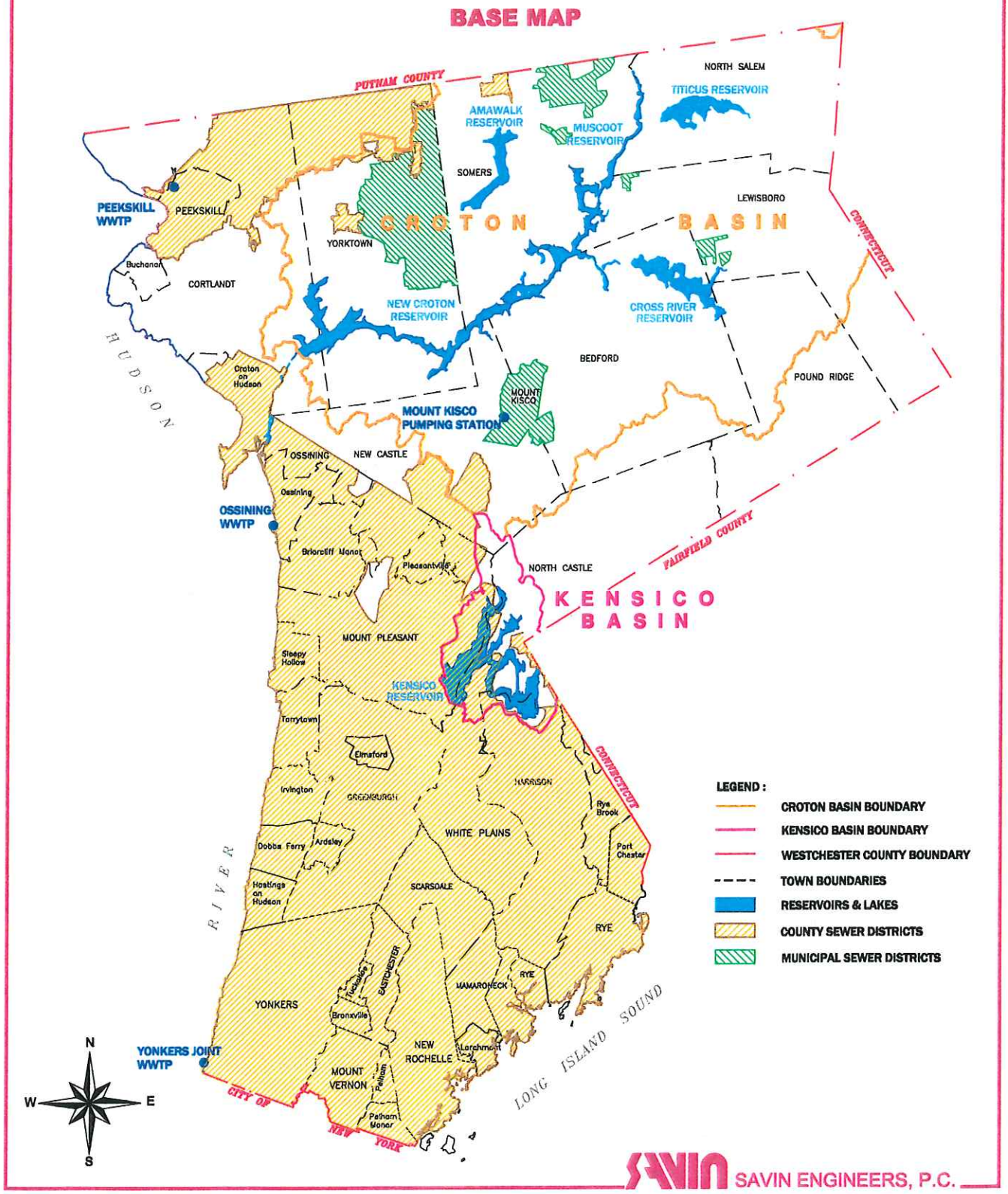
Phase & Description	Cumulative Flow (1000gpd)	Cumulative Cost per GPD: Out-of-Basin Alternatives Alt. No. 4	Out-of-Basin Alternatives Alt. No. 5	In-Basin Alternatives Alt. No. 1	In-Basin Alternatives Alt. No. 7
NORTHERN					
1N-Yorktown Hts	2,500	$17	$17	$34	$40
3N-Hayes Drive Area (1)	2,510	$19	$19	$36	$42
6N-Somers - IBM Line	1,315	$79	$79	$74	$65
7N-Somers - PepsiCo Line (2)	1,461	$77	$77	$72	$63
8N-Peach Lake	73	-	-	-	$100
9N-No. Salem - Other (3)	133	-	-	-	$197
2N-Hunterbrook	268	$13	$13	$13	$13
4N-Cortlandt	105	$102	$102	$102	$102
5N-Baldwin Place	26	$22	$22	$22	$22
SOUTHERN					
1S-Riverwoods/YFS	280	$48	$144	$294	$286
2S-Stanwood (4)	317	$59	$144	$275	$267
3S-Kisco Park (4)	374	$72	$144	$253	$247
4S-Bedford - Main (4)	1,699	$55	$68	$83	$81
5S-Bedford - Other (5)	1,728	$57	$70	$84	$83
6S-Lewisboro (5)	2,169	$80	$90	$99	$98
7S-No. Salem - Main (6)	2,229	$88	$97	$106	-
8S-Peach Lake (7)	2,302	$90	$99	$107	-
9S-Parkview Place	10	$196	$196	$196	$196
10S-Random Farms Line	53	$113	$113	$113	$113
11S-Kensico Basin	20	$486	$486	$486	$486

(1) Costs are based on the assumption that Phase 1N is completed before this phase.
(2) Costs are based on the assumption that Phase 6N is completed before this phase.
(3) Cost is based on the assumption that Phase 8N is completed before this phase.
(4) Costs are based on the assumption that Phase 1S is completed before this phase.
(5) Costs are based on the assumption that Phases 1S & 4S are completed before this phase.
(6) Costs are based on the assumption that Phases 1S, 4S & 6S are completed before this phase.
(7) Costs are based on the assumption that Phases 1S, 4S, 6S &7S are completed before this phase.

FIGURES

FIGURE ES-1

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY



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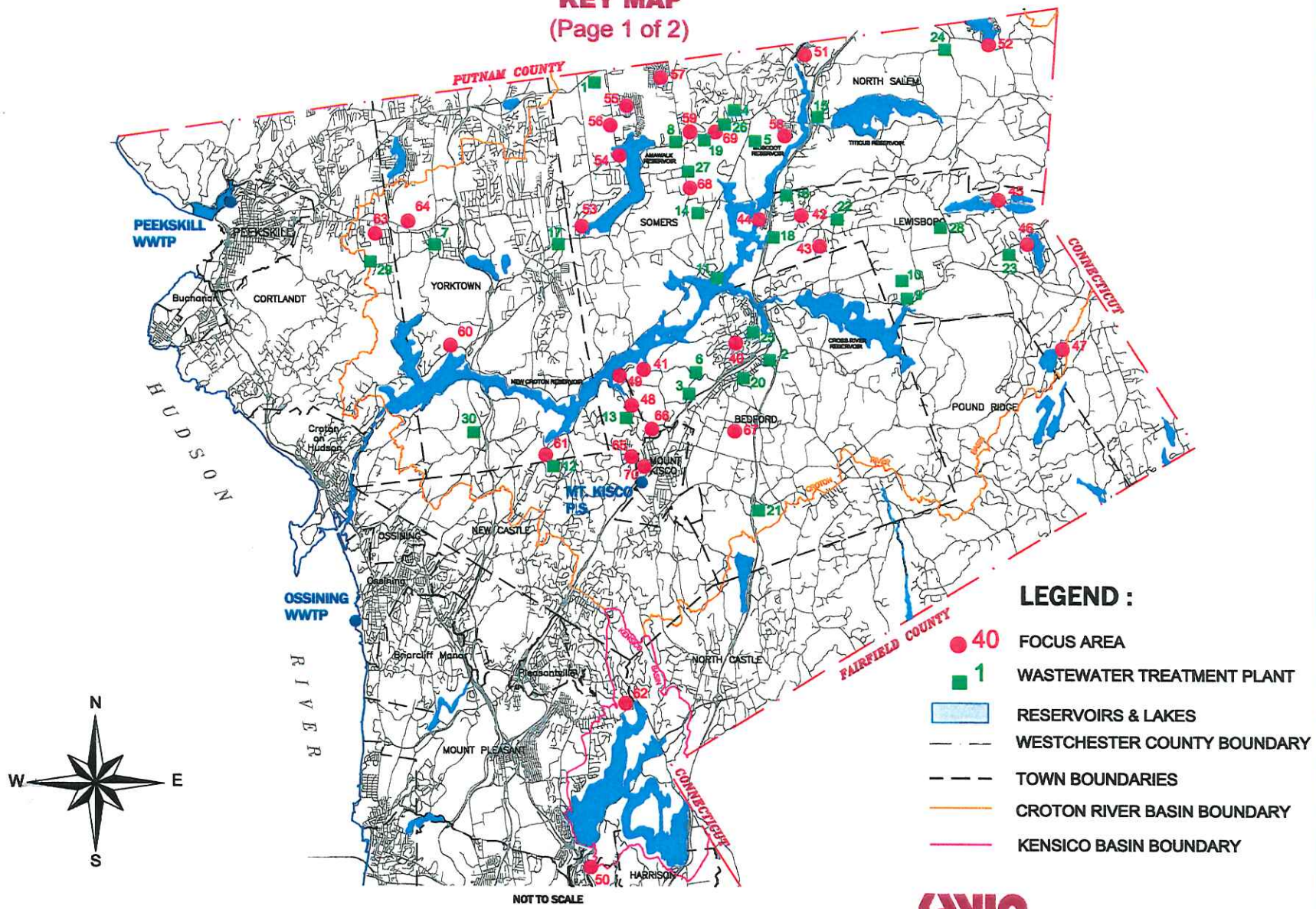
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-2a

KEY MAP
(Page 1 of 2)



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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-2b

LISTING OF WASTEWATER TREATMENT PLANTS AND FOCUS AREA

(Page 2 of 2)

WASTEWATER TREATMENT PLANTS

1. Baldwin Place Shopping Center
2. Bedford Correctional Facility
3. Bedford Lake Estates
4. Heritage Hills
5. IBM - Somers
6. Yeshiva (Bedford) - KAK
7. Lakeside Village
8. Lincoln Hall
9. Meadows
10. Michelle Estates
11. Pepsico
12. Random Farms
13. Riverwoods
14. Somers Manor Nursing Home
15. Waterview Hills
16. Wild Oaks
17. Yorktown Heights
18. Rte. 22 Office Complex
19. Kenilworth Subdivision
20. Bedford Park Apartments
21. Fox Lane High School
22. Increase Miller School
23. Lewisboro Elementary School
24. North Salem Middle School
25. St. Mary's of Assumption
26. Somers Intermediate School
27. Somers Senior High School
28. Waccabuc Country Club
29. Walter Panas High School
30. Yeshiva (Yorktown) - YKY

FOCUS AREAS

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54. Granite Springs
55. Shenorock
56. Horton Estates
57. Lake Lincolndale
58. Lake Purdy
59. Dykeer
60. Hayes Drive Area
61. Saw Mill River Rd at Dell Ave.
62. Usonia Road
63. Parkway Colony/Quarry Acres
64. Hunterbrook Expansion
65. Kisco Park
66. Deer Ridge
67. West Patent School
68. Somers Elementary School
69. Somers Middle School
70. Parkview Place

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FIGURE ES-3

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

ALTERNATIVE 1

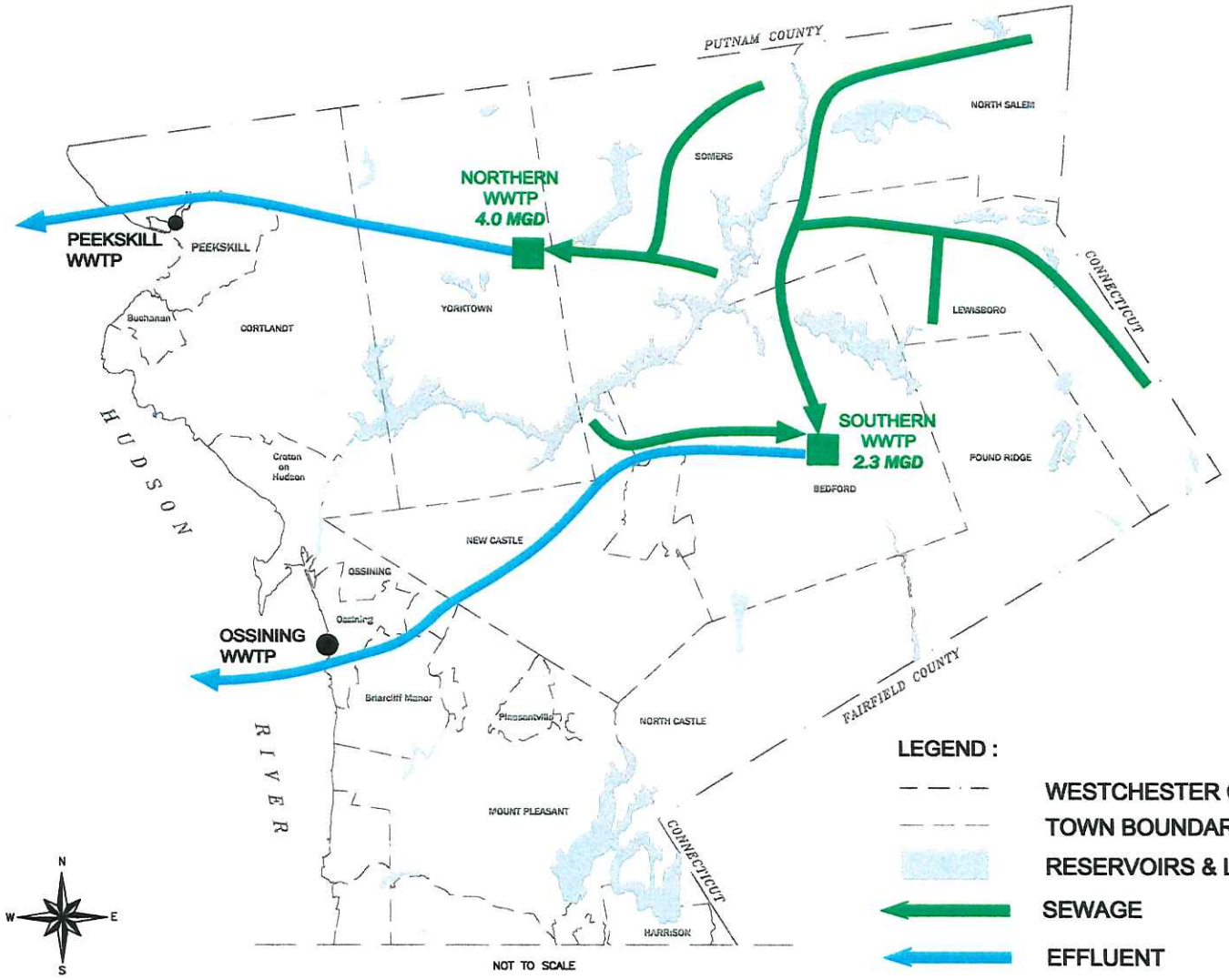

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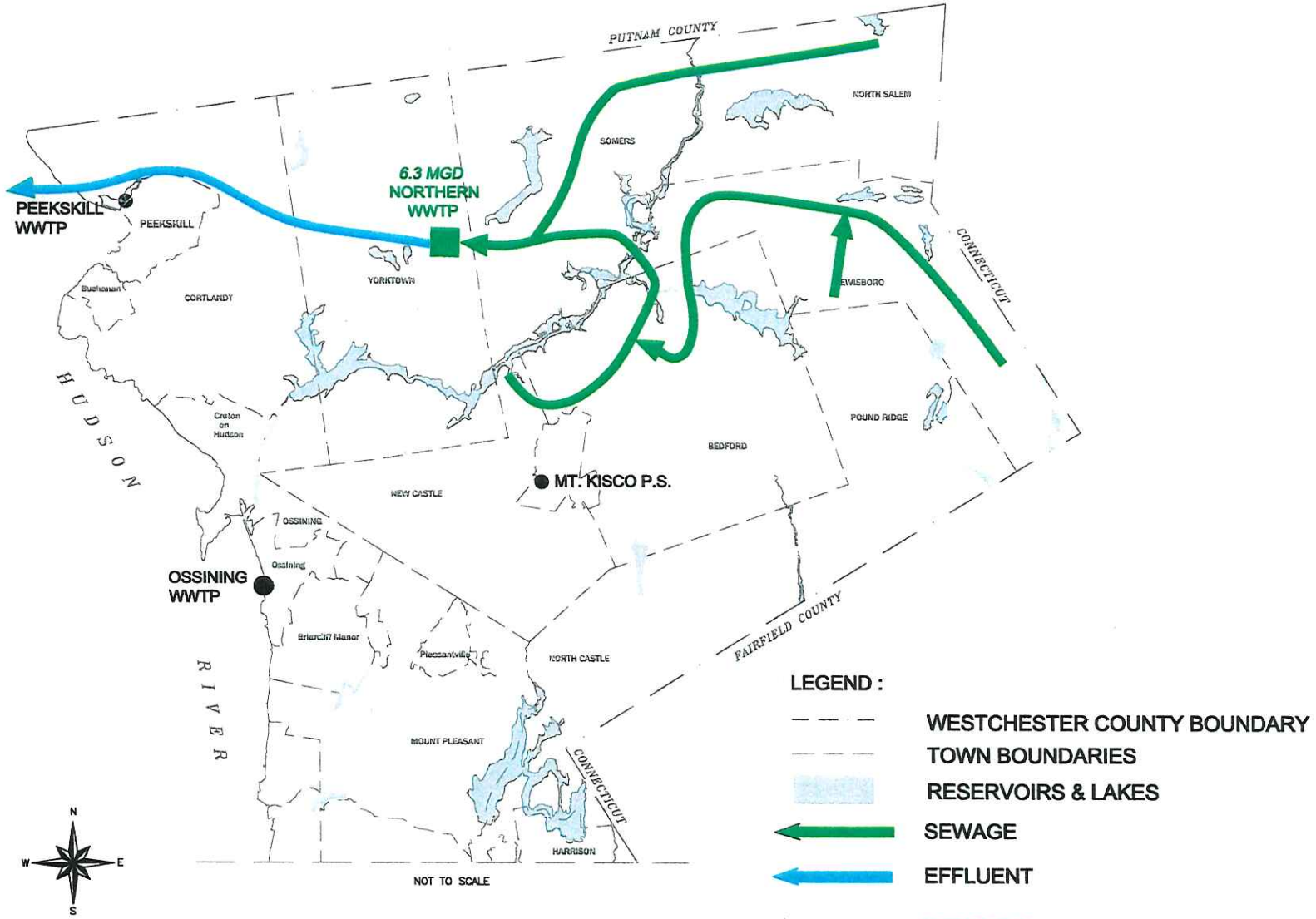
FIGURE ES-4

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

ALTERNATIVE 2



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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-5

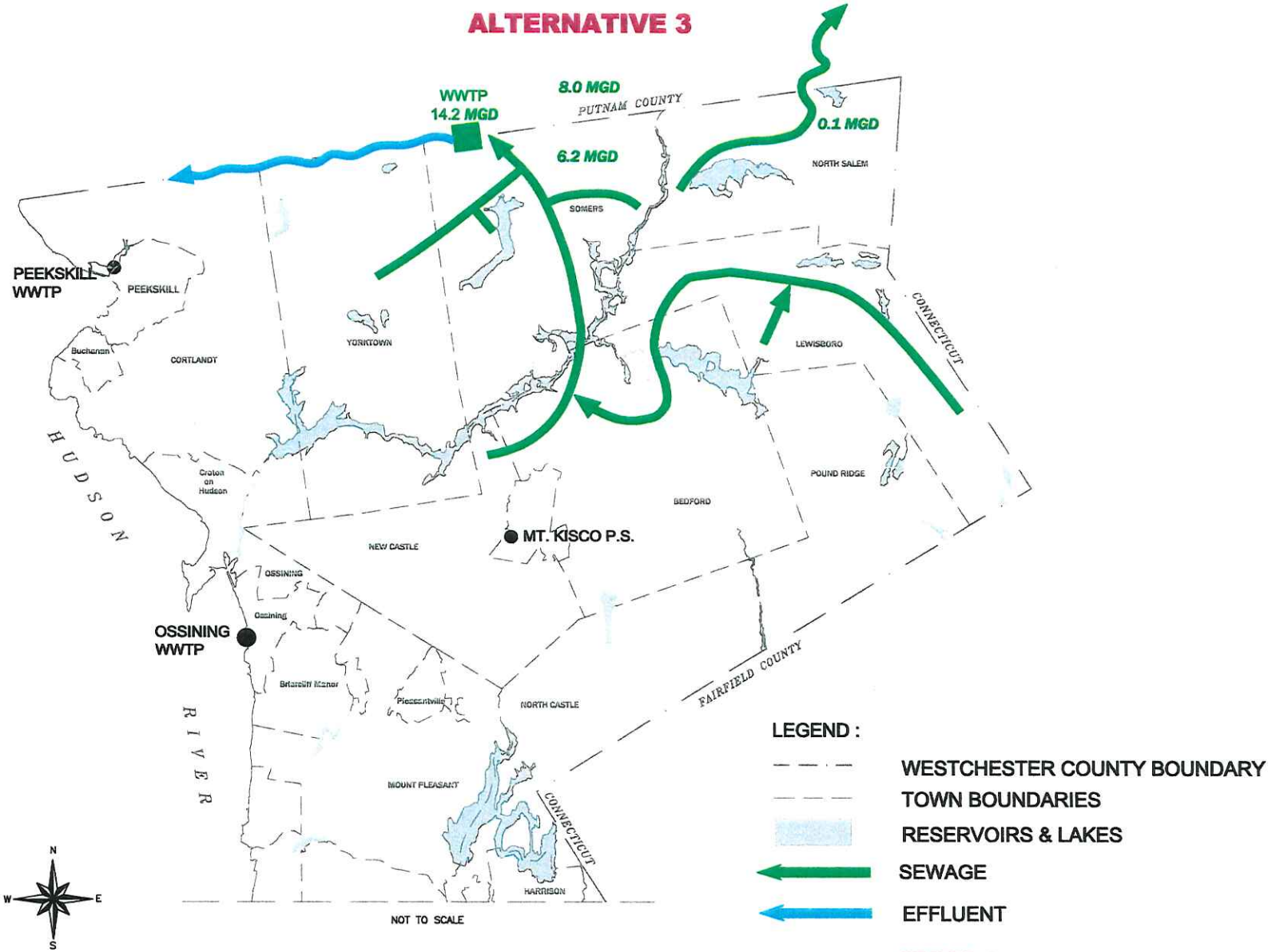

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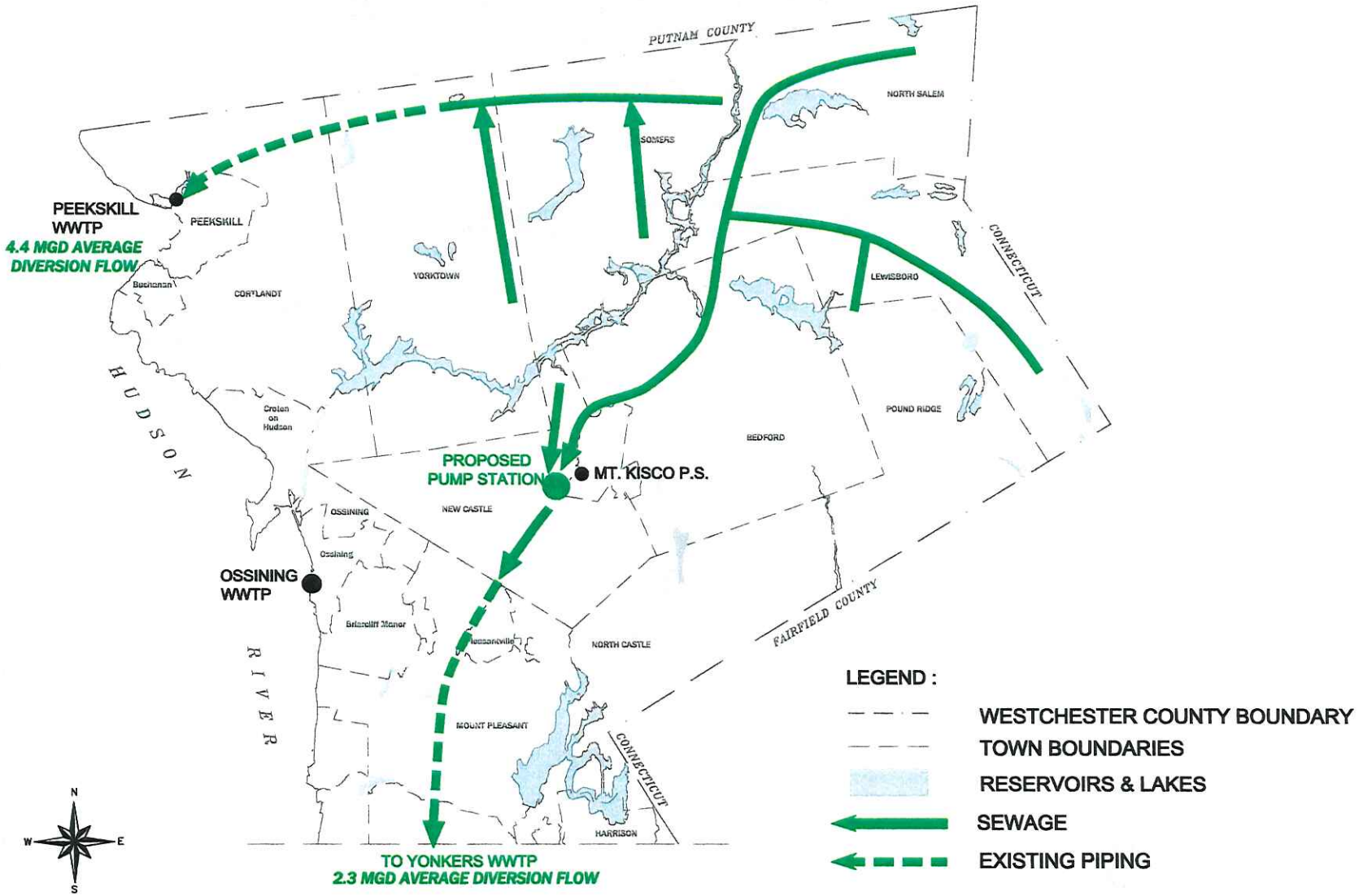
FIGURE ES-6

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

ALTERNATIVE 4



NOT TO SCALE

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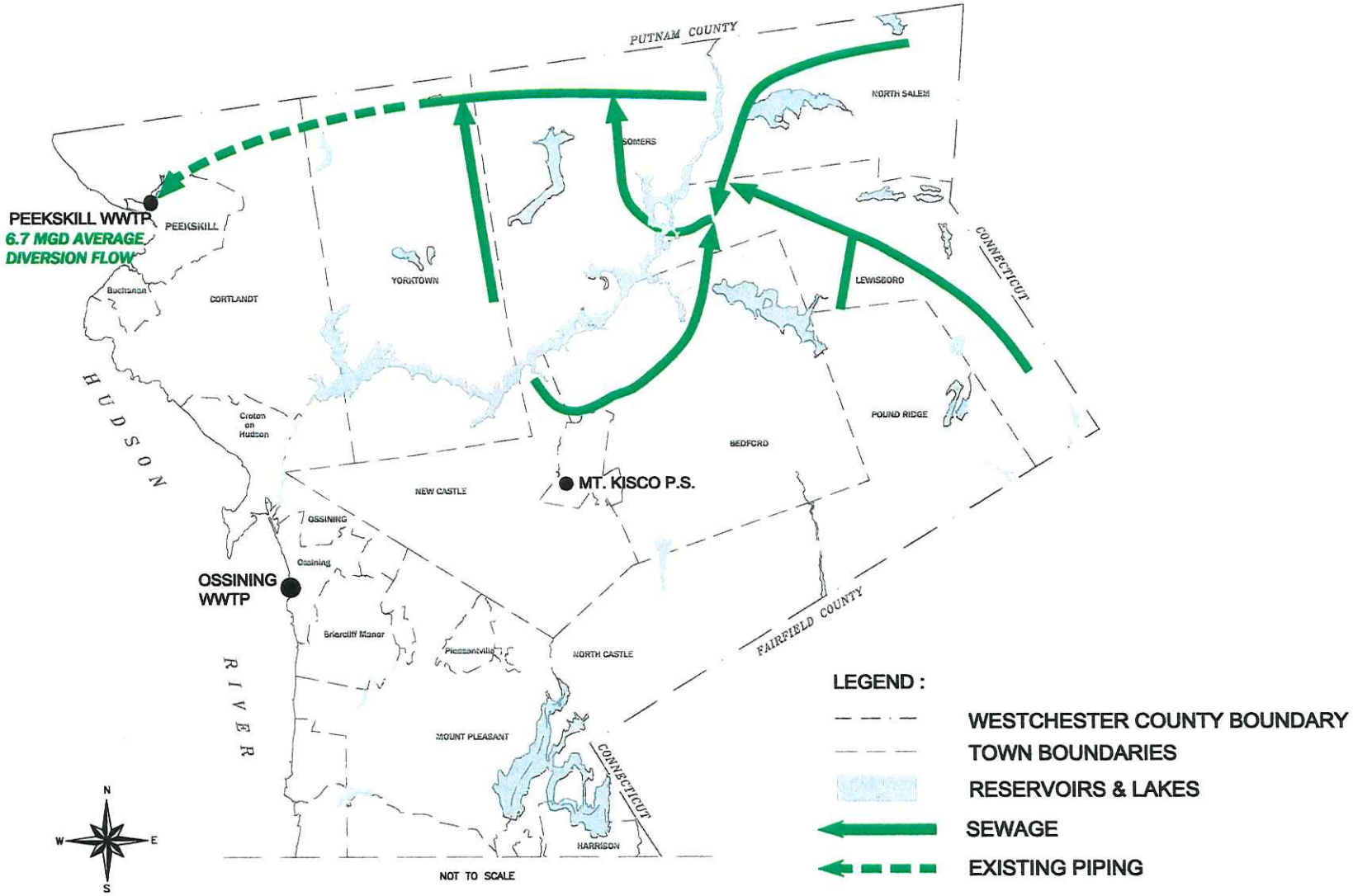
FIGURE ES-8

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

ALTERNATIVE 6



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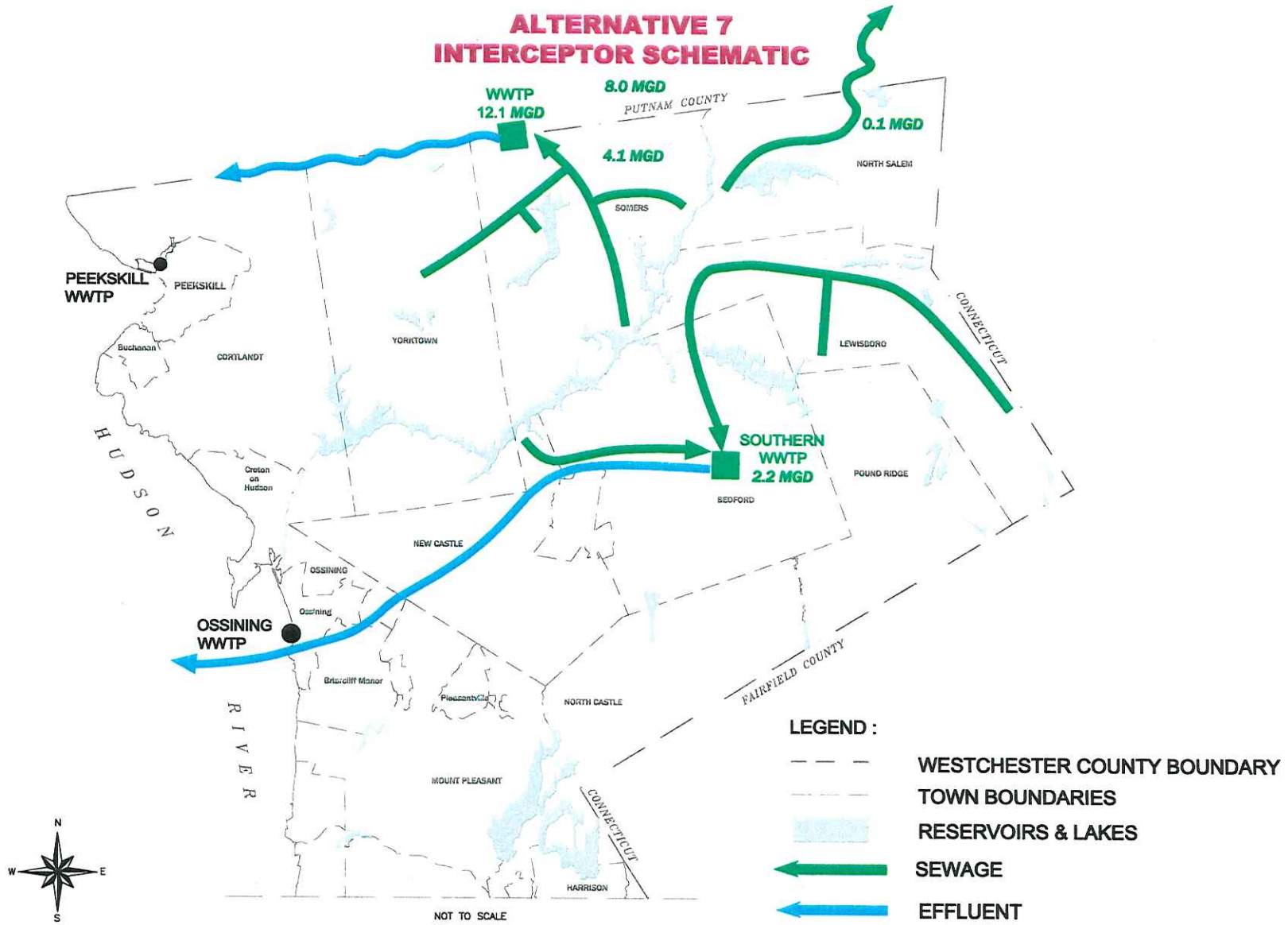
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-9



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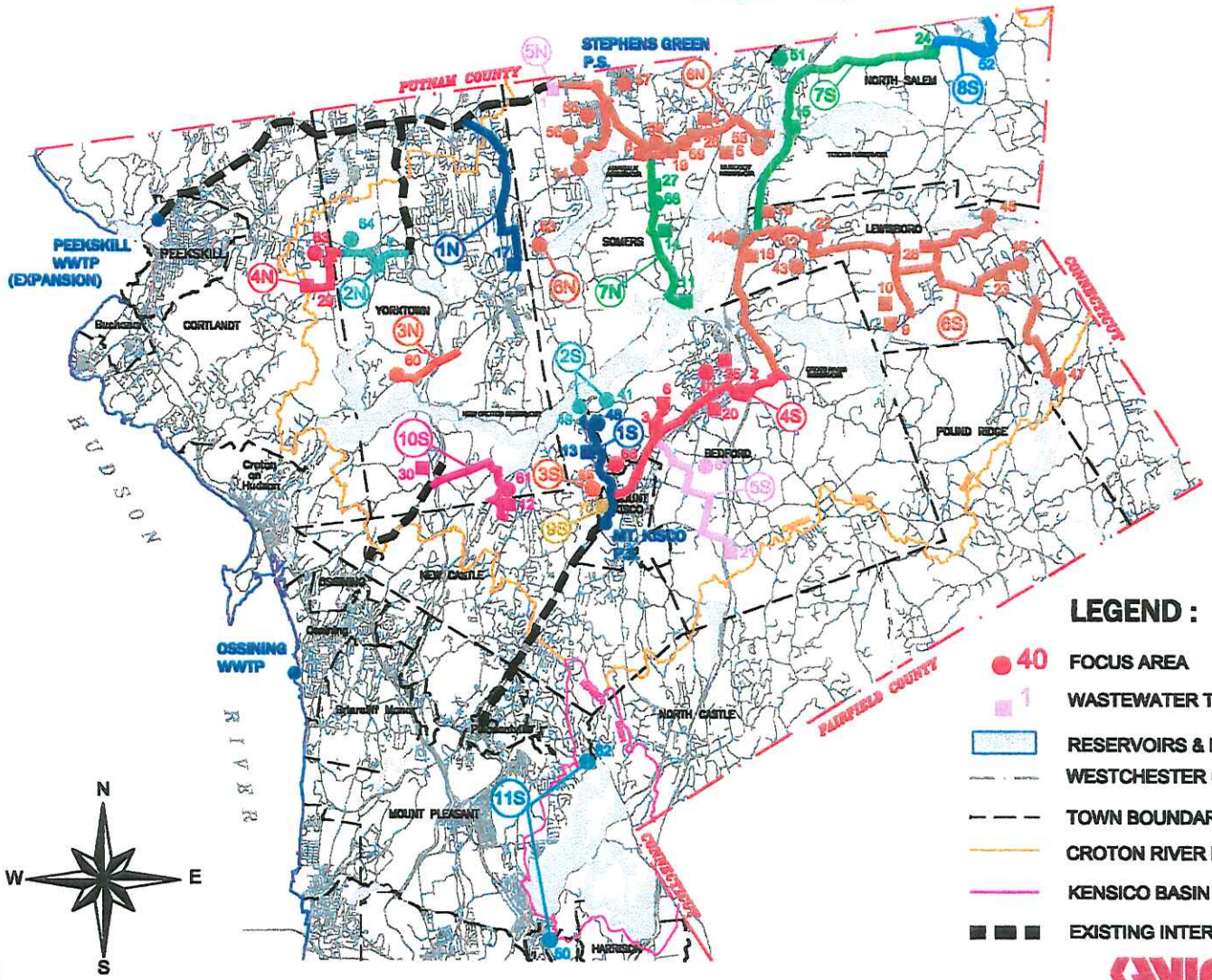
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-10a

ALTERNATIVE 4 PHASING PLAN
(Page 1 of 2)



PHASING LEGEND :

- 1S & 1N
- 2S & 2N
- 3S & 3N
- 4S & 4N
- 5S & 5N
- 6S & 6N
- 7S & 7N
- 8S
- 9S
- 10S
- 11S

LEGEND :

- 40 FOCUS AREA
- 1 WASTEWATER TREATMENT PLANT
- RESERVOIRS & LAKES
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- KENSICO BASIN BOUNDARY
- EXISTING INTERCEPTOR OR FORCE MAIN

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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-10b

LISTING OF WASTEWATER TREATMENT PLANTS AND FOCUS AREA

(Page 2 of 2)

WASTEWATER TREATMENT PLANTS

1. Baldwin Place Shopping Center
2. Bedford Correctional Facility
3. Bedford Lake Estates
4. Heritage Hills
5. IBM - Somers
6. Yeshiva (Bedford) - KAK
7. Lakeside Village
8. Lincoln Hall
9. Meadows
10. Michelle Estates
11. Pepsico
12. Random Farms
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15. Waterview Hills
16. Wild Oaks
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25. St. Mary's of Assumption
26. Somers Intermediate School
27. Somers Senior High School
28. Waccabuc Country Club
29. Walter Panas High School
30. Yeshiva (Yorktown) - YKY

FOCUS AREAS

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54. Granite Springs
55. Shenorock
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58. Lake Purdy
59. Dykeer
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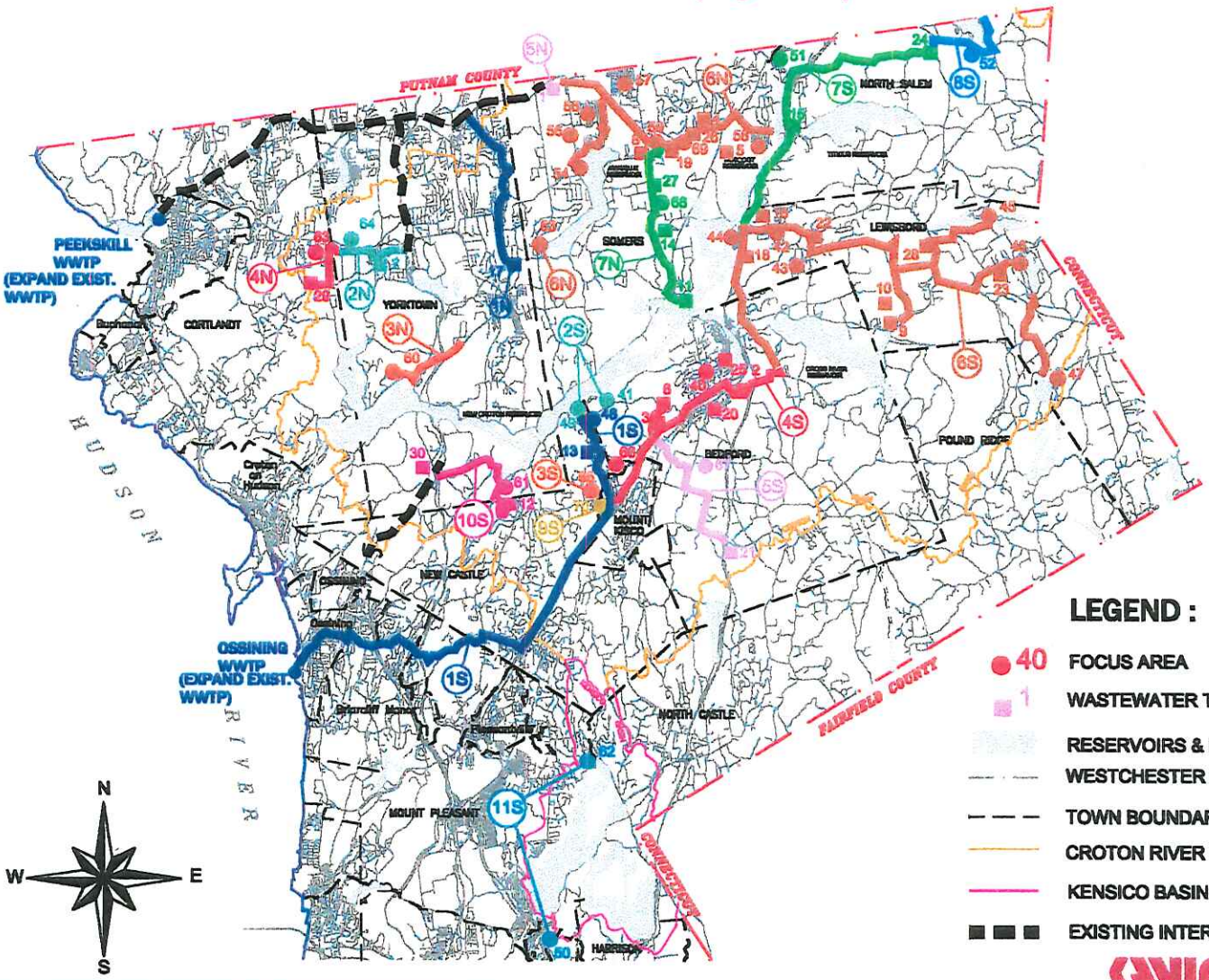
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-11a

ALTERNATIVE 5 PHASING PLAN
(Page 1 of 2)



PHASING LEGEND :

- 1S & 1N
- 2S & 2N
- 3S & 3N
- 4S & 4N
- 5S & 5N
- 6S & 6N
- 7S & 7N
- 8S
- 9S
- 10S
- 11S

LEGEND :

- 40 FOCUS AREA
- 1 WASTEWATER TREATMENT PLANT
- RESERVOIRS & LAKES
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- KENSICO BASIN BOUNDARY
- EXISTING INTERCEPTOR OR FORCE MAIN

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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-11b

LISTING OF WASTEWATER TREATMENT PLANTS AND FOCUS AREA

(Page 2 of 2)

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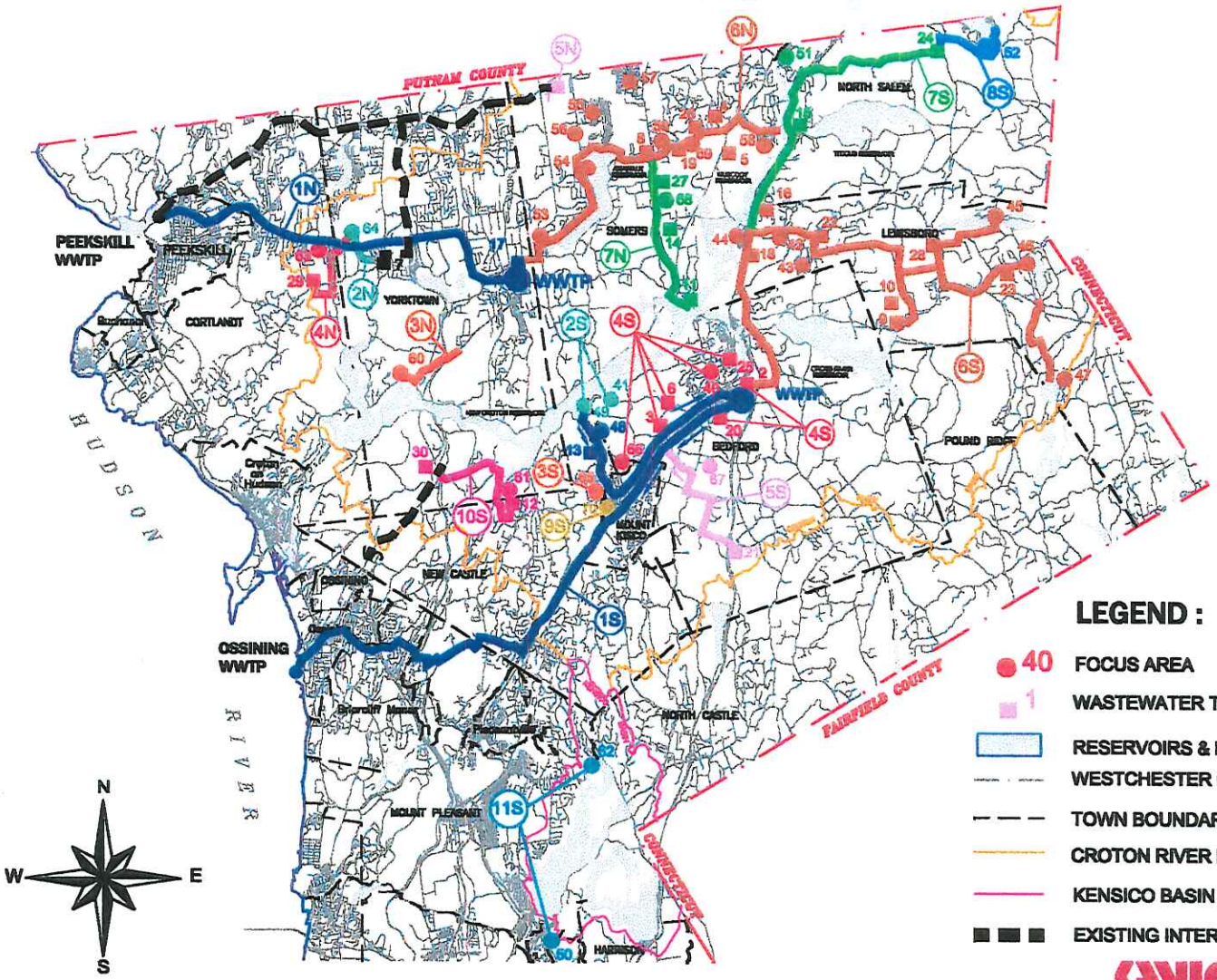
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-12a

ALTERNATIVE 1 PHASING PLAN
(Page 1 of 2)



PHASING LEGEND :

- 1S & 1N
- 2S & 2N
- 3S & 3N
- 4S & 4N
- 5S & 5N
- 6S & 6N
- 7S & 7N
- 8S
- 9S
- 10S
- 11S

LEGEND :

- 40 FOCUS AREA
- 1 WASTEWATER TREATMENT PLANT
- RESERVOIRS & LAKES
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-12b

LISTING OF WASTEWATER TREATMENT PLANTS AND FOCUS AREA

(Page 2 of 2)

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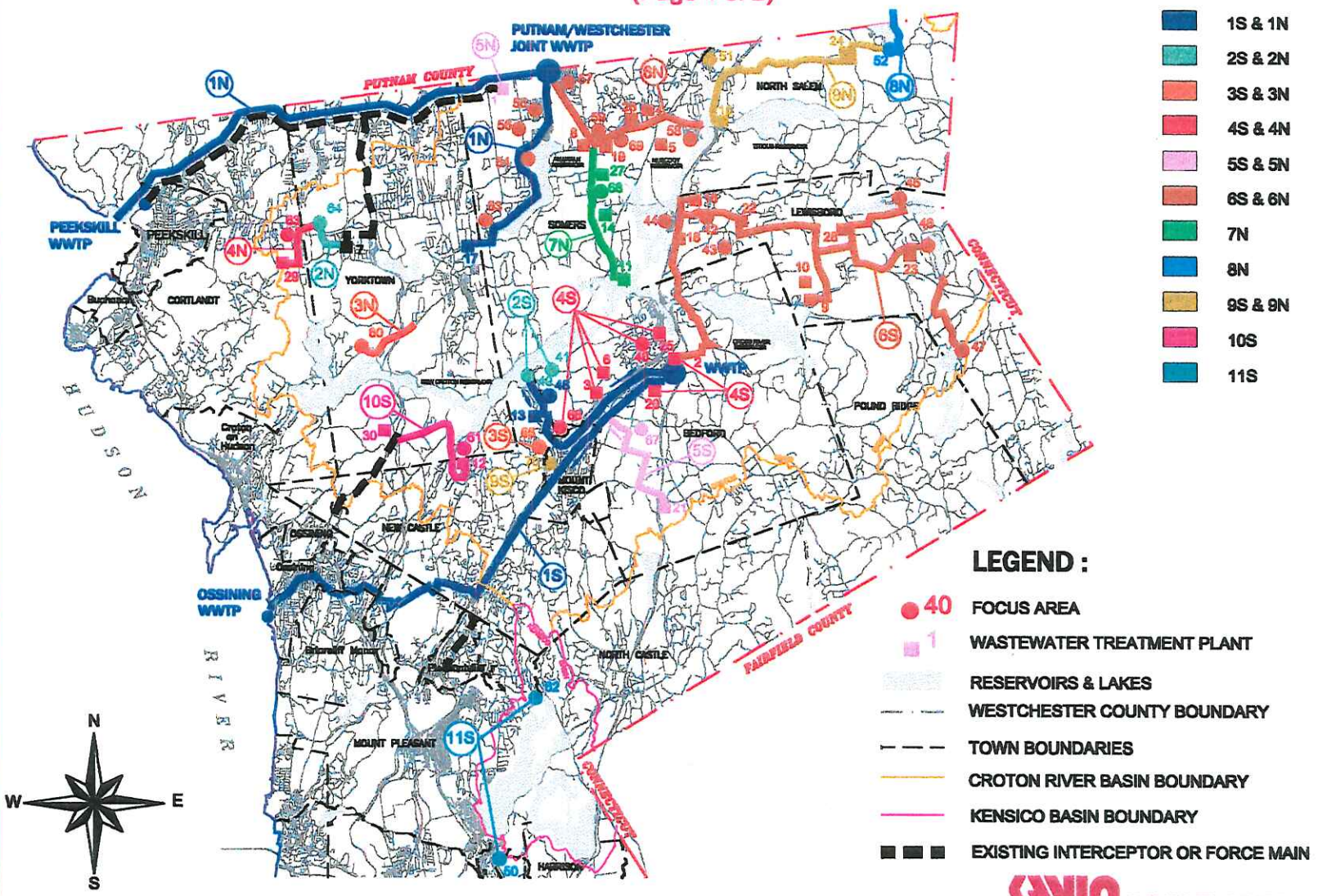
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-13a

ALTERNATIVE 7 PHASING PLAN
(Page 1 of 2)



PHASING LEGEND :

- 1S & 1N
- 2S & 2N
- 3S & 3N
- 4S & 4N
- 5S & 5N
- 6S & 6N
- 7N
- 8N
- 9S & 9N
- 10S
- 11S

LEGEND :

- 40 FOCUS AREA
- 1 WASTEWATER TREATMENT PLANT
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CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

FIGURE ES-13b

LISTING OF WASTEWATER TREATMENT PLANTS AND FOCUS AREA

(Page 2 of 2)

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68. Somers Elementary School
69. Somers Middle School
70. Parkview Place

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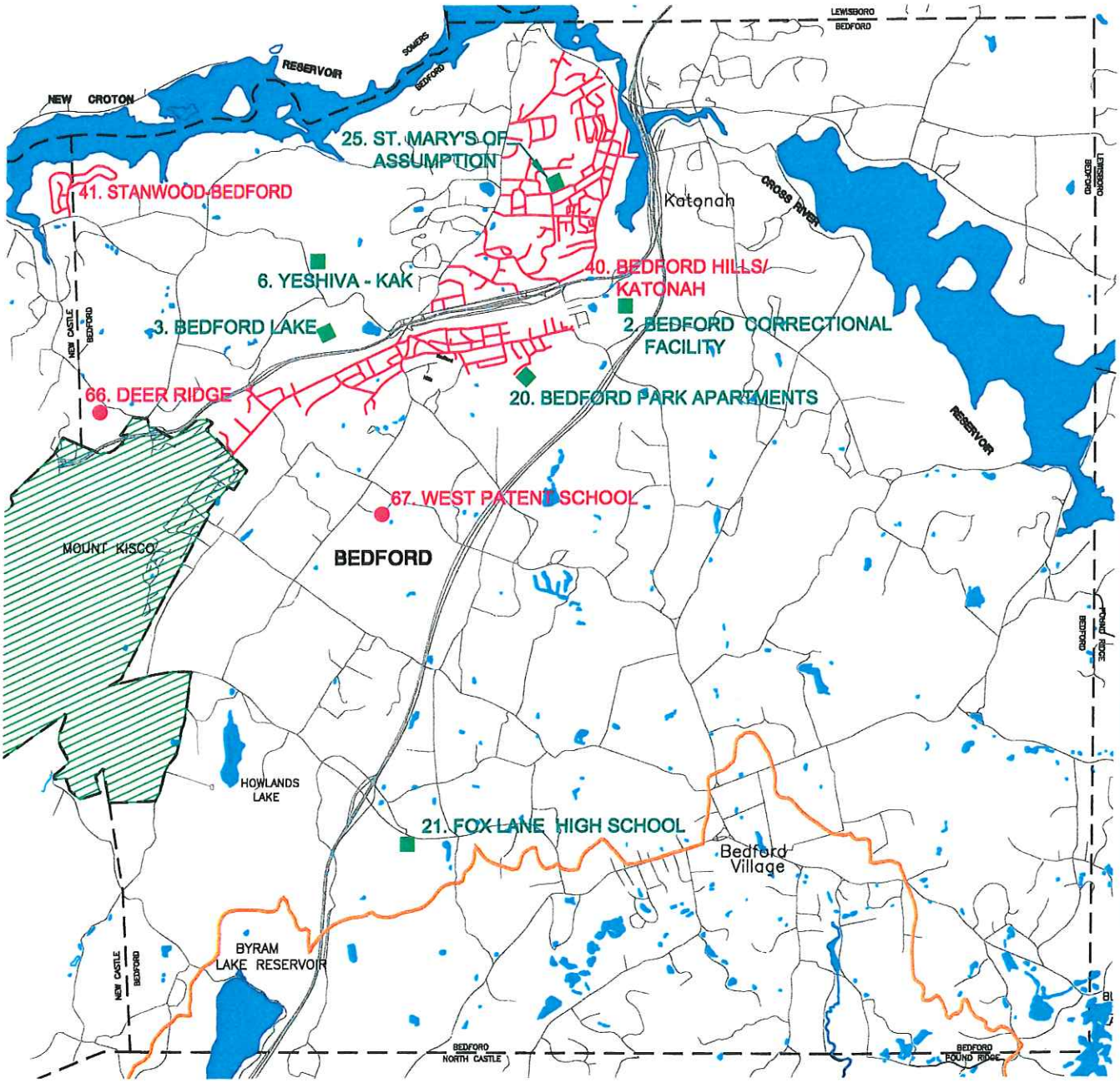
TOWN MAPS

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF BEDFORD



LEGEND :

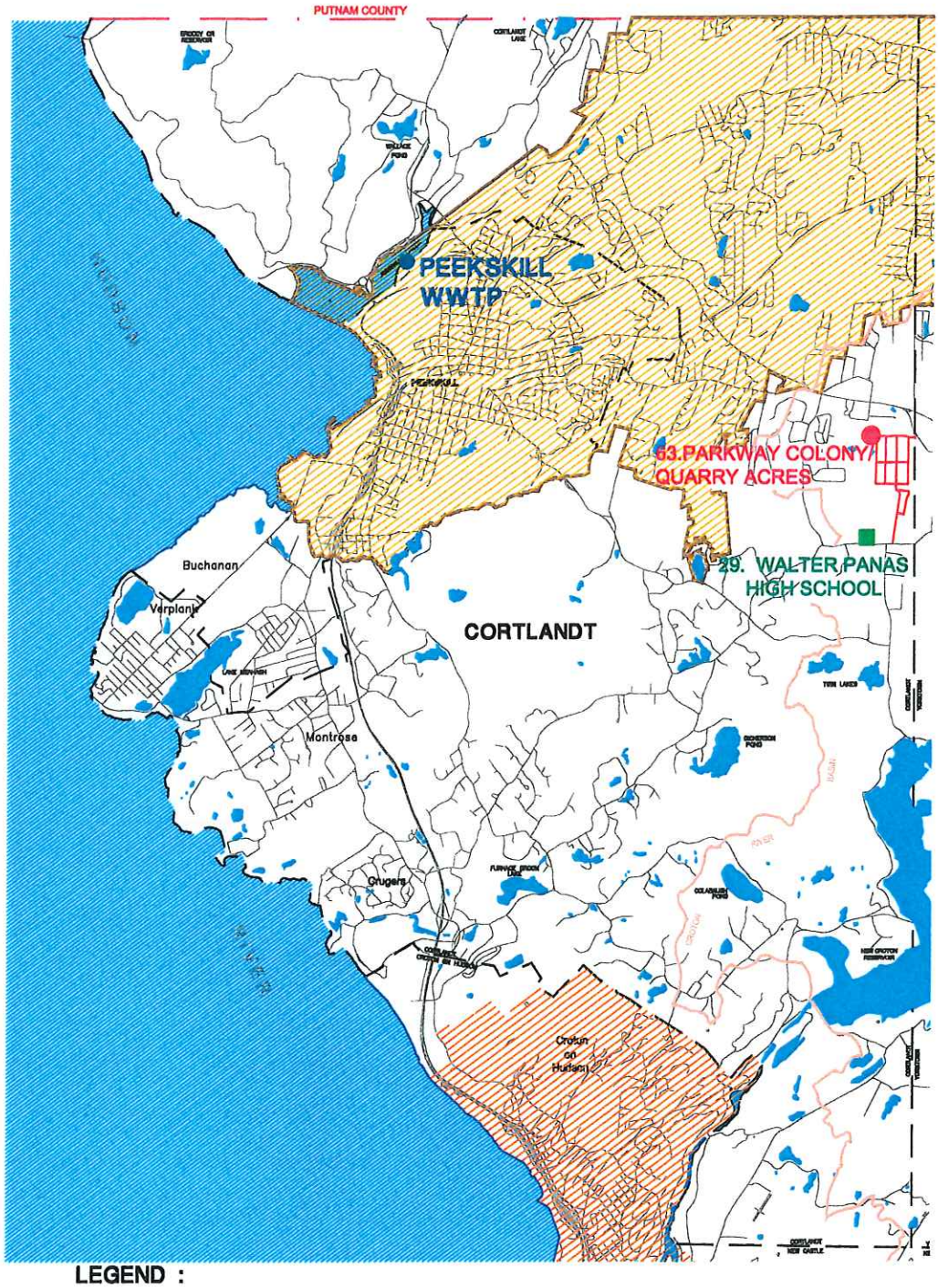
- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- 20 WASTEWATER TREATMENT PLANT
- 66 FOCUS AREA

N W E S

SAVIN ENGINEERS, P.C.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF CORTLANDT



LEGEND :

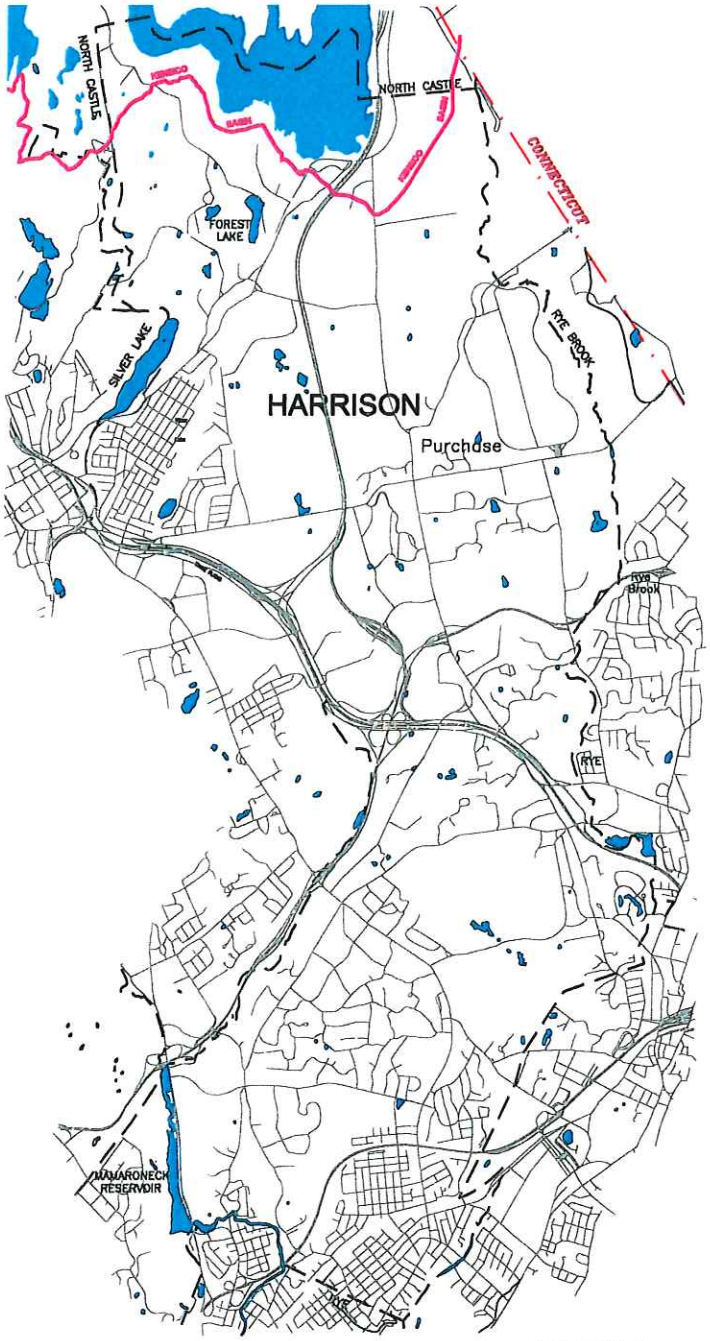
- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- COUNTY SEWER DISTRICTS
- TOWN BOUNDARIES
- WESTCHESTER COUNTY BOUNDARY
- CROTON RIVER BASIN BOUNDARY
- 29 WTP
- 63 FOCUS AREA

N W E S

SAVIN ENGINEERS, P.C.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF HARRISON



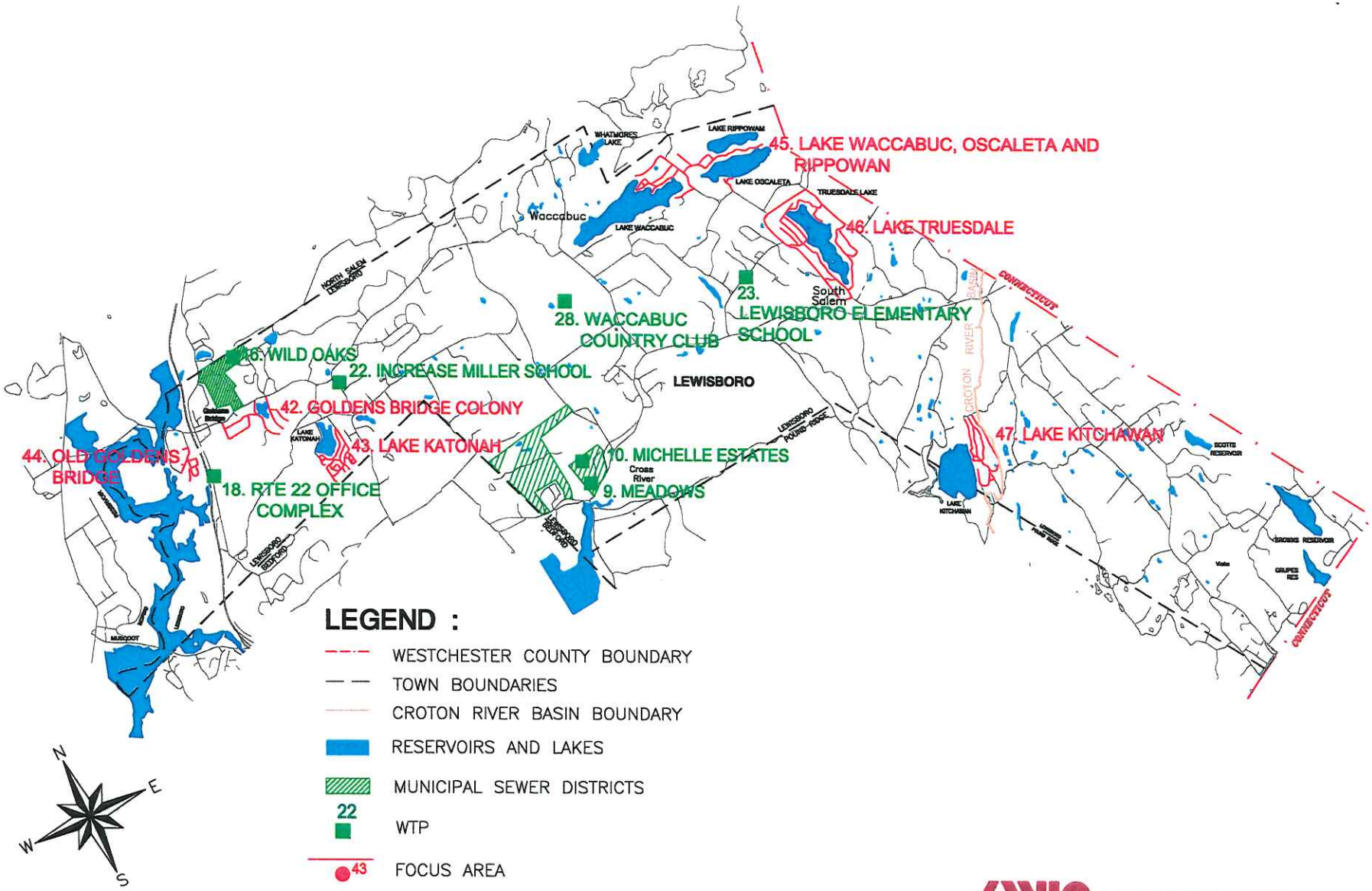
LEGEND :

- RESERVOIRS AND LAKES
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- KENSICO BASIN BOUNDARY

SAVIN ENGINEERS, P.C.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF LEWISBORO



LEGEND :

- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- 22 WTP
- 43 FOCUS AREA

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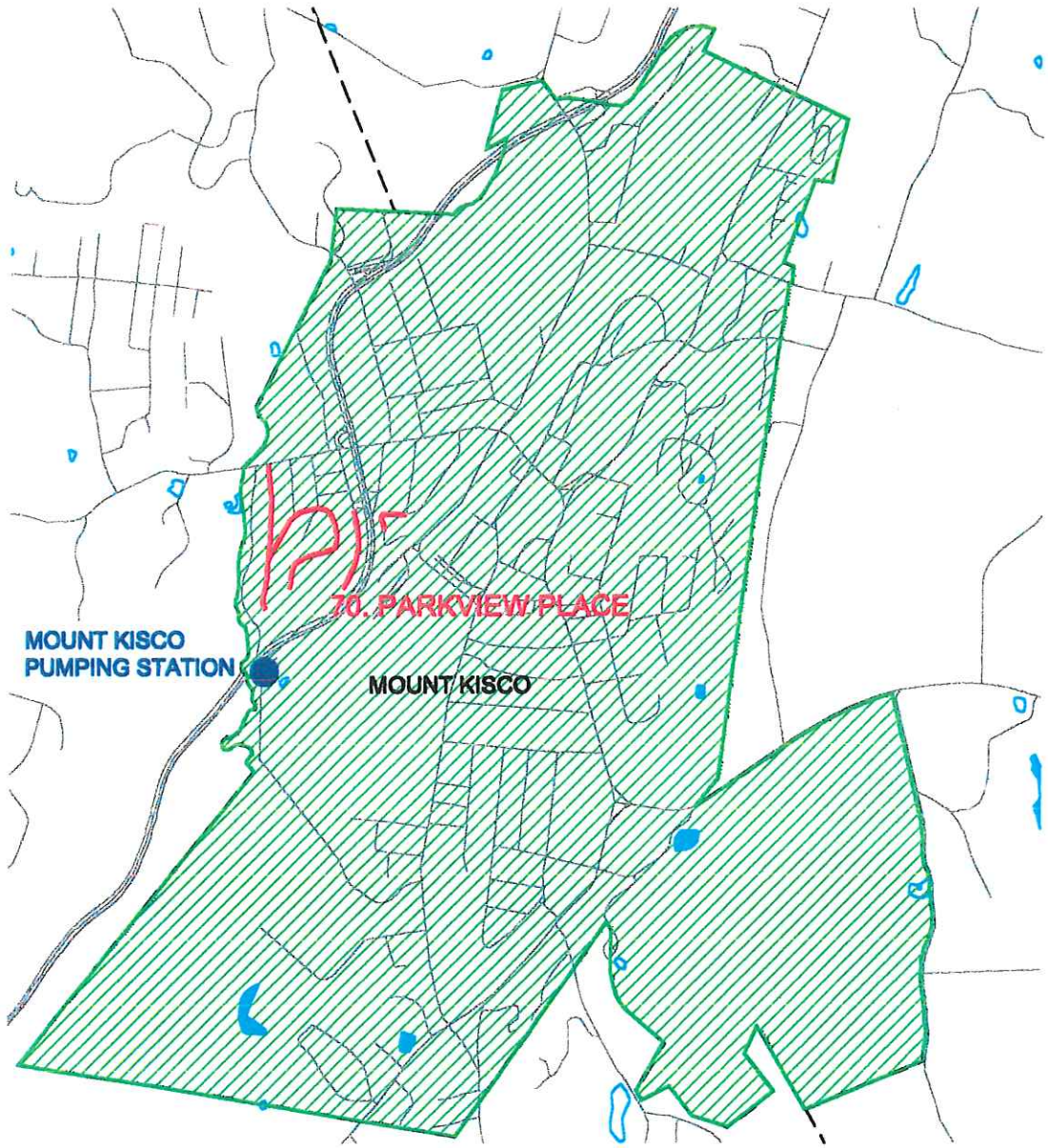
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN/VILLAGE OF MOUNT KISCO



LEGEND :

- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- TOWN BOUNDARIES
- 70 FOCUS AREA

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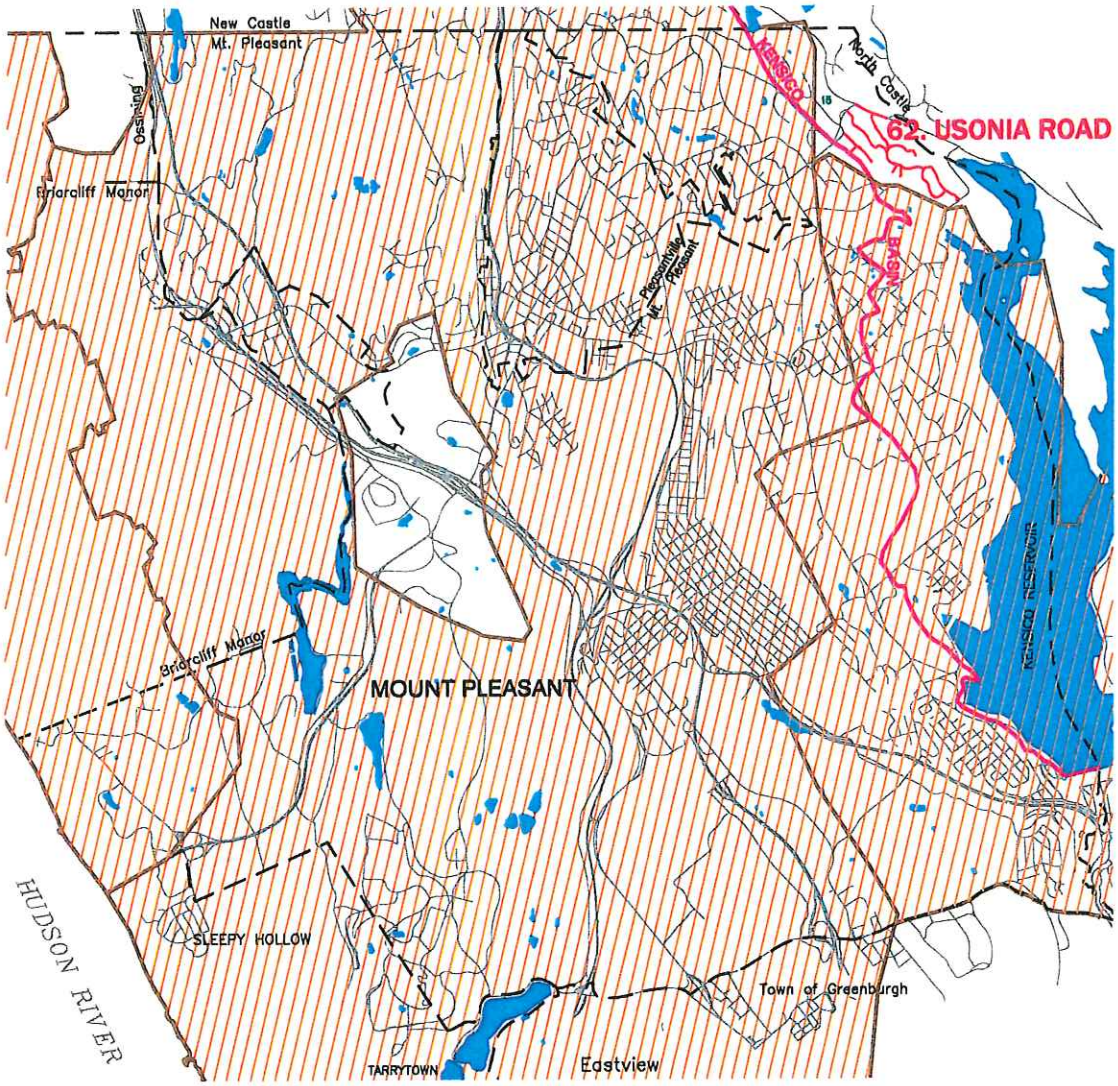
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF MOUNT PLEASANT



LEGEND :

- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- TOWN BOUNDARIES
- KENSICO BASIN BOUNDARY
- 62 FOCUS AREA

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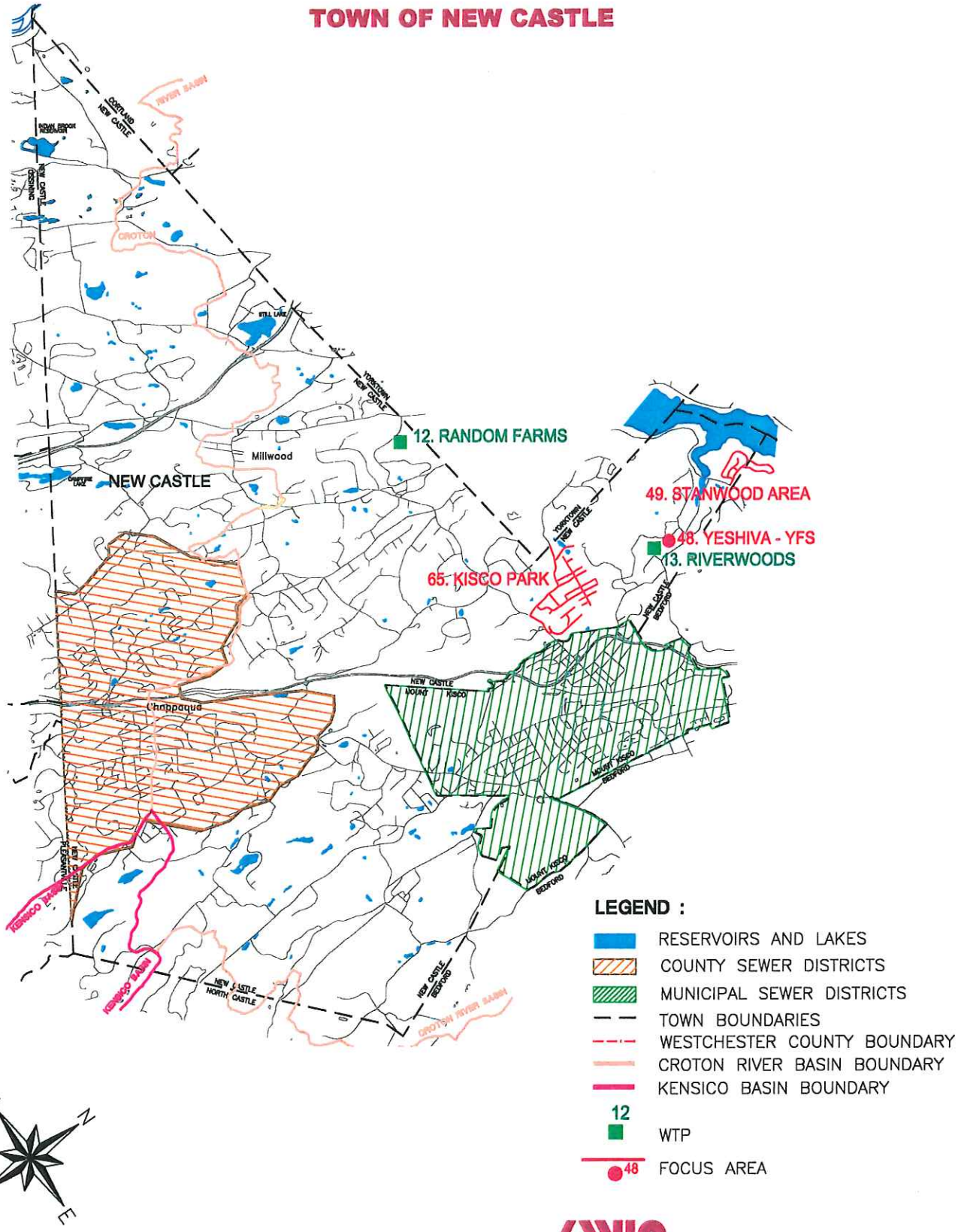
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF NEW CASTLE



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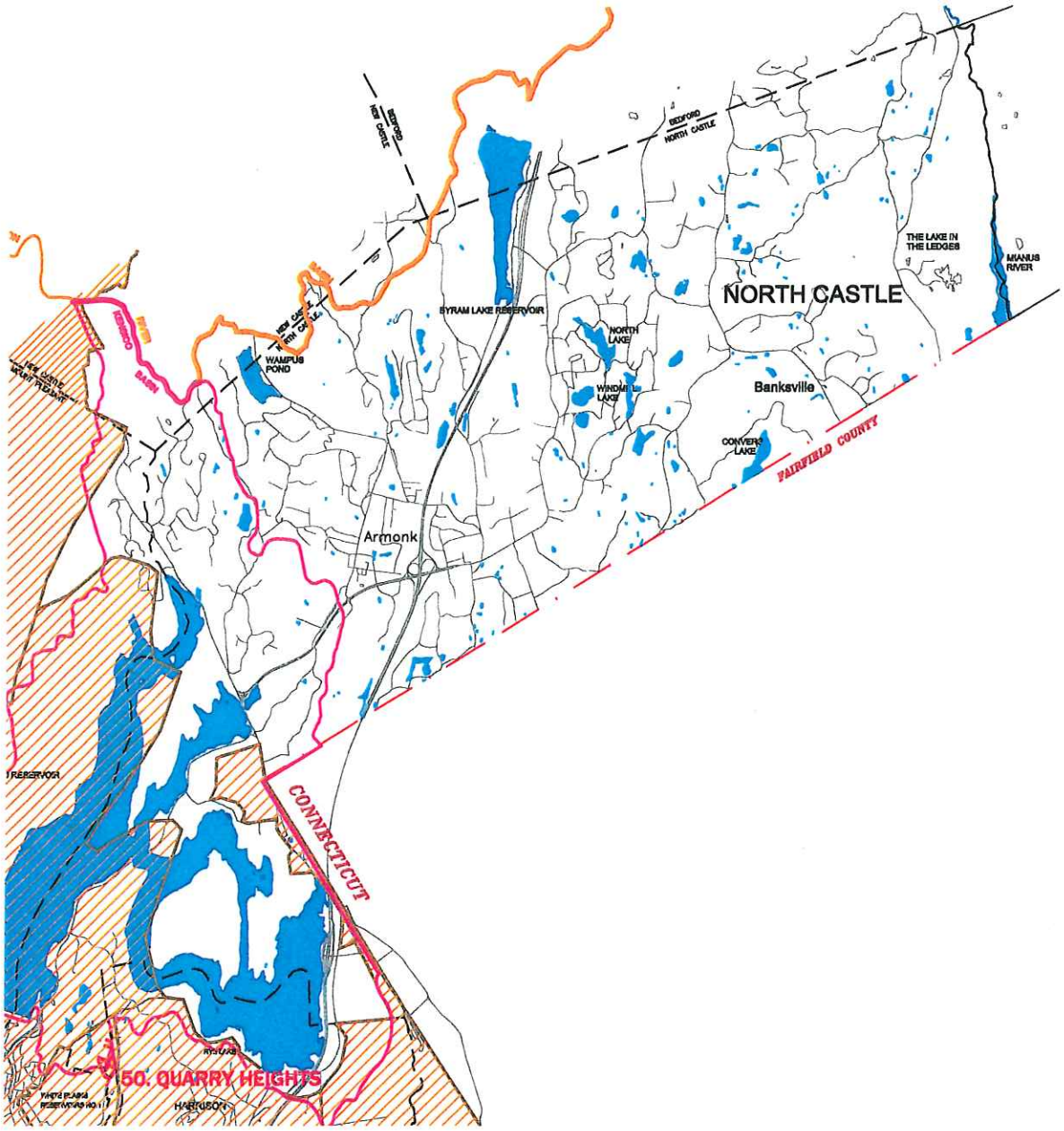
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF NORTH CASTLE



LEGEND :

- RESERVOIRS AND LAKES
- COUNTY SEWER DISTRICTS
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- KENSICO BASIN BOUNDARY
- 50 FOCUS AREA

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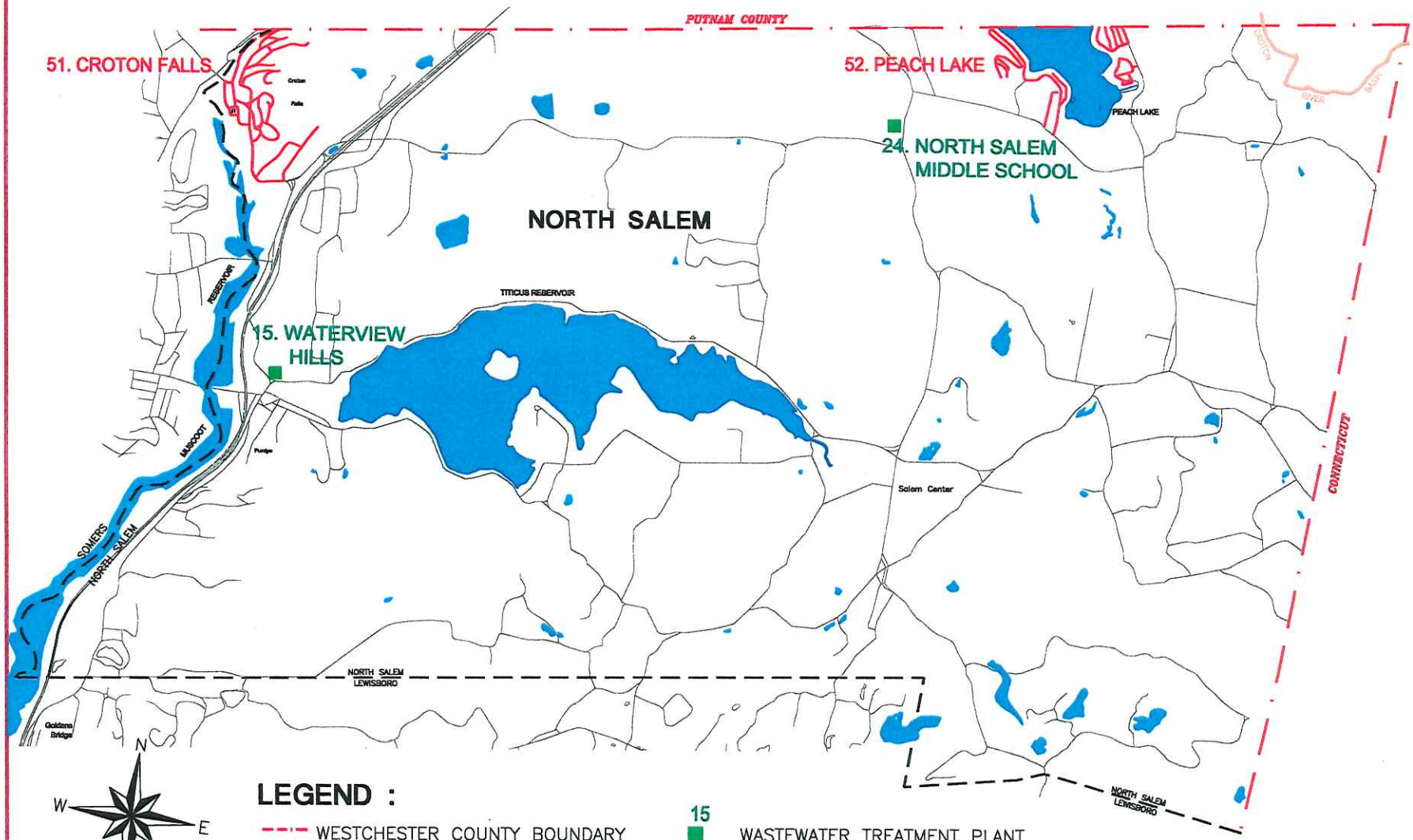
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF NORTH SALEM



LEGEND :

- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- 15 WASTEWATER TREATMENT PLANT
- 52 FOCUS AREA
- RESERVOIRS AND LAKES

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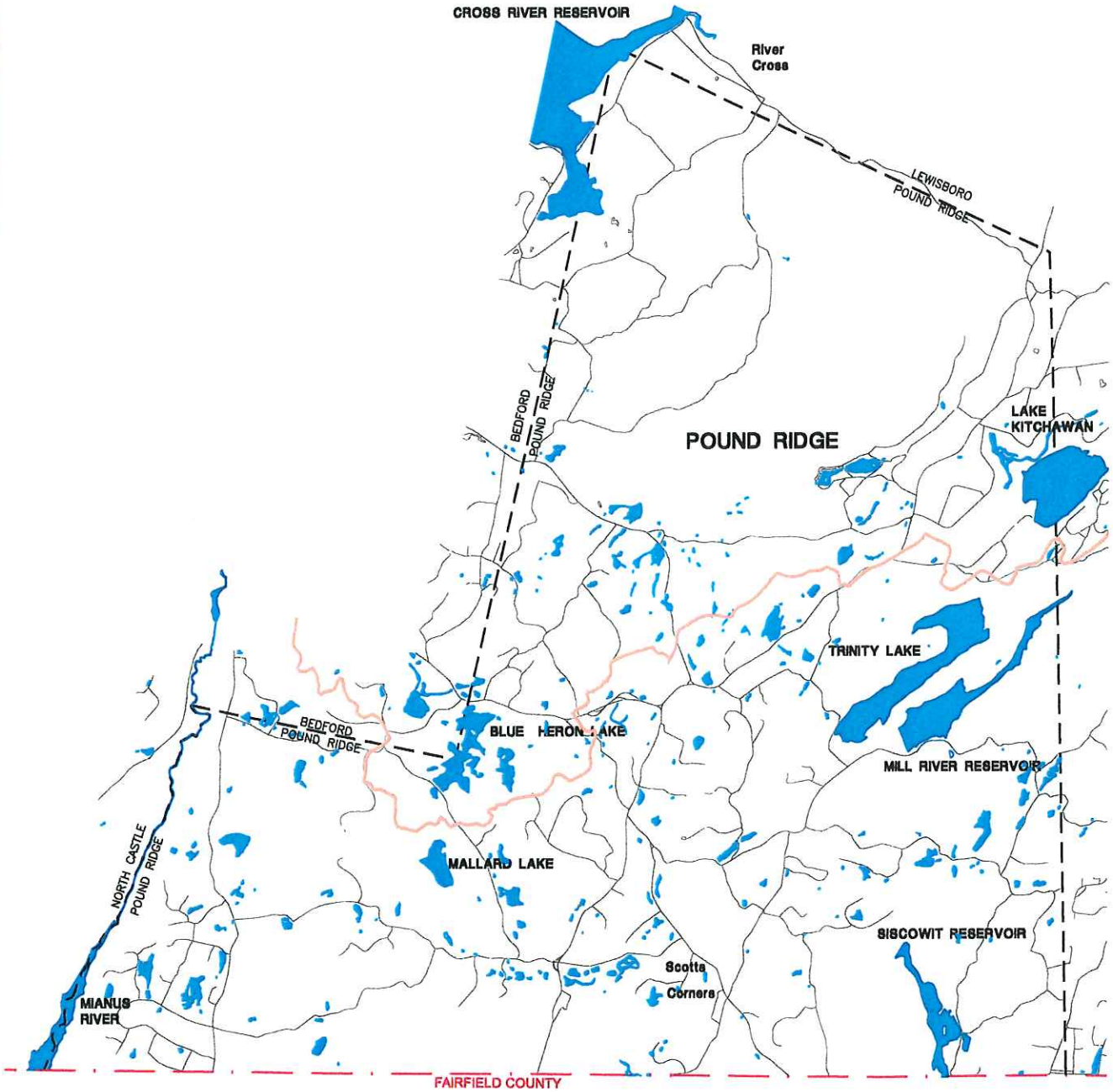
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF POUND RIDGE



LEGEND :

- RESERVOIRS AND LAKES
- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY

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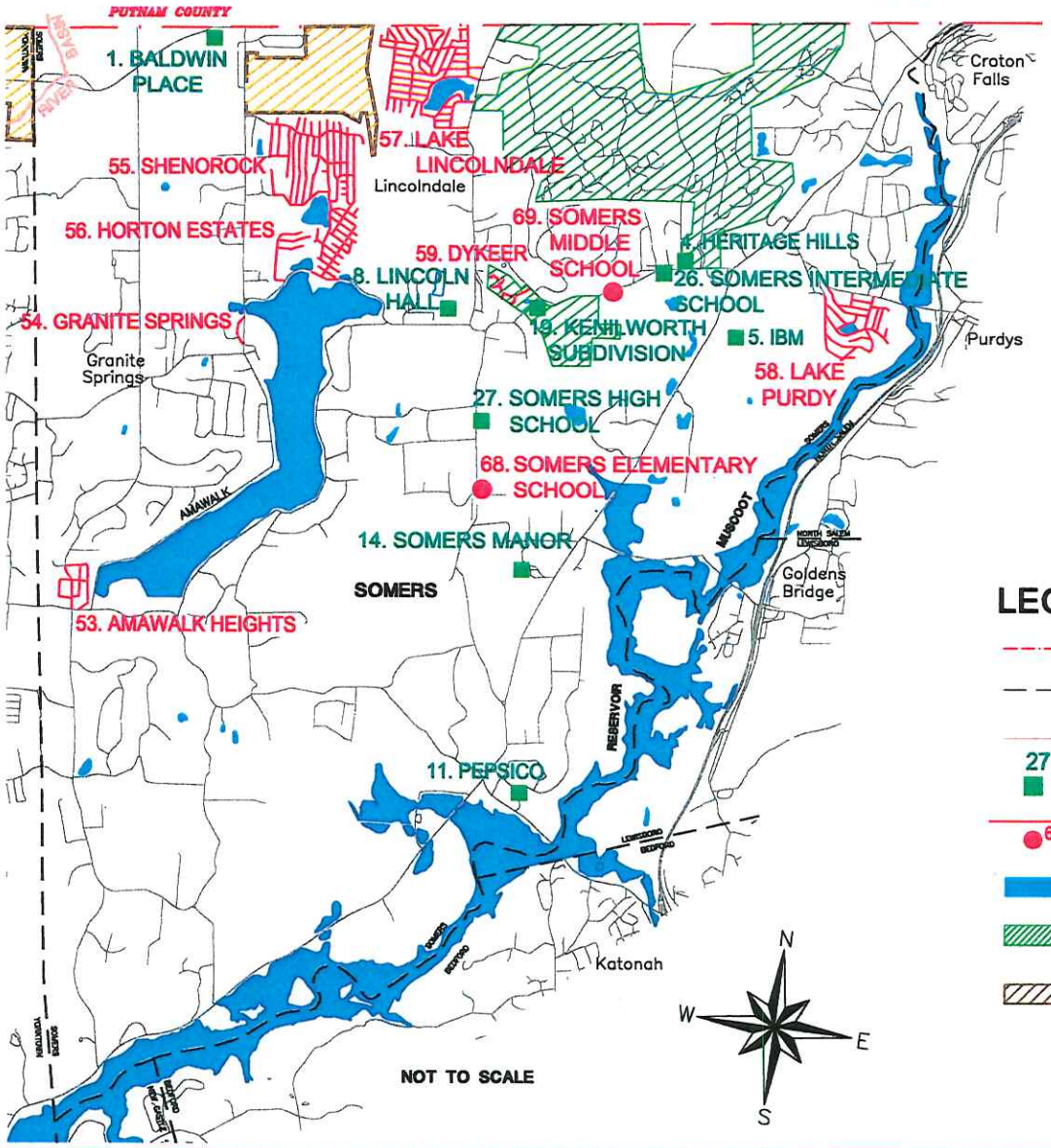
CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF SOMERS



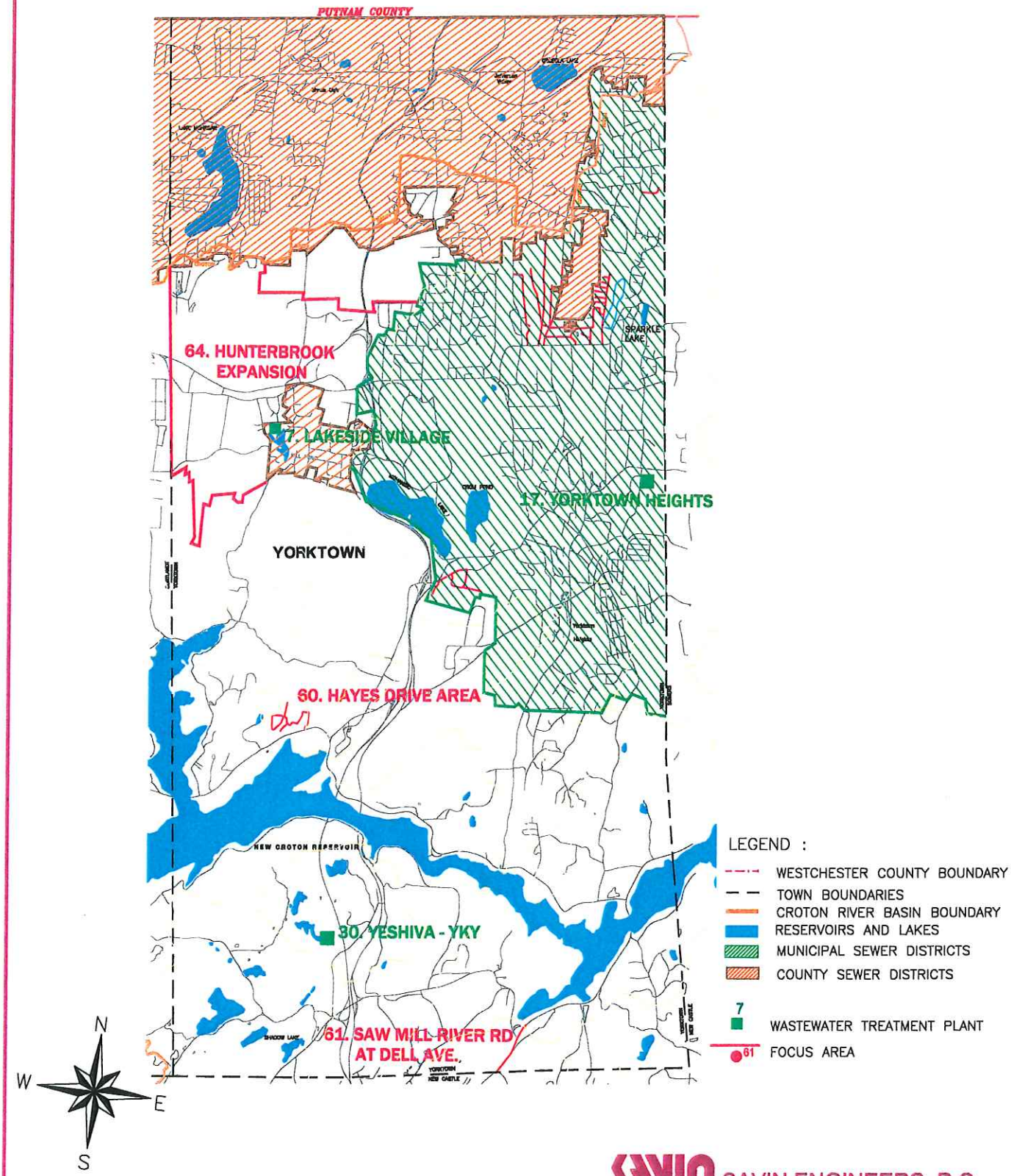
LEGEND :

- WESTCHESTER COUNTY BOUNDARY
- TOWN BOUNDARIES
- CROTON RIVER BASIN BOUNDARY
- 27 WASTEWATER TREATMENT PLANT
- 68 FOCUS AREA
- RESERVOIRS AND LAKES
- MUNICIPAL SEWER DISTRICTS
- COUNTY SEWER DISTRICTS

SAVIN ENGINEERS, P.C.

CROTON WATERSHED WASTEWATER DIVERSION STUDY
DEPARTMENT OF PUBLIC WORKS AND DEPARTMENT OF PLANNING
WESTCHESTER COUNTY, NY

TOWN OF YORKTOWN



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