VILLAGE OF CROTON-ON-HUDSON

STORM WATER MANAGEMENT PLAN

VOLUME 1: PLAN

Prepared By

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JULY 2004

VILLAGE OF CROTON-ON-HUDSON
STORM WATER MANAGEMENT PLAN

VOLUME 1: PLAN

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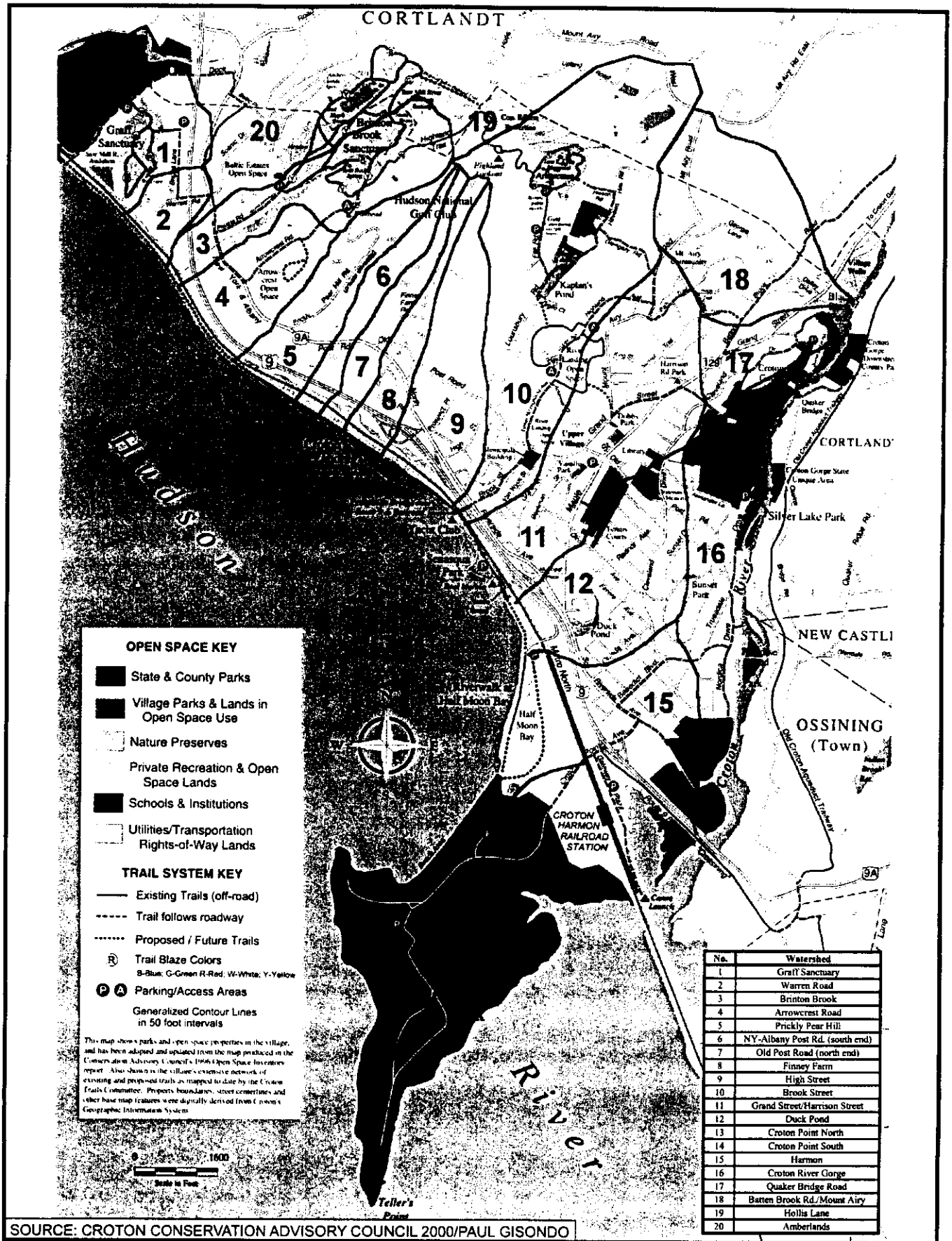

SOURCE: CROTON CONSERVATION ADVISORY COUNCIL 2000/PAUL GISONDO

RLA/MAPS/CROTONHUDSON1954(11/12/01)

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VILLAGE OF CROTON-ON-HUDSON

WATERSHEDS/SUB-DRAINAGE SYSTEMS

FIGURE 1-1

3.0 STORM WATER MANAGEMENT PLAN

The storm water management plan has been designed to make recommendations to provide improvements to the existing storm drain system to allow at a minimum, the conveyance of at least a 5-year storm. This conveyance goal is usually the design criteria for a municipal project and in this case is consistent with Westchester County's recommendations/guidance.

The existing storm water collection for priority subdrainage systems ID No. 9 - High Street, ID No. 10 - Brook Street and I.D. No. 18 - Batten Brook Road/Mount Airy Road consists of natural streams, culverts, ponds, storm drains, catch basins and manmade open channels. On the other hand, the remaining study priority area, ID No. 11 - Grand Street/Harrison Avenue storm water conveyance system are entirely confined within a closed conduit system.

Three of the four priority subdrainage systems discharge into the Hudson River, and as such, the influence of high tide has been incorporated into the storm water modeling. High tide chart information was obtained from an internet website entitled, "Boating on the Hudson.com/tides," which indicates an average high tide elevation of 3.46. The fourth priority drainage area (ID No. 18) discharges into the Croton River.

In addition to the high tide data, D&B obtained the flood insurance rate map from the Federal Emergency Management Agency (FEMA), for the Village of Croton-on-Hudson. This map, Community-Panel No. 3609070002B, effective date November 2, 1983, designates the Hudson River as a Zone A3 (EL 8), which indicates a 100-year flood at elevation 8 and the A3, where the depth of inundation, is 3 feet. Also, a 100-year flood plain area was highlighted in subdrainage system ID No. 10 - Brook Street. This 100-year floodplain area includes the upper portion of Bessimer's Pond, the wetlands of the arboretum and the stream channel that connects these hydrological systems.

Stream classifications for the priority areas were obtained from the New York State Department of Environmental Conservation (NYSDEC), Department of Water. Information

concerning the stream classification were obtained from the NYSDEC State Map Reference No. Q-24 NW entitled, "Haverstraw" and No. Q-24 NE entitled, "Ossining Quad."

With respect to Subdrainage Systems ID No. 9 High Street and ID No. 11 Grand Street/Harrison Avenue, NYSDEC does not designate a stream classification for their main watercourse. However, Subdrainage System No. 10 Brook Street main watercourse has a NYSDEC Item No. 486 with a water index number of H34 entitled, "Tributary of Hudson River."

A classification of "SC" and standards of "SC" have been assigned to this main watercourse. This classification refers to saline surface water with a class of SC indicated the best usage for this stream is for fishing. Class SC states, "These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes."

With respect to subdrainage system ID No. 18 Batten Brook, NYSDEC designates the main watercourse with an NYSDEC Item No. 81 and water index No. H-31-4 entitled, "Tributary of Croton River." A classification of "C" and standards of "C" have been assigned to this main watercourse. This classification refers to fresh surface waters. The best usage for this stream is fishing. "These waters shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes."

3.1 Storm Water Modeling

3.1.1 Subdrainage System

Each of the non-priority subdrainage systems were computer modeled to generate the amount of storm water peak runoff for the 2-, 10- and 100-year storm frequency. It should be noted that the 5-year storm event was performed for the priority areas. These storm frequencies correspond to a storm event duration of a 24-hour rainfall for Westchester County. The amount of rainfall occurring during each particular year storm event is as follows:

Frequency	Rainfall
2-Year	3.5 inches
5-Year	4.5 inches
10-Year	5.0 inches
100-Year	7.5 inches

The above storm frequency design parameter was obtained from the New York Guidelines for Urban Erosion and Sediment Control, Exhibit 10.0 entitled, "New York Rainfall Maps for Different Rainfall Frequencies."

The computer program used to analyze the flow rates of storm water runoff generated during the designated storm frequency, was the Soil Conservation Service Technical Release No. 55 entitled, "Urban Hydrology for Small Watersheds" as incorporated by the HydroCad Software Program. This computer program calculates storm runoff volume, peak rate of discharge and hydrographs based upon measurable watershed characteristics.

The watershed characteristic factors include soil type, soil moisture, rainfall data, ground cover type and impervious surfaces. These major factors are used to determine a runoff coefficient number (RCN). The soil types that are within the Village of Croton-on-Hudson, are shown on Figure 3-1 entitled, "Hydrologic Soil Group" and Figure 3-2 entitled, "Soil Type." The Hydrologic Soil Group is a soil classification system established by the United State Department of Agriculture, Soil Conservation Service (SCS), which indicates the infiltration and transmission rates of four soil groups. These four soil groups are described below:

- Group A - soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands and gravels, and have a high rate of water transmission (greater than 0.30 in./hr.). Sand, loamy sand, or sandy loam.

- Group B - soils have moderate infiltration rates when thoroughly wetted, and consist chiefly of moderately deep-to-deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in./hr.). Silt loam or loam.

- Group C - soils have low infiltration rates when thoroughly wetted, and consist chiefly of soils with a layer that impedes downward movement of water, and soils with moderately fine-to-fine texture. These soils have a low rate of water transmission (0.05-0.15 in./hr.). Sandy clay loam.

- Group D- soils have high runoff potential. They have very low infiltration rates when thoroughly wetted, and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in./hr.).

The storm water runoff amounts are determined primarily by the amount of precipitation and infiltration characteristics. Additionally, the computer model requires input regarding the time of concentration (Tc), which corresponds to the time it takes for runoff to travel from the farthest point in the subdrainage area to the design point, which, in this case, is the Hudson or Croton River.

The travel time is determined primarily by the slope of the land, length of flow path, depth of flow and roughness of the flow surface, which is represented by the Manning Roughness Coefficient. It should be noted that for this project, with respect to the streams in the Village of Croton-on-Hudson, a roughness coefficient of 0.040 was utilized which represents a mountain stream with minimum vegetation and comprised of gravel, cobbles and few boulders.

After the parameters for the runoff coefficient number and time of concentration has been calculated, the final data needed to use the computer model is the total subdrainage area of the watershed. The boundary of each subdrainage area was established by the high points, as shown on the Westchester County Planning Department GIS 5-foot contour topographic maps.

Figures 3-3 through 3-14 for the subdrainage system maps, present the subdrainage system boundary lines and the time of concentration. With respect to these non-priority subdrainage areas, the following assumptions were made:

- Pipes and culvert sizes were assumed for these subdrainage systems. No in-depth study was performed to ascertain the effects of these hydrologic restrictions upon the conveyance of the storm water runoff.

3.1.2.2 - Subdrainage System Brook Street ID No. 10

The area tributary from the Brook Street drainage system, approximately 432 AC, of which 342 AC are within the Village of Croton-on-Hudson, was divided into 13 subcatchments,

13 through 1. Each subcatchment was selected to correspond to a drainage component restrictions, such as a pond, culvert or other structure, which required a detailed analysis (refer to **Figures 3-24** through **3-28**). Storm water runoff is conveyed from subcatchment to subcatchment via reaches which are comprised of either natural streams, manmade channels or pipes. The subcatchments and reaches are described in detail below:

- Subcatchment 13S: This 17.6-acre tributary contributed storm water runoff to Cortlandt Pond 1, north of Foster Court, which is outside of the Village boundary. Cortlandt Pond 1 discharges via Reach 1R and 16R into Subcatchment 10S. Subcatchment 10S is part of the wetland of the arboretum. Subcatchment 13S has the land use described in the table below.

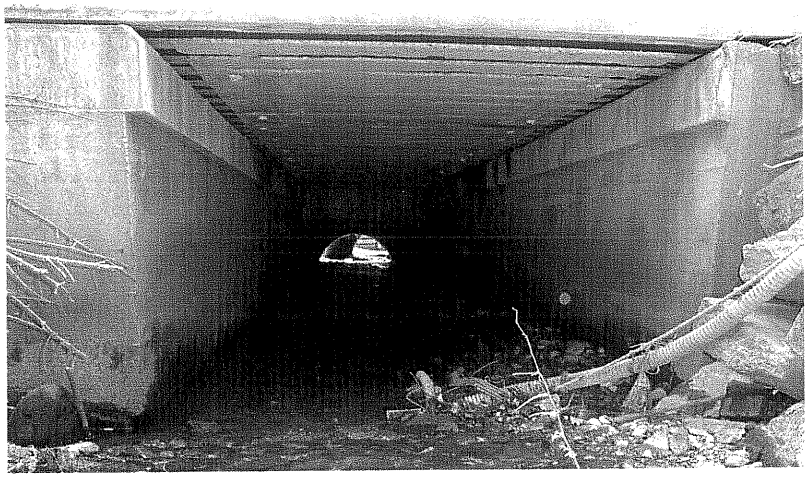
Area (acres)	CN	Description
13.350	55	B, Woods, Good Condition
0.803	61	B, Lawn/Field, Good Condition
0.184	98	B, Roads
0.562	98	B, Buildings
2.731	98	C, Pond
17.630	64	Weighted Average

Storm Water Runoff Rates (CFS)

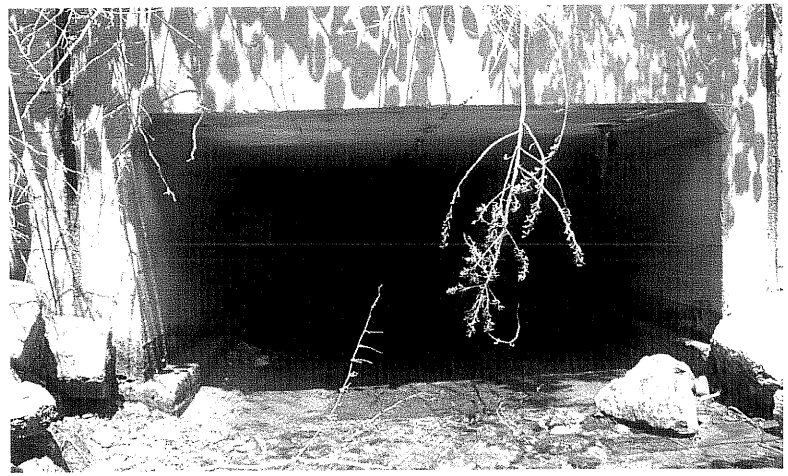
Reach	2-YR	5-YR	10-YR	100-YR
1R	3	4	5	12

- Subcatchment 12S: This drainage area of 38.7 acres drains into Cortlandt Pond 2, south of Foster Court. Cortlandt Pond 2 outfalls by Reach 2R into Subcatchment 10S, which is part of the wetland of the arboretum. It should be noted that drainage information requested from the Town of Cortlandt concerning these two ponds was not provided to our office. As such, a depth of 4 feet for each pond and an outfall structure were assumed for these detention basins.

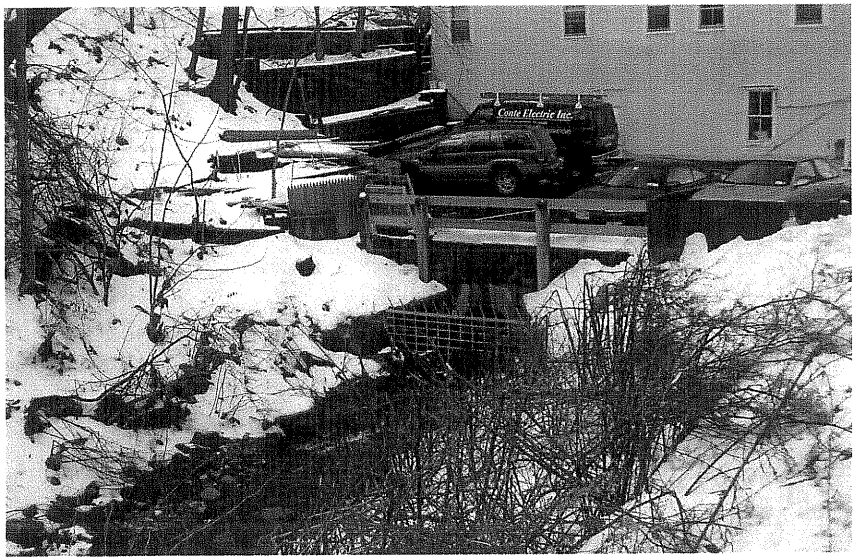
Area (acres)	CN	Description
27.836	55	B, Woods, Good Condition
2.410	61	B, Lawn/Field, Good Condition
4.189	98	B, Roads
1.205	98	B, Buildings
3.110	98	C, Pond
38.750	65	Weighted Average



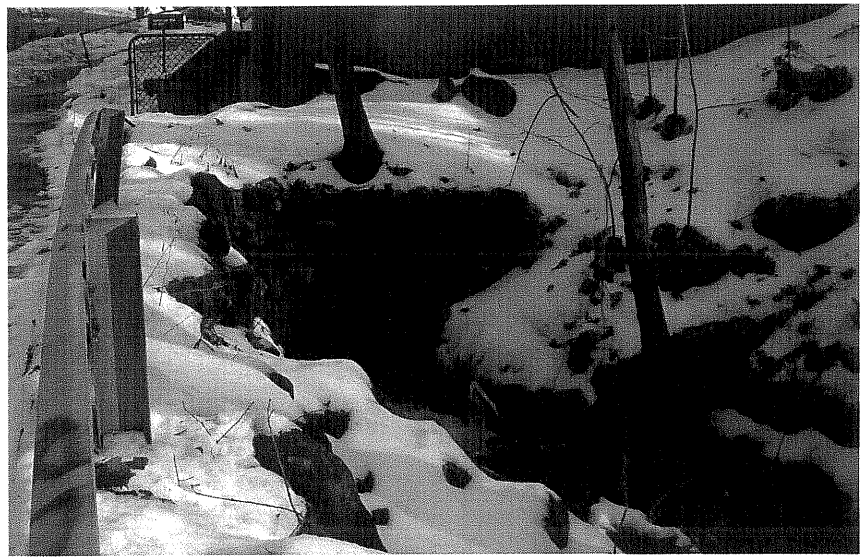
Culvert Under Route 9



Culvert Metro North Rail Road

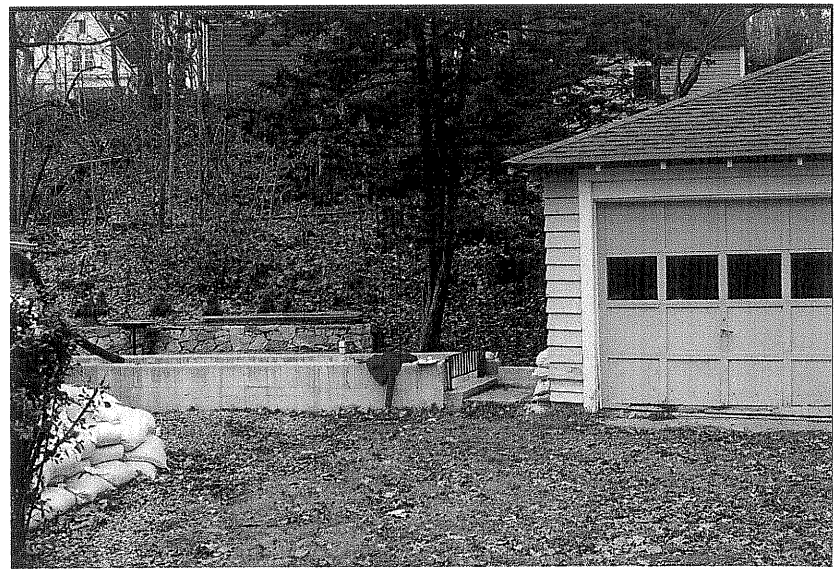


Inlet at Lot 30 on Brook Street



Outlet at Lot 23 on Brook Street

Open Channel at Lot 3 on Brook Street



Concrete Channel at Lot 4 on Brook Street

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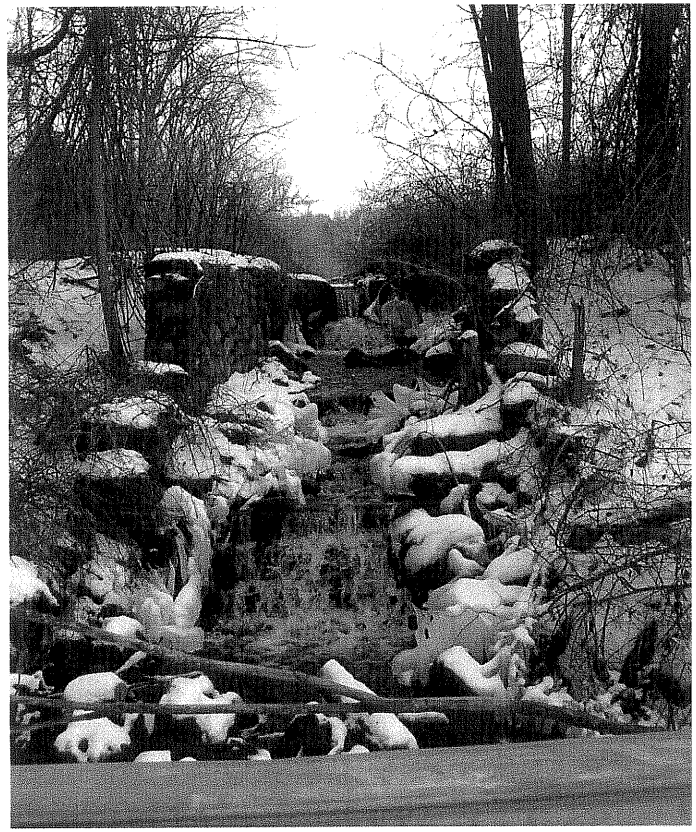
Village of Croton on Hudson
Drainage Area No. 10
Brook Street

Figures 3-26

Inlet on Lot 19 Highland Place



Kaplands Pond Outlet Structure on Giglio Court

Irrigation Pond on Hudson National Golf Club

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Village of Croton on Hudson
Drainage Area No. 10
Brook Street

Figure 3-28

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
2R	7	12	15	36

- Reach 16R carries the combined flows from Reach 1R and 2R to the Arboretum. The flows conveyed through Reach 16R are summarized in the table below:

Reach	2-YR	5-YR	10-YR	100-YR
16R	10	16	20	47

- Subcatchment 11S: This subdrainage area is part of the Hudson National Golf Club along with Subcatchments 9S and 7S, which contribute storm water runoff into the Brook Street subdrainage system. Subcatchment 11S's land use is as follows:

Area (acres)	CN	Description
15.814	55	B, Woods, Good Condition
7.805	70	C, Woods, Good Condition
5.489	61	B, Lawn/Field, Good Condition
0.021	98	B, Buildings
2.132	98	C, Pond
31.261	63	Weighted Average

The discharge for this drainage system is routed through the golf course irrigation pond, which was designed to hold the storm water runoff from Area 11. Due to the fact that Drainage Area 11 was prevented from discharging into the wetland of the arboretum, this golf course is required to pump water to the wetland.

- Subcatchment 10S: This 123.3 AC drainage system incorporates areas of the arboretum with the associated wetland. This tributary drains into the large existing wetland which serves as a natural detention and water quality pond before its storm water runoff is conveyed towards Kaplan's Pond.

Area (ac)	CN	Description
5.223	30	A, Woods, Good Condition
84.444	55	B, Woods, Good Condition
7.989	70	C, Woods, Good Condition
21.579	77	D, Woods, Good Condition
4.309	61	B, Lawn/Field, Good Condition
3.143	98	B, Roads
1.653	98	B, Buildings
128.340	60	Weighted Average

The discharge from the wetland is conveyed via the natural stream labeled Reach 18R with the following discharge rates:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
18R	33	49	60	127

- Subcatchment 9S: This subcatchment is part of the Hudson National Golf Club having a drainage area of 16.4 AC with the following land use:

Area (acres)	CN	Description
9.999	55	B, Woods, Good Condition
3.330	77	C, Woods, Good Condition
1.400	61	B, Lawn/Field, Good Condition
0.046	98	B, Roads
0.257	98	B, Buildings
1.304	98	C, Pond
16.336	64	Weighted Average

The storm water runoff from this area is managed by Storage Basin No. 3. Reach 4R conveys the discharge at the rates given in the table below from Storage Basin No. 3 to Storage Basin No. 4:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
4R	1	1	1	2.3

- Subcatchment 7S: This subcatchment is part of the Hudson National Golf Club having a drainage area of 4.52 AC with the following land use:

Area (acres)	CN	Description
3.233	55	B, Woods, Good Condition
1.078	77	D, Woods, Good Condition
0.138	61	B, Lawn/Field, Good Condition
0.030	98	B, Roads
0.041	98	B, Buildings
4.520	61	Weighted Average

It should be noted that Storage Basin No. 4 discharges minimum rates of storm water runoff into Reach 5R.

- Subcatchment 8S: The drainage area, which storm water runoff enters into Kaplan's Pond, is 50.78 AC. With land use described in the table below. There is an existing outlet structure north of Giglio Court.

Area (acres)	CN	Description
13.749	30	A, Woods, Good Condition
3.025	55	B, Woods, Good Condition
9.166	70	C, Woods, Good Condition
13.630	77	D, Woods, Good Condition

Area (acres)	CN	Description
2.995	98	A, Pond
2.525	98	C, Pond
2.479	61	B, Lawn/Field, Good Condition
1.936	98	B, Roads
1.276	98	B, Buildings
50.781	65	Weighted Average

- The outlet structure at Kaplan's Pond discharges into Reach 21R, which is a 54-inch diameter concrete pipe that runs under Giglio Court and discharges into Reach 5R. It should be noted that the water surface for the 100-year storm exceeds the top of the existing earth embankment. The flow conveyed through Reach 21R is summarized in the table below.

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
21R	17	46	60	172

- Reach 5R storm water flows are given in the table below are conveyed to the 48-inch culvert under Old Post Road, Reach 6R:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
5R	17	46	60	172

- Subcatchment 6S: This is an essentially undeveloped wooded area with a minimum amount of residential dwellings development. The drainage area contributing to this system is 67.930 AC. The storm water runoff associated with this system is conveyed to Reach 6R.

Area (acres)	CN	Description
45.250	55	B, Woods, Good Condition
10.250	77	C, Woods, Good Condition
6.430	61	B, Lawn/Field, Good Condition
3.0	98	B, Roads
3.0	98	B, Buildings
67.930	62	Weighted Average

- Subcatchment 5S: This 23.860 AC subcatchment drainage contributes surface runoff onto Old Post Road, which in turn is conveyed via catch basins into Reach 6R with the following discharge rates.

Area (acres)	CN	Description
7.750	55	B, Woods, Good Condition
4.860	70	B, Woods, Good Condition
5.750	61	B, Lawn/Field, Good Condition

Area (acres)	CN	Description
4.250	98	B, Roads
1.250	98	B, Buildings
23.860	69	Weighted Average

- Reach 6R is the 48-inch culvert under Old Post Road and conveys the following flow:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
6R	17	68	89	237

- Subcatchment 4S: This subcatchment represents the lower topographic depression associated with Lots 3 and 4 on Brook Street. This sump area is 0.94 AC, upon which Reach 7 and 8 traverse these properties, has the following discharge rates:

Area (acres)	CN	Description
0.418	55	B, Woods, Good Condition
0.402	61	B, Lawn/Field, Good Condition
0.124	98	B, Buildings
0.944	63	Weighted Average

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
7R	34	69	89	236
8R	34	69	89	236

- Subcatchment 3S: This primarily residential area of 27.780 AC drains onto Brook Street between Old Post Road and Terrace Place. The land use of Subarea 3S is listed in the table below.

Area (acres)	CN	Description
5.780	55	B, Woods, Good Condition
4.250	70	C, Woods, Good Condition
9.0	61	B, Lawn/Field, Good Condition
5.0	98	B, Roads
3.750	98	B, Buildings
27.780	73	Weighted Average

- The reach associated with this system is 9R with the following discharge rates:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
9R	52	101	129	287

- Subcatchment 2S: The land use of this subarea is listed in the table below.

Area (acres)	CN	Description
3.290	55	B, Woods, Good Condition
1.240	61	B, Lawn/Field, Good Condition
0.297	98	B, Roads
2.754	98	B, Buildings
5.101	61	Weighted Average

- The reach associated with this system is 11R, with the following discharge rates:

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
11R	53	104	131	294

- Subcatchment 1S: This incorporates the last subcatchment adjacent to the Hudson River with a drainage area of 35.3 AC, with the land use listed in the table below:

Area (acres)	CN	Description
10.950	55	B, Woods, Good Condition
5.700	61	B, Lawn/Field, Good Condition
8.420	98	B, Roads
8.160	98	B, Buildings
2.130	89	C, Gravel
35.360	78	Weighted Average

- Reach 12R conveys the storm water flows listed in the table below from Reach 11R and Area 1S.

Storm Water Runoff Rates (CFS)

Reach	2-YR	5-YR	10-YR	100-YR
12R	91	164	204	367

3.1.2.3 - Subdrainage System Grand Street/Harrison Street (ID No. 11)

The Village of Croton-on-Hudson has identified this priority subdrainage system due to the localized flooding within a bounded area of Grand Street on the south, Sunset Trail on the west and Harrison Street on the north and east.

A network of storm drains within this subdrainage system transports storm water runoff from the upper limits of the drainage area being the intersection of Harrison Street and Grand

HUDSON RIVER

METRO-NORTH RAILROAD

APPROXIMATE LOCATION OF HUDSON NATIONAL GOLF CLUB PROPERTY LINE

VILLAGE OF CROTON-ON-HUDSON TOWN OF CORTLANDT

APPROXIMATE LOCATION OF THE VILLAGE OF CROTON-ON-HUDSON BOUNDARY LINE

IRRIGATION POND 3P

WETLAND OF THE ARBORETEM

CORTLANDT POND 1P

CORTLANDT POND 2P

FOSTER COURT

STORAGE BASIN NO.3 4P

STORAGE BASIN NO.4 3P

KAPLAN'S POND

BESSIMER'S POND 8P

GROLIER CT.

LOUNSBURY RD.

HIGHLAND AVE.

BROOK STREET

OLD POST ROAD

GRAND STREET

RTE. 9

LOT 30

LOT 19

LOT 4

LOT 3

PLAN 1

PLAN 2

PLAN 3

PLAN 4

PLAN 5

PLAN 6

1S 2S 3S 4S 5S 6S 7S 8S 9S 10S 11S 12S 13S

1R 2R 3R 4R 5R 6R 7R 8R 9R 10R 11R 12R 13R 14R 15R 16R 17P 18R 21R

LEGEND

7S	SUB-CATCHMENT AREA	PLAN 1	STORMWATER MANAGEMENT PLAN
2R	REACH AND ID No.	2P	POND ID No.

LOT 3 = WESTCHESTER COUNTY TAX MAP 67.20 AND 78.08

DRAINAGE SYSTEM BOUNDARY

SUBCATCHMENT BOUNDRY

REACH

VILLAGE/TOWN LINE

APPROXIMATE TAX MAP. LOT BOUNDRY

EXISTING STORM DRAIN

EXISTING CATCH BASIN

EXISTING MANHOLE

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VILLAGE OF CROTON-ON-THE-HUDSON WESTCHESTER COUNTY, NEW YORK
PHASED STORMWATER MANAGEMENT PLAN

SUB-DRAINAGE SYSTEM: BROOK STREET (ID No. 10)
DRAINAGE AREA MAP, PHASED STORM WATER MANAGEMENT PLAN

SCALE: 1"=300'

FIGURE 4-2

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4.1.2 Brook Street (ID No. 10)

The following conclusions pertain to the Brook Street subdrainage system.

1. Based upon field observation, a vast amount of siltation accumulation was present in approximately 1,000 feet of culverts from the outfall into the Hudson River, proceeding easterly towards North Riverside Drive. This siltation accumulation has severely reduced the designed carry capacity of these culverts and, as such, this sediment needs to be removed upon completion of upstream sediment stabilization measures (i.e., check dams). With respect to the 400± linear feet 48-inch culvert starting at North Riverside Drive, heading easterly under the houses on Brook Street, it was determined that this section of storm drain has the carry capacity to convey a 10-year storm. However, due to confine space limitation, no visual observation was possible; therefore, the need to provide a closed circuit television survey to assess above-mentioned conduit system. This survey is needed to verify that the storm drainpipe does not change in size and no obstruction is present in this section of pipe.

2. Along the 12,000-foot main watercourse for this subdrainage system, a number of locations had drainage pipes entering the stream channel that had evidence of severe sediment and scouring.

3. In one area of Brook Street downstream of Old Post Road where there has been localized flooding (i.e., Lot Nos. 3 and 4), it has been determined that the manmade concrete/stone channels that have been installed on private property along the center line of the main watercourse are impeding the ability of a five-year storm to travel through the properties. These manmade structures are not capable of conveying runoff flow greater than those from a two-year storm for Lot 4. On Lot 3, the concrete channel can convey storm water runoff for the range greater than a 2-year storm and less than a 5-year storm.

4. In another area of Brook Street upstream of Old Post Road where there has also been localized flooding (i.e., Lot 19), it was determined that the culvert has the capacity to convey a five-year storm. However, due to the inlet control which limits the amount of storm water flow entering the drainage system, this may create a flooding condition during the 5-year storm event.

5. Hydrologic/Hydraulic analysis of the Hudson National Golf Club storm water runoff indicates that its existing detention basins and water quality structures adequately control runoff such that the post-development peak runoff rates does not exceed the pre-development peak runoff rates. The pre-development runoff rates were provided from the Hudson National Golf Club drainage report.

6. Upstream of Old Post Road there exists two Village-owned ponds named Kaplan and Bessimers, which combined, encompass an area of approximately 5.5 acres. The

outlet structure of these basins are comprised of a concrete dam with an emergency spillway. The above-described structure is located west of Giglio Court. Based upon field measures and computer modeling of these outlet structures, it was determined that the discharge of these ponds occur at the top of the concrete dam. As a result, these ponds are underutilized as a detention basin facility due to the fact that no low flow (i.e., two-year/five-year storm) could be released at a slower rate, which would result in an increased capacity for storage requirements.

7. In the upper section of the Brook Street subdrainage area, a portion of the drainage area is from the Town of Cortlandt, which outfalls into the main watercourse via two existing ponds located north and south of Foster Court.

4.2.2 Brook Street (ID No. 10)

It is recommended that the Storm Water Management Plan for Brook Street (ID No. 10) be implemented as follows (refer to Figure 4-2):

1. Provide a closed circuit television survey to assess that the existing storm drain system capacity has not been reduced due to obstruction or siltation accumulation. Upon completion of television survey, the drainage system shall be cleared of any restrictions, thus restoring the drainage system to its designed capacity.

2. In an effort to reduce the migration of sediment accumulation upon the drainage system, a system of check dams shall be installed along the stream corridor at the following locations:

   a. North of Lot 30 as shown on Westchester County Tax Map No. 78.08.

   b. North of Lot 19 as shown on the Westchester County Tax Map No. 67.20.

3. Storm Drain Bubbler System on Old Post Road and Highland Avenue to covey surface runoff onto Brook Street (approximately eight catch basins and 300 linear feet of 18-inch pipe). A storm drain bubbler system collects, by catch basin, surface storm water runoff; however, the discharge of the system occurs through the top of the further catch basin downstream. Therefore, redirecting the storm water away from the low areas.

4. Modify Kaplan's Pond outlet structure concrete dam and provide a new emergency spillway. The above-described structure can be found west of Giglio Court. This modification would allow the storage and discharge for low flow storm events (i.e., two-year/five-year storm), which would provide a storm water management facility utilizing the existing basins.

5. Install 1,000± linear feet of new storm drain pipe and 12 catch basins between Old Post Road and the intersection of Brook Street and Terrace Place.

In an effort to procure funding for the implementation of the recommended storm water management improvements within the plan, the Village of Croton-On-Hudson has made efforts to apply for grant money from Westchester County and New York State. With respect to the subdrainage system entitled, "Brook Street (ID No. 10)," the Village is in the process of procuring funding from Westchester Urban County Community Development Block Grant No. C-67-04-P18 for Brook Street neighborhood drainage improvements at Kaplan's Pond outlet structure. The modification at Kaplan's Pond outlet structure was part of the recommended improvements for the Brook Street Drainage System, designated as Plan No. 4 as shown on Table 5-2 in Section 5 of the report.

If this work is performed, it will involve removing and replacing the existing spillway to Kaplan's Pond to provide greater storage capacity. As an added feature to the outlet structure, an inlet pipe may be installed to allow for draining of the pond creating additional storage capacity prior to a predicted major storm event, and the inlet would also serve for pond servicing (i.e., sediment removal). In an effort to reduce potential sediment migration and erosion downstream

of the outlet structure, an energy dissipation device may be constructed at the discharge. Additionally, a new gabion emergency spillway structure may be installed.

The hydraulic performance of the recommended outlet structure compared to the existing concrete spillway can be found in the below table. Also, this table includes the discharge rates if the pond water surface was lower 1-foot by the proposed inlet pipe prior to a major storm event.

Table 4-1

KAPLAN'S POND OUTFLOW DISCHARGE RATES

Structure	Discharge Out Flow Rates (cfs)			
	2-Year	*5-Year*	*10-Year*	*100-Year*
Existing Concrete Spillway	17	46	60	171
Recommended Concrete Outlet Structure	14	41	55	152
Recommended Concrete Outlet Structure with water surface lowered 1-foot	5	28	43	139

As the above table indicates, the new outlet structure, without lowering the water surface, provides an average decrease discharge rate of 11 percent.

This reduction in discharge rates from the new outlet structure may minimize the localized flooding upstream of Old Post Road in the vicinity of Lot 19 (refer to Section 4.1.2, Conclusion No. 4).