CEDAR LANE DRAINAGE STUDY

TOWN OF OSSINING

NEW YORK

Catherine Borgia, *Supervisor*

Town Board

Geoffrey Harter	Michael Tawil
Peter Tripodi IV	Northern Wilcher

Michael G. O'Connor, *Highway Superintendent*

Prepared By:

JJV, PE
CONSULTING ENGINEER
752 Old Kensico Road
Thornwood, NY 10594

and

CHARLES A. MANGANARO
CONSULTING ENGINEERS
A PROFESSIONAL CORPORATION
7 West Cross Street
Hawthorne, NY 10532

November 2011

CAMCE No. 1849

TABLE OF CONTENTS

CEDAR LANE DRAINAGE STUDY

LIST OF TABLES

LIST OF FIGURES

Following Page Number

APPENDICES

EXECUTIVE SUMMARY

ES.1 General

The study area is located in the vicinity of Cedar Lane in the Town of Ossining, bordering Village of Ossining in Westchester County. The storm water from the project area which is approximately 21 acres, drains along the steep slope towards the Village of Ossining and ultimately to the Croton River.

ES.2 Purpose and Scope of Work

This report presents the findings of the hydrologic and hydraulic analyses performed to mitigate the flooding of the areas downhill of Cedar Lane in the Town of Ossining as a result of storm water.

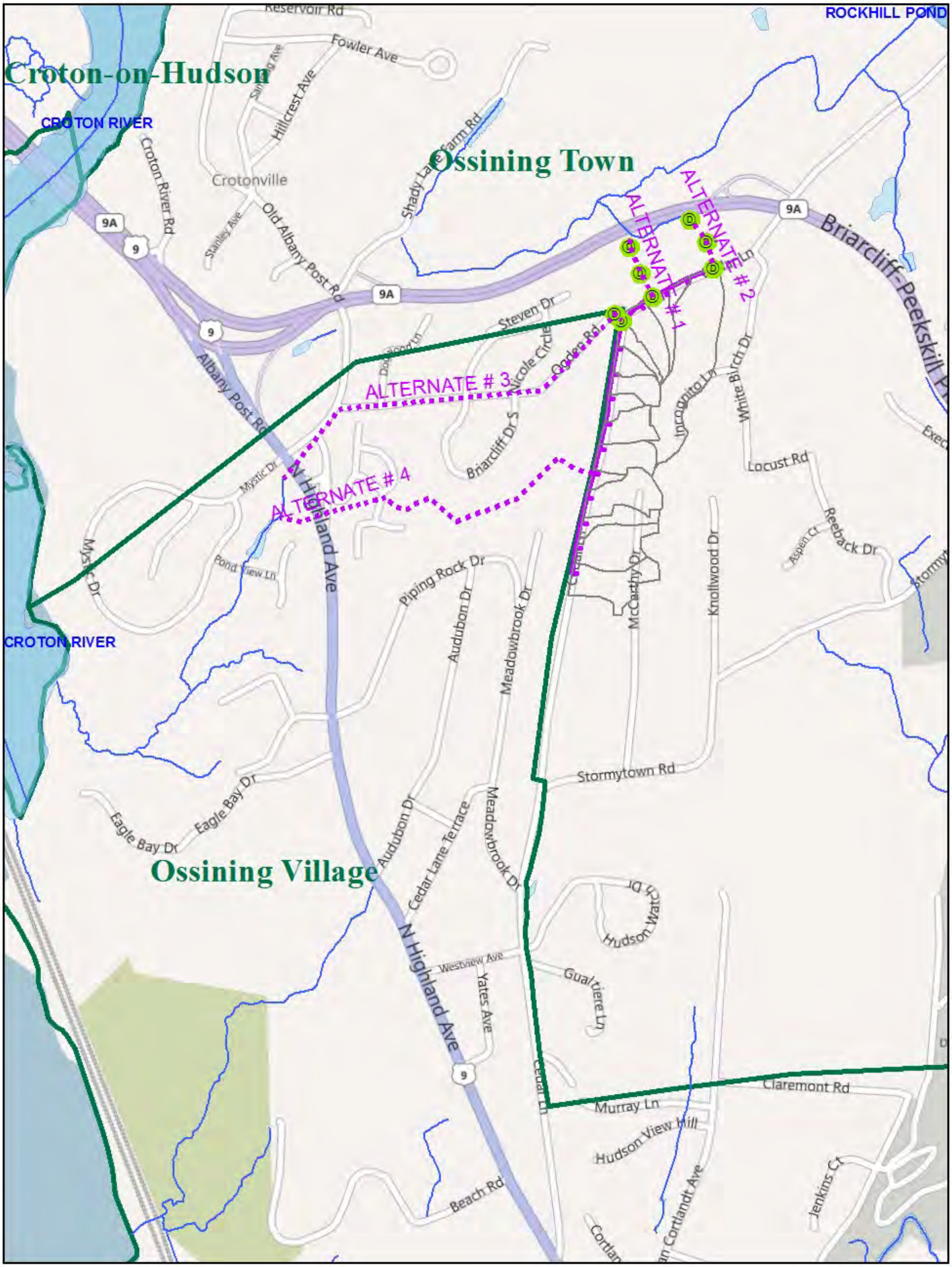
ES.3 Proposed Alternates

This study includes four alternate drainage routes to discharge the storm water as mentioned below. An overall scope is illustrated in *Figure ES-1: Proposed Alternates*.

Table ES-1: Proposed Alternate Drainage Routes

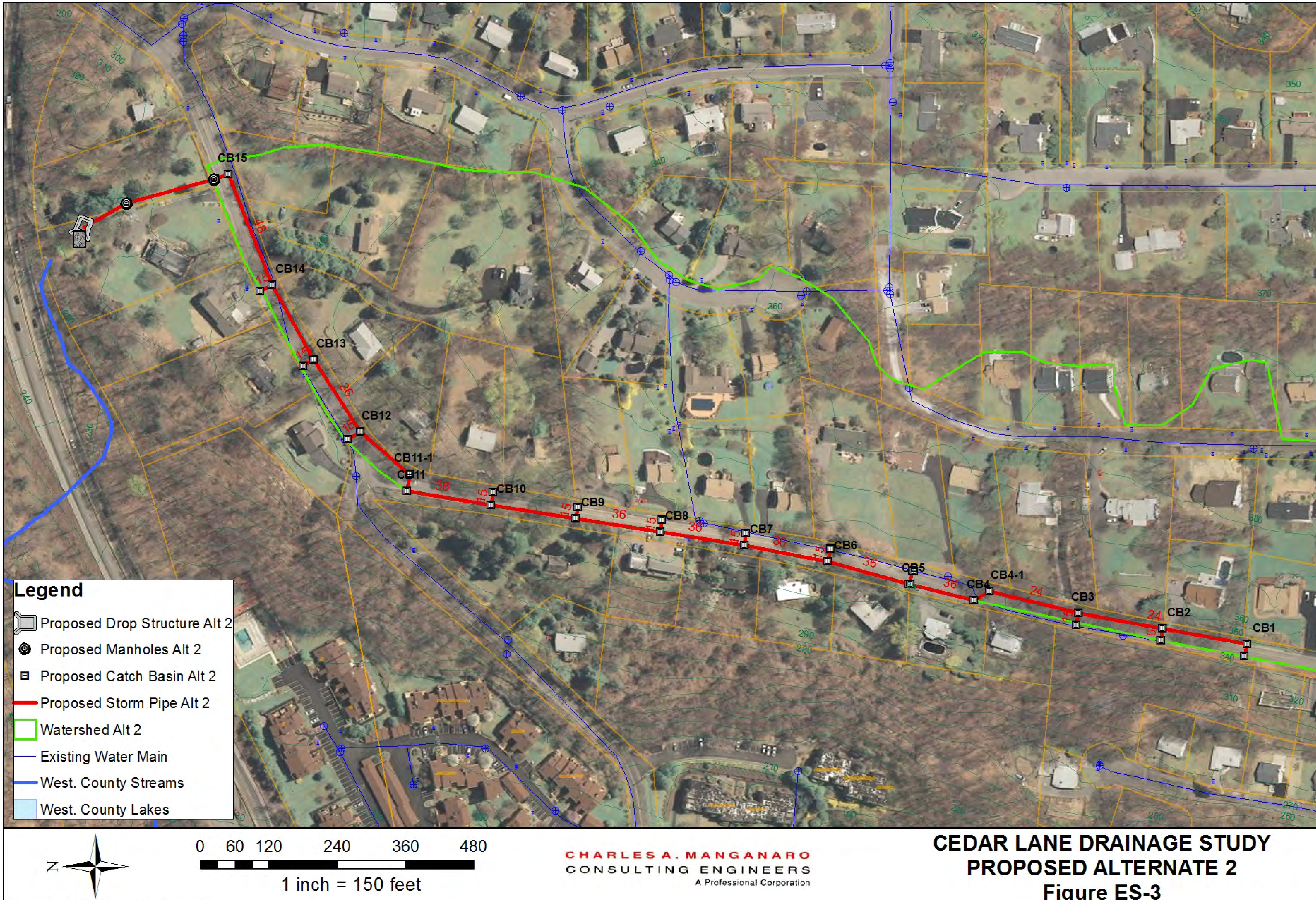
Alternate No. 1	Traditional separate storm water collection system along Cedar Lane, discharging to the existing stream parallel to New York State Route 9A, through a private property in the Town as shown in *Figure ES-2: Proposed Alternate 1*.
Alternate No. 2	Traditional separate storm water collection system along Cedar Lane, running a bit further East on Cedar Lane then to the stream parallel to NYS Route 9A, via private property in the Town, as shown in *Figure ES-3: Proposed Alternate 2*.
Alternate No. 3	Traditional separate storm water collection system along Cedar Lane, Ogden Road (in the Village) and Old Albany Post Road in the Town as shown in *Figure ES-4: Proposed Alternate 3*.
Alternate No.4	A short separate storm water collection system along a portion of Cedar Lane which would then discharge though the Briarcliff Woods Condominium property, then along Old Albany Post Road. A second system would handle the balance of Cedar Lane and follow the discharge route outlines in Alternate No. 1. This pathway is illustrated in as shown in *Figure ES-5: Proposed Alternate 4*.

Figure ES-1: Proposed Alternate



CHARLES A. MANGANARO
CONSULTING ENGINEERS
A Professional Corporation

CEDAR LANE DRAINAGE STUDY
PROPOSED ALTERNATE 1
Figure ES-2



CHARLES A. MANGANARO
CONSULTING ENGINEERS
A Professional Corporation

CEDAR LANE DRAINAGE STUDY
PROPOSED ALTERNATE 2
Figure ES-3

CHARLES A. MANGANARO
CONSULTING ENGINEERS
A Professional Corporation

CEDAR LANE DRAINAGE STUDY
PROPOSED ALTERNATE 3
Figure ES-4

0 100 200 400 600 800

1 inch = 250 feet

CHARLES A. MANGANARO
CONSULTING ENGINEERS
A Professional Corporation

CEDAR LANE DRAINAGE STUDY
PROPOSED ALTERNATE 4
Figure ES-5

Path: I:\ENGINEER\JVANOLI\Cedar Lane\CedarLaneFinal.mxd

ES.4 Cost Summary

The estimated cost for each alternate is summarized in the following table. The costs presented here are in year 2011 dollars.

Table ES-2: Cost Summary

Alternate	Construction Cost ($)
1	$1,818,000.00
2	$2,071,000.00
3	$3,352,000.00
4	*

***Analysis for Alternate #4**:**
This route requires installation of a complete separate storm drainage collection system as described in Alternate #1, plus a piping system down through Briarcliff Woods Condominiums. This route down through the Briarcliff Woods Condominiums obviously entails substantially more pipe and appurtenances.

Therefore the reasons that eliminate Alterative #4 from consideration include, but are not limited to:

1. A great deal of additional pipe and appurtenances (catch basins, drop manholes, etc.) causing an unnecessary cost increase.
2. Extraordinarily difficult working conditions on the 25% + sloped hillside.
3. Contractor's increased liability, and hence increased construction cost, due to the steep slope in regard to:
    - Extraordinary erosion and sediment control
    - Workers' safety
    - Extensive tree removal
    - Displacement of families' daily activities
    - Construction of a safety wall at the foot of the slope and/or construction site
    - Displacement of multiple resident parking spaces
    - Disturbance of approximately 85% of the hillside West and South of the condominium structures
    - Restoration of the hillside
    - Restoration of all disturbed parking areas

4. Extremely difficult access for maintenance of the storm drainage collection system. This will result in additional unnecessary costs.

Additionally, there is a question regarding the legal ability of the Town of Ossining to expend Town funds for highway work in the Village of Ossining. This is particularly true, considering there are less expensive alternates that will perform equally well.

ES.5 Recommendation

It is recommended that Alternate No. 1 be pursued for the following reasons:

1. It is the least expensive to construct.
2. All work is within the Town of Ossining.
3. It provides the most cost effective means of future facility maintenance.

INTRODUCTION

1.1. Project Description

The study area is located in the vicinity of Cedar Lane in the Town of Ossining, Westchester County, New York. As per the Geographic Information Data (GIS Data) of Westchester County, the project area is located in two drainage basins: Indian Brook Drainage Basin and Lower Hudson River Basin, as shown in *Figure 1: Location of Project Area*.

In order to improve the existing storm drainage issues that the Town is confronted with, the Town of Ossining has retained the services of James J. Vanoli, P.E., to investigate and provide recommendations for the necessary improvements to the storm drainage system, required to collect and dispose storm water runoffs.

1.2. Purpose and Scope of Work

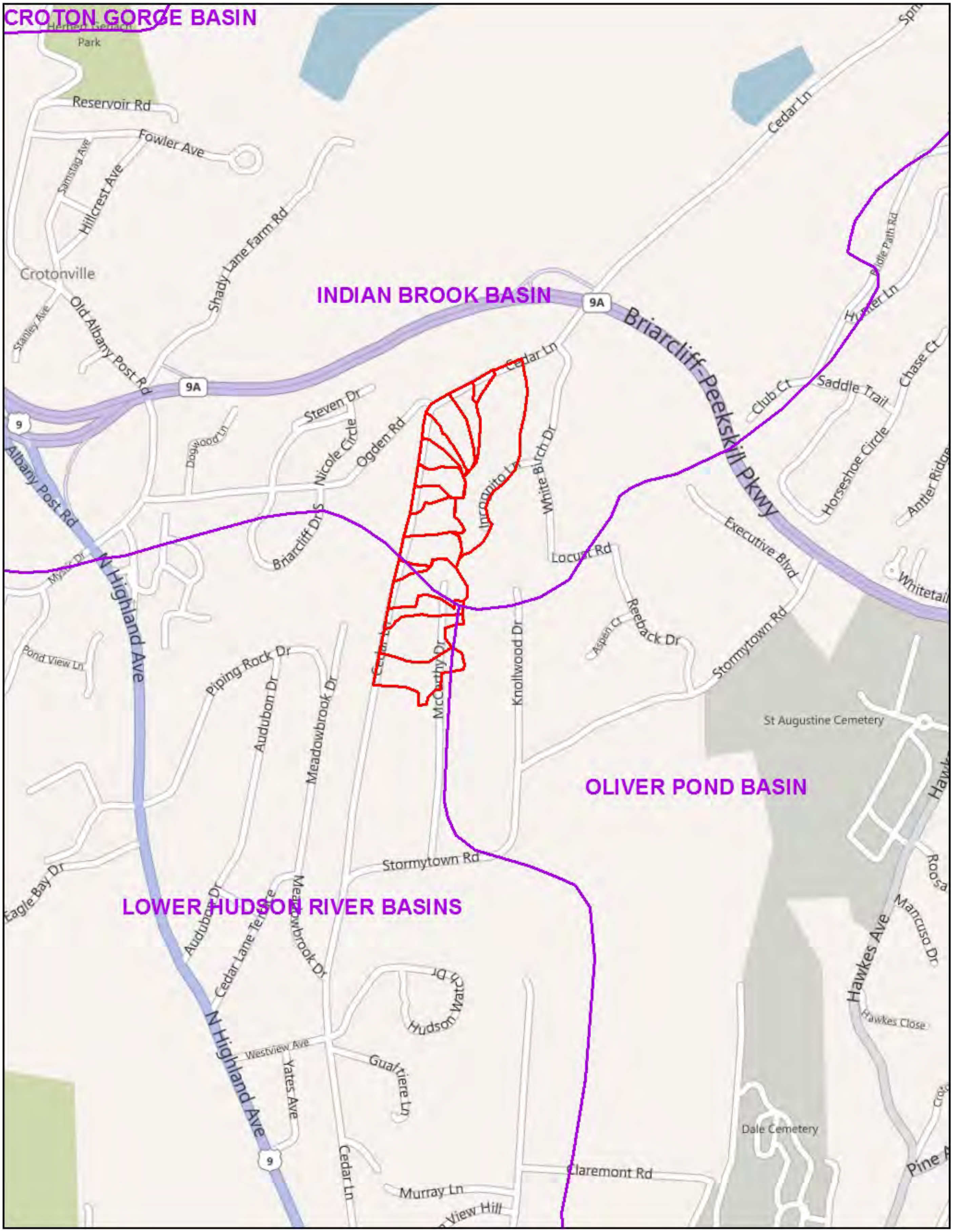
The purpose of this report is to document the findings of the study conducted to mitigate the flooding of the area downstream of Cedar Lane as a result of storm water runoff. The mentioned downstream area, which is comprised of condominiums and single family residences, is located in the Village of Ossining along Cedar Lane, Briarcliff Drive and Ogden Road.

Field investigations were conducted at the site to validate the findings obtained from the Westchester County GIS database. Additionally, a computational analysis was performed using the HydroCAD computer program to model the study area and to arrive at stormwater runoff rates and pipe sizing presented in this report.

1.3. Existing Site Description

The watershed contributing to the proposed separate storm drainage collection system consists mainly of a gently sloping residential area between Cedar Lane and McCarthy Drive and the pavement of Cedar Lane. Currently, the storm water runoff from the residential lots flows generally westward towards Cedar Lane, flows along and over the road, enters the condominium development in the Village of Ossining, via the steep slopes between Cedar Lane and the development, during the extraordinary storm events. The total contributing watershed area is approximately 30 acres.

Figure 1: Location of Project Area



PROPOSED ALTERNATES

2.1. General

Based on the topography and the downstream conditions, four alternate drainage routes were considered for routing of the storm water. A combined view of all four alternates is depicted in *Figure ES-1: Proposed Alternates* (following page ES-1).

Alternate No. 1: A traditional separate storm water collection system along Cedar Lane, discharging to the existing stream parallel to NYS Route 9A, through a private property in the Town as shown in *Figure ES-2: Proposed Alternate 1*.

Alternate No. 2: A traditional separate storm water collection System along Cedar Lane running further north on Cedar Lane, discharging to the existing stream parallel to NYS Route 9A through a private property in the Town, as shown in *Figure ES-3: Proposed Alternate 2*.

Alternate No. 3: A traditional separate storm water collection System along Cedar Lane, Ogden Road (in the Village) and Old Albany Post Road (in the Town) discharging to an existing pond in the Town, as shown in *Figure ES-4: Proposed Alternate 3*.

Alternate No. 4: A short separate storm water collection system along a portion of Cedar Lane, which would discharge through the Briarcliff Woods Condominium property via a storm detention basin and pipes and then along Old Albany Post Road. A second traditional separate storm water collection system along Cedar Lane would handle the rest of Cedar Lane and follow the same discharge route as in Alternate No.1, as shown in *Figure ES-5: Proposed Alternate 4*.

3.1. General

The watershed area was manually developed using the 2-ft contour maps available from the Westchester County GIS. The watershed was divided into sub-drainage basins and mapped using the modeling software ArcGIS.

The parameters required to estimate the runoff such as pervious and impervious areas, associated soil types, and slopes were overlaid on the map. Calculations were then performed using the HydroCAD software developed by Applied Microcomputer Systems, and Microsoft Excel. The storm frequencies used as basis for computing peak discharges and designing the drainage system were 1, 2, 5, 10, 25, 50 and 100 years as outlined in the Westchester County Stormwater Best Management Practices Manual Series, latest edition, and the New York State Stormwater Management Design Manual, Latest Revision.

3.2. Data Collection

The model study was performed based on the 2-ft contour map obtained from the Westchester County GIS data combined with field verification of spot elevations by Thomas C. Merritts Land Surveyors PC. The modeling and mapping efforts were facilitated using Geographic Information System (GIS) technology. Topographic mapping, ortho images, tax maps, land use data and soil types were also obtained from the Westchester County Geographic Information Systems. The soil data report was obtained from Web Soil Survey (WSS) operated by United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). A field visit was conducted to identify the existing utilities such as water main along the Cedar Lane in order to determine the proposed location of storm sewer system.

3.3. HydroCAD Model

Hydrologic and hydraulic modeling was performed using HydroCAD Stormwater Modeling System Version 10.0 software developed by the HydroCAD Software Solution LLC.

a. Model Components

Each subdivided watershed was modeled as a sub-catchment area to develop runoff hydrographs at appropriate locations for the hydraulic model. This process resulted in fifteen sub-watersheds. The runoff generated from each subcatchment area was routed to the downstream catch basin, with negligible storage, at 150 ft. intervals. This allowed evaluation of the outlet control devices without consideration of storage effects. The outlet from each catchbasin was modeled as a culvert.

b. Hydrologic Soil Groups

The soil group shape files of the project area were selected and downloaded from the NRCS Web Soil Survey website. The soil groups in each watershed were clipped from the shape files. The soils at the project area were found primarily Hydrologic Group C which as shown in *Figure 2: Soil Groups within the Project Area* and described in *Appendix 1: Soil Report of the Project Site* with a small proportion of Type B soils.

c. Land Cover

Land use data was taken from the Westchester County GIS Data. Town of Ossining tax parcels and maps were used to identify the types of land coverage, i.e. lawns, impervious areas, etc. The calculated impervious area was further adjusted by adding an additional 25% in order to accommodate future improvements on the private properties. Additionally zoning regulations were used to quantify lot coverage and impervious areas.

d. Time of Concentration

The time of concentration (Tc) calculation involves the computation of travel time (Tt) for sheet flow, shallow concentrated flow and channel flow, or combinations of these. The computation of Tc for each subcatchment was estimated considering sheet and shallow concentrated flow lengths with corresponding slopes and land use.

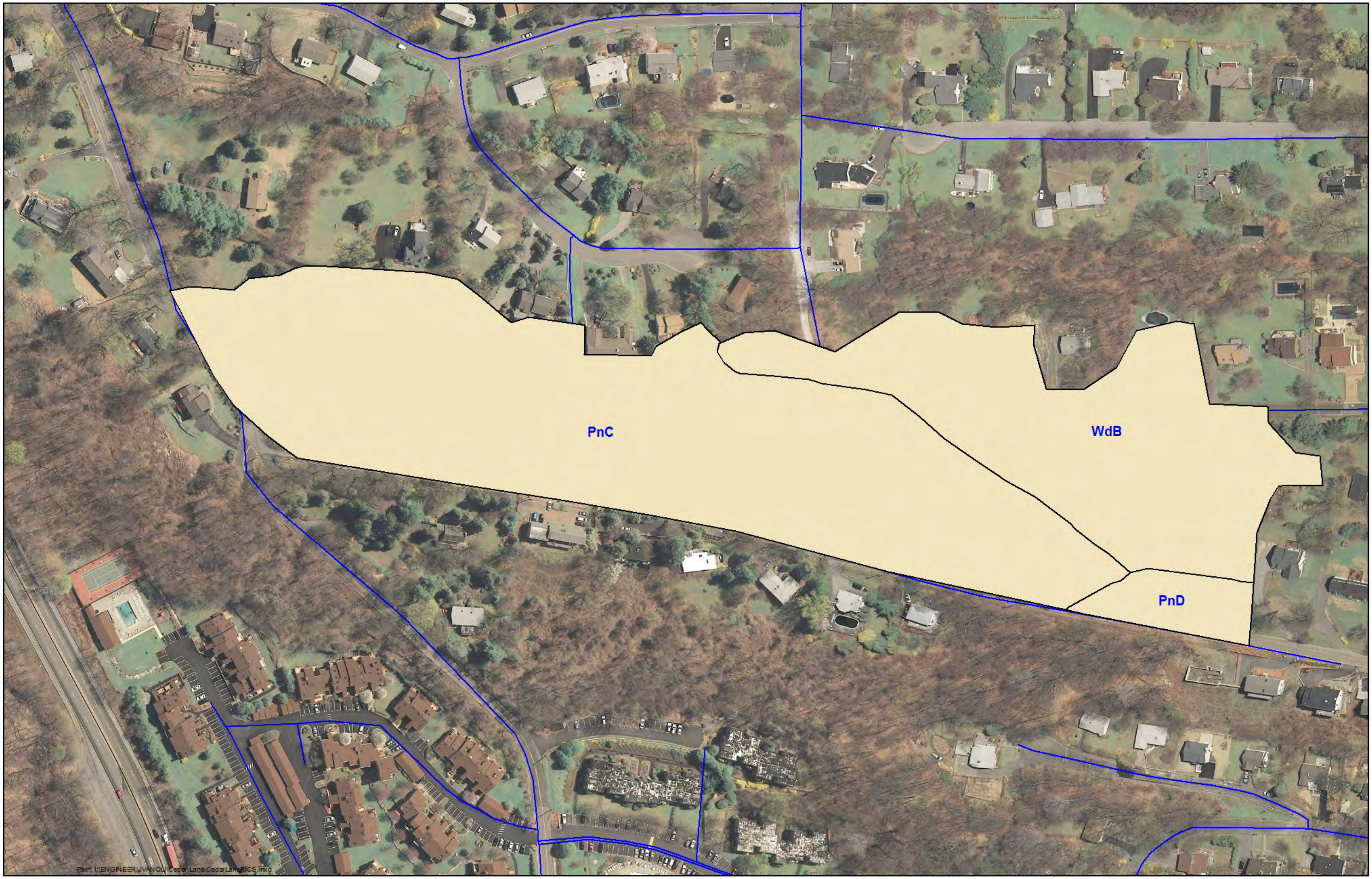
e. Rainfall:

The rainfall frequencies and intensities used in the storm water analysis are based on the values in the New York State Stormwater Management Design Manual for Westchester County and are as follows:

Table 1: Rainfall Intensity

Storm Frequency (Years)	Rainfall (inches)
1	2.8
2	3.5
5	4.5
10	5.0
25	6.0
50	7.0
100	7.5

Figure 2: Soil Groups in the Project Area



4.1. Peak Runoff

A summary of peak runoff from the HydroCAD models are tabulated in *Table 2: Peak Runoff (CFS)*. The locations of the various alternates are illustrated in *Figure* No.s *ES-2 to ES-5*. The watershed areas considered for alternates 1, 2, 3 and 4 are 15.1, 21, 13 and 21 acres respectively.

Table 2: Peak Runoff (CFS)

Design Storm	Alternate No. 1	Alternate No. 2	Alternate No. 3	Alternate No. 4
1	13	17	11	8 & 10
10	35	46	29	20 & 26
25	45	60	37	26 & 34
100	61	80	50	35 & 46

4.2. Selected Diameters of Pipes:

A summary of pipe diameters as derived for each alternate is tabulated below in *Table No. 3: Storm Drainage Pipe Sizes.*

Table 3: Storm Drainage Pipe Sizes (inches)

ALTERNATE NO. 1			
	CB1-1 to CB 4-1	**CB4-1 to CB-13**	**CB-13 to Outfall**
Diameter (inches)	24	36	48
Length (feet)	450	1100	400

ALTERNATE NO. 2			
	CB1-1 to CB 4-1	**CB4-1 to CB-013**	**CB-13 to CB-15 and to Outfall**
Diameter (inches)	24	36	48
Length (feet)	450	1100	700

ALTERNATE NO. 3			
	CB1-1 to CB 4-1	**CB4-1 to CB-11 (Ogden Road)**	**Ogden Road**
Diameter (inches)	24	36	36
Length (feet)	450	1,050	3,200

ALTERNATE NO. 4			
	CB1-1 to CB 2-1 & CB-6 to CB-5	**CB2-1 to CB-4**	**CB-4 to Outfall**
Diameter (inches)	18	24	36
Length (feet)	300	500	2150
	CB-7 to CB-9	**CB-9 to CB-11**	**CB-11 to CB-13 and to Outfall**
Diameter (inches)	18	24	36
Length (feet)	450	600	550

4.3. Cost Estimates

The Engineer's opinion of probable construction cost was prepared for Alternate No's. 1 to 3 and is shown in *Table No.s 4 to 6*. See written analysis for Alternate No. 4 in *Table 7: Preliminary Cost Estimate: Alternate 4*. The costs are summarized and presented in *Table No. ES-2: Cost Summary*.

CHARLES A. MANGANARO CONSULTING ENGINEERS, P.C.

Table 4: Preliminary Cost Estimate - Alternate 1

Installation of Storm Drainage - Cedar Lane, Town of Ossining

Prepared By: SJT/BB Checked By: SRN

CAMCE 1849 Dated: 11/22/2011

Item	Description:	Quantity	Units	Material		Labor		Total Cost
				Unit Cost	Total	Unit Cost	Total	
1	Mobilization (Price Limited By Section 01505)	1	L.S.					$60,000.00
2	Construction Photographs	1	L.S.					$4,500.00
3	As-Built Record Drawings	1	L.S.					$10,000.00
	All work required to install a new 15, 24 & 36-inch diameter storm drainage HDPE Corrugated exterior/smooth interior pipe(Type							
4a	15-inch diameter	250	L.F.	$35.00	$8,750.00	$97.50	$24,375.00	$33,125.00
4b	24-inch diameter	450	L.F.	$45.00	$20,250.00	$123.75	$55,687.50	$75,937.50
4c	36-inch diameter	1825	L.F.	$50.00	$91,250.00	$131.25	$239,531.25	$330,781.25
5a	Controlled strength backfill (50 psi) above dead sand backfill	1100	C.Y.	$60.00	$66,000.00	$15.00	$16,500.00	$82,500.00
5b	Controlled strength backfill (50 psi) at watermain crossings	20	C.Y.	$60.00	$1,200.00	$15.00	$300.00	$1,500.00
5c	Bedding & backfill with dead sand	1800	C.Y.	$50.00	$90,000.00	$15.00	$27,000.00	$117,000.00
6a	Construction of new manhole with frame & cover.	1	Each	$3,000.00	$3,000.00	$3,000.00	$3,000.00	$6,000.00
6b	Construction of new catch basins with frame & grate	28	Each	$3,000.00	$84,000.00	$3,750.00	$105,000.00	$189,000.00
7	Construction of new outfall energy dissipator structure and rip-rap bedding	1	L.S.					$10,000.00
8a	Removal of existing concrete and asphalt curbs	1	L.S.					$5,000.00
8b	Installation of new stone/concrete curbs	3150	L.F.	$14.00	$44,100.00	$15.00	$47,250.00	$91,350.00
8c	Installation of new concrete drop curbs	525	L.F.	$14.00	$7,350.00	$15.00	$7,875.00	$15,225.00
9a	Mill 2-inch off the entire roadway & crossings	1	L.S.					$8,000.00
9b	Installation of Permanent Bituminous Concrete Pavement - Full Width, 2-inch thick.	500	Ton	$32.50	$16,250.00	$97.50	$48,750.00	$65,000.00
9c	Installation of temporary pavement restoration (2-inch thick)	120	Ton	$20.00	$2,400.00	$60.00	$7,200.00	$9,600.00
10	Backfilling behind the curbs (including the removal of sale)	1	L.S.					$3,500.00
11	Rock Excavation	1500	C.Y.	$30.00	$45,000.00	$90.00	$135,000.00	$180,000.00
12	Temporary and permanent vegetation cover	3150	Sq.F.	$1.50	$4,725.00	$4.50	$14,175.00	$18,900.00
13	Construction of retention basin							
14	Removal of existing catch basins and headwall	1	L.S.					$15,000.00
15	Pavement stripping	1	L.S.					$15,000.00
16	Traffic control	1	L.S.					$7,500.00
17	Reconstruction of uncharted and mismarked utilities	1	L.S.					$5,000.00
	Subtotal:							**$1,359,418.75**
18	Contingency Allowance @ 10%	1	L.S.					$135,941.88
	Subtotal:							**$1,495,360.63**
	Surveying Cost - Layout	1	L.S.					$10,000.00
	Rock probe test @ 200 ft. interval	1	L.S.					$10,000.00
	Subtotal:							**$1,515,360.63**
	Engineering Cost @ 20%							$303,072.13
	TOTAL:							**$1,818,000.00**

CHARLES A. MANGANARO CONSULTING ENGINEERS, P.C.

Table 5: Preliminary Cost Estimate - Alternate 2

Installation of Storm Drainage - Cedar Lane, Town of Ossining

Prepared By: SJT/BB Checked By: SRN

CAMCE No. 1849 Dated: 11/22/2011

Item	Description:	Quantity	Units	Material		Labor		Total Cost
				Unit Cost	Total	Unit Cost	Total	
1	Mobilization (Price Limited By Section 01505)	1	L.S.					$60,000.00
2	Construction Photographs	1	L.S.					$4,500.00
3	As-Built Record Drawings	1	L.S.					$10,000.00
	All work required to install a new 15, 24 & 36-inch diameter storm drainage HDPE Corrugated exterior/smooth interior pipe(Type HI-Q).							
4a	15-inch diameter	300	L.F.	$35.00	$10,500.00	$97.50	$29,250.00	$39,750.00
4b	24-inch diameter	450	L.F.	$45.00	$20,250.00	$123.75	$55,687.50	$75,937.50
4c	36-inch diameter	1350	L.F.	$50.00	$67,500.00	$131.25	$177,187.50	$244,687.50
4d	48-inch diameter	750	L.F.	$50.00	$37,500.00	$150.00	$112,500.00	$150,000.00
5a	Controlled strength backfill (50 psi) above dead sand backfill	1200	C.Y.	$60.00	$72,000.00	$15.00	$18,000.00	$90,000.00
5b	Controlled strength backfill (50 psi) at watermain crossings	110	C.Y.	$60.00	$6,600.00	$15.00	$1,650.00	$8,250.00
5c	Bedding & backfill with dead sand	1600	C.Y.	$50.00	$80,000.00	$15.00	$24,000.00	$104,000.00
6a	Construction of new manhole with frame & cover.	1	Each	$3,000.00	$3,000.00	$3,000.00	$3,000.00	$6,000.00
6b	Construction of new catch basins with frame & grate	32	Each	$3,000.00	$96,000.00	$3,750.00	$120,000.00	$216,000.00
7	Construction of new outfall energy dissipator structure and rip-rap bedding	1	L.S.					$10,000.00
8a	Removal of existing concrete and asphalt curbs	1	L.S.					$5,000.00
8b	Installation of new stone/concrete curbs	3875	L.F.	$14.00	$54,250.00	$15.00	$58,125.00	$112,375.00
8c	Installation of new concrete drop curbs	650	L.F.	$14.00	$9,100.00	$15.00	$9,750.00	$18,850.00
9a	Mill 2-inch off the entire roadway & crossings	1	L.S.					$8,000.00
9b	Installation of Permanent Bituminous Concrete Pavement - Full Width, 2-inch thick.	575	Ton	$32.50	$18,687.50	$97.50	$56,062.50	$74,750.00
9c	Installation of temporary pavement restoration (2-inch thick)	145	Ton	$20.00	$2,900.00	$60.00	$8,700.00	$11,600.00
10	Backfilling behind the curbs	1	L.S.					$3,500.00
11	Rock Excavation	2000	C.Y.	$30.00	$60,000.00	$90.00	$180,000.00	$240,000.00
12	Temporary and permanent vegetation cover	2475	Sq.F.	$1.50	$3,712.50	$4.50	$11,137.50	$14,850.00
13	Construction of retention basin							
14	Removal of existing catch basins and headwall	1	L.S.					$15,000.00
15	Pavement stripping	1	L.S.					$15,000.00
16	Traffic control	1	L.S.					$7,500.00
17	Reconstruction of uncharted and mismarked utilities	1	L.S.					$5,000.00
	Subtotal:							**$1,550,550.00**
18	Contingency Allowance @ 10%	1	L.S.					$155,055.00
	Subtotal:							**$1,705,605.00**
	Surveying Cost - Layout	1	L.S.					$10,000.00
	Rock probe test @ 200 ft. interval	1	L.S.					$10,000.00
	Subtotal:							**$1,725,605.00**
	Engineering Cost @ 20%							$345,121.00
	TOTAL:							**$2,071,000.00**

CHARLES A. MANGANARO CONSULTING ENGINEERS, P.C.

Table 6: Preliminary Cost Estimate - Alternate 3

Installation of Storm Drainage - Cedar Lane, Town of Ossining

Prepared By: SJT/BB Checked By: SRN

CAMCE No. 1849 Dated: 11/22/2011

Item	Description:	Quantity	Units	Material Unit Cost	Total	Labor Unit Cost	Total	Total Cost
1	Mobilization (Price Limited By Section 01505)	1	L.S.					$60,000.00
2	Construction Photographs	1	L.S.					$4,500.00
3	As-Built Record Drawings	1	L.S.					$10,000.00
	All work required to install a new 15, 24 & 36-inch diameter storm drainage HDPE Corrugated exterior/smooth interior pipe (Type HI-Q).							
4a	15-inch diameter	225	L.F.	$35.00	$7,875.00	$97.50	$21,937.50	$29,812.50
4b	24-inch diameter	450	L.F.	$45.00	$20,250.00	$123.75	$55,687.50	$75,937.50
4c	36-inch diameter	4250	L.F.	$50.00	$212,500.00	$131.25	$557,812.50	$770,312.50
5a	Controlled strength backfill (50 psi) above dead sand backfill	2600	C.Y.	$60.00	$156,000.00	$15.00	$39,000.00	$195,000.00
5b	Controlled strength backfill (50 psi) at watermain crossings	70	C.Y.	$60.00	$4,200.00	$15.00	$1,050.00	$5,250.00
5c	Bedding & backfill with dead sand	3900	C.Y.	$50.00	$195,000.00	$15.00	$58,500.00	$253,500.00
6a	Construction of new manhole with frame & cover.	12	Each	$3,000.00	$36,000.00	$3,000.00	$36,000.00	$72,000.00
6b	Construction of new catch basins with frame & grate	24	Each	$3,000.00	$72,000.00	$3,750.00	$90,000.00	$162,000.00
7	Construction of new outfall energy dissipator structure and rip-rap bedding	1	L.S.					$10,000.00
8a	Removal of existing concrete and asphalt curbs	1	L.S.					$5,000.00
8b	Installation of new stone/concrete curbs	3000	L.F.	$14.00	$42,000.00	$15.00	$45,000.00	$87,000.00
8c	Installation of new concrete drop curbs	500	L.F.	$14.00	$7,000.00	$15.00	$7,500.00	$14,500.00
9a	Mill 2-inch off the entire roadway & crossings	1	L.S.					$20,000.00
9b	Installation of Permanent Bituminous Concrete Pavement - Full Width, 2-inch thick.	1200	Ton	$32.50	$39,000.00	$97.50	$117,000.00	$156,000.00
9c	Installation of temporary pavement restoration (2-inch thick)	300	Ton	$20.00	$6,000.00	$60.00	$18,000.00	$24,000.00
10	Backfilling behind the curbs	1	L.S.					$3,500.00
11	Rock Excavation	4000	C.Y.	$30.00	$120,000.00	$90.00	$360,000.00	$480,000.00
12	Temporary and permanent vegetation cover	4700	Sq.F.	$1.50	$7,050.00	$4.50	$21,150.00	$28,200.00
13	Construction of retention basin							
14	Removal of existing catch basins and headwall	1	L.S.					$15,000.00
15	Pavement stripping	1	L.S.					$15,000.00
16	Traffic control	1	L.S.					$15,000.00
17	Reconstruction of uncharted and mismarked utilities	1	L.S.					$5,000.00
	Subtotal:							**$2,516,512.50**
18	Contingency Allowance @ 10%	1	L.S.					$251,651.25
	Subtotal:							**$2,768,163.75**
	Surveying Cost - Layout	1	L.S.					$10,000.00
	Rock probe test @ 200 ft. interval	1	L.S.					$15,000.00
	Subtotal:							**$2,793,163.75**
	Engineering Cost @ 20%							$558,632.75
	TOTAL:							**$3,352,000.00**

Table 7: Preliminary Cost Estimate - Alternate 4

<u>Analysis for Alternate #4</u>:

This route requires installation of a complete separate storm drainage collection system as described in Alternate #1, plus a piping system down through the Briarcliff Woods Condominiums. This route down through the Briarcliff Woods Condominiums obviously entails substantially more pipe and appurtenances.

Therefore, the reasons that eliminate Alternate #4 from consideration include, but are not limited to:

1. A great deal of additional pipe and appurtenances (catch basins, detention basins, drop manholes, etc.) causing an unnecessary cost increase.
2. Extraordinarily difficult working conditions on the 25% + sloped hillside.
3. Contractor's increased liability, and hence increased construction cost, due to the steep slope in regard to:
   - Extraordinary erosion and sediment control measures
   - Workers' safety
   - Extensive tree cutting and stump removal
   - Displacement of families' daily activities
   - Construction and maintenance of a safety wall at the foot of the slope and/or at the construction site
   - Displacement of entire sections of resident parking spaces
   - Disturbance of approximately 85% of the hillside West and South of the Briarcliff Manor Condominium structures
   - Restoration/reforestation of the hillside
   - Restoration of all disturbed parking areas, including repaving and curb replacement
   - Restoration of the contractor's field office and material storage areas.
4. Extremely difficult access for maintenance of the storm drainage collection system. This will result in additional unnecessary costs.

Additionally, there is a question regarding the legal ability of the Town of Ossining to expend Town funds for highway work in the Village of Ossining. This is particularly applicable here, considering there are less expensive alternates that will perform equally well.