MidAtlantic
Engineering Partners

February 22, 2023 PRS-2201

UTILITY & STORMWATER ENGINEERING REPORT

FOR

619 MARIN BOULEVARD
BLOCK 7103, LOTS 2-8 & 11
JERSEY CITY
HUDSON COUNTY, NEW JERSEY

PREPARED FOR:

REAL SHELTER FOR ALL, LLC
1203 ROUTE 9 SOUTH
WOODBRIDGE, NJ 07095

PREPARED BY:

MIDATLANTIC ENGINEERING PARTNERS, LLC
2026B BRIGGS ROAD, SUITE 300
MT. LAUREL, NJ 08054

Digitally signed by Joseph Mele
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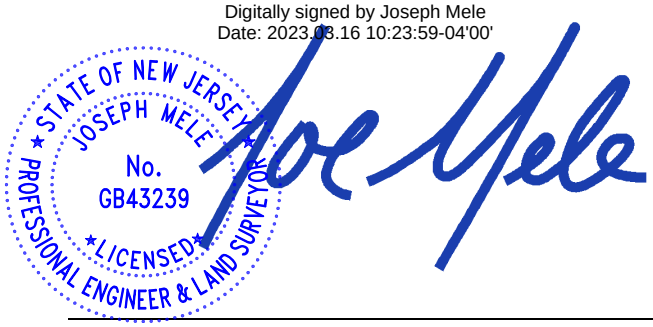

Joseph Mele, P.E.
Licensed Professional Engineer
New Jersey License No. 43239

26 Washington Street ♦ 3rd Floor ♦ Morristown, NJ 07960
Phone: 973.715.8652 ♦ Web: www.midatlanticeng.com

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1.0 INTRODUCTION

A. PROJECT DESCRIPTION AND LOCATION

The site is located in Jersey City along Marin Boulevard. The site is known as Block 7103, Lots 2-8 & 11 and currently contains 1.27 acres of land. The proposed project outlined in this report consists of the construction of a 14-story mixed-use building containing 613 units and ground floor retail spaces. The apartment building contains 188 semi-automated stacker parking spaces and 12 self-park spaces. All proposed parking will be contained within the building structure on the first floor. The first floor also contains residential amenity spaces, a lobby, and three retail spaces. Stormwater management measures have been designed to accommodate flows during the 2, 10, and 100 year storms.

B. EXISTING SITE CONDITIONS

The project area is previously developed and currently has multiple commercial uses including a pet grooming center, a warehouse and a construction yard. The site is within the Jersey Avenue Light Rail Redevelopment Plan, Neighborhood District Area. The main entrance to the building is along Marin Boulevard and is bound to the north by 16th Street and to the south by 15th Street. The site is bound to the west by existing residential buildings currently undergoing redevelopment. Utility mains are located within all adjacent city rights-of-way.

Existing drainage patterns on the site drain from the center of the site out toward 16th Street, Marin Boulevard, and 15th Street. Stormwater flows overland and is eventually collected by the existing inlets located at the corner of 16th and Marin and at the corner of 15th and Marin. Ultimately, the City stormwater collection system discharges into the Hudson River to the east. The center of the site is at approximately elevation 7.5 and the intersection of 15th and Marin Boulevard is at approximately elevation 5. The site topography is generally flat and consistent with typical urban environment conditions.

2.0 STORMWATER MANAGEMENT

A. STORMWATER MANAGEMENT DESCRIPTION

In accordance with the Jersey City rules regarding stormwater management, §345-74, the criteria to handle stormwater for major developments is to design acceptable systems that effectively manage the stormwater with respect to applicable regulations regarding water quality, runoff quantity and groundwater recharge. Each of these requirements were considered in a pre- vs. post-development runoff analysis, conducted in conjunction with an evaluation of site specifications, local ordinance and proposed construction specifications. This was done to facilitate designing an appropriate stormwater management system for the proposed site, based on sound engineering principles. The proposed stormwater management system has been designed to reduce peak flows offsite and match existing drainage patterns per the Jersey City stormwater regulations.

To accomplish these tasks, runoff from the building is routed to a proposed underground detention basin located in the northern portion of the site. The underground detention basin is 50 feet long and 20 feet wide and collected roof runoff via roof leaders and downspouts located internal to the building. Discharge from the basin is proposed to connect to the existing combined sewage pipe located within the 16th Street right-of-way via a 24" RCP that connects into a doghouse manhole.

By decreasing stormwater peak runoff rates generated by any major development in the associated drainage areas, the adequacy of existing culverts and channels will be ensured, and the likelihood of damage to life and property from flooding will be reduced. This approach will also reduce the possibility of soil erosion discharges to surrounding drainage systems and water bodies.

1. Methodology and Software

The existing pre-development and proposed post-development flows were calculated using the USDA Natural Resources Conservation Service methodology, as described in Technical Release 55 - Urban Hydrology for Small Watersheds (TR-55), dated June 1986. These modeling techniques are incorporated in the HydroCAD 10.00 software package, which was used to analyze the pre and post development flows. All of the undisturbed areas of the site have been assumed to be in good hydrologic condition, with good cover for the pre-development analysis. All of the

significant land features and structures that could reduce pre-construction stormwater runoff rates and volumes, including depressions and culverts have been accounted for in the pre-development analysis.

The structural stormwater management measures have been designed to take into account the existing site conditions including environmentally critical areas, slopes, soil types and permeability. They have also been designed to be strong, durable and corrosion resistant so as to minimize maintenance, facilitate maintenance and repairs and ensure proper functioning within the context of their operational requirements.

2. Green Infrastructure Standards

In an effort to reduce the stormwater runoff as well as providing beneficial effects to lowering energy costs, reducing urban heat effects and reducing local air pollution, the building is proposed with 11,900 SF of green roof area. These areas are split between both the north and south towers of the proposed buildings. To minimize any potential flooding effects, the roof is also designed with roof drains and downspouts to collect any stormwater that is not retained by the green roof areas as well as stormwater that collects on areas that are not planted with a green roof.

3. Ground Water Recharge

The Jersey City stormwater control regulation 345-74.7.C states that any the groundwater recharge requirements do not apply to projects within the "Urban Redevelopment Area". The project is located within the Metropolitan Planning Area (PA1) as delineated on the State Plan Policy Map. Therefore the project area meets the definition of an Urban Redevelopment Area and the groundwater recharge rules do not apply.

4. Runoff Quality

All anticipated stormwater runoff that will be routed to the proposed detention basin will be "clean" roof runoff that will not require quality treatment. Due to the proposed parking area being covered and within the building podium, the proposed project results in a decrease of regulated motor vehicle surface. Therefore, the project does not propose stormwater quality mitigation prior to entering the proposed detention basin.

5. Runoff Quantity

The Jersey City ordinances require that any post-construction peak runoff rains for the 2-, 10-, and 100-year storms events are reduced by 50, 75, and 80 percent, respectively, from the pre-development runoff rates. To accomplish this task, the proposed buildings will be constructed with 11,900 SF of green roof area split between the north and south towers on the proposed building. The green roof area serves to decrease the intensity of the runoff as well as retaining small storm events. To retain larger storms and attenuate flows, an underground storage vault is located beneath the parking area on the ground floor. The concrete storage vault is 20 feet wide by 50 feet long by 4 feet high. The chamber contains an outlet structure that is used to control the outflows from the basin that is carried via a 24" RCP to the existing stormwater system located within the City's right-of-way.

6. Soil Erosion and Sediment Control

To minimize the effects of erosion, the proposed design and construction concepts and practices incorporate the standards for Soil Erosion and Sediment Control in New Jersey as provided by the New Jersey State Soil Conservation Committee. These erosion deterrents include but are not limited to the use of silt fence or other sediment barriers at downgrade slopes, soil stockpiles, and inlet protection. In addition, dust control measures, stone tracking mats, and temporary and permanent vegetative cover will be utilized. General notes and guidelines are provided on the Soil Erosion and Sediment Control Plans for the contractor to ensure against soil erosion on the site while construction is in progress.

The soil erosion and sediment control plans will be reviewed by the Hudson-Essex-Passaic Soil Conservation District, which also monitors site activities during construction. The Department will inspect the site and may also recommend additional erosion and sediment control measures as appropriate. Before construction can occur, the Hudson-Essex-Passaic Soil Conservation District must approve the soil erosion and sediment control measures proposed, in addition to the approvals required at the local level.

B. PRE-DEVELOPMENT STORMWATER MANAGEMENT SUMMARY

To determine the peak runoff rate from the site for the 2-, 10-, and 100-year storm event prior to development, the site was modeled as one drainage area that discharges to existing stormwater infrastructure located in the surrounding rights-of-way. Based on existing structures and

topography, the site was modeled and a time of concentration was determined. Drainage Area EA-1 consists of 1.27 acres including 1.19 acres of impervious surfaces. Time of concentration was determined to be 4.6 minutes and the peak runoff was determined using HydroCAD modeling. Below is a table of the pre-development peak runoff rates.

2-Year Storm	10-Year Storm	100-Year Storm
4.23 cfs	6.50 cfs	10.85 cfs

C. POST-DEVELOPMENT STORMWATER MANAGEMENT SUMMARY

It is the purpose of this report to the provide information on the methods and techniques employed in the stormwater management analysis of the site under consideration. This analysis has been performed to address the requirements set forth in the Jersey City stormwater control ordinances while demonstrations that the risk of offsite flooding will be reduced and minimized. Accordingly, stormwater management analysis in the report consists of: (1) calculating runoff from the 2-, 10-, 100-year storm events for the pre and post-development conditions of each drainage area; (2) comparing the results of the pre-development and post-developed conditions to ensure that an appropriate stormwater management plan has been implemented; and (3) providing a conclusion of the results of the analysis.

The analysis demonstrates that stormwater runoff will not adversely affect the area as a result of the proposed redevelopment of the property. Runoff is analyzed as a total flow at the point of analysis (the existing stormwater infrastructure within 16th Street and Marin Boulevard), including discharge from the proposed detention chamber.

For the post development condition, the runoff from 1.27 acres of the roof area will be collected via roof leaders and downspouts and conveyed to the proposed storage chamber. The storage chamber provides quantity control and because the roof runoff area is “clean” there is no pretreatment required within the storage chamber. The allowable peak runoff rates for the post-developed site were found by applying the required reductions to the pre-developed peak flows. The calculations to the determine the allowable flows are as follows:

Storm Event	Pre-Dev Runoff (cfs)	% Reduction	Total Allowable Runoff (cfs)	Proposed Post-Dev Runoff (cfs)
2-Year	4.23	50%	2.11	2.03
10-Year	6.50	75%	4.87	4.50
100-Year	10.85	80%	8.68	8.54

1. Detention Basin

The proposed subsurface detention basin accepts runoff from 1.27 acres of roof area. The proposed basin is located beneath the parking area and drive aisle into the internal parking area. The basin consists of sections of reinforced concrete sections that create a 20'W by 50'L by 4'H storage area. An outlet control device is proposed within the structure that is used to attenuate flows from the design storms. These outlet control measures include a 14"x3" orifice, a 24"x6" orifice, and an overflow weir at elevation 3.50. The detention basin discharges to the existing stormwater pipe within 16th Street via a 24" RCP and a proposed doghouse manhole.

2. Drainage System Discussion (Methodology)

The stormwater control measures were designed according to the following criteria:

1. The SCS TR-20 Method was used to determine the design flows.
2. NJ Rainfall Intensity Curves, with a minimum 25-year storm frequency were utilized.
3. All conduits were designed to convey the design storm by open channel flow.
4. No minimum time of concentration was used.
5. All proposed stormwater conduits are reinforced concrete pipe, Class III with an 'n' value of 0.013.

3.0 SANITARY SEWER

To convey effluent sanitary flows from the proposed 14-story building, one 8" SDR-35 PVC sanitary sewer later will be used to convey sewage to the existing CIP combine sewer line within 16th Street. The projected wastewater flow from the building and sewer lateral are calculated in accordance with the standards outlined in Title 7 of the New Jersey Administrative Code. Collection system details are prepared in accordance with the requirements of the City of Jersey City. It is the purpose of this section of the report to show that all proposed sanitary sewerage

facilities will safely convey the required sewage volumes to the existing sanitary sewer system owned and operated by the City of Jersey City.

A. FLOW CALCULATIONS

The proposed collection system will convey sanitary sewer flows from the proposed residential development. Design flows are calculated based on criteria established in N.J.A.C. 7:14A-23.3.

1. Proposed Average Daily Flow:

	Proposed Flow					
483	Studio apartment and one-bedroom units	$Q_{avg.}$ = 150 g.p.d./d.u.	x 483	d.u. =	72,450	gpd
82	Two-bedroom units	$Q_{avg.}$ = 225 g.p.d./d.u.	x 82	d.u. =	18,450	gpd
48	Three -bedroom units	$Q_{avg.}$ = 300 g.p.d./d.u.	x 48	d.u. =	14,400	gpd
5,100	SF Retail	$Q_{avg.}$ = 0.10 g.p.d./sf	x 5,100	sf =	510	gpd

Total Proposed Flow 105,810 gpd ≈ 0.106 mgd

2. Service Connection Capacity Analysis

The proposed 8-inch PVC lateral will be sufficient to convey the projected flow from the proposed development, as calculated below:

$$Qd = \frac{1.486}{N} \times A \times R^{2/3} \times S^{1/2}$$

where,

Q_d = design capacity, cfs (1/2 full)

n = Mannings roughness coefficient (PVC = 0.010)

A = flow area (1/2 full) = 0.174 S.F.

R = hydraulic radius = A/WP = 0.167 ft.

S = pipe slope = 0.005 ft/ft.

$$Qd = \frac{1.486}{0.010} \times 0.174 \times 0.167^{2/3} \times 0.005^{1/2} = 0.55 \text{ cfs}$$

Q_d = 0.55 cfs x 0.6463 mgd/cfs = 0.36 mgd

Minimum Design Capacity = 2 x $Q_{avg.}$ (flowing 1/2 full)

$$\frac{\mathbf{Qd}}{\mathbf{Q_{avg.}}} = \frac{\mathbf{0.36 \text{ mgd}}}{\mathbf{0.106 \text{ mgd}}} = \mathbf{3.4 > 2} \quad \therefore \ \mathbf{OK}$$

(Capacity exceeds demand)

4.0 WATER SERVICE

This report analyzes the water conveyance system design and establishes the proposed water demand for the project. The analysis presented herein is intended to support applications for approval of the service connection by the City of Jersey City as well as by the New Jersey Department of Environmental Protection Bureau of Water System Engineering.

The project consists of the construction of two 6" DIP combined domestic and fire service that connects to the existing 8" and 20" CIP water mains along Marin Boulevard. The proposed water service connections will be constructed in compliance with the Standards of the New Jersey Department of Environmental Protection, Bureau of Safe Drinking Water. ("New Jersey Safe Drinking Water Act, N.J.A.C. 7:10-11.1 et seq. – Standards for the Construction of Public Community Water Systems.") and the requirements of the City of Jersey City. Water services and plumbing shall conform to the requirements of the Plumbing Subcode of the State of New Jersey Uniform Construction Code, N.J.A.C. 5:23-3.15.

Fire protection for the proposed building will be provided via the two combined service lines mentioned above that connects to an internal sprinkler system in accordance with applicable requirements of the city fire office. The proposed services will provide adequate pressures for domestic service (including peak periods) and during a single fire event.

A. PROJECT DEMAND

The daily water demands were based on N.J.A.C. 5:21-5.2 – Table 5.1 and all units are classified as "High-rise". Non-residential demands were based on N.J.A.C. 7:10-12.6 Table 1. The demand is calculated as follows:

Proposed Average Daily Demand:

Studio Apartment and 1-Bedroom apartment:

Studio Apartment:	Q_{avg} = 65 gpd/unit	x 176 units	=	11,440 gpd
1-Bedroom Apartment:	Q_{avg} = 80 gpd/unit	x 307 units	=	24,560 gpd
2-Bedroom Apartment:	Q_{avg} = 130 gpd/unit	x 82 units	=	10,660 gpd
3-Bedroom Apartment:	Q_{avg} = 230* gpd/unit	x 48 units	=	11,040 gpd
Retail :	Q_{avg} = 0.125 gpd/sf	x 5,100 sf	=	638 gpd

Total Proposed Average Daily Demand: 58,338 gpd = 0.058 mgd

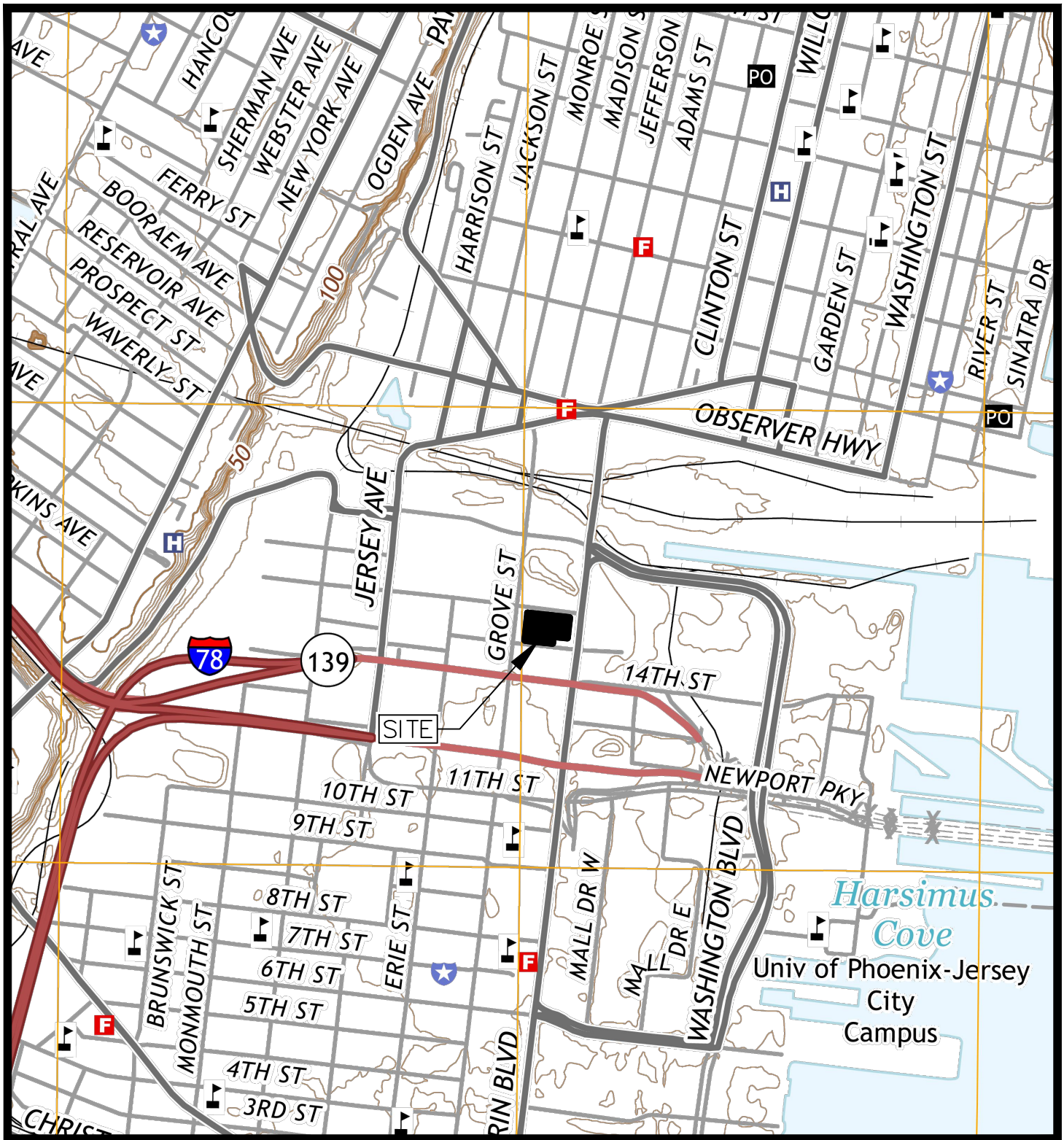
*Estimated from 3-bedroom for "Low and mid-rise" apartments.

Peak Daily Demand:

Peak Demand: 0.058 mgd x 3 = 0.17 mgd

APPENDIX A

USGS QUAD MAP



MidAtlantic
Engineering Partners, llc

USGS QUAD MAP
BLOCK 7301, LOTS 2–8 & 11
619 MARIN BOULEVARD

SITUATED IN
CITY OF JERSEY CITY, HUDSON COUNTY, NEW JERSEY

DRAWN BY:	CHECKED BY:	RELEASED BY:	PROJECT No.:
MS	JM	JM	PRS–2201
DATE:	**HORIZONTAL SCALE:**	**VERTICAL SCALE:**	**DRAWING NAME:**
02/22/23	1"=1,000'	N/A	01–Title Sheet.dwg

Certificate of Authorization No. 24GA28184000

Louis L. Zuegner IV P.E. PE No. GE04226500
William J. Parkhill II P.E. PE No. GE04753800

Gateway 195 Centre
5 Commerce Way, Suite 200
Hamilton, NJ 08691
609-910-4450

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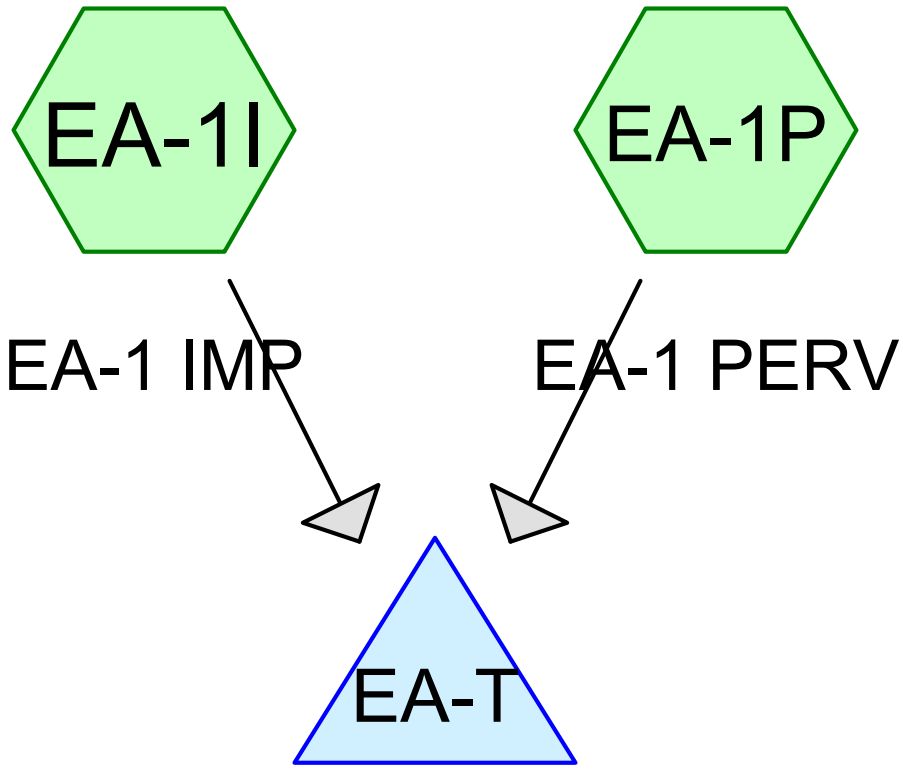
APPENDIX B

PRE-DEVELOPTMENT DRAINAGE ANALYSIS



EA-Total

Subcat Reach Pond Link

Routing Diagram for Pre & Post-Development
Prepared by {enter your company name here}, Printed 9/16/2022
HydroCAD® 10.00-26 s/n 07360 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.080	89	<50% Grass cover, Poor, HSG D (EA-1P)
1.190	98	Unconnected roofs, HSG A (EA-1I)

Summary for Subcatchment EA-1I: EA-1 IMP

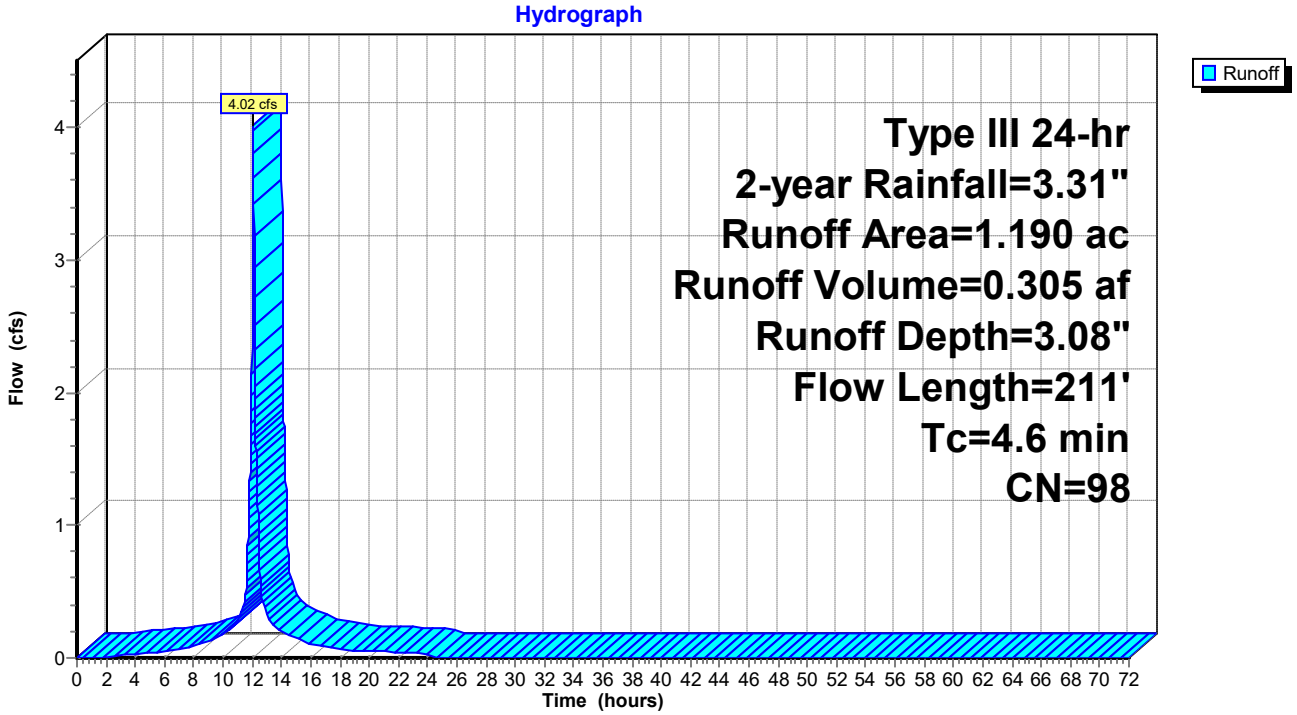
Runoff = 4.02 cfs @ 12.06 hrs, Volume= 0.305 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.31"

Area (ac)	CN	Description
1.190	98	Unconnected roofs, HSG A
1.190		100.00% Impervious Area
1.190		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1I: EA-1 IMP



Summary for Subcatchment EA-1P: EA-1 PERV

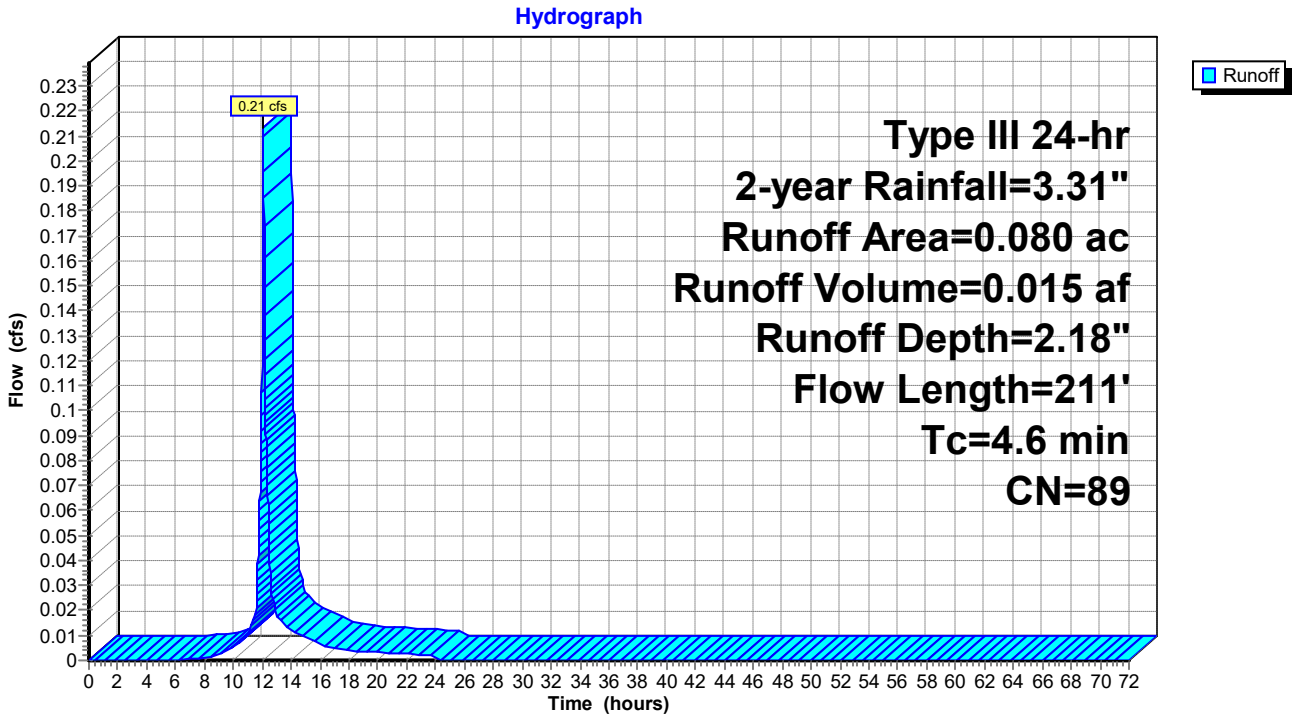
Runoff = 0.21 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.31"

Area (ac)	CN	Description
0.080	89	<50% Grass cover, Poor, HSG D
0.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1P: EA-1 PERV

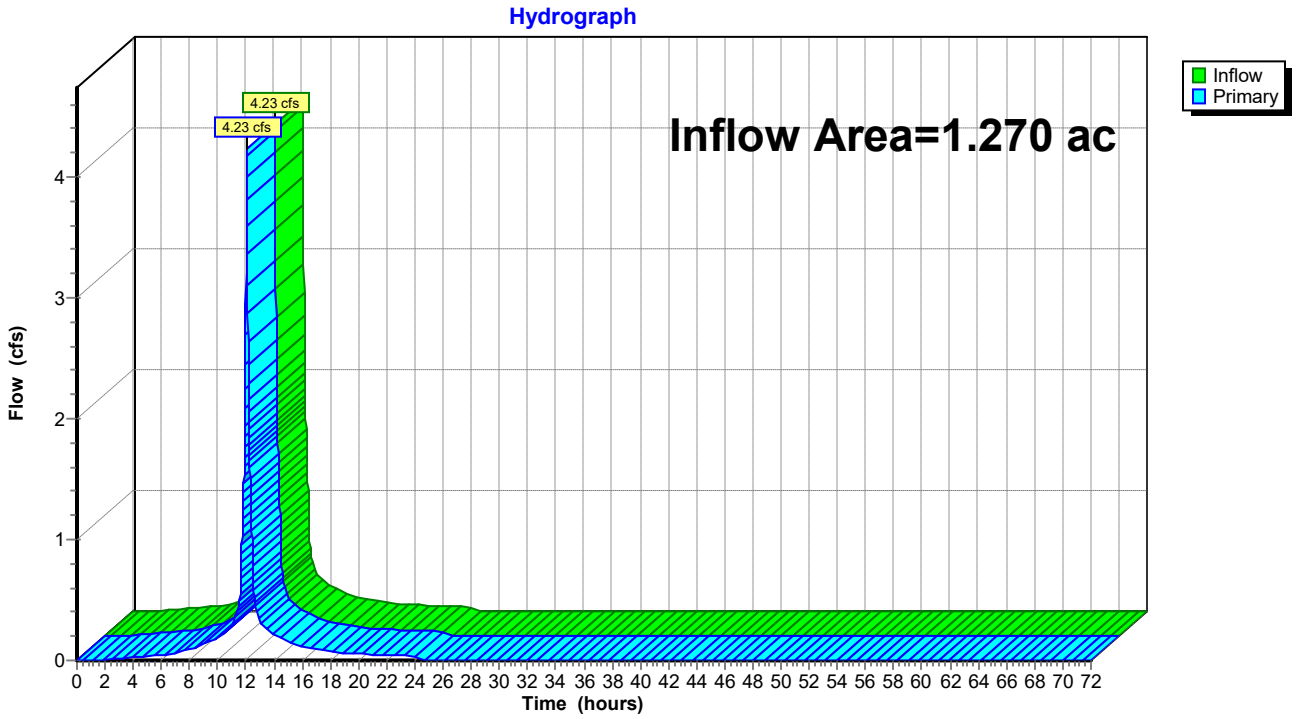


Summary for Pond EA-T: EA-Total

Inflow Area = 1.270 ac, 93.70% Impervious, Inflow Depth = 3.02" for 2-year event
Inflow = 4.23 cfs @ 12.06 hrs, Volume= 0.320 af
Primary = 4.23 cfs @ 12.06 hrs, Volume= 0.320 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond EA-T: EA-Total



Summary for Subcatchment EA-1I: EA-1 IMP

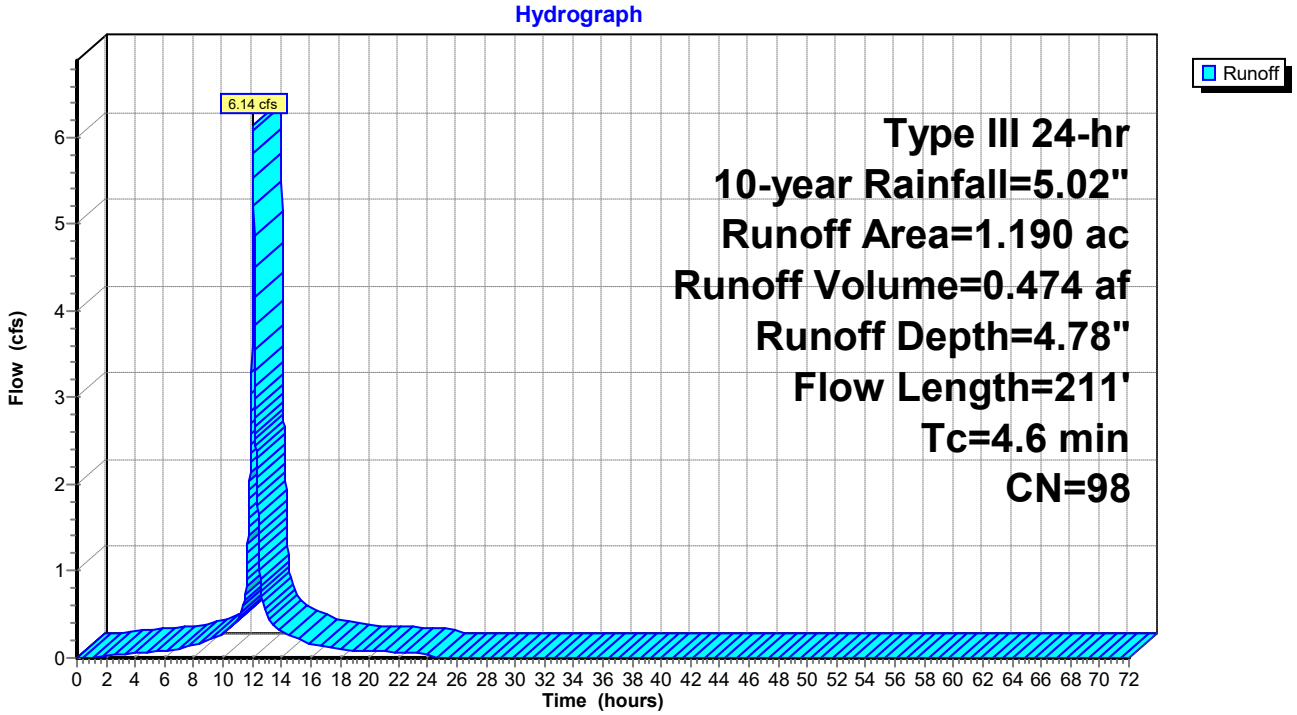
Runoff = 6.14 cfs @ 12.06 hrs, Volume= 0.474 af, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (ac)	CN	Description
1.190	98	Unconnected roofs, HSG A
1.190		100.00% Impervious Area
1.190		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1I: EA-1 IMP



Summary for Subcatchment EA-1P: EA-1 PERV

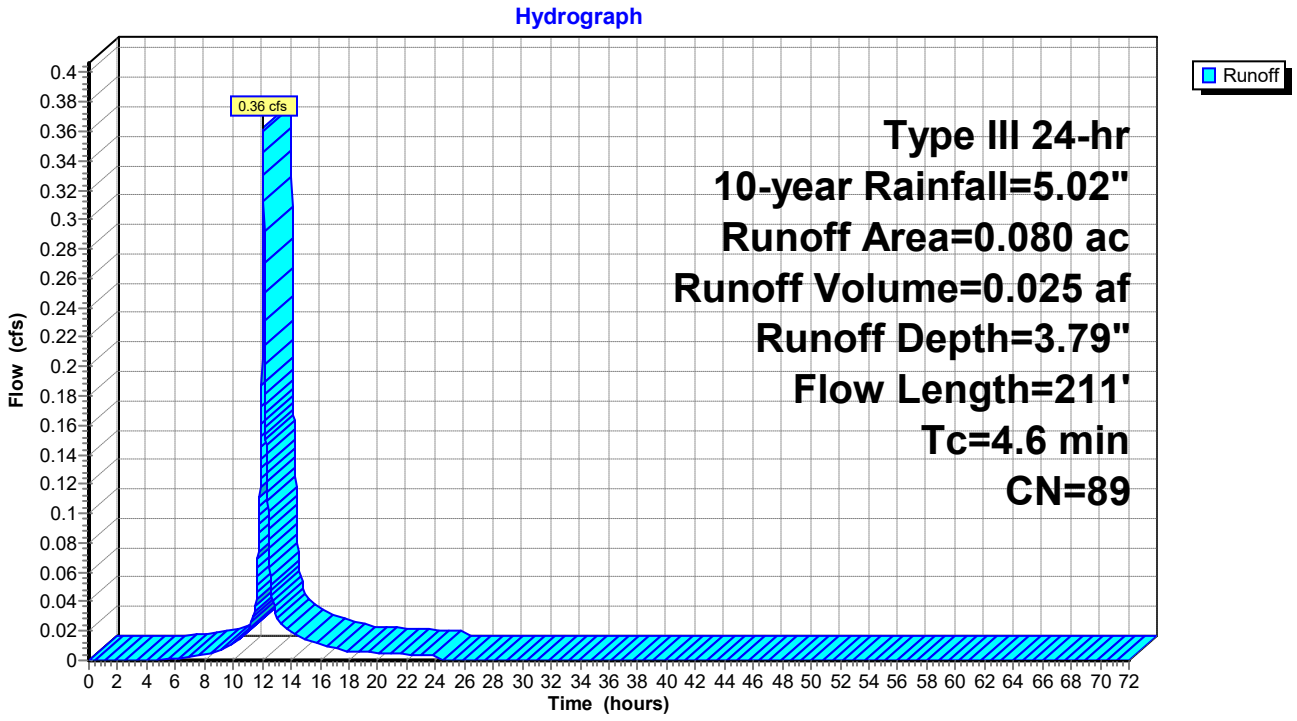
Runoff = 0.36 cfs @ 12.07 hrs, Volume= 0.025 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (ac)	CN	Description
0.080	89	<50% Grass cover, Poor, HSG D
0.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1P: EA-1 PERV

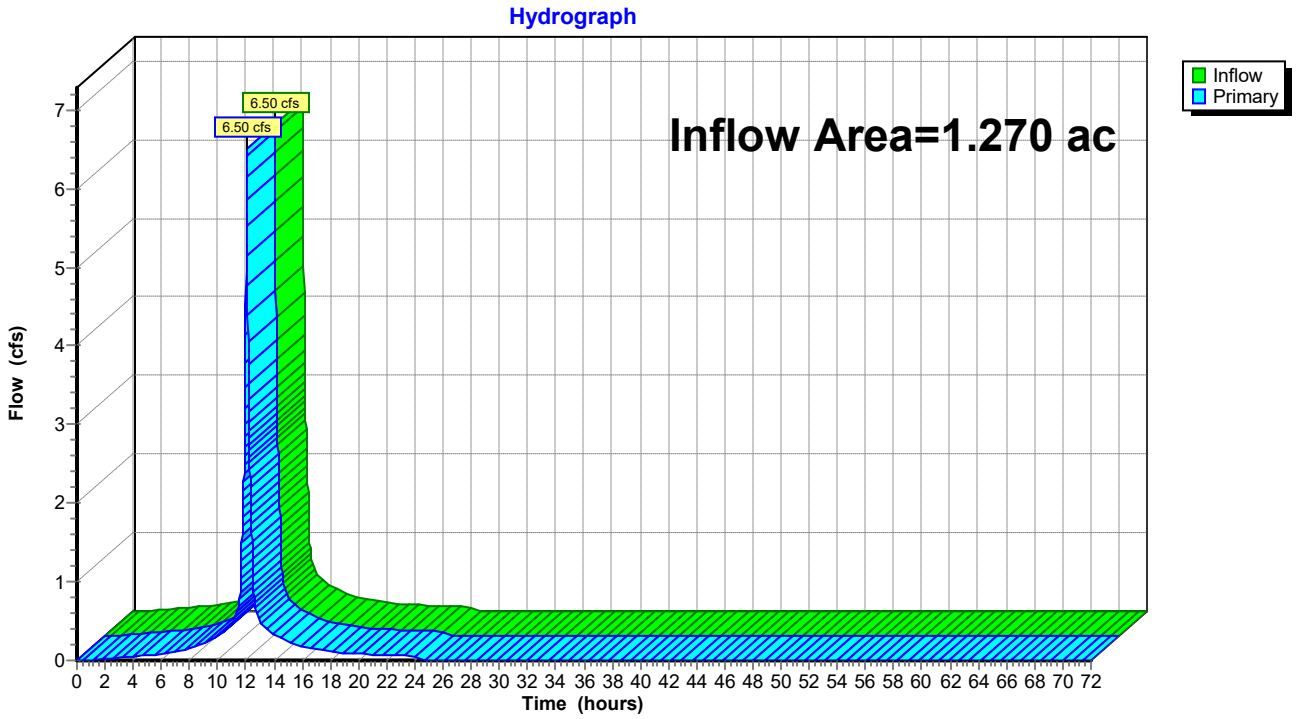


Summary for Pond EA-T: EA-Total

Inflow Area = 1.270 ac, 93.70% Impervious, Inflow Depth = 4.72" for 10-year event
Inflow = 6.50 cfs @ 12.06 hrs, Volume= 0.500 af
Primary = 6.50 cfs @ 12.06 hrs, Volume= 0.500 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond EA-T: EA-Total



Summary for Subcatchment EA-1I: EA-1 IMP

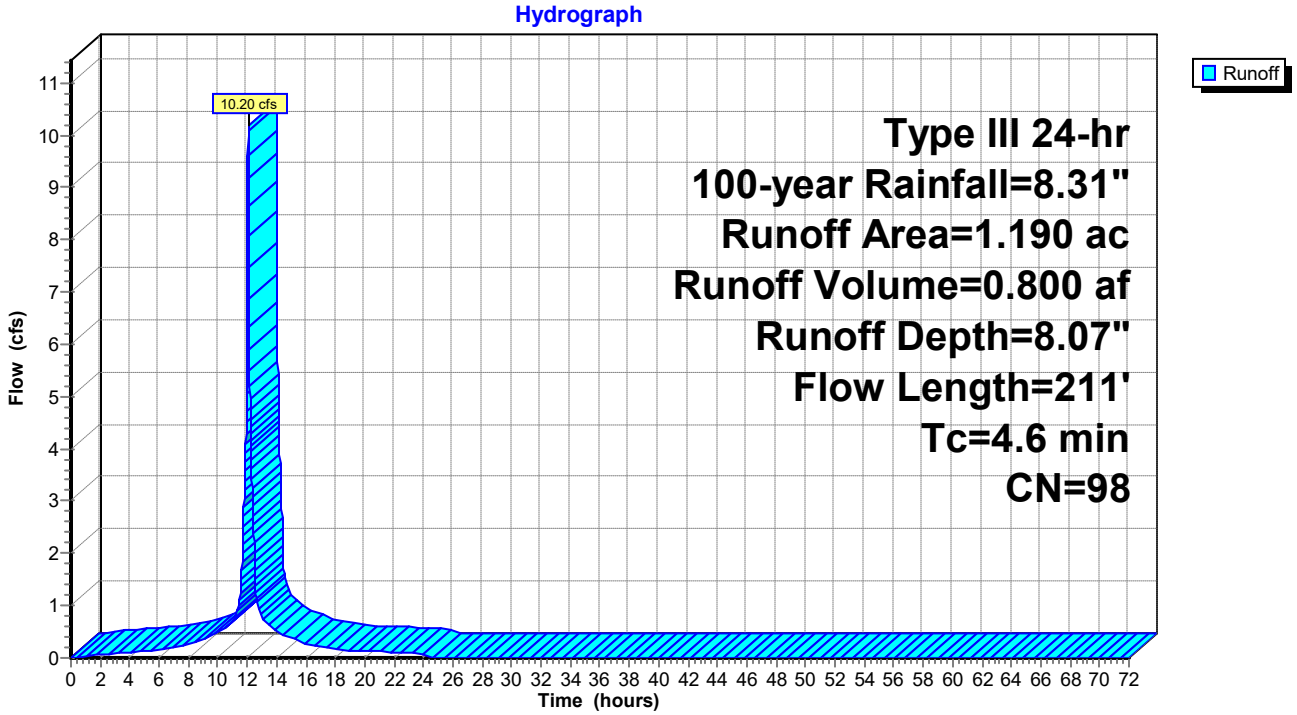
Runoff = 10.20 cfs @ 12.06 hrs, Volume= 0.800 af, Depth= 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.31"

Area (ac)	CN	Description
1.190	98	Unconnected roofs, HSG A
1.190		100.00% Impervious Area
1.190		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1I: EA-1 IMP



Summary for Subcatchment EA-1P: EA-1 PERV

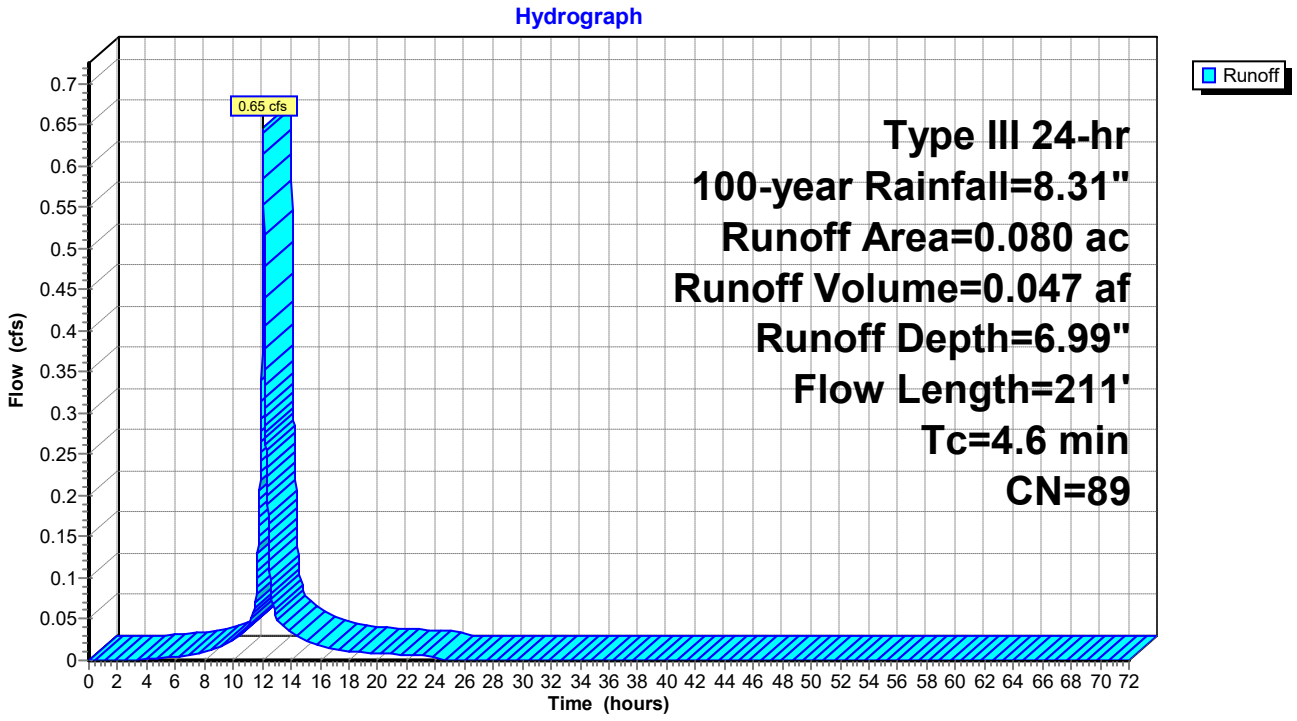
Runoff = 0.65 cfs @ 12.07 hrs, Volume= 0.047 af, Depth= 6.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.31"

Area (ac)	CN	Description
0.080	89	<50% Grass cover, Poor, HSG D
0.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.31"
0.3	27	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	18	0.1800	8.61		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.1	116	0.0040	0.63		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
4.6	211	Total			

Subcatchment EA-1P: EA-1 PERV

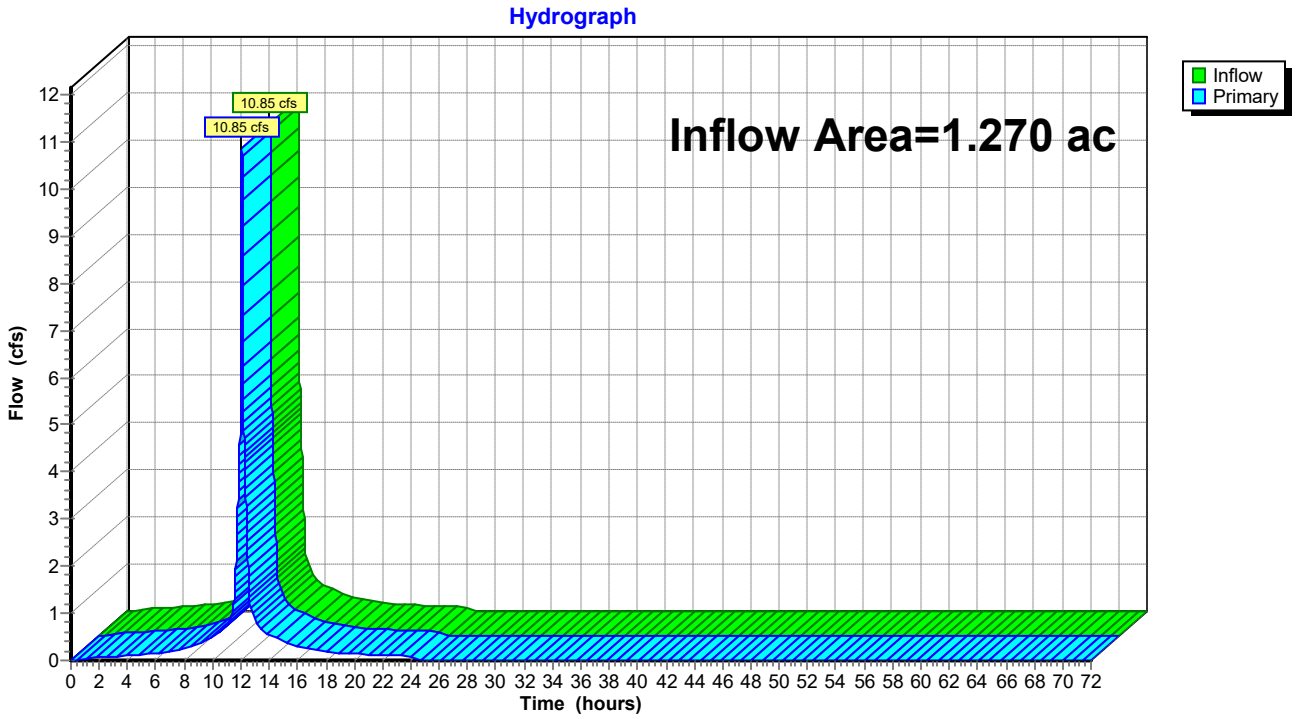


Summary for Pond EA-T: EA-Total

Inflow Area = 1.270 ac, 93.70% Impervious, Inflow Depth = 8.00" for 100-year event
Inflow = 10.85 cfs @ 12.06 hrs, Volume= 0.847 af
Primary = 10.85 cfs @ 12.06 hrs, Volume= 0.847 af, Atten= 0%, Lag= 0.0 min

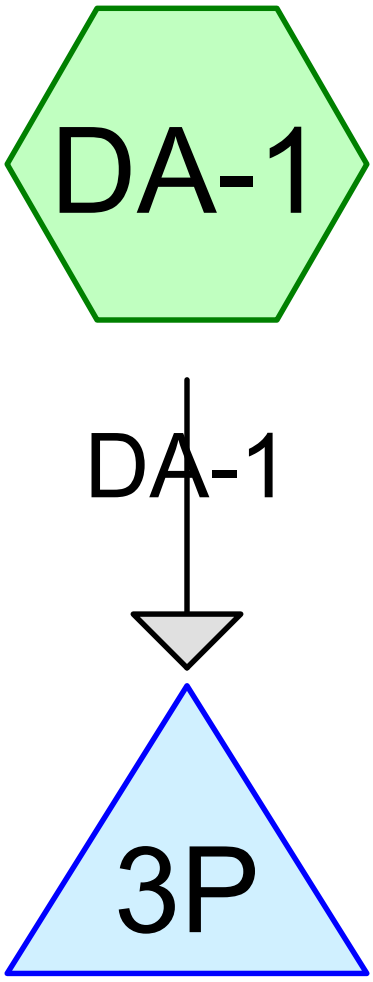
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Pond EA-T: EA-Total



APPENDIX C

POST-DEVELOPTMENT DRAINAGE ANALYSIS



Detention Tank

Subcat Reach Pond Link

Routing Diagram for Pre & Post-Developtment
Prepared by {enter your company name here}, Printed 9/16/2022
HydroCAD® 10.00-26 s/n 07360 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.270	98	Roofs, HSG A (DA-1)

Summary for Pond 3P: Detention Tank

Inflow Area = 1.270 ac,100.00% Impervious, Inflow Depth = 3.08" for 2-year event
Inflow = 3.58 cfs @ 12.13 hrs, Volume= 0.326 af
Outflow = 2.03 cfs @ 12.30 hrs, Volume= 0.326 af, Atten= 43%, Lag= 9.9 min
Primary = 2.03 cfs @ 12.30 hrs, Volume= 0.326 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2.22' @ 12.30 hrs Surf.Area= 0.023 ac Storage= 0.030 af

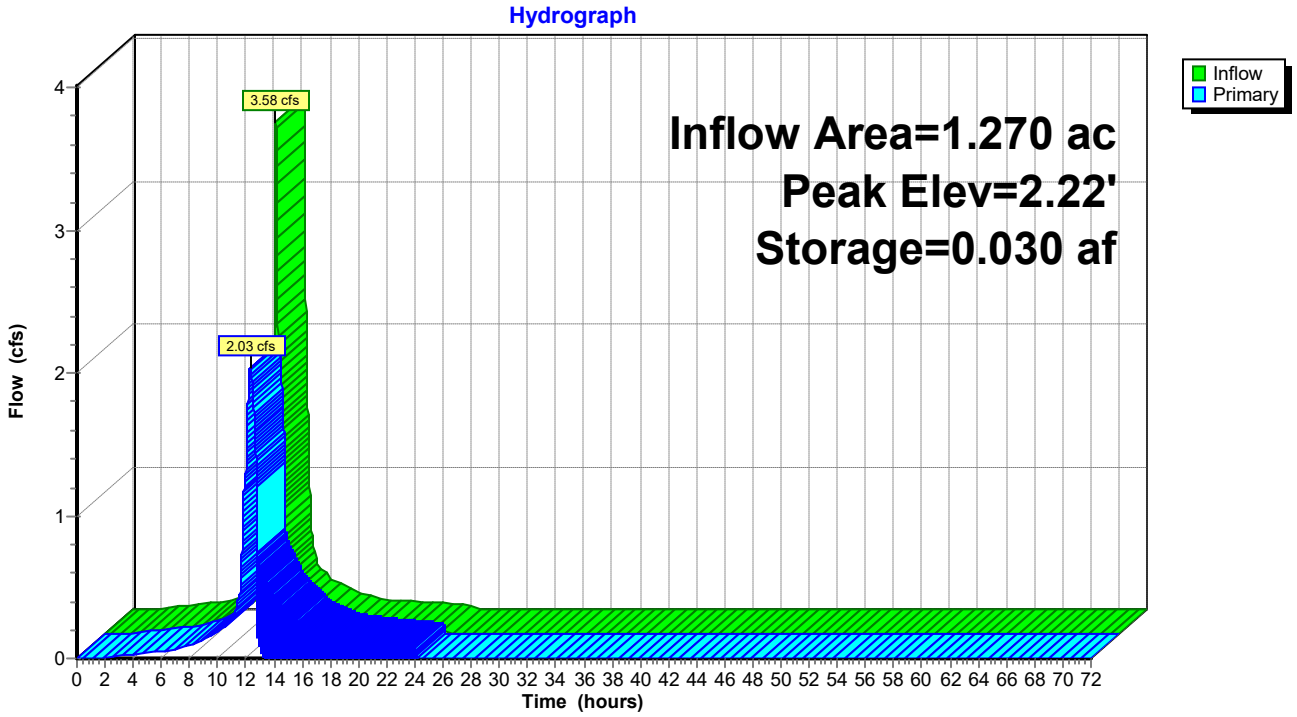
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 2.8 min (762.2 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.089 af	**RCP Box 10x4 @ 50.00' L** x 2 Inside= 120.0"W x 48.0"H => 38.61 sf x 50.00'L = 1,930.6 cf Outside= 140.0"W x 68.0"H => 66.11 sf x 50.00'L = 3,305.6 cf 2 Chambers in 2 Rows

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**24.0" Round Culvert** L= 37.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.00' / -0.37' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	0.00'	**14.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	2.50'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	3.50'	**4.0' long x 0.5' breadth Broad Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.03 cfs @ 12.30 hrs HW=2.22' (Free Discharge)
└**1=Culvert** (Passes 2.03 cfs of 15.86 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.03 cfs @ 6.97 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Broad Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Tank



Summary for Subcatchment DA-1: DA-1

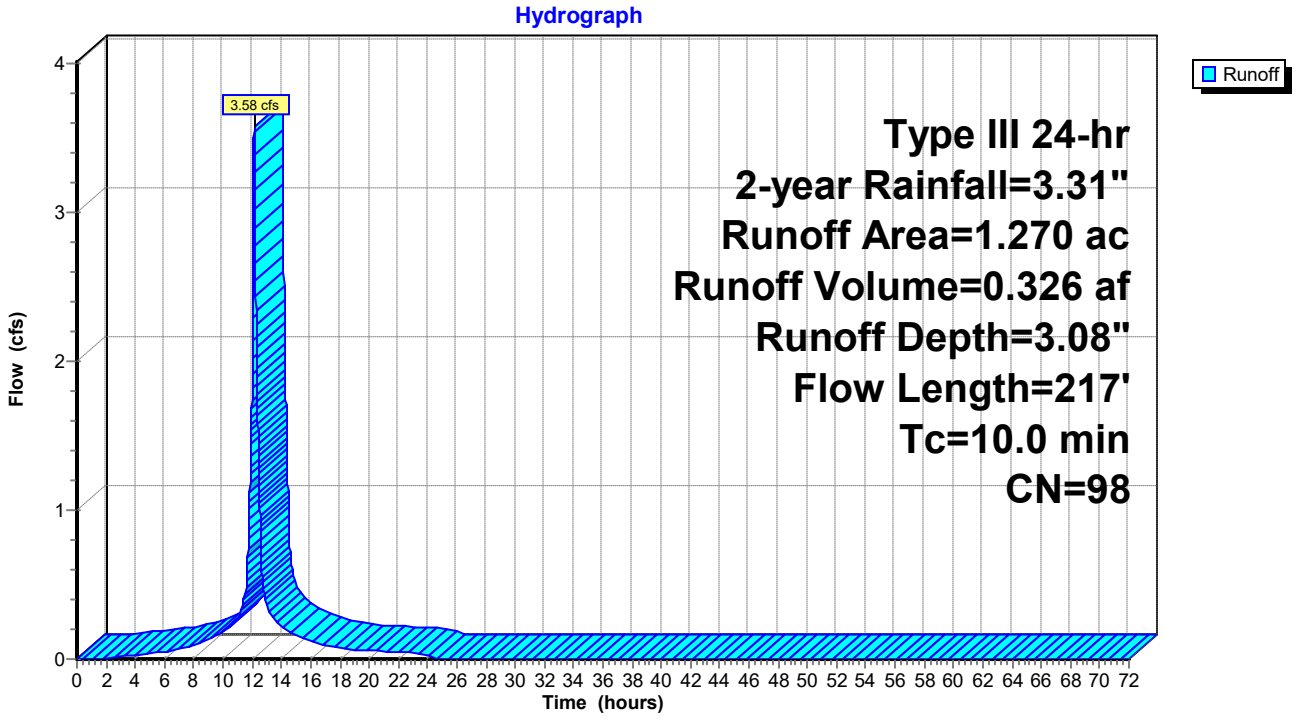
Runoff = 3.58 cfs @ 12.13 hrs, Volume= 0.326 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.31"

Area (ac)	CN	Description
1.270	98	Roofs, HSG A
1.270		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.31"
0.4	117	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.0	217	Total			

Subcatchment DA-1: DA-1



Summary for Pond 3P: Detention Tank

Inflow Area = 1.270 ac,100.00% Impervious, Inflow Depth = 4.78" for 10-year event
Inflow = 5.47 cfs @ 12.13 hrs, Volume= 0.506 af
Outflow = 4.50 cfs @ 12.21 hrs, Volume= 0.506 af, Atten= 18%, Lag= 4.4 min
Primary = 4.50 cfs @ 12.21 hrs, Volume= 0.506 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 2.98' @ 12.21 hrs Surf.Area= 0.023 ac Storage= 0.048 af

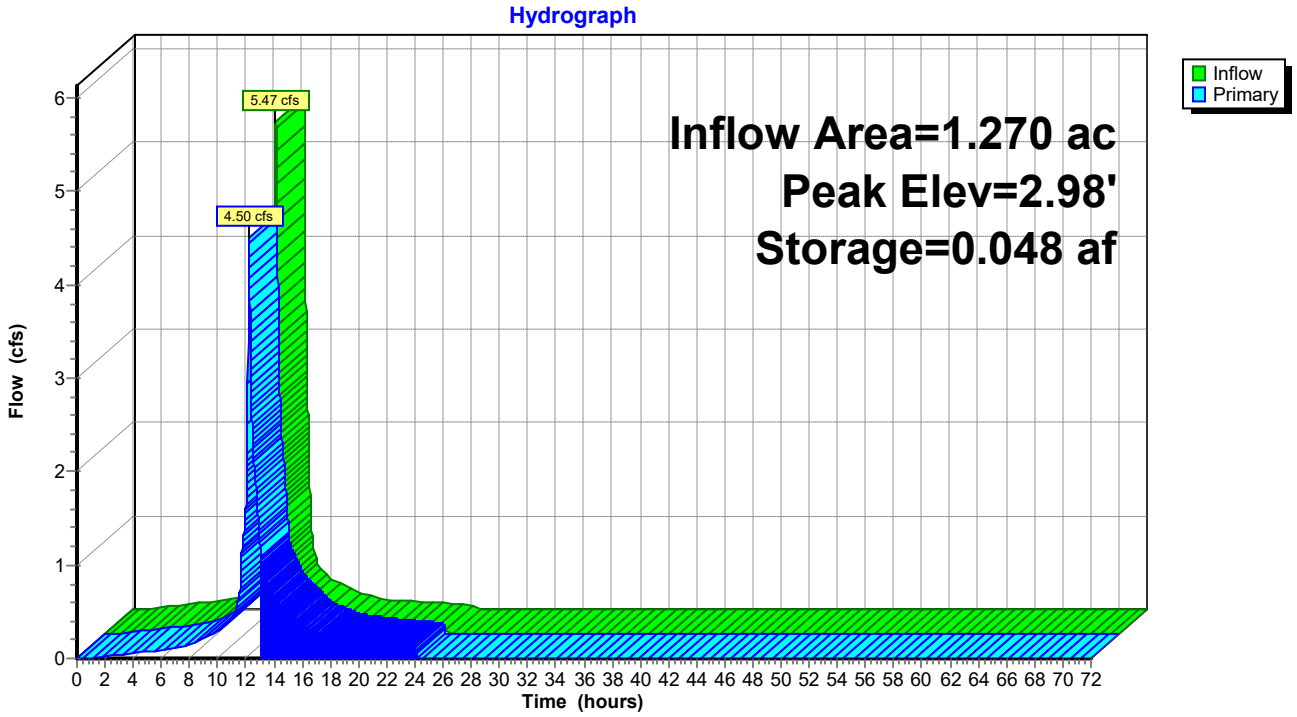
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.6 min (755.3 - 751.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.089 af	**RCP Box 10x4 @ 50.00' L** x 2 Inside= 120.0"W x 48.0"H => 38.61 sf x 50.00'L = 1,930.6 cf Outside= 140.0"W x 68.0"H => 66.11 sf x 50.00'L = 3,305.6 cf 2 Chambers in 2 Rows

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**24.0" Round Culvert** L= 37.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.00' / -0.37' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	0.00'	**14.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	2.50'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	3.50'	**4.0' long x 0.5' breadth Broad Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.50 cfs @ 12.21 hrs HW=2.98' (Free Discharge)
└**1=Culvert** (Passes 4.50 cfs of 20.90 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 2.37 cfs @ 8.13 fps)
  ├**3=Orifice/Grate** (Orifice Controls 2.12 cfs @ 2.22 fps)
  └**4=Broad Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Tank



Summary for Subcatchment DA-1: DA-1

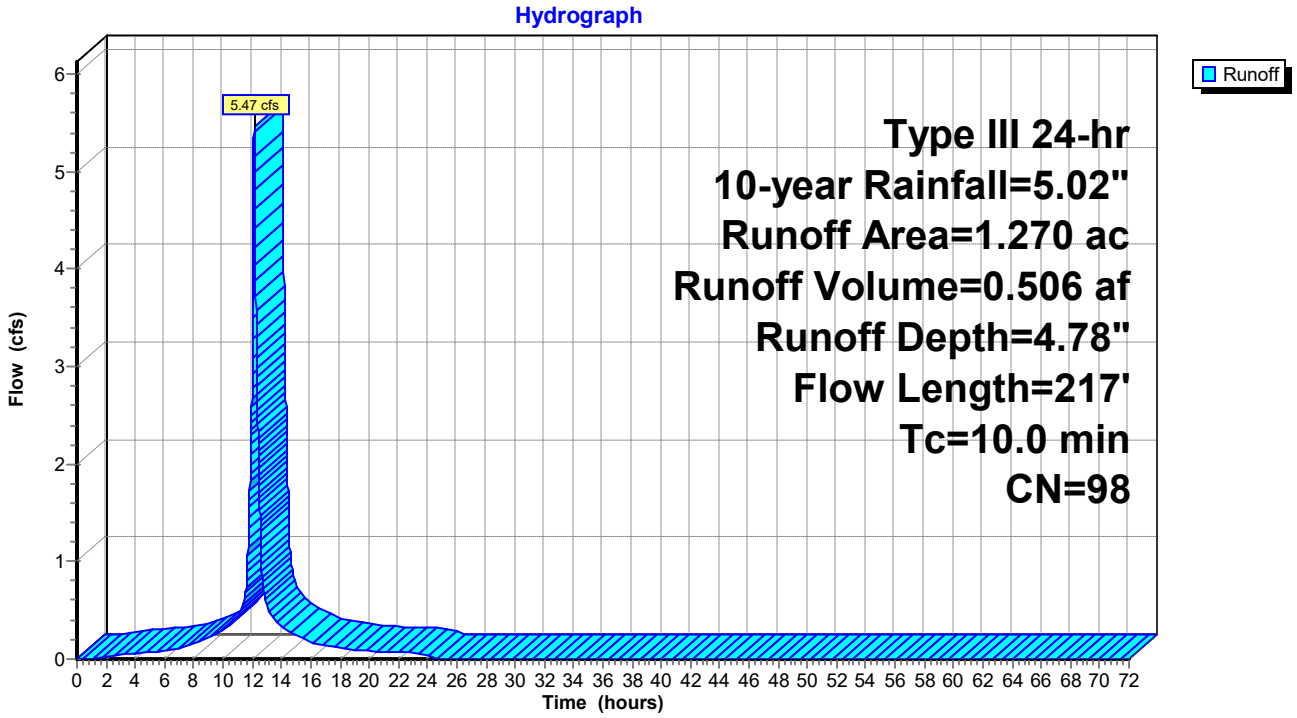
Runoff = 5.47 cfs @ 12.13 hrs, Volume= 0.506 af, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=5.02"

Area (ac)	CN	Description
1.270	98	Roofs, HSG A
1.270		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.31"
0.4	117	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.0	217	Total			

Subcatchment DA-1: DA-1



Summary for Pond 3P: Detention Tank

Inflow Area = 1.270 ac,100.00% Impervious, Inflow Depth = 8.07" for 100-year event
Inflow = 9.10 cfs @ 12.13 hrs, Volume= 0.854 af
Outflow = 8.54 cfs @ 12.17 hrs, Volume= 0.854 af, Atten= 6%, Lag= 2.3 min
Primary = 8.54 cfs @ 12.17 hrs, Volume= 0.854 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 3.72' @ 12.17 hrs Surf.Area= 0.023 ac Storage= 0.065 af

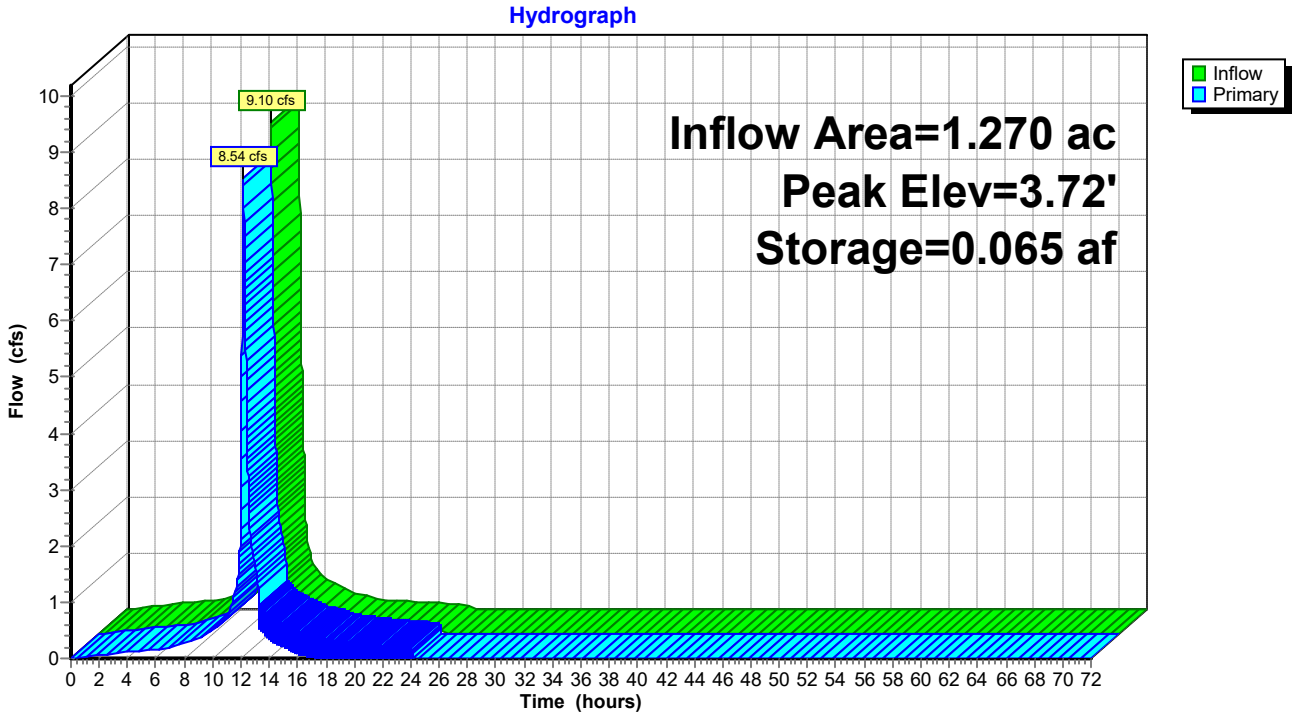
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.5 min (747.9 - 744.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.089 af	**RCP Box 10x4 @ 50.00' L** x 2 Inside= 120.0"W x 48.0"H => 38.61 sf x 50.00'L = 1,930.6 cf Outside= 140.0"W x 68.0"H => 66.11 sf x 50.00'L = 3,305.6 cf 2 Chambers in 2 Rows

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**24.0" Round Culvert** L= 37.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.00' / -0.37' S= 0.0100 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 3.14 sf
#2	Device 1	0.00'	**14.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600
#3	Device 1	2.50'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	3.50'	**4.0' long x 0.5' breadth Broad Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=8.52 cfs @ 12.17 hrs HW=3.72' (Free Discharge)
└─**1=Culvert** (Passes 8.52 cfs of 24.93 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 2.66 cfs @ 9.13 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 4.72 cfs @ 4.72 fps)
  └─**4=Broad Crested Rectangular Weir** (Weir Controls 1.14 cfs @ 1.31 fps)

Pond 3P: Detention Tank



Summary for Subcatchment DA-1: DA-1

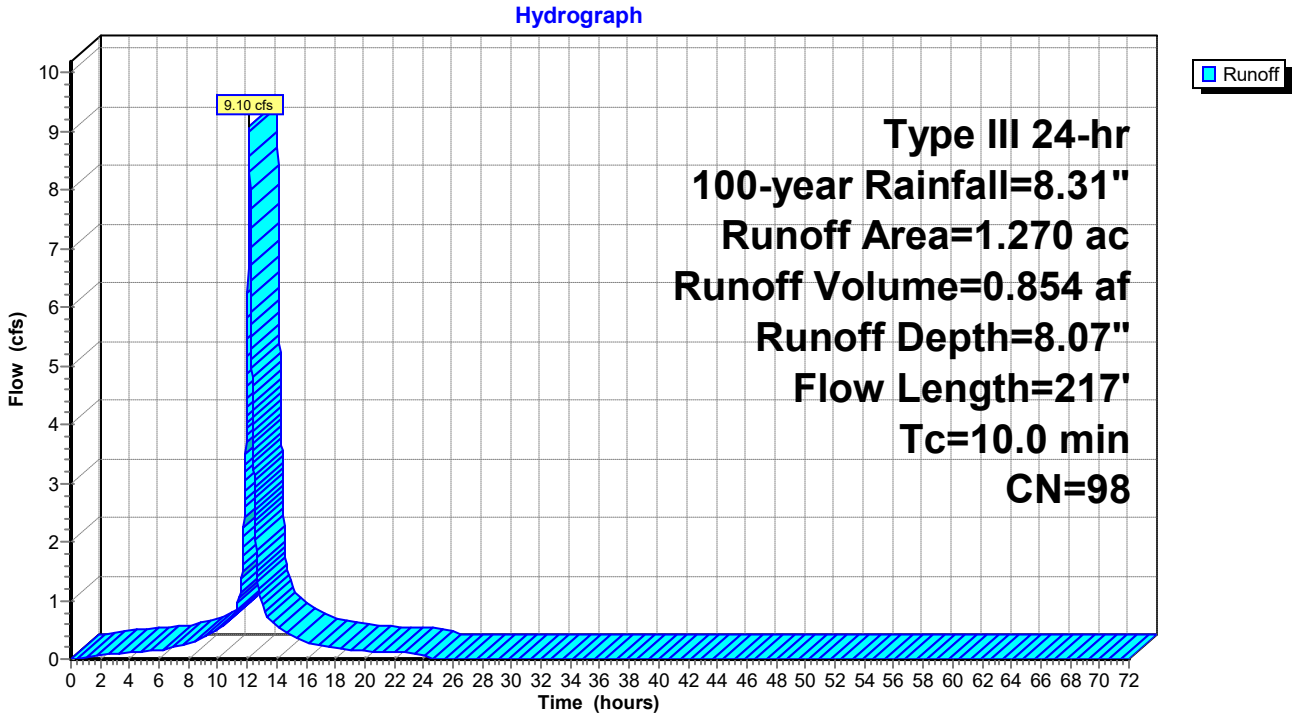
Runoff = 9.10 cfs @ 12.13 hrs, Volume= 0.854 af, Depth= 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=8.31"

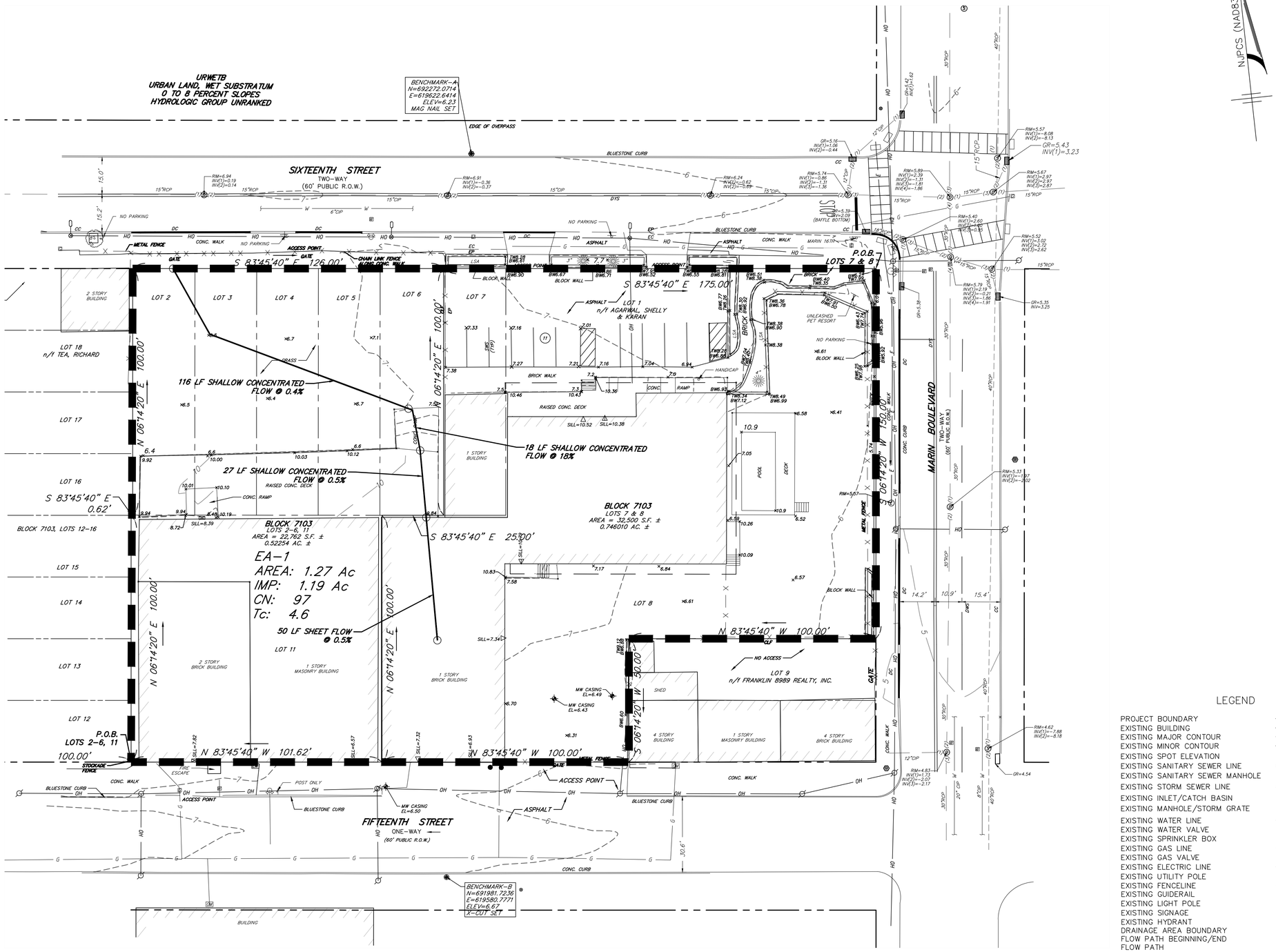
Area (ac)	CN	Description
1.270	98	Roofs, HSG A
1.270		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0200	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.31"
0.4	117	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
10.0	217	Total			

Subcatchment DA-1: DA-1



APPENDIX D
DRAINAGE MAPS



LEGEND

PROJECT BOUNDARY	
EXISTING BUILDING	
EXISTING MAJOR CONTOUR	
EXISTING MINOR CONTOUR	
EXISTING SPOT ELEVATION	x 57.6
EXISTING SANITARY SEWER LINE	
EXISTING SANITARY SEWER MANHOLE	S
EXISTING STORM SEWER LINE	
EXISTING INLET/CATCH BASIN	
EXISTING MANHOLE/STORM GRATE	D
EXISTING WATER LINE	W W W
EXISTING WATER VALVE	W
EXISTING SPRINKLER BOX	W
EXISTING GAS LINE	G G G
EXISTING GAS VALVE	G
EXISTING ELECTRIC LINE	E E E
EXISTING UTILITY POLE	
EXISTING FENCELINE	X X X
EXISTING GUIDERAIL	
EXISTING LIGHT POLE	
EXISTING SIGNAGE	
EXISTING HYDRANT	
DRAINAGE AREA BOUNDARY	
FLOW PATH BEGINNING/END	
FLOW PATH	

20 10 0 20 40 60
15 5
GRAPHIC SCALE
1 INCH = 20 FEET

DATE	REVISIONS	DRAWN BY	CHECKED BY

DRAWN BY: RPD
CHECKED BY: MJR
RELEASED BY: JM
DATE: 09/16/22
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: N/A
PROJECT No.: PRS-2201
DRAWING NAME: 99-MAPS.dwg

PRE-DEVELOPMENT DRAINAGE AREA MAP
619 MARVIN BOULEVARD
BLOCK 713
LOTS 2-8 & 11
SITUATED IN
CITY OF JERSEY CITY, HUDSON COUNTY, NEW JERSEY

McAtlantic
Engineering Partners LLC
Certificate of Authorization No. 24GA28184600
Louis L. Zwegner IV P.E. PE No. GE054256500
William J. Parisi II P.E. PE No. GE047538000
Gateway 195 Centre
5 Commerce Way, Suite 200
Hamilton, NJ 08691
609-910-4450

Sheet Number
1 OF 2

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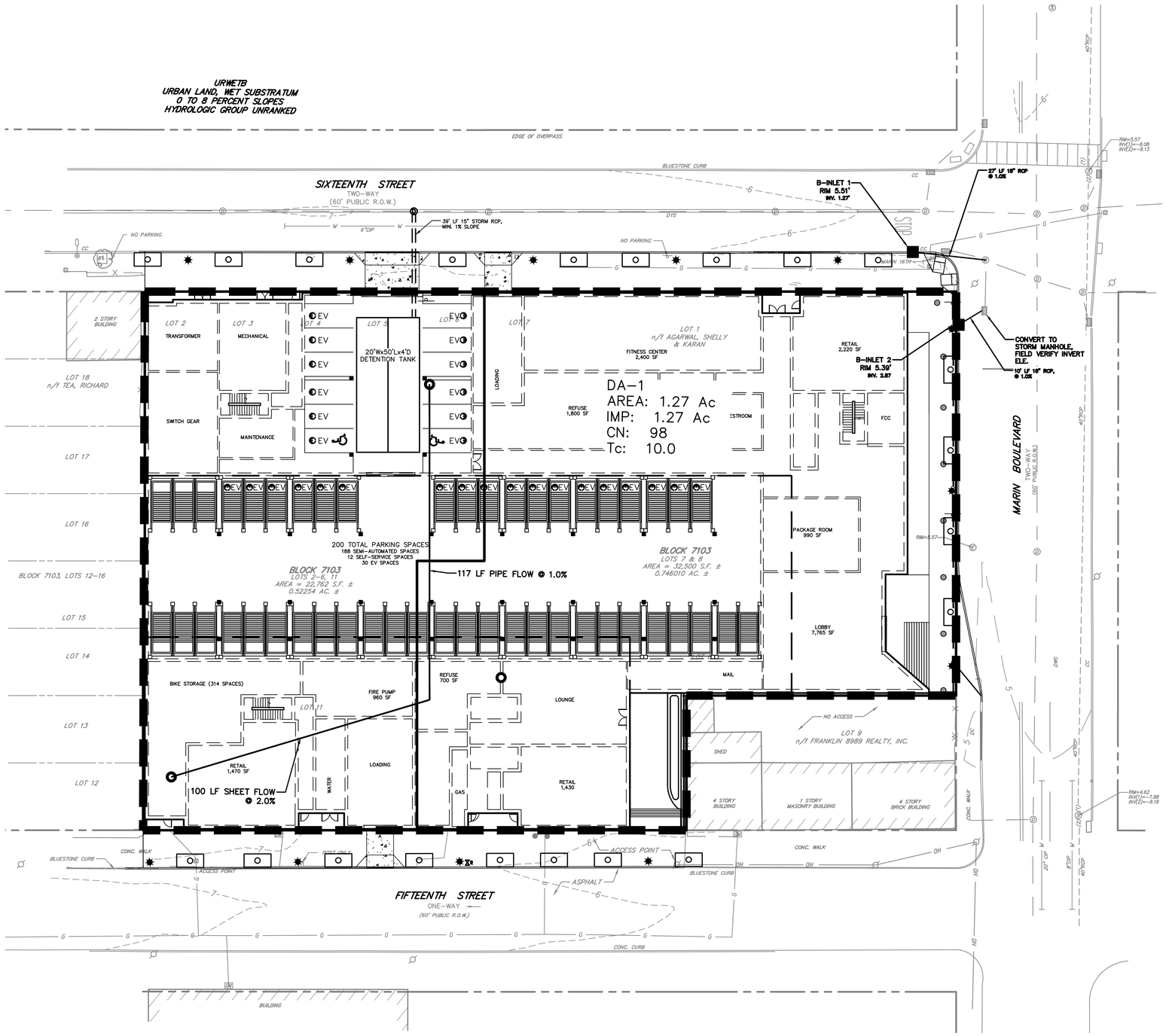
Plot Time: Sep 16, 2022 - 2:34pm



LEGEND

PROJECT BOUNDARY	
EXISTING BUILDING	
EXISTING MAJOR CONTOUR	
EXISTING MINOR CONTOUR	
EXISTING SPOT ELEVATION	x 57.6
EXISTING SANITARY SEWER LINE	
EXISTING SANITARY SEWER MANHOLE	(S)
EXISTING STORM SEWER LINE	
EXISTING INLET/CATCH BASIN	
EXISTING MANHOLE/STORM GRATE	(D)
EXISTING WATER LINE	
EXISTING WATER VALVE	
EXISTING SPRINKLER BOX	(S)
EXISTING GAS LINE	
EXISTING GAS VALVE	
EXISTING ELECTRIC LINE	
EXISTING UTILITY POLE	
EXISTING FENCELINE	
EXISTING GUIDERAIL	
EXISTING LIGHT POLE	
EXISTING SIGNAGE	
EXISTING HYDRANT	
DRAINAGE AREA BOUNDARY	
FLOW PATH BEGINNING/END	
FLOW PATH	

20 10 0 20 40 60
15 5

GRAPHIC SCALE
1 INCH = 20 FEET

					CHECKED BY
					DRAWN BY
				REVISIONS	
				DATE	

DRAWN BY: RPD
CHECKED BY: MJR
RELEASED BY: JM
DATE: 09/XX/22
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: N/A
PROJECT No.: PRS-2201
DRAWING NAME: 99-MAPS.dwg

PRE-DEVELOPMENT DRAINAGE AREA MAP
619 MARVIN BOULEVARD
BLOCK 713
LOTS 2-8 & 11
SITUATED IN
CITY OF JERSEY CITY, HUDSON COUNTY, NEW JERSEY

Mid-Atlantic Engineering Partners, LLC
Galloway 195 Centre
5 Commerce Way, Suite 200
Galloway, NJ 08205
609-910-4450
Certificate of Authorization No. 24GA28184000
PE No. GE04026500
PE No. GE04733800
Louis L. Zeugner IV P.E.
William J. Parkhill II P.E.

Sheet Number
1 OF 2

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Plot Time: Sep 16, 2022 - 8:19am

APPENDIX E

SANITARY CONSTRUCTION ESTIMATE REPORT

MidAtlantic
Engineering Partners

Cost Estimate of Sanitary Sewer Improvements

619 Marin Boulevard - Block 7103, Lots 2-8 & 11

City of Jersey City, Hudson County, New Jersey

Job Number: PRS-2201 **Date: 09/16/22**

Ref.	Description	Units	Qty.	Cost	Total
	8" PVC SDR - 35 (0'-8')	L.F.	34	$44.00	$ 1,496.00
	Deep Main Connection	Unit	1	$300.00	$ 300.00
	Trenching and Pavement Repair	L.S.	1	$2,000.00	$ 2,000.00

Sub-Total	$3,796.00
Contingencies (10%)	$379.60
Inspection Fees (10%)	$379.60
As-Built Drawings (2%)	$75.92
Total	**$4,631.12**

Gateway 195 Centre ♦ 5 Commerce Way - Suite 200 ♦ Hamilton, NJ 08691
Phone: 609.910.4450 ♦ Web: www.midatlanticeng.com

APPENDIX F

SANITARY SEWER SPECIFICATIONS

1.0 MATERIALS

1.1 Concrete:

Concrete shall consist of Portland Cement, washed sand and coarse aggregate, and shall be mixed in such proportions to yield a minimum compressive strength of 4,500 pounds per square inch (Class B) at 28-days.

1.2 Non-Shrink Mortar:

All non-shrink mortar caulking to be used for pipe joints and manhole walls as indicated on the drawings or as specified herein, shall consist of Master Builder's Embeco mortar or equal. Premixed, ready-to-use, non-shrink metallic mortar shall be applied to counter-act drying shrinkage and develop high bond strength.
The mortar will be used in strict compliance with the manufacturer's directions applicable thereto. Mortar shall contain Type II Portland Cement which is waste water resistant.

1.3 Concrete Block and Manholes:

Concrete blocks to be used in the construction of manholes shall be manufactured in accordance with New Jersey State Highway Department Standard
Specifications

1.4 Manhole Castings:

Manhole castings shall be cast iron of the dimensions shown on the drawings, and shall be free from imperfections and thoroughly cleaned. All inequalities and/or projections on the cover or frame surfaces shall be removed to allow a close fit between the cover and frame, without jamming.

1.5 Ladder Rungs:

Ladder rungs shall be solid aluminum and must meet the requirements of ASTM C-478 specifications. All embedded portions of aluminum shall be coated with alumastic paint or approved equal.

1.6 Sewer Pipe:

Pipe for sewers shall be SDR-35 polyvinyl chloride (PVC) pipe with bell and spigot ends of the size shown on the drawings. O-ring rubber gasketed joints as specified herein and plastic pipe and fittings shall conform to ASTM D-1785. The plastic material from which the pipe and fittings are extruded shall be high impact types of PVC, unplastized having high mechanical strength and maximum chemical resistance, conforming to ASTM D 2466, latest edition. Pipe shall be free from defects, bubbles and other imperfections in accordance with accepted commercial practice. The adequacy of the gasketed joint shall be demonstrated, if required, by a test at the manufacturing plant in accordance with ASTM D 2444 for impact and ASTM D 2412 for deflection and pipe stiffness. Joints for SDR35 PVC shall be of a material suitable for transporting domestic and industrial wastes.

Stubs and fittings for sewer pipe shall be SDR 35 PVC sewer pipe fittings and shall have the same type joints as the SDR 35 PVC sewer pipe herein above specified.

1.7 Backfill Materials:

All backfill material must be imported and meet New Jersey Residential Direct Contact soil criteria. Fabric liners or approved equal are to be installed in all excavations and trenches and shall remain in place to minimize soil contact. Backfill materials around the sides of the pipe and over the top of the pipe for a distance of at least 8 inches should consist of approved fill and compacted by hand. All backfill material shall be free of stumps, brush, weeds, roots, rubbish, wood, and other materials that may decay. Above this level, controlled compacted fill should be placed to attain the final design grades.

Imported fill material required to complete the backfill operations should consist of relatively well-graded granular soils containing less than 15% by weight passing a U.S. standard No. 200 sieve and having a maximum particle size of 3inches. All backfill should be placed in layers on the order of 8-inches in loose thickness and uniformly compacted using vibratory compaction equipment to at least 92% of its maximum dry density as determined by the ASTM D-1557 test procedure. In addition, the upper 3 feet of backfill below roadways, sidewalks, and other structural areas should be compacted with a heavy vibrating drum compactor to at least 95% of its maximum dry density as determined by the ASTM D-1557 test procedure.

1.8 Pipe Foundation Material

An 8-inch thick layer of ¾ inch clean stone shall be placed below the proposed sanitary sewer piping up to the spring line to provide a uniform bed for support.

1.9 Road Materials:

Road materials shall be in accordance with the construction drawings.

1.10 Precast Manholes:

Precast manholes shall be of the sizes and details shown on the plan conforming to the requirements of ASTM Designation C 478.

1.11 Shop Drawings:

Shop drawings, material specifications and catalogue information for all pipe, manholes, materials, and appurtenances must be submitted to the Engineer for review and approval prior to purchase or delivery of any items for installation. The Engineer reserves the right to reject any items not meeting the requirements of the specifications and construction drawings.

2.0 CONSTRUCTION

2.1 Piling of Materials:

All materials shall be neatly piled, and the excavated material shall be banked on one side of the trench and stabilized to leave a clear footway of two-feet between the bank and the trench to create as little inconvenience to owners of neighboring properties and to the public as possible. Gutters, driveways and street crossings must be kept clear, except when the latter are unavoidably obstructed by the open trench.

2.2 Precautions:

All excavations, embankments, materials, rubbish, and heaps of other obstacles incident to the work must be enclosed with barricades and well-lit to prevent accidents. Special precautions must be taken to secure buildings and property

near the excavation. All ordinances relating to such precautions and safeguards must be faithfully observed by the Contractor, as he shall be held personally amenable for any disregard or violation of them by his employees or agent.

2.3 Excavation - Trench:

No trench excavation shall be started until all materials and equipment necessary to complete the sewer main, house connections, manholes, etc., are on the job site and ready for installation and operation, including, among other items, sewer pipe, branches, tees, plugs, manholes, blocks, castings, steps, pumps, cranes, mechanical tampers, etc. The Contractor shall also satisfy the Engineer that he has made arrangements for acquiring road gravel and bituminous patch material and that it will be delivered as soon as required.

The Contractor shall do all excavation of whatever substances encountered to the depth shown on the drawings. Excavated material shall be placed and leveled where directed by the Engineer and not used for backfill. Only imported fill material meeting the requirements noted in Section 1.7 above may be used. No excavated material shall be removed from the site.

Excavation for manholes and other accessories shall have 12-inch minimum and 24-inch maximum clearance on all sides. Ground adjacent to all excavations shall be graded to prevent water running in.

Trenches for house connections shall not be opened on both sides of the street at the same time unless permission is granted by the Engineer to close the street. The interior to the sewer and house connections shall be carefully freed from all dirt, cement or foreign material of every description as the work progresses. Pipe shall be thoroughly flushed at the completion of the work of laying and jointing. All connections or stubs which are for future use shall be properly capped, with a fitting manufactured for this purpose.

No trench shall be opened more than 100 feet in advance of the completed sewer, and not more than 50-feet shall be left uncovered in the rear of same without the written consent of the Engineer. Trenches shall be excavated to the depths required for the foundations of the sewers and appurtenances shown on the drawings.

The sewers must be laid and all appurtenances constructed to conform to the lines and grades as indicated by stakes or other points set by the Contractor. The Contractor shall furnish all necessary materials such as stakes, spikes and other items to transfer and maintain the points set.

2.4 Preparation of Trenches

Trenches will at first be excavated only to a depth of 4-inches above the final grade, the remaining earth being taken out and the bottom of the trench dressed to fit the grade of the pipe to be laid therein, not more than 10 feet in advance of the pipe laying. If soil conditions warrant fabric liners (at discretion of project engineers), fabric liners or approved equal should be installed in the trench and shall remain in place to minimize soil contact. The Contractor shall then install a pipe foundation of broken stone 8-inches in depth for the full width of the trench. The top of the foundation shall be dressed to form a bed for the pipe and bells. The trench then will be backfilled with stone to the spring line of the pipe and the approved backfill material above. Fabric liners shall be non-woven geotextile such as Geotex 401 by Propex, or approved equal.

2.5 Plugging of Laterals:

All abandon laterals serving the subject property shall be permanently abandoned at the sewer main. Lateral connections to the existing main can be excavated and the main repaired or can be plugged with the use of short liners, to the satisfaction of the engineer.

2.6 Laying of Pipe:

All pipes must be laid in a straight grade between manholes and shall be graded by measurements from an overhead grade line or other system approved by the Engineer set parallel to the grade of the sewer by direction of the Engineer.

All sheathing and bracing which may not be left in place under the foregoing pro-visions of the agreement shall be removed in such manner as not to endanger the constructed sewer or other structures, utilities or property whether public or private.

2.7 Inspection of Pipe Laying:

The pipe laying, brick laying and the first two feet of backfill shall be under the special supervision of the Engineer or his Inspector, and whenever any work of this character is done in the absence of the Engineer or Inspector, they shall have the right to cause it to be reconstructed and re-laid, or uncovered and refilled, as the case may be, at the Contractor’s expense.

2.8 Sheathing and Shoring:

Sheathing and shoring shall be used to support the sides of the trench wherever, in the opinion of the Engineer, it is necessary. Said sheathing shall be removed as the work of backfilling progresses, except as herein provided.

The Contractor shall furnish, implement and maintain such sheathing, bracing, etc. as may be required to support the sides and roof of the excavation and to prevent any movement which can in any way injure the masonry; diminish the necessary width of the excavation; or otherwise injure or delay the work or endanger adjacent buildings or other structures. If the Engineer is of the opinion that any point is insufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor; furthermore, the compliance with such orders shall not release the Contractor from his responsibility for the sufficiency of such support.

The Contractor shall leave in place to be embedded in the backfill of the trench all sheathing, bracing, etc., which the Engineer may direct in writing, to be left in place. The Engineer may direct termination of timber used for sheathing and bracing in trenches as specified elevations.

For the purpose of preventing injury to persons, corporations or property, whether public or private, the liability for damages on account is to be assumed entirely and solely by the Contractor under his contract. The Contractor may also leave in place to be embedded in the backfill of the trench, any and all sheathing, bracing, etc., in addition to that ordered in writing by the Engineer to be left in place, except that no sheathing and bracing which is within four (4) feet of the surface of the street may be left in place in the trench without written permission of the Engineer.

The right of the Engineer to order sheathing and bracing left in place shall not be construed as creating any obligation on his part to issue such orders. His failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from, or work of constructing the sewer occasioned by, negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheathing and bracing to prevent any caving or moving of the ground adjacent to the banks of the trench.

2.9 Care of Water, Gas and Other Pipes:

In digging near water pipes, gas or drain pipes, house connections, or service pipes, workmen must exercise special care to provide proper timber or chain

supports. The cost of such work and the repairs made necessary by injury to said pipes shall be paid for by the Contractor. Where such pipes or conduits form an obstruction to the line and grade of the sewer, the Contractor shall, at his own cost and in the manner prescribed by the Engineer, make such removals, alternations or rearrangements as may be required by said Engineer.

The location of utilities is shown on the drawings in their approximate location from information supplied by the utility companies to the Engineer. The Contractor is required to investigate and inspect the site of the work including calling for underground utility markouts as required by law and include the cost of doing the things specified herein in the price bid for pipe laid.

2.10 Joints:

All joints in sewer pipe shall be made in accordance with the instruction of the manufacturers of the pipe as hereinabove specified.

2.11 Pumping Ground Water:

The Contractor shall at his expense provide machinery, underdrains, and any equipment necessary to remove ground water from all excavation. No payment will be made for removing ground water as the cost thereof is to be included in the price bid for pipe laying. All sewerage improvements shall be installed in a dry trench which must remain dry until backfilling has been completed.

2.12 Backfilling

Backfill materials around the sides of the pipe and over the top of the pipe for a distance of at least 8 inches should consist of approved imported fill meeting New Jersey Residential Direct Contact soil criteria and compacted by hand. All backfill material shall be free of stumps, brush, weeds, roots, rubbish, wood, and other materials that may decay. Above this level, controlled compacted fill should be placed to attain the final design grades.

The imported fill material required to complete the backfill operations should consist of relatively well-graded granular soils containing less than 15% by weight passing a U.S. standard No. 200 sieve and having a maximum particle size of 3-inches. All backfill should be placed in layers on the order of 8-inches in loose thickness and uniformly compacted using vibratory compaction equipment to at least 92% of its maximum dry density as determined by the ASTM D-1557 test procedure. In addition, the upper 3 feet of backfill below roadways, sidewalks, and other structural areas should be compacted with a

heavy vibrating drum compactor to at least 95% of its maximum dry density as determined by the ASTM D-1557 test procedure.

2.13 Manholes:

Precast manholes shall be installed along the sewer line where shown on the drawings, and at such other places as directed by the Engineer. The manholes shall correspond to the detail shown on the drawings. All manholes shall be water-tight and shall be founded on a minimum of 12-inch thick ¾" crushed stone modified crushed stone as indicated on the drawings. Invert channels shall be smooth, accurately shaped and in accordance with the drawings. Manholes shall be constructed as the pipe laying progresses and completed promptly.

2.14 Branches:

All branches and other fittings shall be laid and jointed in the same manner as prescribed for straight pipes, and in laying wye branches the invert of the branch shall be slightly above the horizontal diameter of the connecting pipes. In all sewers where the depth of sewer does not exceed 10-feet, wye branches shall be installed at locations designated by the Engineer.

Where the depth of the sewer exceeds 10 feet, riser pipes for house connections shall be installed at all locations designated by the Engineer by inserting a tee in the main sewer connected to a riser pipe extending to a height as shown on the plan. A tee shall be installed at the upper end of the riser pipe with a cement pipe plug or clay pipe plug closing the upper end of the tee.

2.15 Building Connections:

Building connections shall be constructed from the branch connection to the location shown on the drawings or as directed by the Engineer. The ends of all building connections must be closed with a PVC cap or a "tear out" aluminum stopper.

2.16 Quality Control:

Test for watertightness shall be made by the Contractor in the presence of the Engineer. Under exterior normal ground water pressures, sewer connections and appurtenances shall not leak in excess of 100 gallons per inch of pipe diameter per mile of sewer per day. The tests and the measurement of infiltration shall be conducted in the presence of the Engineer in a manner approved by the Engineer. As the work on the sanitary sewer progresses, each

line shall be tested from manhole to manhole for leakage and alignment, by the Contractor providing the necessary watertight plugs.

Where the groundwater is 18-inches or more above the top of the pipe, the Contractor shall perform infiltration tests. As detailed above, the conduit, connections, and appurtenances shall not leak under exterior groundwater pressure in excess of a rate of 100 gallons per inch of pipe diameter per mile of sewer per day. The tests and the measure of infiltration shall be conducted in a manner approved by the Engineer.

Where the groundwater level is less than 18 inches above the top of pipe, the Contractor shall perform exfiltration tests as directed by the engineer:

Infiltration Test:

Upon completion of the sewer and manholes, and other appurtenances, the Contractor shall dewater the sewer and conduct a satisfactory test to measure infiltration for at least 24-hours. The contractor shall construct such weirs or means of measurement as required to enable proper infiltration testing. The rate of infiltration shall not exceed 100 gallons per mile of sewer per 24 hours per inch diameter of sewer. There shall be no gushing or spurting streams entering the sewer. The Contractor shall be held responsible for the satisfactory watertightness of the line and shall affect repairs to ensure same and then shall make additional tests of the infiltration until same conforms to the requirements given herein.

The tests shall be conducted on lengths of sewers of not to exceed 2,000 linear feet, unless otherwise determined by the Engineer. The rate of infiltration for each section shall not exceed the unit rates given above. In the event that the groundwater level is lower than the top of the pipe, an exfiltration test shall be substituted for the infiltration test. It is the Contractor's responsibility to determine the groundwater elevations at the time of testing. Same can be accomplished by means of sight tubes within the manhole. The exfiltration test shall be conducted between manholes. The pipe shall be filled with clean water and additional water introduced to raise the level two feet above the top of the pipe in the upstream manhole. The Contractor shall furnish all water required for exfiltration tests. The quantity of water to maintain this level is to be measured. The test shall be maintained for a 4-hour period. The rate of exfiltration shall not exceed 100 gallons per inch of pipe diameter per mile of sewer per twenty-four hours. The Contractor shall be held responsible for the satisfactory watertightness of the line and shall satisfactorily repair all joints or other parts not sufficiently watertight, and then shall make additional tests of the exfiltration, until the exfiltration conforms to the requirement given herein.

Water Exfiltration Test:

The pipe shall be filled with water, provided by the Contractor, to a depth of 18inches above the top of the pipe at the highest point of the line being tested. The water level in the upstream manhole shall be carefully monitored. Measured amounts of water shall be added during the period of the test to maintain water level. The test shall be conducted in a manner approved by the Engineer, and the sewer, connections, and appurtenances shall not leak under such conditions in excess of the amount of specified for infiltration tests.

Low Pressure Pneumatic Test:

The test shall be performed between manholes and subsequent to completion of backfill but prior to replacement of pavement. The following procedure shall be implemented as a method of test:

2.17 Foundation Under Pipe:

As indicated on the drawings, the Contractor shall excavate below the bottom of the proposed pipe and install the pipe on a bed of broken stone a minimum of 8inch thick with stone up to the spring line of the pipe.

2.18 Removal and Restoration of Existing Surface:

Where the Contractor removes, destroys or damages existing surfaces, paved or unpaved, they shall be returned to a condition similar to that found at the beginning of the work in accordance with the drawings.

Upon completion of the work, the Contractor shall replace all fences, curbs, gutters, sidewalks, driveways, and all other items disturbed by his operations. Concrete surface such as driveways, curbs and walks shall be replaced with new concrete and the said replacement shall extend from joint to joint in the original work.

APPENDIX G

WATER IMPROVEMENT CONSTRUCTION ESTIMATE REPORT

MidAtlantic
Engineering Partners

Cost Estimate of Water Improvements

619 Marin Boulevard - Block 7103, Lots 2-8 & 11

City of Jersey City, Hudson County, New Jersey

Job Number: PRS-2201 **Date: 09/16/22**

Ref.	Description	Units	Qty.	Cost	Total
	6" DIP Class 52	L.F.	592	$30.00	$ 17,760.00
	Water valve	Unit	4	$80.00	$ 320.00
	8" x 6" Tee	Unit	1	$150.00	$ 150.00
	20" x 6" Tee	Unit	1	$400.00	$ 400.00
	Hydrant Relocation	L.S.	2	$1,560.00	$ 3,120.00

Sub-Total	$21,750.00
Contingencies (10%)	$2,175.00
Inspection Fees (10%)	$2,175.00
As-Built Drawings (2%)	$435.00
Total	**$26,535.00**

Gateway 195 Centre ♦ 5 Commerce Way - Suite 200 ♦ Hamilton, NJ 08691
Phone: 609.910.4450 ♦ Web: www.midatlanticeng.com

APPENDIX H

WATER SERVICE SPECIFICATIONS

TECHNICAL SPECIFICATIONS

1.0 MATERIALS

1.01 Pipe and Fittings

Pipe material to be used in construction of water mains shall be Class 53, cement lined ductile iron pipe manufactured in accordance with ANSI A21.5 AWWA C151 and installed in accordance with manufacturer's recommendation.

Ductile iron pipe shall be centrifugally cast in metal or sand molds in accordance with the latest ANSI Specification A21.51(AWWA C-101), thickness Class 53, unless otherwise required. The joint shall conform with the requirements of ANSI A.21.11 (AWWA C-111) and shall be of a type that employs a single elongated grooved gasket to effect a joint seal, such as United States Cast Iron Pipe Company's "Tyton" joint, James B. Clow and Sons, Inc. "Bell-tite" or approved equal.

The outside of all pipe and fittings shall be coated with a uniform thickness of a bituminous coating and the inside of the pipe shall be lined with a double thickness of cement mortar and bituminous seal in accordance with the American Standard Specifications for cement mortar lining for cast iron pipe fittings, ANSI A21.4 (AWWA C-104).

All fittings shall be ductile iron Class 350, suitable for use with DIP and conforming to ANSI A21.10 (AWWA C-110). Fittings shall be mechanical joint; end plugs shall be set screw type.

1.02 Gate Valves

Gate valves shall be AWWA non-rising stem type with valve box, M&H metropolitan mechanical joint gate valves as manufactured by Dresser Company or approved equal, conforming to the latest AWWA Standard for Gate Valves - 3 in. through 48 in. - for Water and Other Liquids, AWWA Designation C-500. Sizes up to and including 12" shall be 200 p.s.i. working pressure; 16" shall be 150 p.s.i. working pressure with bypass provisions. The valves must have "O" ring seals, inside screw and parallel seats and be so constructed that they will give an unobstructed passage of at least the full pipe area. They shall be perfectly tight when closed. The ends of the valves shall correspond in type and dimension with those of the pipe. All valves shall be arranged to open in clockwise (open right) direction unless otherwise indicated on the Plans and operating nuts shall be 2" square. The valves shall be tested to a pressure of not less than 400 lbs. per

square inch. All valves shall be 100% solid heat cure epoxy coated and holiday free within the waterway and shall be suitable for locations intended.

1.03 Service Loop

A house service connection shall be comprised of a corporation stop at the main, a curb stop located two feet (2') on the street side of the property line, and an inside compression stop; in that order.

House service connection pipe shall be not less than 4' deep and a minimum of 3/4" in diameter, Type K copper.

1.04 Tapping Sleeves & Valves

Tapping sleeves shall be ductile iron or cast iron dual compression type and extra heavy pattern of the sizes suitable for use on the pipe on which the respective sleeve is to be installed and for use with the tapping valves. They shall be designed for a working pressure of 200 p.s.i. and the same manufacturer as the tapping valves. Cast iron tapping sleeves shall be as manufactured by Mueller Company or an approved equal.

Tapping valves shall conform to the applicable requirements of AWWA C507. Tapping valves shall have flanged inlet with mechanical joint outlets, enclosed bevel gears, bypass valve, rollers, tracks and scrapers.

Installation of the tapping sleeves, tapping saddle, and tapping valve is to be in accordance with the manufacturers instructions. The tapping procedure is to be in accordance with the tapping machine manufacturer's instructions. After installation of the tapping sleeve and valve assembly but prior to making the tap the assembly shall be pressure tested hydrostatically to the test pressure specified in Section 3.07 with no allowable pressure prop.

1.05 Valve Boxes

Valve boxes shall be Fort Lee standard as manufactured by Bingham and Taylor, or approved equal. Boxes shall have a minimum of 5-1/4 inch diameter and shall be an adjustable screw type with the box extending from the surface to three (3") inches above the valve bonnet base. Valve box shall be cast iron with a standard coal tar foundry dip with cast iron water drop cover and the word "water" cast in cover. Valve box cover shall be installed flush with the existing grade elevation.

1.06 Broken Stone

Unless otherwise approved by the engineer, broken stone shall be installed as bedding for all piping, valves and hydrants. Broken stone shall be nominal 3/4" size and shall be installed a minimum or 6" thick under ductile iron piping and minimum to spring line of polyvinyl chloride pipe.

1.07 Backfill Material

Material for backfill may consist of run of the bank sand and gravel containing not more than two percent (2%) elutriable clay.

1.08 Road Material

1.08.1 Stone and Gravel

Stone for base course shall conform to New Jersey Department of Transportation Standards for Broken Stone and be of the size known commercially as 1-1/2" Quarry Blend, of which 100% shall pass a 2-1/4" screen with round openings. Not less than 20% nor more than 30% shall pass a #4 sieve, and not more than 10% shall pass #200 sieve.

Gravel for base course shall be placed at the grade and contour shown on the plan. Gravel shall be Type 2, Class A or Class B.

1.08.2 Bituminous Concrete

For temporary surfacing, the commercial mixtures of Bituminous Concrete known as Cold Patch may be used only as approved by Engineer. The final surfacing shall be done with Bituminous concrete Type FABC, mixed in accordance with applicable standards of the New Jersey Department of Transportation.

1.08.3 Concrete

Concrete for gutter, curb, sidewalk, and drives shall have a 28 day strength of 4,500 psi, shall match the color of the existing concrete as nearly as possible and shall be finished so that the surface texture matches the original.

1.09 Polyethylene Encasement

Piping shall be encased in polyethylene to prevent contact with surrounding backfill and bedding material in areas shown or designated by the Engineer. Polyethylene material shall be installed in accordance with ANSI/AWWA C105/A21.5 Standards.

Polyethylene material will deteriorate rapidly when exposed to direct sunlight. Store all polyethylene encasement out of the sunlight. If during the installation period it is anticipated that the polyethylene encasement will be exposed to sunlight for more than two weeks (i.e., an open trench) Type C (black) polyethylene material must be used.

Service taps for polyethylene encased pipe shall follow the procedure described in AWWA Standard C600-87 Section 7.1.

2.0 EXISTING UTILITIES AND STRUCTURES

2.01 Scope Of Work

Attention to the Contractor is directed to the fact that the approximate locations of known utility structures and facilities (including but not limited to sanitary sewers, storm sewers, potable water lines and appurtenances, natural gas lines, electric, telephone and CATV lines and underground storage tanks) that may be encountered with and adjacent to the limits of the work are shown on the plans. The accuracy and completeness of this information is not guaranteed by the Engineer, and the Contractor is advised that he shall verify in the field all the facts concerning the location of these utilities or other construction obstacles prior to construction. The Contractor shall notify the Engineer, in writing, prior to construction, of any discrepancies which may affect the project design.

2.02 Notifications Of Utilities

Contractor shall notify all utility companies through, the NJ One Call System, that construction of the work under this Contract will pass through the areas where their services exist. Notification to the utilities must be made in a sufficient amount of time in advance (min. 72 hours) prior to start of any construction work in the affected areas.

2.03 Materials

Materials for temporary support, adequate protection, and maintenance for all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

2.04 Obstructions By Other Utility Structures

Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, pipes, branch connections to main sewers, or drains, the obstruction shall be permanently supported, relocated, removed or reconstructed by the Contractor in cooperation with the owners of such utility structures. Before proceeding the Contractor must reach an agreement with the Engineer on method to avoid obstruction.

No deviation shall be made form the required line or depth except with the consent of the Engineer.

2.05 Repairs

Existing pipes or conduits crossing the trench, or otherwise exposed, shall be adequately braced and supported to prevent trench settlement from disrupting the line or grade of the pipe or conduit, all in accordance with the direction of the Engineer. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the Engineer, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by construction and subsequently repaired must be properly maintained by the Contractor.

2.06 Relocation

Where it is necessary to relocate an existing utility or structure, the work shall be done in such a manner as is necessary to restore it to a condition equal to that of the original facility. No such relocation shall be done until approval is received form the owner of the utility or structure being changed.

2.07 Separation Of Water Mains, Sanitary Sewer And Storm Sewers

A. General

The following factors should be considered in providing adequate separation:

(1) Materials and type of joints for water and sewer pipes,

(2) Soil conditions,

(3) Service and branch connections into the water main and sewer line,

(4) Compensating variations in horizontal and vertical separations,

(5) Space for repair and alterations of water and sewer pipes,

(6) Off-setting of pipes around manholes.

B. Parallel Installation

Water mains shall be laid at least 10 feet horizontally form any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the New Jersey Department of Environmental Protection may allow deviation on a case-by-case basis, if

supported by data from the Engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

C. Crossings

Whenever water mains must cross building drains, storm drains, or sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the drain or sewer. this vertical separation shall be maintained for the portion of the water main located within 10 feet horizontally of any sewer or drain it crosses. The 10 feet is to be measured as a perpendicular distance from the drain or sewer line to the water line.

D. Exception

When it is impossible to obtain the proper horizontal and vertical separation as stipulated above the Engineer is to be notified. If directed by the Engineer both the water main and sewer line shall be constructed of cast iron, ductile iron, galvanized steel or protected steel pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the Engineer after consultation with the New Jersey Department of Environmental Protection. Thermoplastic pipe may be used provided mechanical or solvent weld pipe joints are used. These shall be pressure-tested to assure water tightness before backfilling. Where water mains must cross under a sewer, additional protection shall be provided by:

(1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.

(2) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3) That the length of the water line be centered at the point of the crossing so that the joints shall be equidistant and as far as possible from the sewer.

Through the Engineer the New Jersey Department of Environmental Protection shall be consulted when any of the above conditions cannot be met to discuss the use of double casing or concrete encasement of sewer and/or water lines as possible alternatives.

3.0 CONSTRUCTION

3.01 Piling of Materials

All materials shall be neatly piled, and the excavated material shall be banked on one side of the trench and stabilized to leave a clear footway of two feet between the bank and the trench to create as little inconvenience to owners of neighboring properties and to the public as possible. Gutters, driveways and street crossings must be kept clear, except when the latter are unavoidably obstructed by the open trench.

3.02 Precautions

All excavations, embankments, materials, rubbish and heaps of other obstacles incident to the work must be enclosed with barricades and well-lit to prevent accidents. Special precautions must be taken to secure buildings and property near the excavation. All ordinances relating to such precautions and the safeguards must be faithfully observed by the Contractor, as he shall be held personally amenable for any disregard or violation of them by his employees or agent.

The Contractor shall specifically comply with the OSHA Standards for Excavations (29 CFR Part 1926, Subpart P), "OSHA Standards". As such, the Contractor shall be responsible for providing a "competent person" as defined in the OSHA Standards and as required by the standards. The Contractor shall be solely responsible for the selection, design, installation, and implementation of all "protective systems" as defined in the OSHA standards. The pipeline design by the Engineer does not include the design of the "protective systems" since the design of the "protective systems" is the responsibility of the Contractor.

3.03 Dewatering

The dewatering of all areas where work must be performed under this Contract is the responsibility of the Contractor and no additional sum will be allowed for any dewatering operation, overtime, equipment rental or any other expense incurred due to the occurrence of groundwater, surface water or water from possible leakage of existing buildings, structures and piping in the vicinity of the CONTRACTOR'S operations.

Should water be encountered, the Contractor shall furnish and operate suitable pumping equipment of such capacity adequate to dewater the trench. The trench shall be sufficiently dewatered so that the laying and joining of the pipe is made in the dry. the Contractor shall convey all trench water to a natural drainage channel

or storm sewer without causing any property damage and in strict accordance with state and/or local requirement.

Disposal of silt and debris which accumulates during construction shall be performed in strict accordance with state and/or local requirements.

3.04 Permits

The Contractor shall be responsible for obtaining and paying for any permits required for dewatering and disposal.

3.05 Pipe Bedding and Trenching

The minimum depth of cover shall be four feet (4") from the top of the pipe to the finished grade.

The trench shall be dug to the required depth and alignment shown on the plans. The trench shall be braced and drained when necessary so that workmen may work therein safely and efficiently in compliance with current OSHA requirements.

The trench width at the ground surface may vary with and depend upon its depth and the nature of the ground encountered. Unless otherwise authorized by the Engineer in writing, the trench width shall be ample to permit proper installation of the pipe or accessories and proper placing and compacting of backfill. Unless otherwise authorized by the Engineer, the minimum clear width of sheeted or unsheeted trench shall be 18 inches (18") or one foot greater than the outside diameter of the barrel of the pipe, whichever is greater, and maximum width of trench at the top of the pipe shall not be greater than the outside diameter of the barrel of the pipe plus two feet.

In cases where use of special equipment designed to cut narrow trenches is permitted in writing by the Engineer, precaution shall be exercised to insure bearing for the full length of the barrel of the pipe. When ordered by the Engineer, the backfill shall be compacted by puddling with water.

The trench, unless otherwise specified, shall have a flat bottom conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil cut true and even, so that the barrel of the pipe will have a bearing for its full length. When any part of the trench is excavated below grade by the Contractor's inadvertence or where, in the opinion of the Engineer, the use of a machine excavator has rendered unfit an otherwise suitable bottom, the trench shall be corrected with approved material, thoroughly compacted. When the bottom material uncovered at subgrade is soft and in the opinion of the Engineer, cannot support the pipe, further depth and/or width shall be excavated and refilled to pipe foundation grade as required.

Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six inches below all parts of the pipe, valves or fittings. Excavations below grade in rock or in boulders shall be refilled to grade with choked stone no larger than one inch in size, thoroughly compacted to provide support for the pipe.

Wherever necessary to prevent caving, the trench shall be adequately sheeted and braced. The sheeting shall remain in place until the pipe has been laid and the earth around it compacted to a minimum depth of two feet (2') over the top of the pipe. All pipe and accessories shall be carefully lowered into the trench pieces by

piece in such a manner as to prevent damage. Under no circumstances shall the pipe and accessories be dropped or dumped into the trench.

Every precaution shall be taken to prevent foreign material from entering the pipe. During laying operations no debris, tools, clothing or other material shall be placed in the pipe.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means satisfactory to Engineer.

Whenever it is necessary to deflect pipe from a straight line either in a vertical or horizontal plane, the amount of deflection in each joint shall not exceed four degrees.

3.06 Setting Fittings

Reaction or thrust backing shall be placed at bends and tees, and where changes in pipe diameter occur at reducer or in fittings. The size and shape of concrete thrust backing shall be as indicated on the appended detail sheet.

Reaction or thrust backing shall be placed at plugs and caps unless another method of restraint shall be directed by the Engineer.

Reaction or thrust backing shall be or a concrete mix not leaner than 1 cement, 2-1/2 sand, 5 stone, having compressive strength of not less than 4,000 psi at 28 days when using standard cement. Backing shall be placed between solid ground and the fitting. The backing shall be placed so that the pipe and fitting joints will be accessible for repair unless otherwise directed by the Engineer.

Valve boxes shall be firmly supported and maintained centered and plumb over the operating nut or the valve, with box cover flush with the surface of the finished pavement or at such other level as may be directed by the Engineer.

Hydrants shall be placed in locations designated on the plans. When placed behind curbs the hydrant shall be set so that no portion of the hydrant on the street side is less than six inches (6") or more than twelve inches (12") from the vertical faces of the curb, unless otherwise directed by the Engineer.

Whenever directed by the Engineer, a drainage pit two feet (2') in diameter and two feet (2') deep shall be excavated below each hydrant. The pit shall be filled compactly with coarse gravel or broken stone mixed with coarse sand, under and around the base of the hydrant to a level six inches (6") above the waste opening. No hydrant drainage pit shall be connected to a sewer.

A reaction or thrust backing shall be provided at the base of each hydrant and shall be provided at the base of each hydrant and shall not obstruct the drainage outlet of the hydrant, or the base of the hydrant shall be tied to the pipe line as directed by the Engineer.

3.07 Inspection of Water System

All construction of water systems shall be under the jurisdiction of the owner's Engineer and the Engineer for the Fort Lee Water Department, either directly or through inspectors under his supervision. He shall enforce compliance with the approved plans and specifications. He shall have the authority to stop work in the event of non-compliance.

The Contractor shall give 48 hours notice to the Owner and the Fort Lee Water Department prior to construction of water systems at all times during the construction period for the project. Should any water construction be performed wherein a qualified inspector is absent due to the Contractor's failure to provide the proper notification, the Owner may require said work to be uncovered at the Contractor's expense. Failure to do so may result in non-acceptance of the work.

3.08 Testing of Completed Water System

All pipe lines shall be pressure and leakage tested prior to construction of permanent pavement repair, a minimum of seven days after the last concrete thrust block has been cast if constructed with normal Portland cement. All materials and equipment required for testing shall be supplied by the Contractor.

Hydrostatic of the testing of ductile iron pipe shall conform to AWWA Standard C-600 Section 13.

The pressure test shall be performed by increasing the hydrostatic pressure to a specified value and maintaining the pressure for a period of one hour. Any pipe, fittings, or valves found defective shall be replaced. Prior to performing the test, all air pockets and bubbles must be eliminated. Hydrostatic test pressure shall be 250 psi for ductile iron and polyvinyl chloride pipe.

The leakage test shall be performed after the pressure test has been satisfactorily completed and shall be accomplished by increasing the hydrostatic pressure to a specified value and maintaining that pressure for a period of two hours. Leakage is the quantity of water that must be supplied into the newly laid pipe, or any valued section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled. The hydrostatic pressure for the leakage test shall be 150 psi. The leakage from each portion of the pipeline being tested shall not exceed 25 gallons per inch of internal diameter per mile of pipe per day for ductile iron or polyvinyl chloride pipe. If any test of pipe laid discloses a greater leakage than specified, the Contractor shall , at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

3.09 Disinfection

All pipelines shall be disinfected in conformance with AWWA Standard C-601 for disinfection water mains prior to being put into service. Hypochlorite and liquid for use in disinfection shall conform to AWWA Standards B-300 and B-301, respectively.

All pipelines shall be thoroughly flushed before introduction of chlorinating materials which shall be done in an approved manner. The amount of chlorine shall be such as to provide a dosage of not less than 50 parts per million. the chlorinated water shall be retained in the main for at least 24 hours during which time all hydrants and valves in the section treated shall contain no less than 25 parts per million chlorine throughout the length of the main.

After the applicable retention period, heavily chlorinated water should not remain in contact with pipe for more than 48 hours. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Contractor shall contact the local sewer department to arrange for disposal of the heavily chlorinated water to he sanitary sewer.

The chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed in the Table below. If a sanitary sewer system is unavailable for disposal of the chlorinated water an alternative disposal site must be selected.

The proposed alternative disposal site to which the chlorinated water is to be discharged shall be inspected and approved by the Engineer. A reducing agent shall be applied to the chlorinated water to be wasted to completely neutralize the chlorine residual remaining in the water. (See Table 5 for neutralizing chemicals). Where necessary, federal, state and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

TABLE

Pounds of chemical required to neutralize various residual chlorine concentrations in 100,000 gallons of water.

Residual Chlorine Concentration mg/L	**Sulfur Dioxide ($S0_2$)**	**Sodium Bisulfate ($NaHS0_3$)**	**Sodium Sulfite ($NaS0_3$)**	**Sodium Thiosulfate ($Na_2S_20_3.5H_20$)**
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.0	60.0

After flushing, the Contractor shall then have samples taken by an approved testing laboratory and bacteriological analysis made. Should the initial treatment prove ineffective, disinfection shall be repeated until satisfactory samples have been obtained.

3.10 Backfilling and Cleaning Up

Selected backfill material approved by the Engineer, unfrozen and free from rock, large stones, boulders or other unsuitable substances, shall be deposited in the trench uniformly on both sides of the pipe for the full width of the trench. This backfill material shall be tamped in four inch (4") layers and shall be sufficiently damp to permit thorough compaction under and on each side of the pipe to provide support free from voids to a cover of twelve inches (12") over the barrel of the pipe. After the pipe barrel has a twelve inch (12") cover fully compacted, the backfill shall be placed in layers not exceeding eight inches (8') until the entire trench is backfilled. No layer shall be placed until the prior layer is thoroughly and fully compacted.

The Contractor shall restore and /or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed surfaces or structures to a condition equal to that before the work began and the satisfaction of the Engineer.

In paved streets or roads, the edges of the paved areas to be excavated shall be cut vertically with an approved cutting tool prior to the excavation of the trench. At the end of each work day temporary paving shall be installed on all trenches excavated during the day in all residential, commercial and industrial areas, as well as any main thoroughfares, as required by governmental regulations, as necessary to protect persons and property and to the satisfaction of the Engineer.

All existing lawn areas shall be restored with sod unless otherwise specified by the Engineer.

Tools, temporary structures, and rubbish shall be removed by the Contractor and the construction site shall be left clean to the satisfaction of the Engineer. Any excess dirt shall be swept up and removed from the developed areas, and the construction site shall be left with a neat and clean appearance to the satisfaction of the Engineer.

4.0 Traffic Protection

4.01 General

The Contractor shall provide and install any and all traffic barricades, markers, signage and controls and furnish flagmen, traffic police, and other facilities required by the federal, state or other local government authorities and the Engineer to protect the general public and maintain the existing roads, streets and highways.

Competent uniformed traffic directors shall be required at every location where the Contractor's equipment is working immediately adjacent to, entering, leaving, and or is crossing active traffic lanes. The traffic directors shall be continuously employed for the entire time such conditions exist.

Special attention shall be given to the protection of pedestrians, especially children going to and coming from school. A means of ingress and egress shall be maintained for all properties abutting the worksite at all times.

The Contractor shall notify the Federal, State and Local Police, fire departments, and ambulance services of any and all traffic diversions.

The Owner or Engineer makes no guarantee or representation that the Contractor will be permitted to divert traffic and the Contractor shall be fully responsible to comply with all obligations of the Contract regardless of any restrictions which may be imposed by Federal, State, of Local Authorities.

4.02 Maintaining Traffic

Whenever it becomes necessary to divert traffic from its design flow channel into another channel, such diversion shall be clearly marked out with the use of cones, drums, barricades, signage or the use of temporary guardrail. If the diversion is to remain into the evening hours, suitable lighting shall be provided and maintained.

Whenever one way traffic is established, at least two flagmen shall be employed.

When and where permitted by jurisdictional agencies, the Contractor may close streets for minimal periods of time. The Contractor must notify and acquire the permission of local police and fire departments, local public authorities, and if so require by any law, regulation or ordinance, occupants or owners of all premises bordering the streets. The Contractor must provide adequate notice to all occupants and owners with respect to the closing of any street, in whole or in part, even when not required by any law, ordinance, or regulation. The Contractor shall

schedule his work to keep the duration of the street closing to a minimum, and wherever possible, during off peak hours. The Contractor shall provide access for police, fire, ambulance, and emergency vehicles at all times. Fire hydrants and other public utility valves shall remain accessible at all times.

4.03 Traffic Controls and Signals

The installation of all traffic control devices shall conform to the requirements of all federal, state and local government highway departments.

To protect persons from injury and to avoid potential property damage, adequate barricades and guards as required will be placed and maintained during the course of the construction work and until it is safe for traffic and pedestrians to use the trenched area.

When the Contractor is permitted to close a street or road to traffic, the Contractor shall furnish, erect, maintain and remove barricades, lights, and other traffic diversion devices at the limits of the project, where side streets intersect, and at other points of public access to the project site.

The Contractor provide and maintain advanced warning and barricades on side streets at the first street intersection beyond the one closed by construction stating " Street Closed. One Block Ahead". In addition, the Contractor shall remove detour signs on temporary routes when appropriate.

Before the completion of each day's work, in traveled areas, the pipe trench shall be completely backfilled and tamped, and a necessary temporary paving installed. 3/4/ inch stone base will be used in the sidewalk and walkways and blacktop in driveways. These areas are not to be left open, impassable or unsafe through the night. In the event the trench can not be completely backfilled and tamped, temporary bridges and crossings shall be used to accommodate the general publics need for through traffic. The job site will be left in a neat and satisfactory condition at the end of each day. These requirements are in conjunction with and federal, state or local laws, rules, regulations, or ordinances or any requirements found elsewhere in the Contract Documents.

Any and all equipment stored on the site shall be clearly marked at all times. In the evening, any such material and equipment to be stored between side ditches or between the lines five feet behind raise curbs, must be outlined or clearly marked with an appropriate warning device and be approved by the Engineer. The Contractor shall also provide and maintain any and all lighting, barricades, signage, or other necessary devices that may be needed for the protection of pedestrian traffic.

4.04 Additional Requirements

If the regulation of traffic controls and devices are not being provided in accordance with these specifications, and the public is being inconvenienced or its welfare is being endangered, in the judgment of the Engineer, the Owner may take such steps as he/she deems advisable to provide such services and all costs in providing such services will be deducted from any payment which may be due of may thereafter become due to the Contractor.