STORMWATER MANAGEMENT REPORT
FOR
NORTH AVENUE ACCESS ROAD
SUBMITTED IN PART WITH
PRELIMINARY\FINAL SITE PLAN APPLICATION OF
703-727 SPRING STREET CAPPING PLAN & 729-763
MEADOW STREET ACCESS ROAD

Block 8, Lot 1299.A
City of Elizabeth
Union County, New Jersey

Prepared by
Jarmel Kizel Architects & Engineers, Inc.

Jarmel Kizel Project No. SSD-S-17-109
Dated: February 28, 2020

Gerard P. Gesario, PE
Professional Engineer
N.J. License No. GE038255

Signature
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INTRODUCTION

This report has been prepared on behalf of the applicant, Spring Street Development Corp., in support of and in conjunction with the application for approval of an Amazon Logistics Facility located on lot 1699.D at 703-727 Spring Street. This report is solely and specifically for the proposed access road to connect lot 1699.D with North Avenue. A separate storm report has been submitted for 703-727 Spring Street capping portion of the project. The two lots associated with this application have separate and distinct drainage watersheds allowing for the reports to be done separately. This report presents the existing and proposed conditions for lot 1299.A and provides the design calculations for the construction of the access road and the associated proposed stormwater management system.

PROJECT DESCRIPTION

The subject property is located in the City of Elizabeth, Union County. The site is known as Lot 1299.A, Block 8 and is located within the City’s Highway Commercial (HC) zone. It is located on the southeast intersection of U.S. Route 1 & 9 and North Avenue. The area of the site is approximately 3.64 acres. The site was at one time developed with an industrial use and was an asphalt plant prior to being remediated as part of the preparation for development of the property. Research indicates the site was occupied by approximately 60% impervious features including buildings and paved areas. The remaining 40% was open space. The proposed development is for construction of a 28-foot wide paved access road, approximately 500 feet in length, that would provide access to and from lot 1699.D and North Avenue. The perimeter of the site is proposed to include a 5-foot wide landscaped buffer. The remainder of the site, with the exception of the proposed storm treatment system, will remain undeveloped.

STORMWATER MANAGEMENT

Existing Site Conditions

As noted above, the site had a prior development consisting of an industrial use. From review of historical aerial mapping, it has been determined that the site had approximately 60% impervious coverage with the remaining 40% open space. The soils onsite are of the urban complex. Soils classified as such are soils extensively influenced by human activities, found mostly, but not only, in urban areas. Soil testing on a site by site basis is typically required to determine the precise nature of the underlying soils. A recent survey of the property indicates nearly one half the site, 1.71 acres, drains toward Spring Street and the remaining 1.93 acres
toward North Avenue. The area that drains toward Spring Street enters into storm structures that are part of the NJDOT Route 1 & 9 storm system. No changes to the tributary area to the NJDOT Route 1 & 9 system are proposed. The area draining toward North Avenue drains into the North Avenue storm system.

Due to the small size of the study area, the Rational Method was utilized in calculating peak runoff rates for the project. The total area of the parcel is 3.64 acres but only 0.557 acres are proposed to be disturbed. Only the 1.93 acres draining toward North Avenue were analyzed for comparison of the existing and proposed conditions. A runoff coefficient of 0.35 was used for unimproved or pervious areas and 0.95 for paved or impervious areas. Using the above criteria, the peak runoff values were determined for the 2, 10, 25, and 100-year storm events. The existing condition peak runoff values are presented in Table 1 below:

**Table 1: North Avenue Existing Peak Runoff Summary**

<table>
<thead>
<tr>
<th>Storm Event (Yrs.)</th>
<th>Existing Peak Runoff Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.291</td>
</tr>
<tr>
<td>10</td>
<td>3.492</td>
</tr>
<tr>
<td>25</td>
<td>4.337</td>
</tr>
<tr>
<td>100</td>
<td>5.871</td>
</tr>
</tbody>
</table>

**Proposed Site Conditions**

In an effort to improve ingress and egress from the adjacent lot 1699.D site, an access road is proposed that would connect lot 1699.D with North Avenue. The proposed access road will be 28-feet wide with a length of approximately 500 linear feet. The access road will be graded such that nearly all of it will drain directly to a proposed collection/infiltration basin proposed along the entire length of the northeast property line. There is a small area, 0.05 acres, that will get disturbed, including 0.02 acres of roadway, that will bypass the basin. The remainder of the site will remain as is and will drain toward North Avenue as is does today. A runoff coefficient of 0.35 was used for unimproved or pervious areas and 0.95 for paved or impervious areas. Using the above criteria, the peak runoff values were determined for the 2, 10, 25, and 100-year storm events. The developed condition peak runoff values are presented in Table 2 below:
Table 2: North Avenue Developed Peak Runoff Summary

<table>
<thead>
<tr>
<th>Storm Event (Yrs.)</th>
<th>Developed Peak Runoff Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.734</td>
</tr>
<tr>
<td>10</td>
<td>2.643</td>
</tr>
<tr>
<td>25</td>
<td>3.282</td>
</tr>
<tr>
<td>100</td>
<td>4.443</td>
</tr>
</tbody>
</table>

**Stormwater Quantity Control**

The project has been designed to utilize a long, narrow, and shallow infiltration basin such that 100 percent of the runoff entering the basin will be infiltrated. Collection and infiltration of runoff has been selected due to the temporary nature of the proposed access road as there are plans currently underway for the total re-development of lot 1299.A. Also, construction of the proposed basin requires minimal additional site disturbance and eliminates the need to disturb North Avenue and the North Avenue storm system. The system will be graded with an overflow spillway at the North Avenue end of the basin. The bottom of the basin will be constructed with a minimum 2-inch thicker choker stone layer and a minimum 18-inch thick sand layer.

The basin has been sized so that the maximum depth of water in the basin will not exceed 18-inches under the 100-year storm event conditions. The design calculations assume the basin area 1-foot above the basin bottom to be saturated and therefore, impervious. The Modified Rational Method was used to generate the developed conditions hydrograph entering the basin. This method extends the peak time of concentration, which lessens the peak flow when compared to the standard Rational Method but extends the time of the peak resulting in a greater volume found to be more accurate in routing of detention basins. Using the above criteria, the peak runoff values were determined and are presented in Table No. 3 below:
Table 3: Infiltration Basin Summary

<table>
<thead>
<tr>
<th>Storm Event (Yrs.)</th>
<th>Peak Inflow Runoff (cfs)</th>
<th>Inflow Volume (cu. ft.)</th>
<th>Maximum Water Depth in Basin (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.746</td>
<td>1,745</td>
<td>11.52</td>
</tr>
<tr>
<td>10</td>
<td>1.189</td>
<td>2,355</td>
<td>13.92</td>
</tr>
<tr>
<td>25</td>
<td>1.345</td>
<td>2,743</td>
<td>15.48</td>
</tr>
<tr>
<td>100</td>
<td>2.226</td>
<td>2,939</td>
<td>16.68</td>
</tr>
</tbody>
</table>

Lastly, Table 4 below provides the comparison of the existing site conditions peak flows to North Avenue (Table 1) with the developed condition peak flows which is made up of the developed bypass area plus the remaining undisturbed site area (Table 2). For each storm event, the peak discharge to North Avenue will be less than the existing conditions. As a result, there will be a positive impact on the downstream drainage system.

Table 4: North Avenue Pre and Post Development Comparison

<table>
<thead>
<tr>
<th>Storm Event (Yrs.)</th>
<th>Existing Peak Runoff (cfs)</th>
<th>Developed Peak Runoff (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2.291</td>
<td>1.734</td>
</tr>
<tr>
<td>10</td>
<td>3.492</td>
<td>2.643</td>
</tr>
<tr>
<td>25</td>
<td>4.337</td>
<td>3.282</td>
</tr>
<tr>
<td>100</td>
<td>5.871</td>
<td>4.443</td>
</tr>
</tbody>
</table>

SOIL EROSION AND SEDIMENT CONTROL DESIGN

The soil erosion measures which will be implemented on this project will include, but may not be limited to the following:

1. Construction access protection will be provided at the construction entrance area to prevent tracking of soil and sediment onto paved surfaces.
2. Temporary and permanent grassing and/or landscaping will be provided for all disturbed areas as soon as possible after grading.

3. Silt fence will be placed at the downstream limit of all disturbed areas.

4. All storm drain inlets will be provided with sediment protection in the form of hay bales or gravel covers.

5. Permanent seeding and landscaping once the construction has been completed.

6. Ongoing maintenance of stormwater management systems in accordance with the operation and maintenance manual.

CONCLUSION

As a result of the analysis, it has been demonstrated that the proposed project will have no impact on adjacent properties or existing storm drainage systems. The proposed system for lot 1299.A and the North Avenue access road will infiltrate 100 percent of the design storms up to and including the 100-year design storm and provide for significant reductions of all design storm peaks. This will provide a positive impact on the existing downstream North Avenue drainage system.
FIGURE 1
SITE LOCATION MAP
APPENDIX A

EXISTING CONDITION HYDROGRAPHS
<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mod. Rational</td>
<td>0.746</td>
<td>1</td>
<td>10</td>
<td>1,745</td>
<td></td>
<td></td>
<td></td>
<td>Post Mod Rational</td>
</tr>
<tr>
<td>2</td>
<td>Rational</td>
<td>0.120</td>
<td>1</td>
<td>10</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
<td>Post Bypass</td>
</tr>
<tr>
<td>3</td>
<td>Reservoir</td>
<td>0.000</td>
<td>1</td>
<td>n/a</td>
<td>0</td>
<td>1</td>
<td>13.26</td>
<td>1,700</td>
<td>Access Road Basin Rout</td>
</tr>
<tr>
<td>4</td>
<td>Rational</td>
<td>2.291</td>
<td>1</td>
<td>10</td>
<td>1,375</td>
<td></td>
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<tr>
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<td>Rational</td>
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<td>1</td>
<td>10</td>
<td>1,040</td>
<td></td>
<td></td>
<td></td>
<td>DEVELOPED TO NORTH AVE</td>
</tr>
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</table>

Access Road ALT.gpw  
Return Period: 2 Year  
Tuesday, Mar 3, 2020
## Hydrograph Summary Report

<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mod. Rational</td>
<td>1.189</td>
<td>1</td>
<td>10</td>
<td>2,355</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Post Mod Rational</td>
</tr>
<tr>
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<td>Rational</td>
<td>0.184</td>
<td>1</td>
<td>10</td>
<td>110</td>
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<td>---</td>
<td>---</td>
<td>Post Bypass</td>
</tr>
<tr>
<td>3</td>
<td>Reservoir</td>
<td>0.000</td>
<td>1</td>
<td>n/a</td>
<td>0</td>
<td>1</td>
<td>13.46</td>
<td>2,284</td>
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</tr>
<tr>
<td>4</td>
<td>Rational</td>
<td>3.492</td>
<td>1</td>
<td>10</td>
<td>2,095</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>EXISTING TO NORTH AVE</td>
</tr>
<tr>
<td>5</td>
<td>Rational</td>
<td>2.643</td>
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<td>10</td>
<td>1,586</td>
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Access Road ALT.gpw

Return Period: 10 Year

Tuesday, Mar 3, 2020
<table>
<thead>
<tr>
<th>Hyd. No.</th>
<th>Hydrograph type (origin)</th>
<th>Peak flow (cfs)</th>
<th>Time interval (min)</th>
<th>Time to peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strge used (cuft)</th>
<th>Hydrograph description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mod. Rational</td>
<td>1.345</td>
<td>1</td>
<td>10</td>
<td>2,743</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Post Mod Rational</td>
</tr>
<tr>
<td>2</td>
<td>Rational</td>
<td>0.228</td>
<td>1</td>
<td>10</td>
<td>137</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Post Bypass</td>
</tr>
<tr>
<td>3</td>
<td>Reservoir</td>
<td>0.000</td>
<td>n/a</td>
<td>n/a</td>
<td>0</td>
<td>1</td>
<td>13.59</td>
<td>2,662</td>
<td>Access Road Basin Rout</td>
</tr>
<tr>
<td>4</td>
<td>Rational</td>
<td>4.337</td>
<td>1</td>
<td>10</td>
<td>2,602</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>EXISTING TO NORTH AVE</td>
</tr>
<tr>
<td>5</td>
<td>Rational</td>
<td>3.282</td>
<td>1</td>
<td>10</td>
<td>1,969</td>
<td>---</td>
<td>---</td>
<td>---</td>
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Access Road ALT.gpw

Return Period: 25 Year

Tuesday, Mar 3, 2020
## Hydrograph Summary Report

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<th>Hydrograph type (origin)</th>
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<th>Time interval (min)</th>
<th>Time to peak (min)</th>
<th>Hyd. volume (cuft)</th>
<th>Inflow hyd(s)</th>
<th>Maximum elevation (ft)</th>
<th>Total strgc used (cuft)</th>
<th>Hydrograph description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mod. Rational</td>
<td>2.226</td>
<td>1</td>
<td>10</td>
<td>2,939</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>Post Mod Rational</td>
</tr>
<tr>
<td>2</td>
<td>Rational</td>
<td>0.309</td>
<td>1</td>
<td>10</td>
<td>185</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>Post Bypass</td>
</tr>
<tr>
<td>3</td>
<td>Reservoir</td>
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<td>1</td>
<td>n/a</td>
<td>0</td>
<td>1</td>
<td>13.69</td>
<td>2,939</td>
<td>Access Road Basin Rout</td>
</tr>
<tr>
<td>4</td>
<td>Rational</td>
<td>5.871</td>
<td>1</td>
<td>10</td>
<td>3,522</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>EXISTING TO NORTH AVE</td>
</tr>
<tr>
<td>5</td>
<td>Rational</td>
<td>4.443</td>
<td>1</td>
<td>10</td>
<td>2,666</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>DEVELOPED TO NORTH AVE</td>
</tr>
</tbody>
</table>

Access Road ALT.gpw

Return Period: 100 Year

Tuesday, Mar 3, 2020
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 4

EXISTING TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 1.930 ac
Intensity = 3.392 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 2.291 cfs
Time to peak = 10 min
Hyd. volume = 1,375 cuft
Runoff coeff. = 0.35
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

EXISTING TO NORTH AVE

Hyd. No. 4 -- 2 Year

Q (cfs)

0.00 1.00 2.00 3.00

Time (min)

Q (cfs)

0.00 1.00 2.00 3.00

Hyd No. 4
Hydrograph Report

Hyd. No. 4
EXISTING TO NORTH AVE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrograph type</td>
<td>Rational</td>
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<tr>
<td>Storm frequency</td>
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</tr>
<tr>
<td>Time interval</td>
<td>1 min</td>
</tr>
<tr>
<td>Drainage area</td>
<td>1.930 ac</td>
</tr>
<tr>
<td>Intensity</td>
<td>5.170 in/hr</td>
</tr>
<tr>
<td>IDF Curve</td>
<td>trenton1986.idf</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>3.492 cfs</td>
</tr>
<tr>
<td>Time to peak</td>
<td>10 min</td>
</tr>
<tr>
<td>Hyd. volume</td>
<td>2,095 cuft</td>
</tr>
<tr>
<td>Runoff coeff.</td>
<td>0.35</td>
</tr>
<tr>
<td>Tc by User</td>
<td>10.00 min</td>
</tr>
<tr>
<td>Asc/Rec limb fact</td>
<td>1/1</td>
</tr>
</tbody>
</table>

![Graph](Q(cfs) vs Time (min))

**EXISTING TO NORTH AVE**

Hyd. No. 4 -- 10 Year

- **Q (cfs)**
  - 4.00
  - 3.00
  - 2.00
  - 1.00
  - 0.00

- **Time (min)**
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

**Legend**
- Red: Hyd No. 4
Hydrograph Report
Hydraflow Hydrographs by Intelisolve v9.1
Tuesday, Mar 3, 2020

Hyd. No. 4
EXISTING TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 1.930 ac
Intensity = 6.421 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 4.337 cfs
Time to peak = 10 min
Hyd. volume = 2,602 cuft
Runoff coeff. = 0.35
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

EXISTING TO NORTH AVE
Hyd. No. 4 -- 25 Year

Q (cfs)
5.00
4.00
3.00
2.00
1.00
0.00
0 2 4 6 8 10 12 14 16 18 20
Time (min)
Hydrograph Report

Hydraflow Hydrographs by Intellisolve v9.1

Hyd. No. 4
EXISTING TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 1.930 ac
Intensity = 8.691 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 5.871 cfs
Time to peak = 10 min
Hyd. volume = 3,522 cuft
Runoff coeff. = 0.35
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

Hyd. No. 4

EXISTING TO NORTH AVE

Hyd. No. 4 -- 100 Year

Q (cfs)

Time (min)
APPENDIX B

PROPOSED CONDITION HYDROGRAPHS
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 2
Post Bypass

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 0.050 ac
Intensity = 3.392 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 0.120 cfs
Time to peak = 10 min
Hyd. volume = 72 cuft
Runoff coeff. = 0.71*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.030 x 0.95) + (0.020 x 0.35)] / 0.050

---

Post Bypass
Hyd. No. 2 — 2 Year

---

Hyd No. 2
Hydrograph Report
Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5
DEVELOPED TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 2 yrs
Time interval = 1 min
Drainage area = 1.420 ac
Intensity = 3.392 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 1.734 cfs
Time to peak = 10 min
Hyd. volume = 1,040 cuft
Runoff coeff. = 0.36*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.020 x 0.95) + (1.370 x 0.35) + (0.030 x 0.35)] / 1.420

DEVELOPED TO NORTH AVE
Hyd. No. 5 -- 2 Year

Q (cfs)
0.00 1.00 2.00
0 2 4 6 8 10 12 14 16 18 20
Time (min)

Hyd No. 5
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 2

Post Bypass

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 0.050 ac
Intensity = 5.170 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 0.184 cfs
Time to peak = 10 min
Hyd. volume = 110 cuft
Runoff coeff. = 0.71*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.030 x 0.95) + (0.020 x 0.35)] / 0.050

---

**Post Bypass**

Hyd. No. 2 -- 10 Year

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Q (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>4</td>
<td>0.10</td>
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<tr>
<td>6</td>
<td>0.15</td>
</tr>
<tr>
<td>8</td>
<td>0.20</td>
</tr>
<tr>
<td>10</td>
<td>0.25</td>
</tr>
<tr>
<td>12</td>
<td>0.30</td>
</tr>
<tr>
<td>14</td>
<td>0.35</td>
</tr>
<tr>
<td>16</td>
<td>0.40</td>
</tr>
<tr>
<td>18</td>
<td>0.45</td>
</tr>
<tr>
<td>20</td>
<td>0.50</td>
</tr>
</tbody>
</table>

---

*Red line indicates Hyd No. 2*
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5
DEVELOPED TO NORTH AVE

Hydrograph type = Rational
Peak discharge = 2.643 cfs
Storm frequency = 10 yrs
Time to peak = 10 min
Time interval = 1 min
Hyd. volume = 1,586 cuft
Drainage area = 1.420 ac
Runoff coeff. = 0.36*
Intensity = 5.170 in/hr
To by User = 10.00 min
IDF Curve = trenton1986.idf
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.020 x 0.95) + (1.370 x 0.35) + (0.030 x 0.35)] / 1.420

Q (cfs)

Time (min)
**Hydrograph Report**

**Post Bypass**

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 0.050 ac
Intensity = 6.421 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 0.228 cfs
Time to peak = 10 min
Hyd. volume = 137 cuft
Runoff coeff. = 0.71*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

*Composite (Area/C) = [(0.030 x 0.95) + (0.020 x 0.35)] / 0.050

---

**Graph**

- **Q (cfs)**
  - 0.50
  - 0.45
  - 0.40
  - 0.35
  - 0.30
  - 0.25
  - 0.20
  - 0.15
  - 0.10
  - 0.05
  - 0.00

- **Time (min)**
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

**Hyd. No. 2 -- 25 Year**

- **Hyd No. 2**
- **Hyd. No. 2**
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5
DEVELOPED TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 1.420 ac
Intensity = 6.421 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 3.282 cfs
Time to peak = 10 min
Hyd. volume = 1,969 cuft
Runoff coeff. = 0.36*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.020 x 0.95) + (1.370 x 0.35) + (0.030 x 0.35)] / 1.420

---

DEVELOPED TO NORTH AVE
Hyd. No. 5 -- 25 Year

Q (cfs)

<table>
<thead>
<tr>
<th>0.00</th>
<th>1.00</th>
<th>2.00</th>
<th>3.00</th>
<th>4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time (min)

---

Hyd No. 5
Hydrograph Report

Hydraflow Hydrographs by Intelsolve v9.1

Hyd. No. 2
Post Bypass

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 0.050 ac
Intensity = 8.691 in/hr
IDF Curve = trenton1986.idf

Peak discharge = 0.309 cfs
Time to peak = 10 min
Hyd. volume = 185 cuft
Runoff coeff. = 0.71*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.030 x 0.95) + (0.020 x 0.35)] / 0.050

---

Post Bypass
Hyd. No. 2 -- 100 Year

---
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 5
DEVELOPED TO NORTH AVE

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 1.420 ac
Intensity = 8.691 in/hr
IDF Curve = trenton1986.idf

Hyd. No. 5

Peak discharge = 4.443 cfs
Time to peak = 10 min
Hyd. volume = 2,666 cuft
Runoff coeff. = 0.36*
Tc by User = 10.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(0.020 x 0.95) + (1.370 x 0.35) + (0.030 x 0.35)] / 1.420

---

DEVELOPED TO NORTH AVE

Hyd. No. 5 -- 100 Year

---

Graph showing the hydrograph for Hyd. No. 5, with peak discharge of 4.443 cfs, time to peak of 10 min, and runoff coefficient of 0.36.*
APPENDIX C

INFILTRATION BASIN HYDROGRAPHS
# Pond Report

Hydraflow Hydrographs by Intelisolve v9.1

**Pond No. 1 - ACCESS ROAD BAMI**

**Pond Data**

Contours - User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 12.30 ft

## Stage / Storage Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuf)</th>
<th>Total storage (cuf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>12.30</td>
<td>00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.70</td>
<td>13.00</td>
<td>2,690</td>
<td>941</td>
<td>941</td>
</tr>
<tr>
<td>1.70</td>
<td>14.00</td>
<td>3,106</td>
<td>2,888</td>
<td>3,840</td>
</tr>
<tr>
<td>2.70</td>
<td>15.00</td>
<td>4,194</td>
<td>3,650</td>
<td>7,490</td>
</tr>
</tbody>
</table>

## Culvert / Orifice Structures

<table>
<thead>
<tr>
<th></th>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[PrfRsr]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise (in)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Span (in)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Invert El. (ft)</td>
<td>0.00</td>
<td>13.00</td>
<td>13.80</td>
<td>0.00</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>0.00</td>
<td>50.00</td>
<td>50.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>0.00</td>
<td>1.00</td>
<td>1.00</td>
<td>n/a</td>
</tr>
<tr>
<td>N-Value</td>
<td>.013</td>
<td>.013</td>
<td>.013</td>
<td>n/a</td>
</tr>
<tr>
<td>Orifice Coeff.</td>
<td>.60</td>
<td>.60</td>
<td>.60</td>
<td>.60</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>n/a</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

## Weir Structures

<table>
<thead>
<tr>
<th></th>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest Len (ft)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Crest El. (ft)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Weir Coeff.</td>
<td>3.33</td>
<td>3.33</td>
<td>3.33</td>
<td>3.33</td>
</tr>
<tr>
<td>Weir Type</td>
<td>---</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

## Stage / Storage / Discharge Table

<table>
<thead>
<tr>
<th>Stage ft</th>
<th>Storage cuf</th>
<th>Elevation ft</th>
<th>Clv A cfs</th>
<th>Clv B cfs</th>
<th>Clv C cfs</th>
<th>PrfRsr cfs</th>
<th>Wr A cfs</th>
<th>Wr B cfs</th>
<th>Wr C cfs</th>
<th>Wr D cfs</th>
<th>Exfil cfs</th>
<th>User cfs</th>
<th>Total cfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0</td>
<td>12.30</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.00</td>
</tr>
<tr>
<td>0.70</td>
<td>941</td>
<td>13.00</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.00</td>
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<tr>
<td>1.70</td>
<td>3,840</td>
<td>14.00</td>
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<td>0.00</td>
</tr>
<tr>
<td>2.70</td>
<td>7,490</td>
<td>15.00</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).
**Hydrograph Report**

Hydraflow Hydrographs by Intellisolve v9.1

**Hyd. No. 1**

Post Mod Rational

- Hydrograph type: Mod. Rational
- Storm frequency: 2 yrs
- Time interval: 1 min
- Drainage area: 0.510 ac
- Intensity: 1.924 in/hr
- IDF Curve: trenton1986.idf
- Target Q: 0.630 cfs

- Peak discharge = 0.746 cfs
- Time to peak = 10 min
- Hyd. volume = 1,745 cuft
- Runoff coeff. = 0.76*
- Tc by User = 10.00 min
- Storm duration = 3.9 x Tc
- Est. Req'd Storage = 783 cuft

*Composite (Area/C) = [(0.347 x 0.95) + (0.160 x 0.35)] / 0.510

---

![Post Mod Rational Hydrograph](image)

**Post Mod Rational**

Hyd. No. 1 -- 2 Year

- Q (cfs) vs. Time (min)
- Est. Mod. Rational Est. Storage = 783 cuft
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 3
Access Road Basin Rout

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Time interval = 1 min
Inflow hyd. No. = 1 - Post Mod Rational
Reservoir name = ACCESS ROAD BASIN

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 13.26 ft
Max. Storage = 1,700 cuft

Storage Indication method used.

Access Road Basin Rout

Hyd. No. 3 -- 2 Year

Q (cfs)

0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00

Time (min)

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Hyd. No. 3
Hyd. No. 1
Total storage used = 1,700 cuft
Hydrograph Report

Hyd. No. 1

Post Mod Rational

Hydrograph type = Mod. Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 0.510 ac
Intensity = 3.069 in/hr
IDF Curve = trenton1986.idf
Target Q = 0.880 cfs

Peak discharge = 1.189 cfs
Time to peak = 10 min
Hyd. volume = 2,355 cuft
Runoff coeff. = 0.76*
Tc by User = 10.00 min
Storm duration = 3.3 x Tc
Est. Req'd Storage = 1,160 cuft

* Composite (Area/C) = [(0.347 x 0.95) + (0.160 x 0.35)] / 0.510

Post Mod Rational
Hyd. No. 1 -- 10 Year

Q (cfs)

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>0.00</th>
<th>2.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>0.88</td>
<td>0.88</td>
</tr>
<tr>
<td>20</td>
<td>1.19</td>
<td>1.19</td>
</tr>
<tr>
<td>30</td>
<td>2.36</td>
<td>2.36</td>
</tr>
<tr>
<td>40</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Hyd No. 1

Mod. Rational Est. Storage = 1,160 cuft
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 3
Access Road Basin Rout

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyd. No. = 1 - Post Mod Rational
Reservoir name = ACCESS ROAD BASIN

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 13.46 ft
Max. Storage = 2,284 cuft

Storage Indication method used.

Access Road Basin Rout

Q (cfs)

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Q (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
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<tr>
<td>2.00</td>
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<tr>
<td>4.00</td>
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<td>6.00</td>
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<td>8.00</td>
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<tr>
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<tr>
<td>40.00</td>
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</tr>
<tr>
<td>42.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Time (min)

Q (cfs)

Total storage used = 2,284 cuft
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Mar 3, 2020

Hyd. No. 1

Post Mod Rational

Hydrograph type = Mod. Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 0.510 ac
Intensity = 3.469 in/hr
IDF Curve = trenton1986.idf
Target Q = 1.000 cfs

Peak discharge = 1.345 cfs
Time to peak = 10 min
Hyd. volume = 2,743 cuft
Runoff coeff. = 0.76*
Tc by User = 10.00 min
Storm duration = 3.4 x Tc
Est. Req'd Storage = 1,356 cuft

* Composite (Area/C) = [(0.347 x 0.95) + (0.160 x 0.35)] / 0.510

Q (cfs)

0.00 0.50 1.00 1.50 2.00

Hyd No. 1 -- 25 Year

Time (min)
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 3
Access Road Basin Rout

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 1 min
Inflow hyd. No. = 1 - Post Mod Rational
Reservoir name = ACCESS ROAD BASIN

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 13.59 ft
Max. Storage = 2,662 cuft

Storage Indication method used.

Access Road Basin Rout

Hyd. No. 3 -- 25 Year

Q (cfs)

0.00 0.50 1.00 1.50 2.00

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44

Time (min)

Total storage used = 2,662 cuft

Hyd No. 3
Hyd No. 1
Hyd No. 1

Hyd No. 1
Hyd No. 1
Hyd No. 1
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 1

Post Mod Rational

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrograph type</td>
<td>Mod. Rational</td>
</tr>
<tr>
<td>Storm frequency</td>
<td>100 yrs</td>
</tr>
<tr>
<td>Time interval</td>
<td>1 min</td>
</tr>
<tr>
<td>Drainage area</td>
<td>0.510 ac</td>
</tr>
<tr>
<td>Intensity</td>
<td>5.744 in/hr</td>
</tr>
<tr>
<td>IDF Curve</td>
<td>trenton1986.idf</td>
</tr>
<tr>
<td>Target Q</td>
<td>1.200 cfs</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>2.226 cfs</td>
</tr>
<tr>
<td>Time to peak</td>
<td>10 min</td>
</tr>
<tr>
<td>Hyd. volume</td>
<td>2,939 cuft</td>
</tr>
<tr>
<td>Runoff coeff.</td>
<td>0.76*</td>
</tr>
<tr>
<td>Tc by User</td>
<td>10.00 min</td>
</tr>
<tr>
<td>Storm duration</td>
<td>2.2 x Tc</td>
</tr>
<tr>
<td>Est. Req'd Storage</td>
<td>1,766 cuft</td>
</tr>
</tbody>
</table>

* Composite (Area/C) = [(0.347 x 0.95) + (0.160 x 0.35)] / 0.510

---

Post Mod Rational

Hyd. No. 1 -- 100 Year

---

Hyd No. 1

Mod. Rational Est. Storage = 1,766 cuft
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 3
Access Road Basin Rout

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyd. No. = 1 - Post Mod Rational
Reservoir name = ACCESS ROAD BASIN

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 13.69 ft
Max. Storage = 2,939 cuft

Storage Indication method used.

---

Access Road Basin Rout
Hyd. No. 3 -- 100 Year

Total storage used = 2,939 cuft

---

Hyd No. 3  
Hyd No. 1  
Total storage used = 2,939 cuft
APPENDIX D
DRAINAGE AREA MAPS

EXISTING DRAINAGE AREA PLAN
PROPOSED DRAINAGE AREA PLAN

2. ENTIRE SITE UNDERLAIN BY historic FILL, TO BE CAPPED PER NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION REQUIREMENTS.


5. EXISTING PIPING SHALL BE FIELD VERIFIED FOR DEPTH AND LOCATION, PRIOR TO INSTALLATION OF PROPOSED DRAINAGE SYSTEMS.


7. ZONING BOARD CASE NO.: Z-05-19