Stormwater Management Report

For

Regency at Boxborough
700-800 Massachusetts Ave
Boxborough, MA

December 22, 2016

Applicant: Boxborough Town Center, LLC
P.O. Box 985
Acton, MA 01720

SM-2069

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Stormwater Management Narrative
December 22, 2016

The proposed project is the construction of a 100 unit elderly two-family development, a clubhouse, pool, pickleball court, bocce court, and their associated appurtenances on a 62.84 acre lot. Stormwater management practices have been designed for the proposed roadway, dwellings, and other impervious surfaces.

According to the Natural Resources Conservation Service (N.R.C.S.) soil survey indicated the presence of Swansea Muck, Freetown Muck, Ridgebury Fine Sandy Loam, Whitman Fine Sandy Loam, Charlton-Hollis-Rock outcrop, Hollis-Rock Outcrop-Charlton Complex, Paxton Fine Sandy Loam, Woodbridge Fine Sandy Loam, and Carlton Fine Sandy Loam. Carlton Fine Sandy Loam rate as Hydrologic Group A. Charlton-Hollis-Rock outcrop and Hollis-Rock Outcrop-Charlton complex rate as Hydrologic Group B. Paxton Fine Sandy Loam and Woodbridge Fine Sandy Loam rate as Hydrologic Group C. Swansea Muck, Freetown Muck, Ridgebury Fine Sandy Loam, and Whitman Fine Sandy Loam rate as Hydrologic Group D.

Pre-Development

The site currently consists of primarily woodlands with a single family dwelling located in the northern portion of the property. There is Bordering Vegetated Wetland (BVW) located in the northeast and northwest portion of the property. The development drainage was broken up into 6 subcatchments.

Runoff from subcatchment E1A remains in the site and drains to the Bordering Vegetated Wetlands and intermittent stream in the center of the property. The vegetative coverage is primarily wooded with small amounts of impervious coverage from a portion of the existing dwelling and an old driveway.

Runoff from subcatchment E1B remains in the site and drains to the Bordering Vegetated Wetlands and intermittent stream in the center of the property. The vegetative coverage is primarily wooded with the exception of an offsite portion of neighboring Sheriff's Meadow which includes three condominiums and a portion of the driveway.

Runoff from subcatchment E2 exits the site to the northwest and eventually drains to the same Bordering Vegetated Wetland system. The vegetative coverage is primarily wooded with small amounts of impervious coverage from a portion of the existing dwelling and an old driveway.

Runoff from subcatchment E3 exits the site to the southwest near Priest Lane. The vegetative coverage is primarily wooded.

Runoff from subcatchment E4 exits the site to the south closer to Burroughs Road. The vegetative coverage is primarily wooded.

Runoff from subcatchment E5 exits the site to the southeast to a lot on Burroughs Road. The vegetative site coverage is primarily wooded.

Post-Development

The project proposes a series of private roads to serve 50 two-family dwellings reserved for the elderly. A clubhouse, pool, pickleball court, bocce court, and extra parking are also proposed. The total length of road is approximately 4,958 feet long. The roadway will make use of deep sump hooded catch basins and a combination of infiltration basins and underground chambers. Most of the dwellings are connected to roof drywells, while others utilize infiltration basins.

Subcatchment P1A remains undeveloped with the exception of some grading for the road and infiltration basins, and remains similar to subcatchment E1A but a smaller area. It will continue to drain to the Bordering Vegetated Wetlands and intermittent stream in the center of the site.

Subcatchment P1B remains undeveloped with the exception of some grading for the infiltration basins, soil absorption system, and a portion of the existing Sheriff's Meadow dwellings on the neighboring lot. It will remain similar to subcatchment E1B but a smaller area. It will continue to drain to the Bordering Vegetated Wetlands and intermittent stream in the center of the site.

Subcatchment P1C contains a portion of Private Drive A, associated sidewalk, a portion of the parking associated with the clubhouse, and the model unit (Unit 1). It also contains open space around the proposed clubhouse. Runoff from the road flows to two catch basins at the low point in the road, directing runoff to a drainage manhole, sediment forebay, and infiltration basin. The runoff is treated before being infiltrated in the basin.

Subcatchment P1D contains a portion of Private Drive A, the associated sidewalks, and the private drives to several of the two-family dwellings. It also contains open space around the proposed dwellings. Runoff from the road flows to catch basins, directing runoff to drainage manholes, a sediment forebay, and infiltration basin. The runoff is treated before being infiltrated in the basin.

Subcatchment P1E contains a portion of Private Drive A, all of Private Drive C, open space around the proposed dwellings, and a portion of off-site land. It also contains units 18 and 19. Runoff from the road flows to catch basins, directing runoff to drainage manholes, a sediment forebay, and infiltration basin. The roof runoff from the units will be piped directly into the infiltration basin. The road runoff is treated before being infiltrated in the basin.

Subcatchment P1F contains units 38-41 and some open space around the infiltration basin. Roof runoff will be piped directly into the basin.

Subcatchment P1G contains units 20-22, 32-37, 49-50 open space around these units, and some off-site land. Roof runoff will be piped directly into the basin. Open space runoff flows overland and eventually drains to a series of infiltration areas connected via pipes underneath Private Drive A and Private Drive C.

Subcatchment P1H contains all of Private Drive B, units 26-28, and open space around these units. Roof runoff will be piped directly into the subsurface chambers. Runoff from the road flows to catch basins, directing runoff to drainage manholes, a sediment forebay, and subsurface infiltration chambers. The road runoff is treated before being infiltrated in the basin.

Subcatchment P1I contains units 28-31 and 23-25, and the open space in the center of Private Drive B. Roof runoff will be piped directing into the basin. Open space runoff flows overland and eventually drains to a series of infiltration areas connected via pipes underneath Private Drive B.

Subcatchment P2A contains the portion of Private Drive A that connects to Massachusetts Avenue, the bocce and pickleball courts, the pool and surrounding patio, the clubhouse, and a portion of the associated parking. Runoff from the road and parking area flows to catch basins, directing runoff to drainage manholes, a sediment forebay, and infiltration basin.

Subcatchment P2B contains undeveloped open space behind the proposed clubhouse and amenities. Runoff will drain offsite to the northwest and eventually drains into the same Bordering Vegetated Wetland system.

Subcatchment P3 contains open space around the end of Private Drive C, and the emergency connection to Priest Lane. Runoff from this subcatchment flows overland towards the southwest near Priest Lane.

Subcatchment P4 contains a small amount of open space around the southern portion of Private Drive B. Runoff flows offsite to the south.

Subcatchment P5 contains a small amount of open space behind units off Private Drive B at the southeastern portion of the site. Runoff flows offsite to the southeast.

There will be no increase in runoff leaving the site for the 2 year, 10 year, 25 year, and 100 year storm event comparing pre-development to post-development.

Compliance with the Stormwater Management Standards is as follows:

Standard 1: No Untreated Discharges
No untreated discharges to the wetlands are proposed. Infiltration basins with grassed channels and deep sump hooded catch basins as pretreatment will treat impervious runoff prior to runoff reaching the BVW.

Standard 2: Peak Rate Attenuation

The Post-Development peak discharge rates must not be increased from pre-development rates for the 2-year, 10-year, 25-year, and 100-year storm events. Also, offsite flood impact from the 100-year storm must not be increased. With a combination of infiltration and detention, the peak runoff rate and volume have been decreased. The peak runoff rates have been summarized in the following tables.

Discharge Summary Tables

Total Runoff – On-Site Bordering Vegetated Wetlands (1)

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
3.523	3.210	20.61	15.61	35.27	26.47	58.93	49.72

Total Runoff – Northwestern Off-Site (2)

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.338	0.287	1.790	1.429	2.977	2.381	4.885	4.021

Total Runoff – Southwestern Off-Site (3)

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.216	0.127	1.284	0.768	2.195	1.324	3.681	2.223

Total Runoff – Southern Off-Site (4)

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.133	0.127	0.795	0.489	1.359	0.757	2.279	1.175

Total Runoff – Southeastern Off-Site (5)

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.035	0.012	0.234	0.079	0.412	0.133	0.691	0.219

Standard 3: Stormwater Recharge

The infiltration basins have been sized to infiltrate the required recharge volume as specified in the Massachusetts Stormwater Handbook. The "Simple Dynamic" method was used with the Rawls Rate in sizing the required storage volume to infiltrate the recharging runoff. Calculations were performed to insure drawdown within 72 hours to provide storage for the next storm event. Detailed calculations showing compliance with Standard 3 have been attached to this report.

Standard 4: Water Quality

The required water quality volume for this project is 0.5" of runoff over the impervious area in the areas where the soils are not classified as rapid infiltration. In the IWPA

regions and in the areas of soil classified as rapid infiltration, the required water quality volume is 1" of runoff over the imperious area. This volume will be treated to meet the 80% TSS removal requirement of Standard 4. The infiltration basins will treat much greater than the required water quality volume. Calculations showing treatment levels are attached.

Standard 5: Land Uses with Higher Potential Pollutant Loads
The site is will not contain "land uses with higher potential pollutant loads."

Standard 6: Critical Areas
The site does not discharge runoff to critical areas.

Standard 7: Redevelopment
The proposed project is new development.

Standard 8: Construction Period Controls
The erosion and sedimentation control measures will be followed in accordance with the Erosion and Sedimentation Control Plan and will be consistent with the requirements of the NPDES Construction General Permit. The project will require coverage under the NPDES Construction General Permit.

Standard 9: Operation and Maintenance Plan
An Operation and Maintenance Plan will be provided.

Standard 10: Illicit Discharges to Drainage System
An Illicit Discharge Compliance will be provided prior to the discharge of stormwater runoff to the post-construction stormwater BMP's.

Design Basis

1. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
2. The twenty-four hour rainfall, taken from N.R.C.S. publications, is 6.4 inches for the 100-year storm, 5.3 inches for the 25-year storm, 4.5 inches for the 10-year storm, and 3.1 inches for the 2-year storm event.
3. The hydrologic calculations were performed using the computer program: "Hydraflow Hydrographs 2007" by Intelisolve.
4. The soil types of the site were taken from the N.R.C.S. Soil Survey Map for Middlesex County.
5. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
6. The Natural Resources Conservation Service (N.R.C.S.) soil survey indicated the presence of Swansea Muck, Freetown Muck, Ridgebury Fine Sandy Loam, Whitman Fine Sandy Loam, Charlton-Hollis-Rock outcrop, Hollis-Rock Outcrop-Charlton Complex, Paxton Fine Sandy Loam, Woodbridge Fine Sandy Loam, and Carlton Fine Sandy Loam. Carlton Fine Sandy Loam rate as Hydrologic Group A. Charlton-Hollis-Rock outcrop and Hollis-Rock Outcrop-Charlton complex rate as Hydrologic Group B. Paxton Fine Sandy Loam and Woodbridge Fine Sandy Loam rate as Hydrologic Group C. Swansea Muck, Freetown Muck, Ridgebury Fine Sandy Loam, and Whitman Fine Sandy Loam rate as Hydrologic Group D.

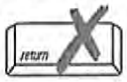
Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
GEORGE
DIMAKARAKOS
CIVIL
No. 41281
REGISTERED PROFESSIONAL ENGINEER

12/22/16

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Subsurface Drainage Structures, Sediment Forebays, Infiltration Basins

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Pre-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	1.198	2	744	9,742	----	------	------	E1A
2	SCS Runoff	2.449	2	750	26,652	----	------	------	E1B
3	SCS Runoff	0.338	2	752	3,402	----	------	------	E2
4	SCS Runoff	0.216	2	750	2,265	----	------	------	E3
5	SCS Runoff	0.133	2	750	1,402	----	------	------	E4
6	SCS Runoff	0.035	2	742	330	----	------	------	E5
8	Combine	3.523	2	748	36,394	1, 2,	------	------	TOTAL E1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	5.810	2	734	29,540	----	------	------	E1A
2	SCS Runoff	15.16	2	740	90,388	----	------	------	E1B
3	SCS Runoff	1.790	2	742	10,871	----	------	------	E2
4	SCS Runoff	1.284	2	740	7,573	----	------	------	E3
5	SCS Runoff	0.795	2	740	4,689	----	------	------	E4
6	SCS Runoff	0.234	2	728	1,105	----	------	------	E5
8	Combine	20.61	2	738	119,928	1, 2,	------	------	TOTAL E1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	9.479	2	732	43,969	----	------	------	E1A
2	SCS Runoff	26.10	2	738	138,454	----	------	------	E1B
3	SCS Runoff	2.977	2	740	16,404	----	------	------	E2
4	SCS Runoff	2.195	2	736	11,558	----	------	------	E3
5	SCS Runoff	1.359	2	736	7,157	----	------	------	E4
6	SCS Runoff	0.412	2	728	1,686	----	------	------	E5
8	Combine	35.27	2	736	182,423	1, 2,	------	------	TOTAL E1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	15.30	2	732	66,528	----	------	------	E1A
2	SCS Runoff	44.07	2	736	214,853	----	------	------	E1B
3	SCS Runoff	4.885	2	738	25,126	----	------	------	E2
4	SCS Runoff	3.681	2	736	17,880	----	------	------	E3
5	SCS Runoff	2.279	2	736	11,072	----	------	------	E4
6	SCS Runoff	0.691	2	728	2,609	----	------	------	E5
8	Combine	58.93	2	734	281,381	1, 2,	------	------	TOTAL E1

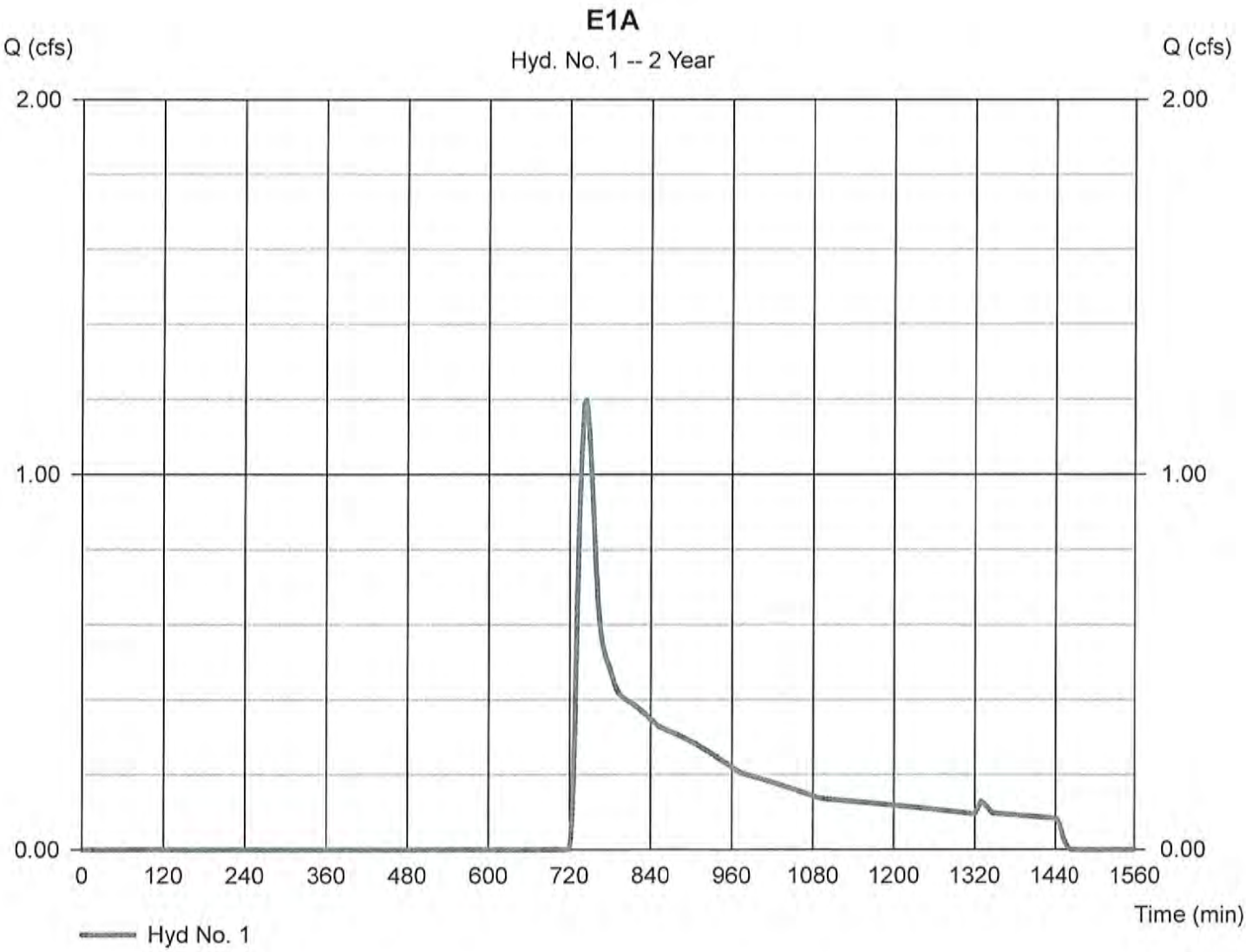
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 1

E1A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.198 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 9,742 cuft
Drainage area	= 9.640 ac	Curve number	= 57.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



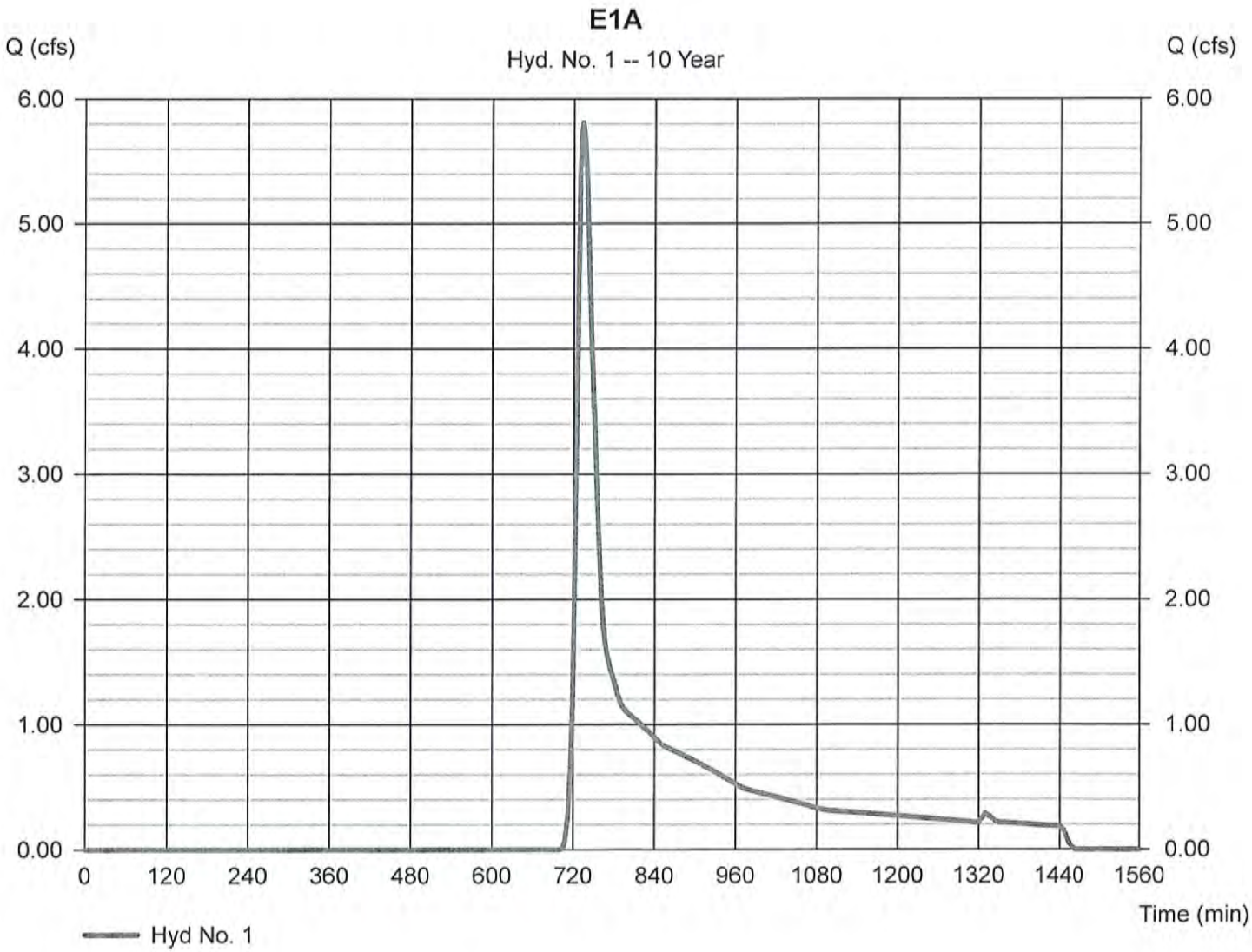
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 1

E1A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.810 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 29,540 cuft
Drainage area	= 9.640 ac	Curve number	= 57.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



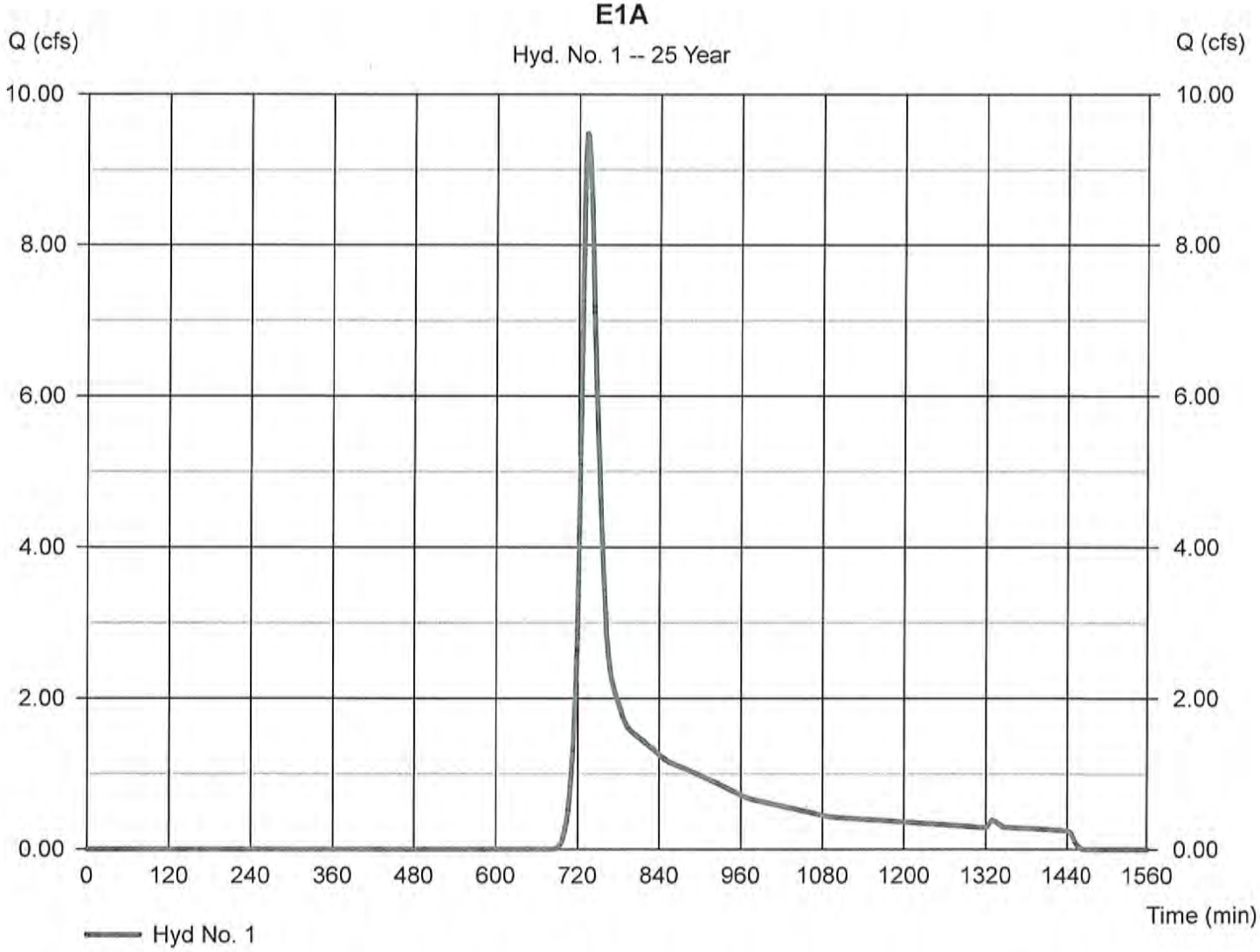
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 1

E1A

Hydrograph type	= SCS Runoff	Peak discharge	= 9.479 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 43,969 cuft
Drainage area	= 9.640 ac	Curve number	= 57.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.20 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



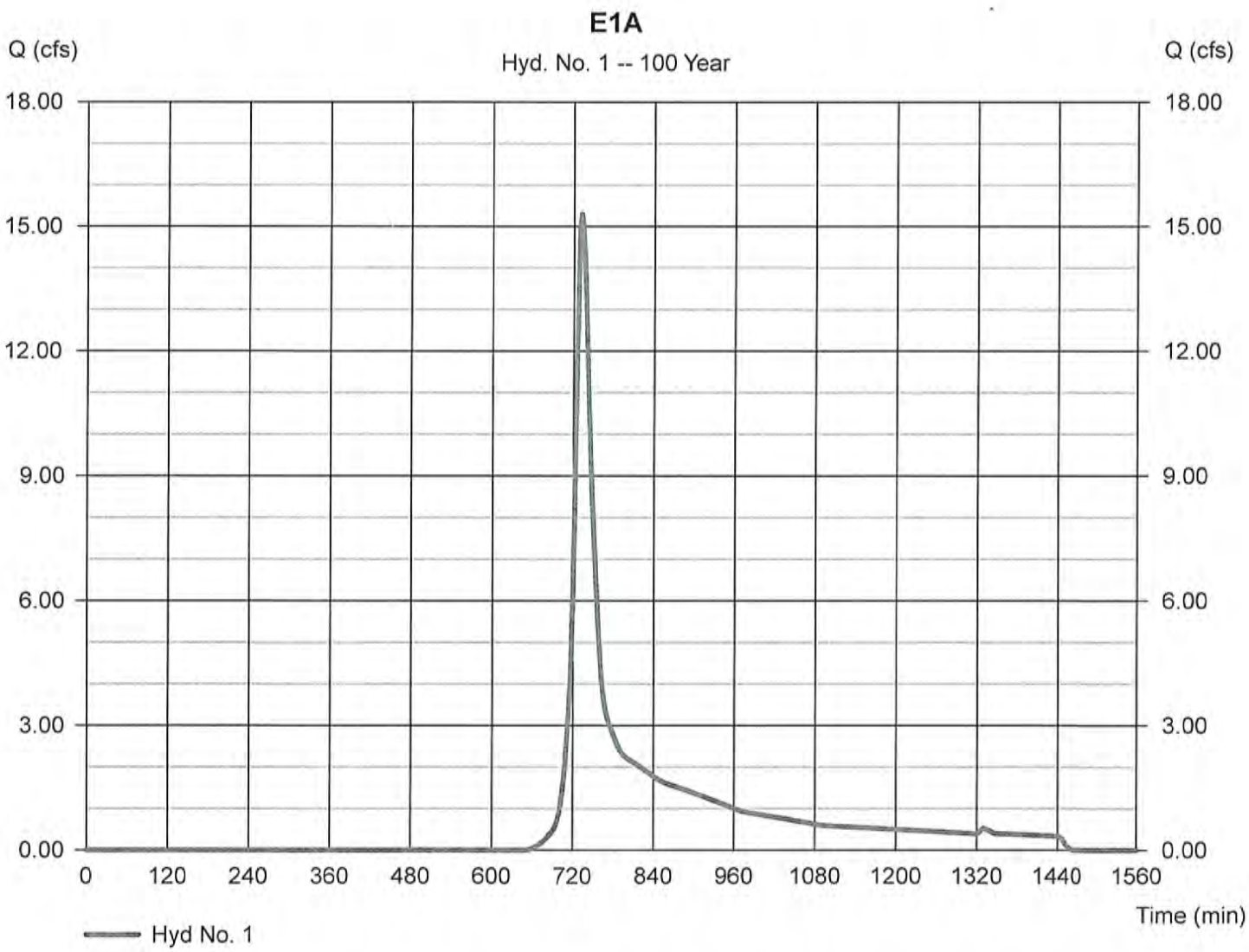
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 1

E1A

Hydrograph type	= SCS Runoff	Peak discharge	= 15.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 66,528 cuft
Drainage area	= 9.640 ac	Curve number	= 57.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 14.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-1A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			8.25	453.88
B	Open- Good Condition	61			0.16	9.87
C	Woods- Good Condition	70			1.11	77.52
C	Open- Good Condition	74			0.02	1.26
D	Woods- Good Condition	77			0.00	0.24
	Impervious	98			0.10	9.84
				Totals =	9.64	552.60

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{552.60}{9.64} = 57.31$; Use CN = 57.3

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.29	0.87	1.95
Runoff, Q.....	cf	10019	30326	68284

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-1A
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.04			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.22			0.22

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	325			
9. Watercourse slope, s		ft/ft	0.093			
10. Average Velocity, V (figure 3-1)		ft/s	4.92			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.24
min 14.2

(210-VI-TR-55, Second Ed., June 1986)

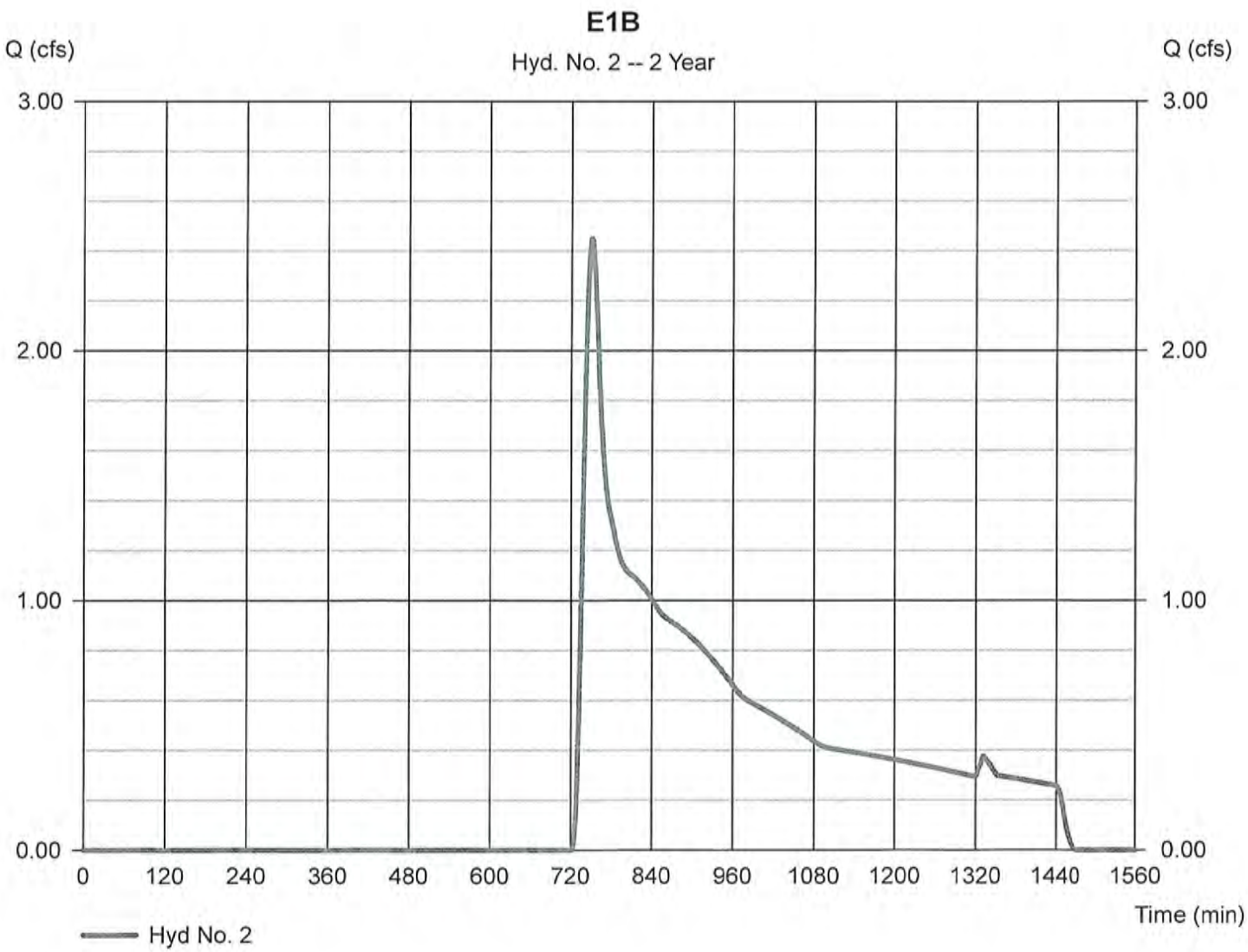
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 2

E1B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.449 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 26,652 cuft
Drainage area	= 34.260 ac	Curve number	= 54.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



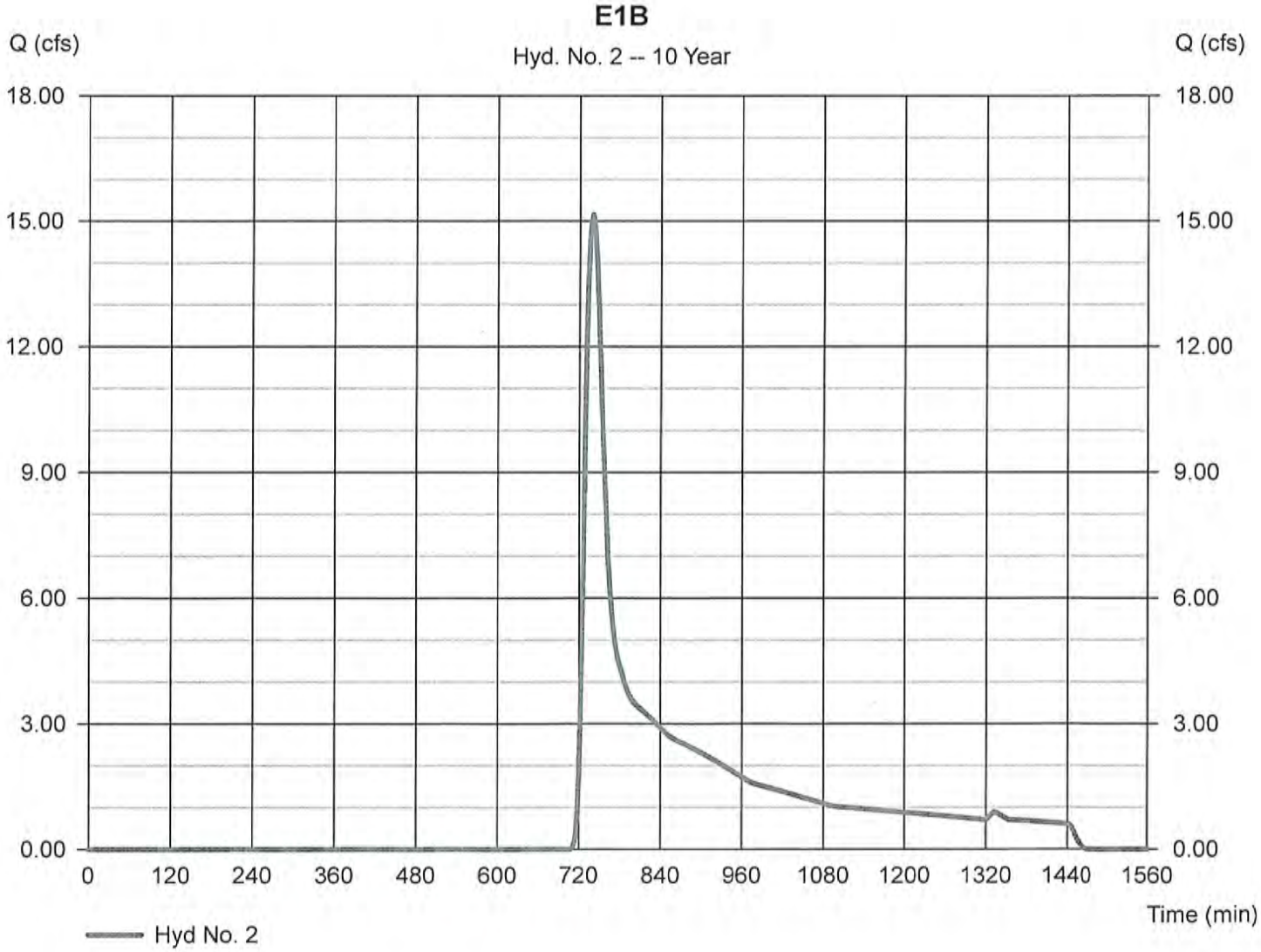
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 2

E1B

Hydrograph type	= SCS Runoff	Peak discharge	= 15.16 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 90,388 cuft
Drainage area	= 34.260 ac	Curve number	= 54.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



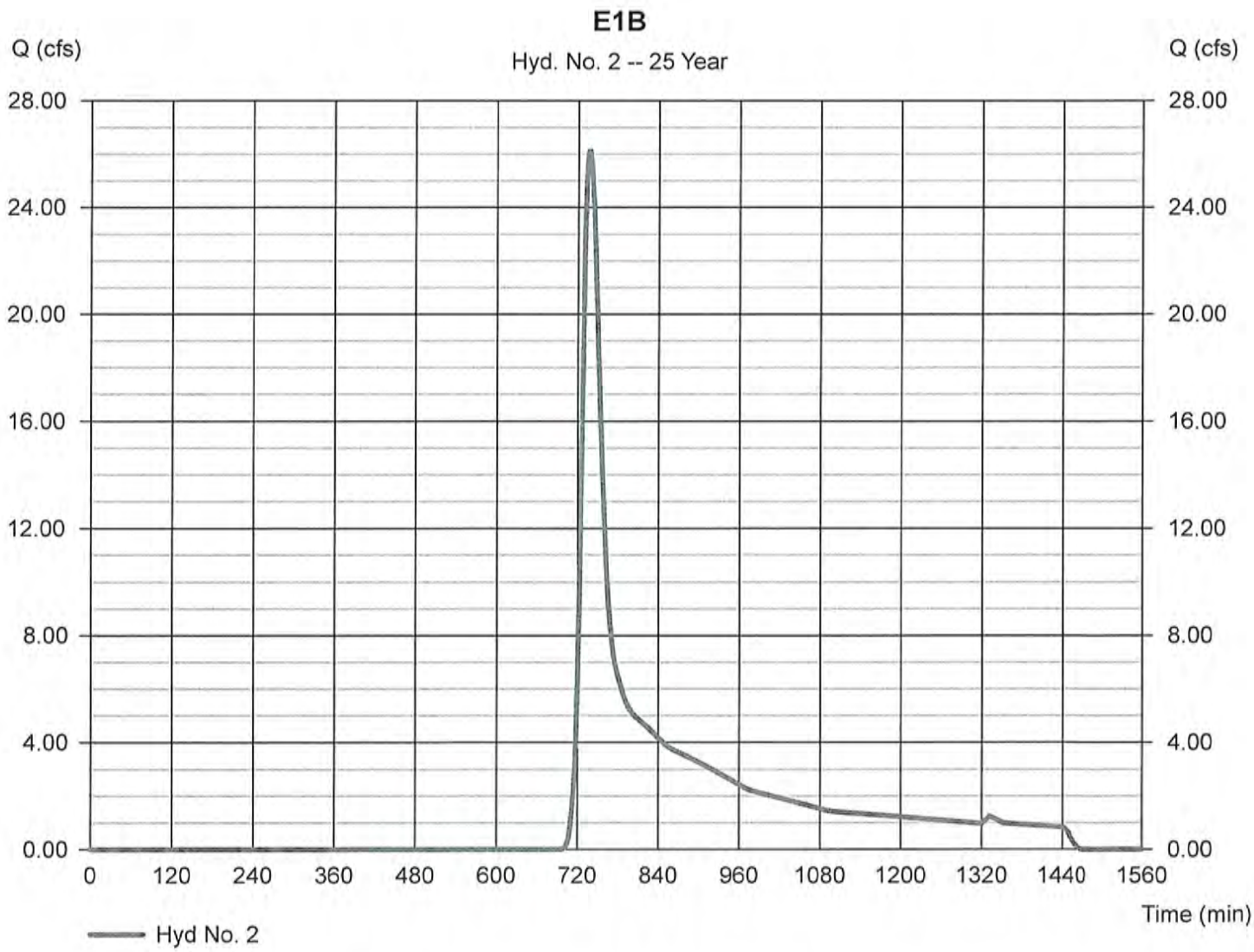
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Monday, Nov 28, 2016

Hyd. No. 2

E1B

Hydrograph type	= SCS Runoff	Peak discharge	= 26.10 cfs
Storm frequency	= 25 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 138,454 cuft
Drainage area	= 34.260 ac	Curve number	= 54.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.20 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



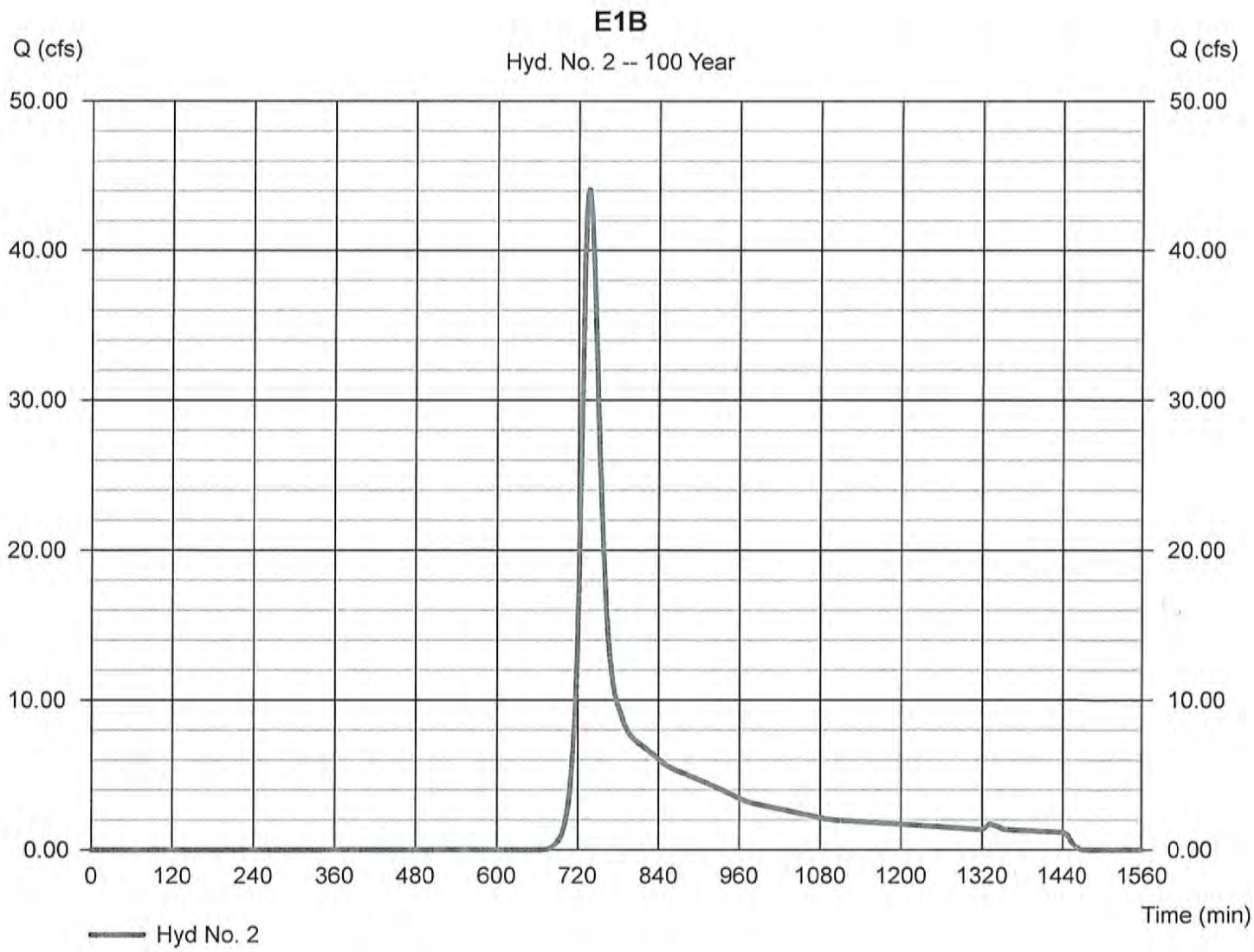
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 2

E1B

Hydrograph type	= SCS Runoff	Peak discharge	= 44.07 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 214,853 cuft
Drainage area	= 34.260 ac	Curve number	= 54.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-1B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			23.59	1297.69
C	Woods- Good Condition	70			2.76	193.11
D	Woods- Good Condition	77			0.05	3.88
A	Woods- Good Condition	30			4.63	138.79
	Impervious	98			0.45	43.72
C	Open- Good Condition	74			1.26	93.10
C	Open- Fair Condition	79			0.54	42.55
B	Open- Good Condition	61			0.99	60.11
				Totals =	34.26	1872.95

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{1872.95}{34.26} = 54.67$; Use CN = 54.7

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1.) or eqs. 2-3 and 2-4.)	in	0.21	0.73	1.73
Runoff, Q.....	cf	26561	90210	214545

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-1B
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.054			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.19			0.19

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	963			
9. Watercourse slope, s		ft/ft	0.032			
10. Average Velocity, V (figure 3-1)		ft/s	2.89			
11. Tt = L / 3600V	Compute Tt	hr	0.09			0.09

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.29
min 17.2

(210-VI-TR-55, Second Ed., June 1986)

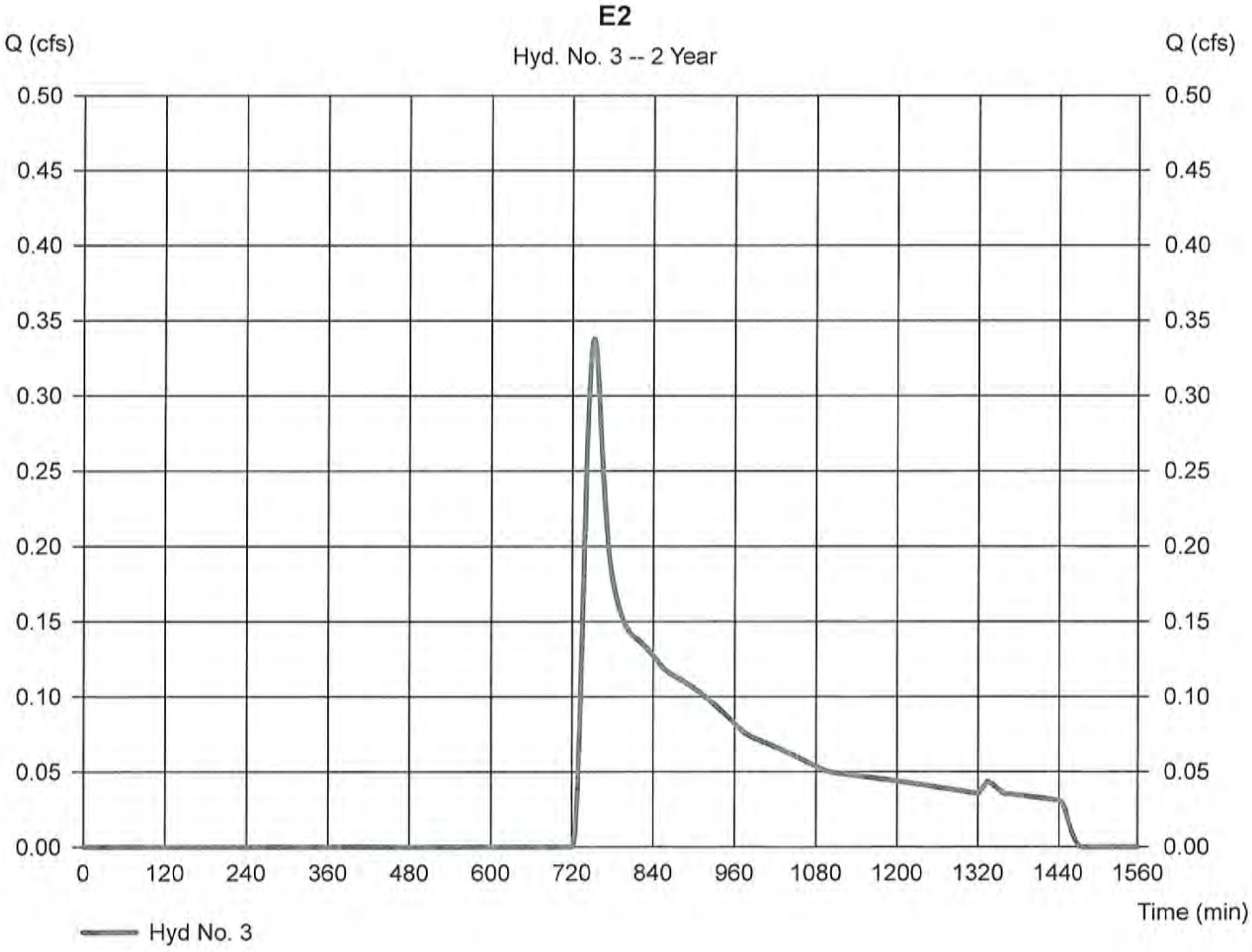
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 3

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.338 cfs
Storm frequency	= 2 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 3,402 cuft
Drainage area	= 3.700 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 21.90 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



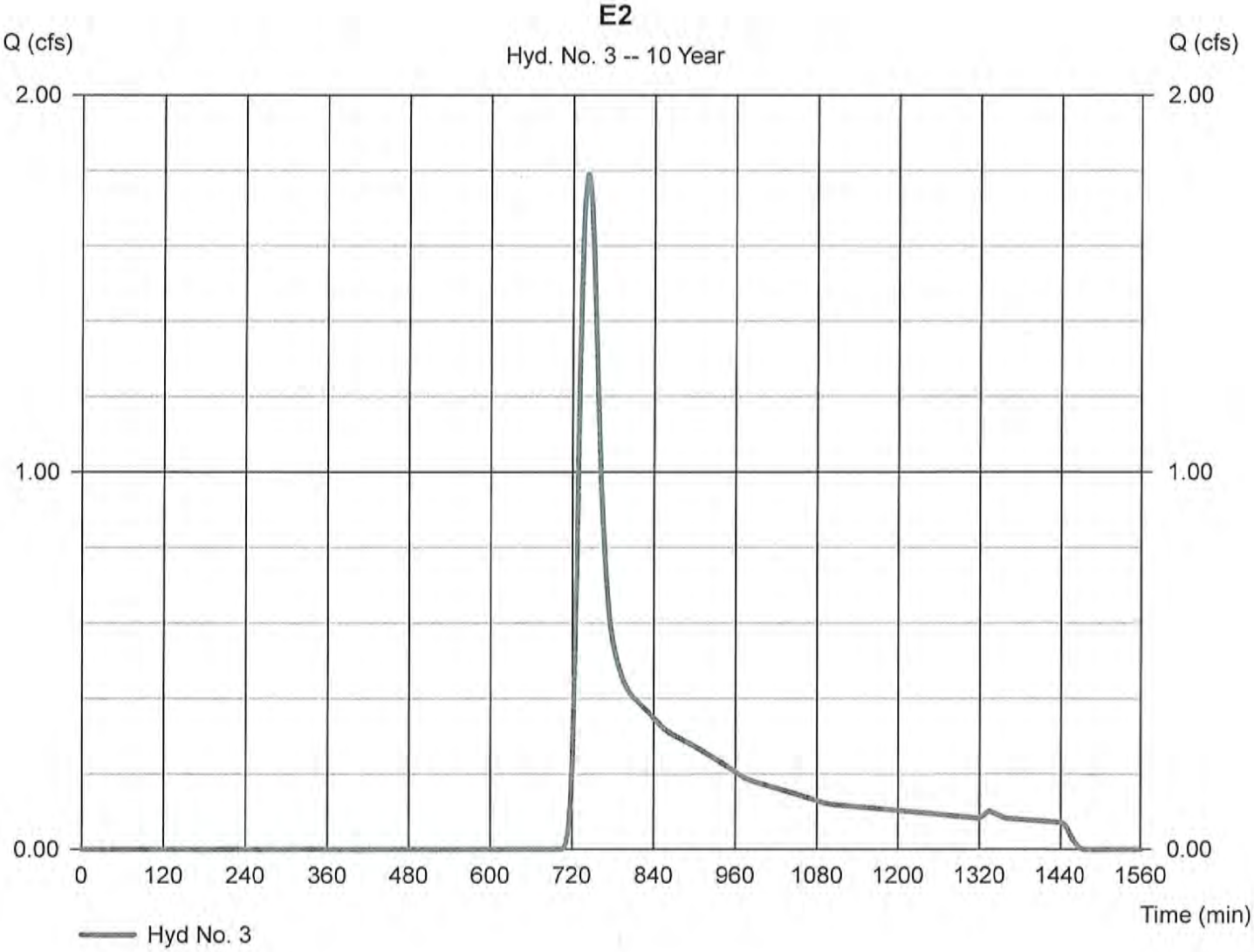
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 3

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.790 cfs
Storm frequency	= 10 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 10,871 cuft
Drainage area	= 3.700 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 21.90 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



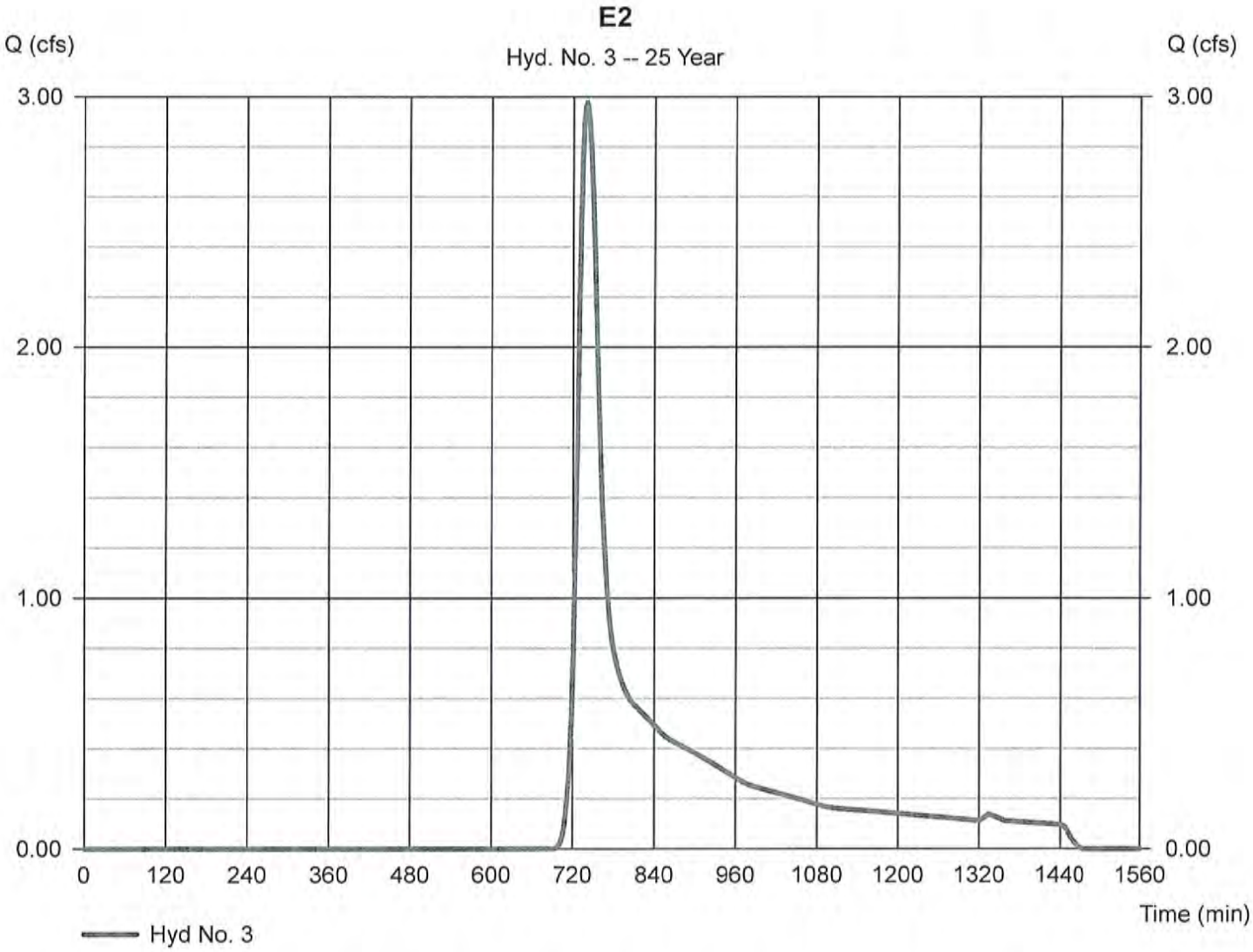
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 3

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.977 cfs
Storm frequency	= 25 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 16,404 cuft
Drainage area	= 3.700 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 21.90 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



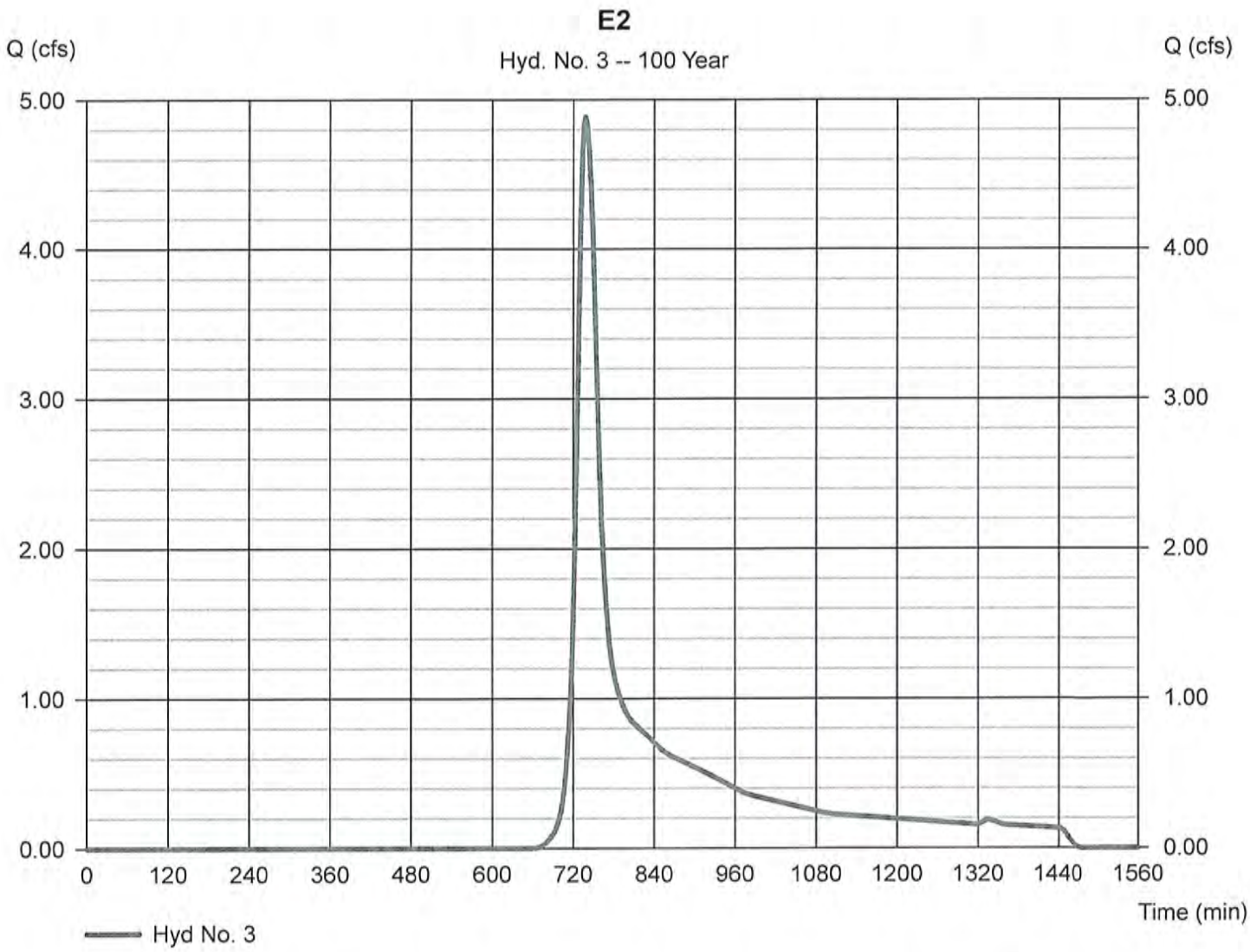
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 3

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 4.885 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 25,126 cuft
Drainage area	= 3.700 ac	Curve number	= 56
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 21.90 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2069**

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-2

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.08	7.84
B	Woods- Good Condition	55			3.55	195.37
B	Open Space-Good Condition	61			0.06	3.95
					Totals =	3.70	207.16

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{207.16}{3.70} =$ 56.04 ; Use CN = 56.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.25	0.80	1.84
Runoff, Q.....	cf	3354	10696	24705

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-2
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.012			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.35			0.35

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	143			
9. Watercourse slope, s		ft/ft	0.059			
10. Average Velocity, V (figure 3-1)		ft/s	3.92			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.36
min 21.9

(210-VI-TR-55, Second Ed., June 1986)

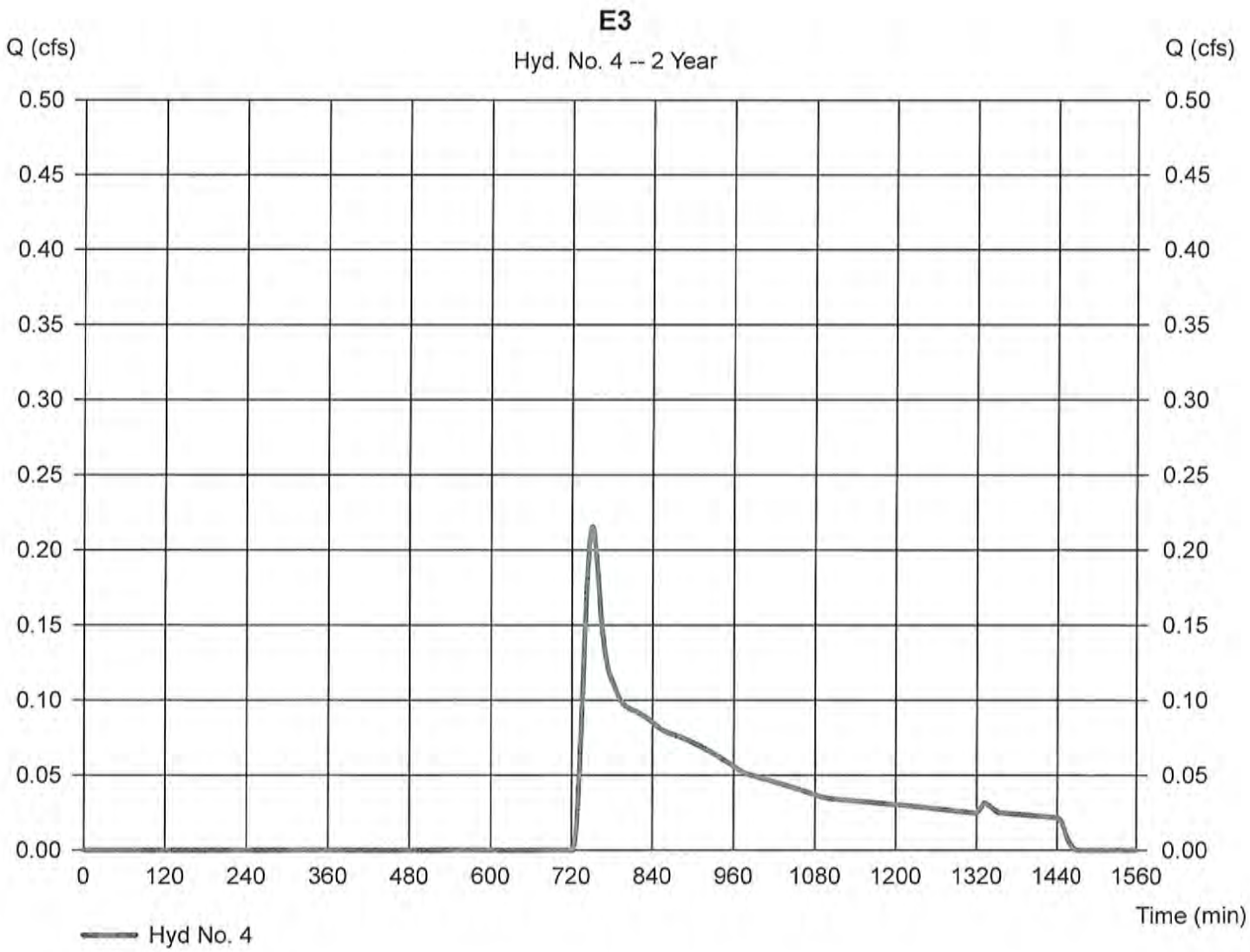
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Monday, Nov 28, 2016

Hyd. No. 4

E3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.216 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 2,265 cuft
Drainage area	= 2.810 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 18.30 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



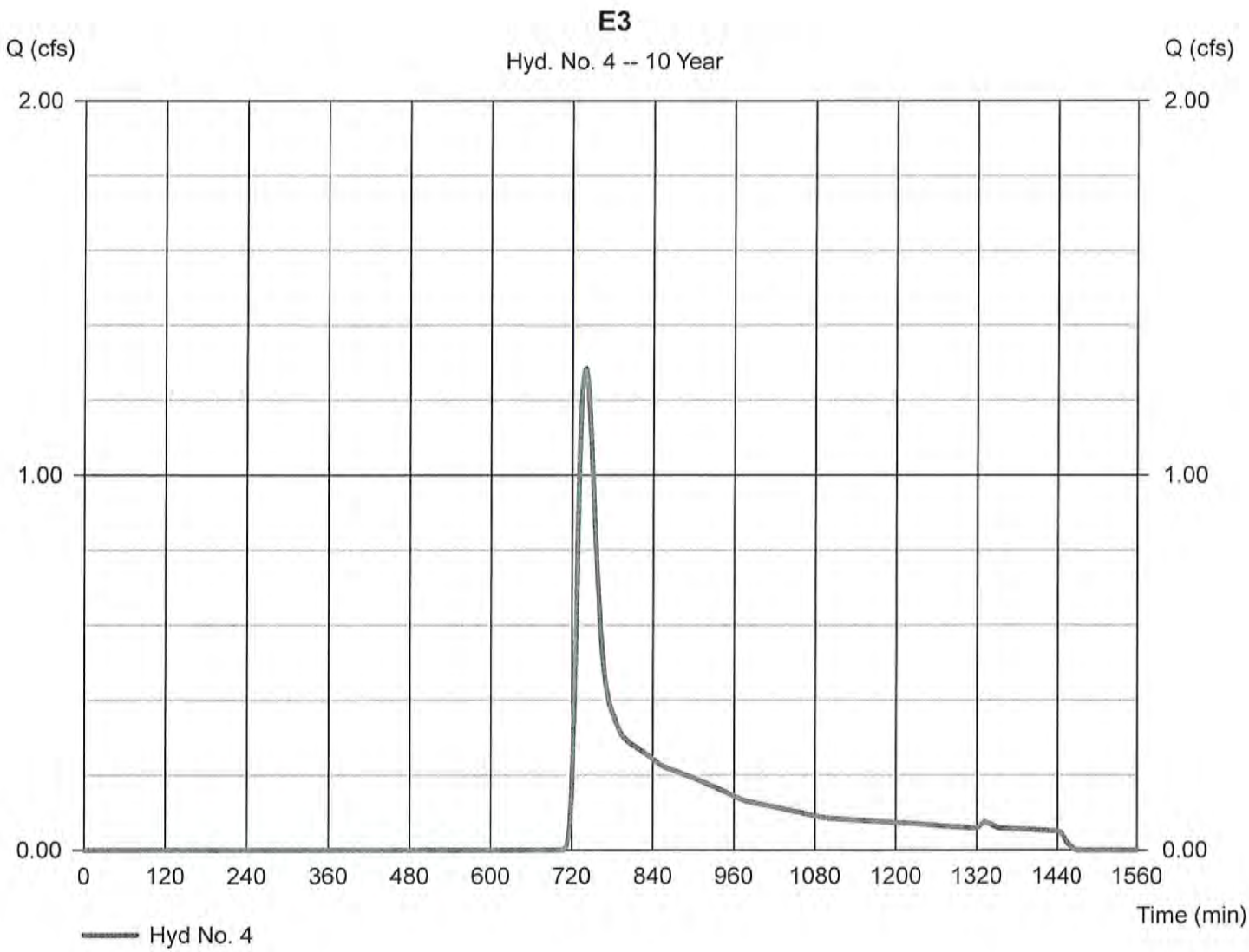
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 4

E3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.284 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 7,573 cuft
Drainage area	= 2.810 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 18.30 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



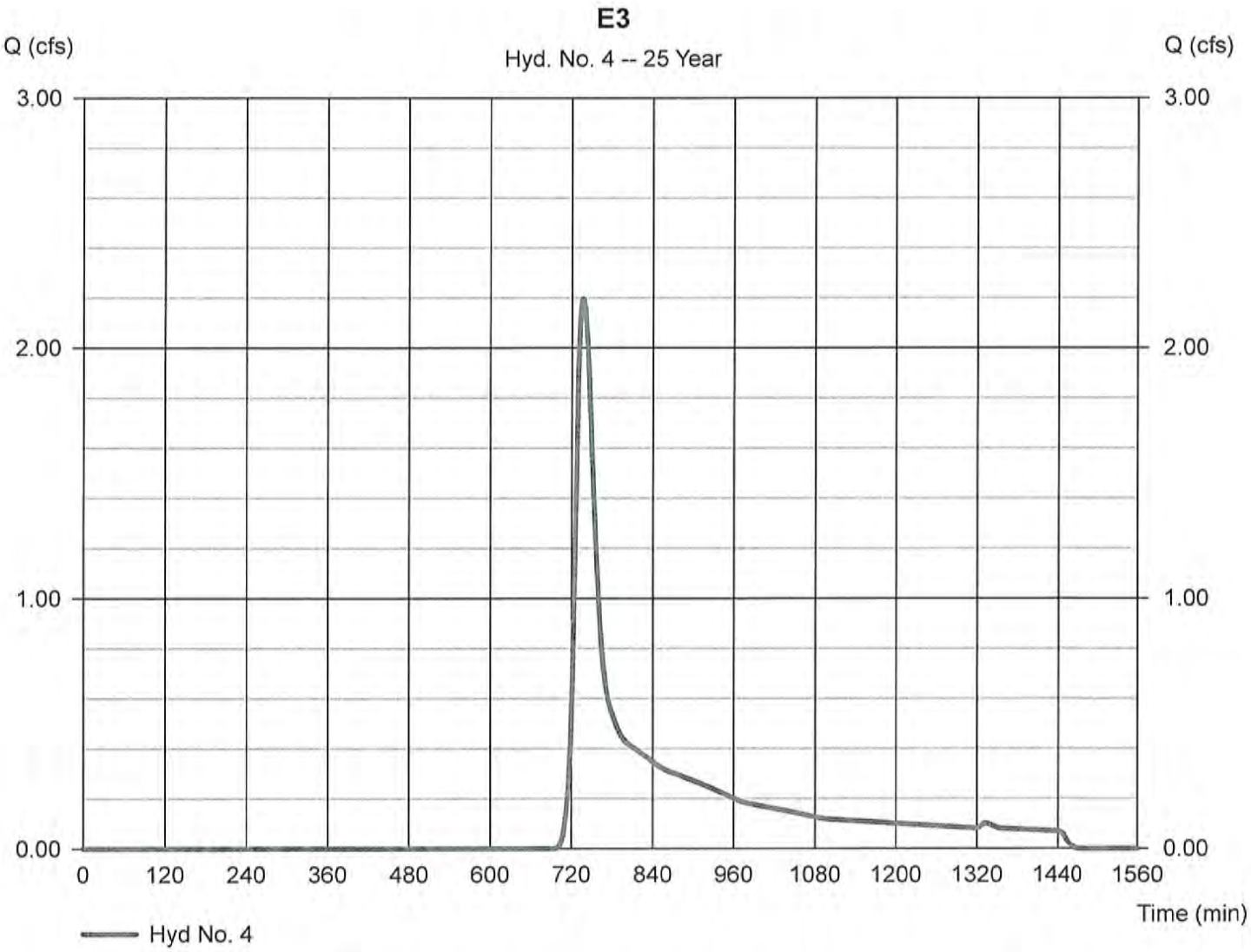
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 4

E3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.195 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 11,558 cuft
Drainage area	= 2.810 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 18.30 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



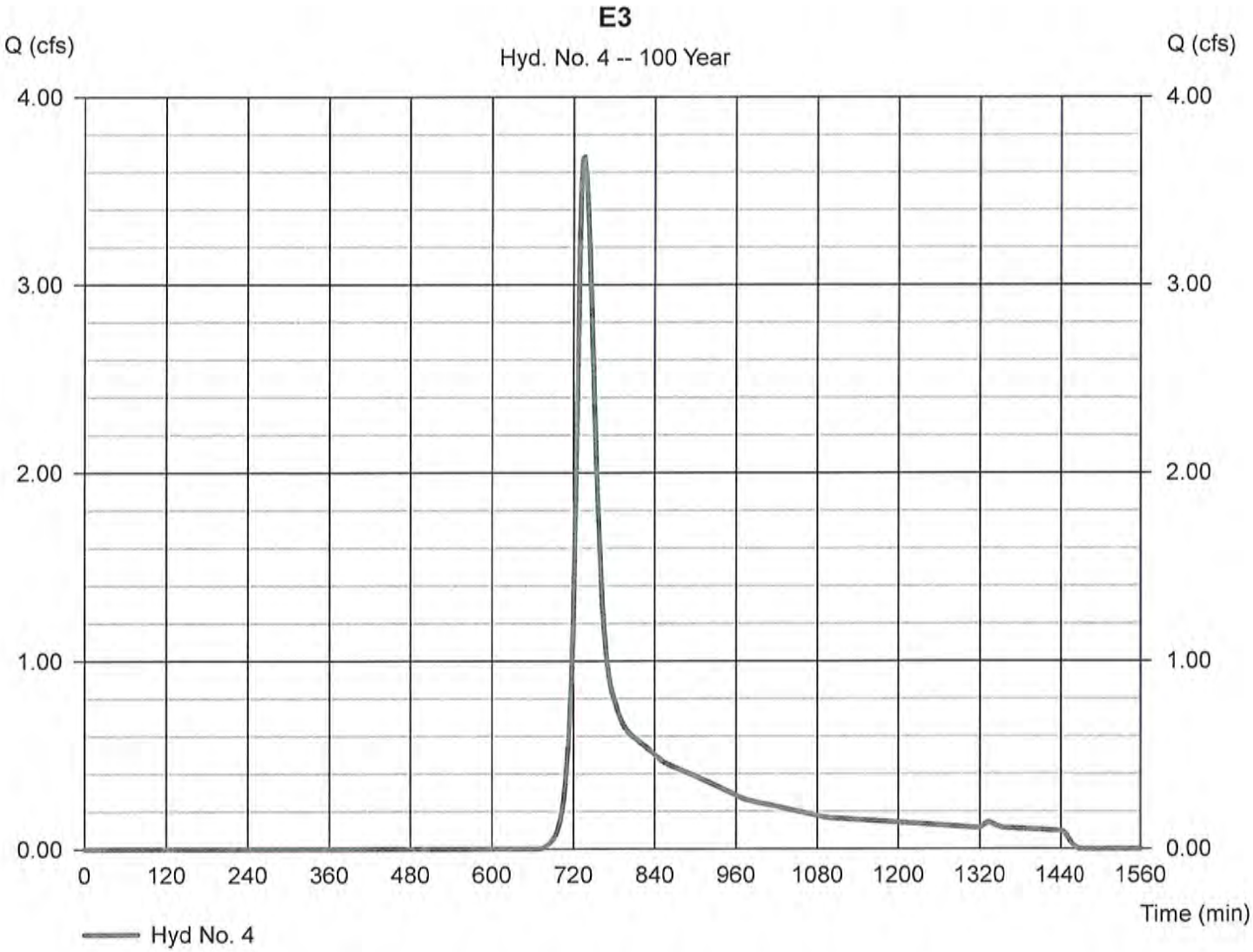
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 4

E3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.681 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 17,880 cuft
Drainage area	= 2.810 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 18.30 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			2.81	154.52
				Totals =	2.81	154.52

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{154.52}{2.81} =$ 55.00 ; Use CN = 55.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.22	0.74	1.75
Runoff, Q.....	cf	2265	7572	17877

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-3
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.02			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	221			
9. Watercourse slope, s		ft/ft	0.061			
10. Average Velocity, V (figure 3-1)		ft/s	3.98			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.30
min 18.3

(210-VI-TR-55, Second Ed., June 1986)

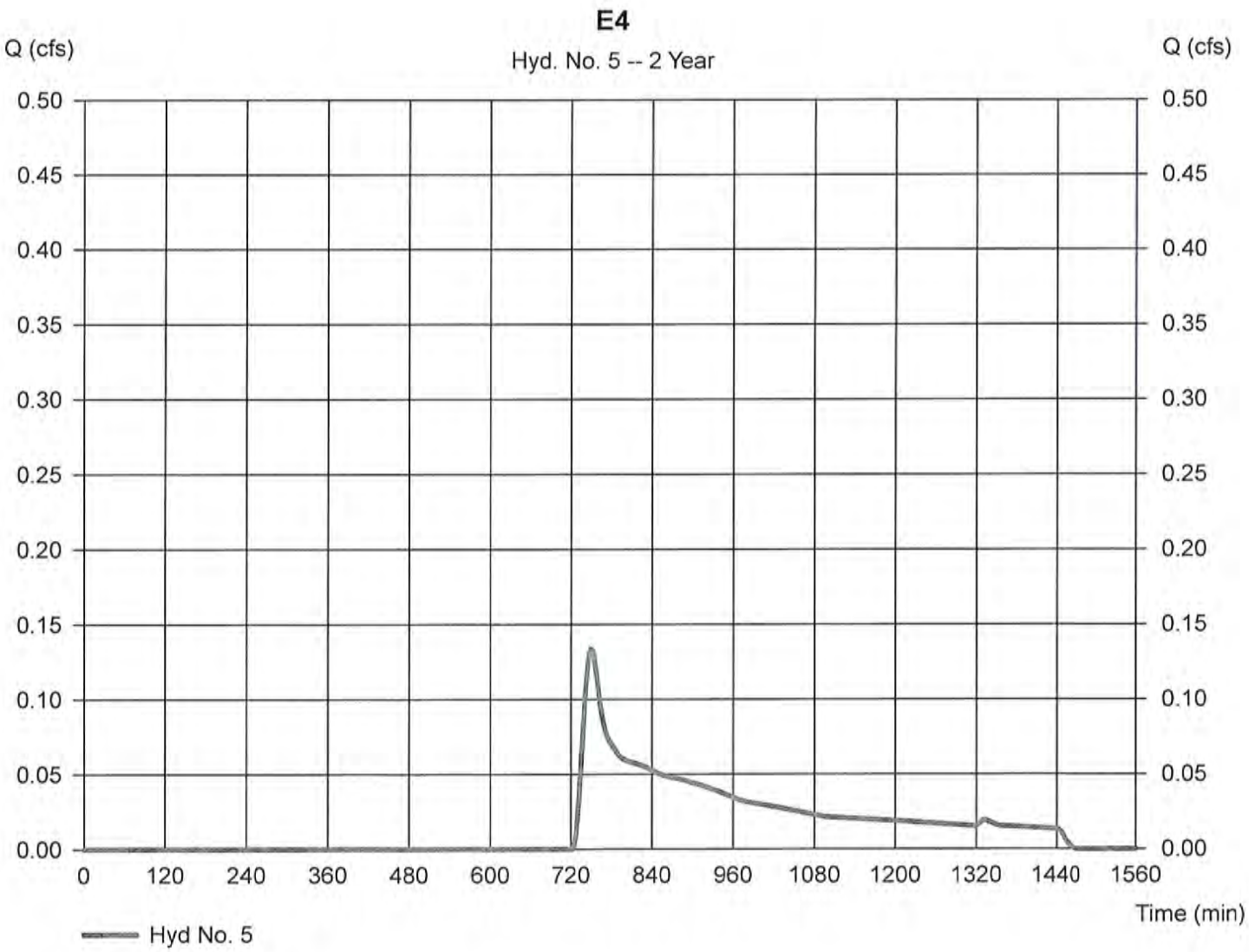
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 5

E4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.133 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 1,402 cuft
Drainage area	= 1.740 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.70 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



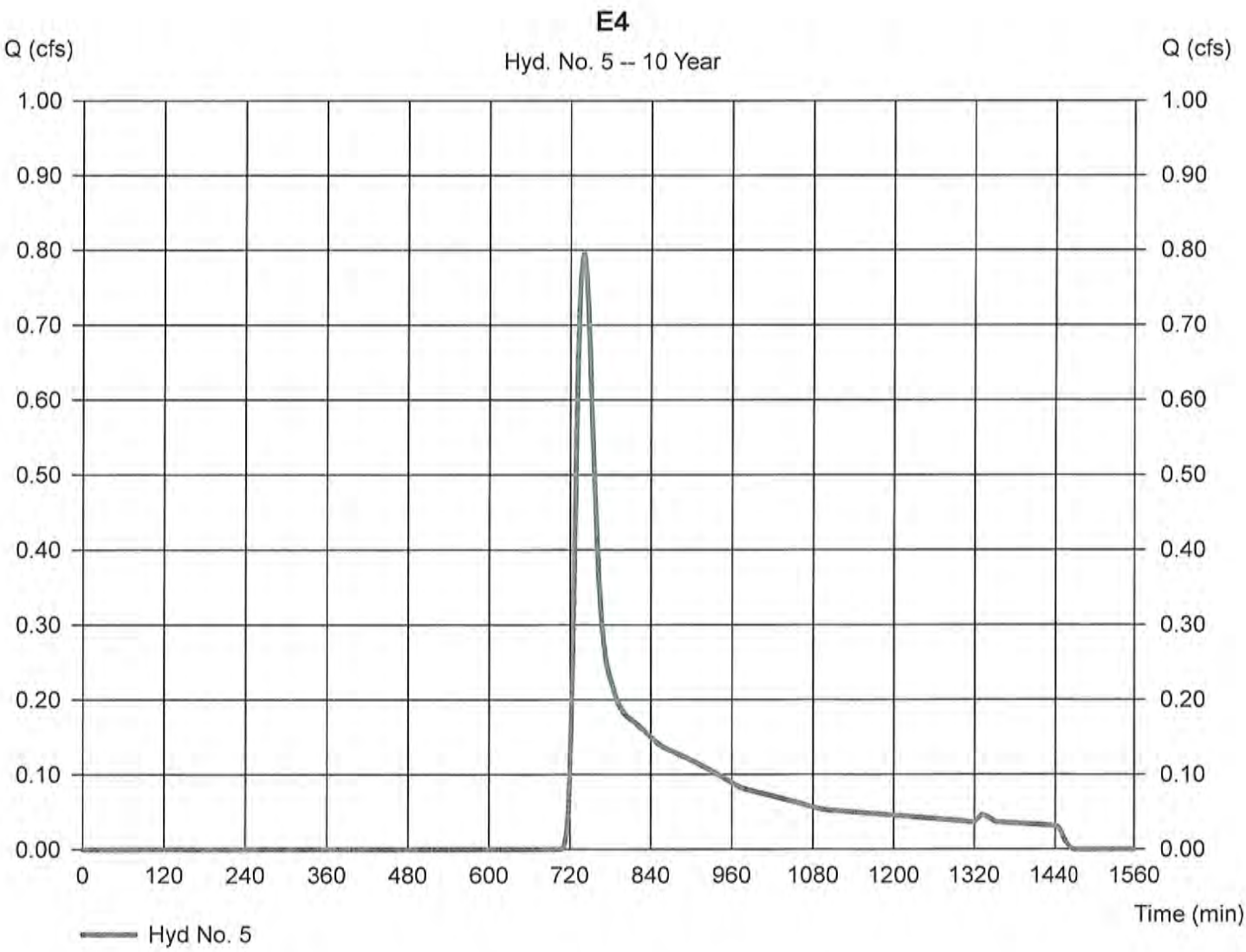
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 5

E4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.795 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 4,689 cuft
Drainage area	= 1.740 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.70 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



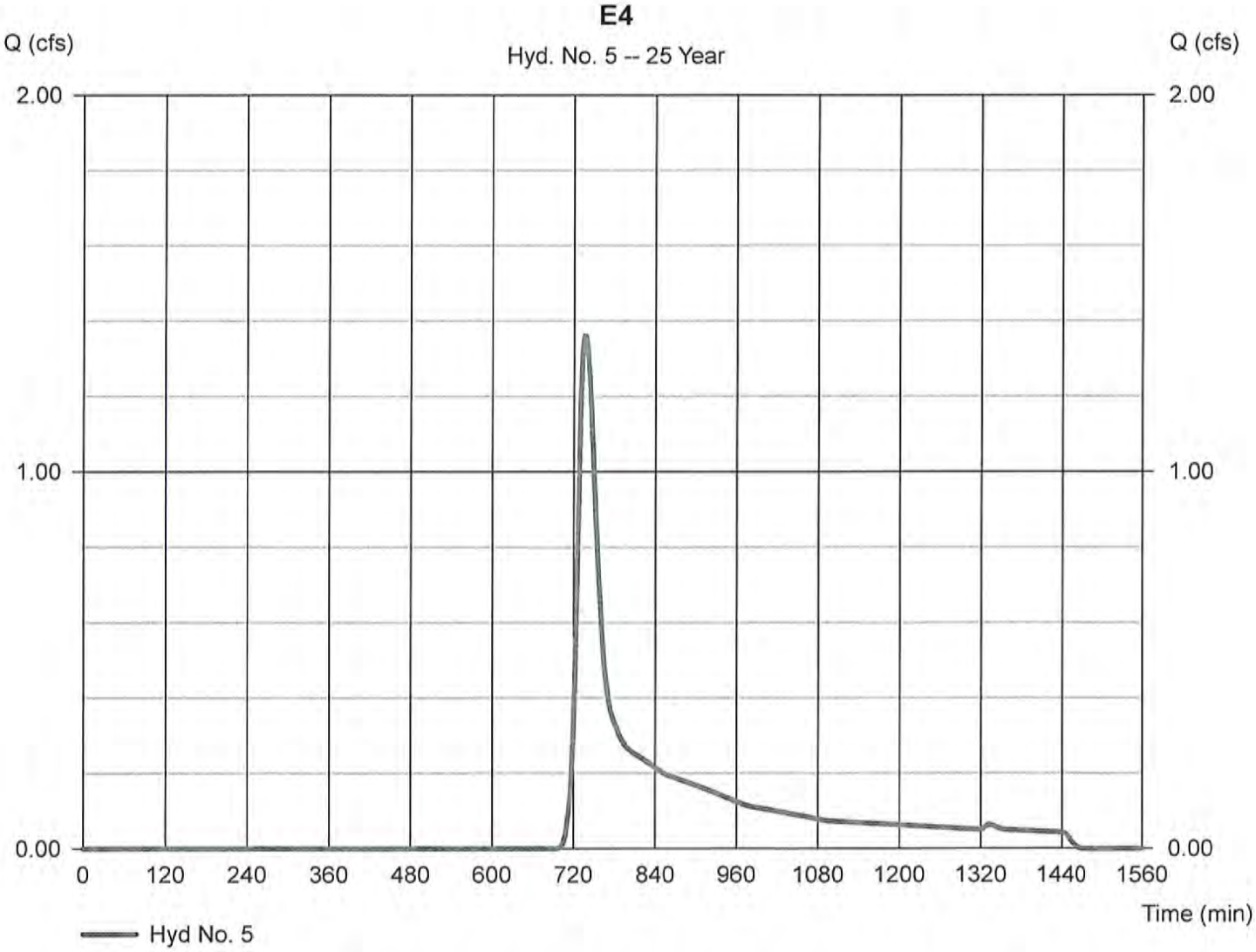
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 5

E4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.359 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 7,157 cuft
Drainage area	= 1.740 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.70 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



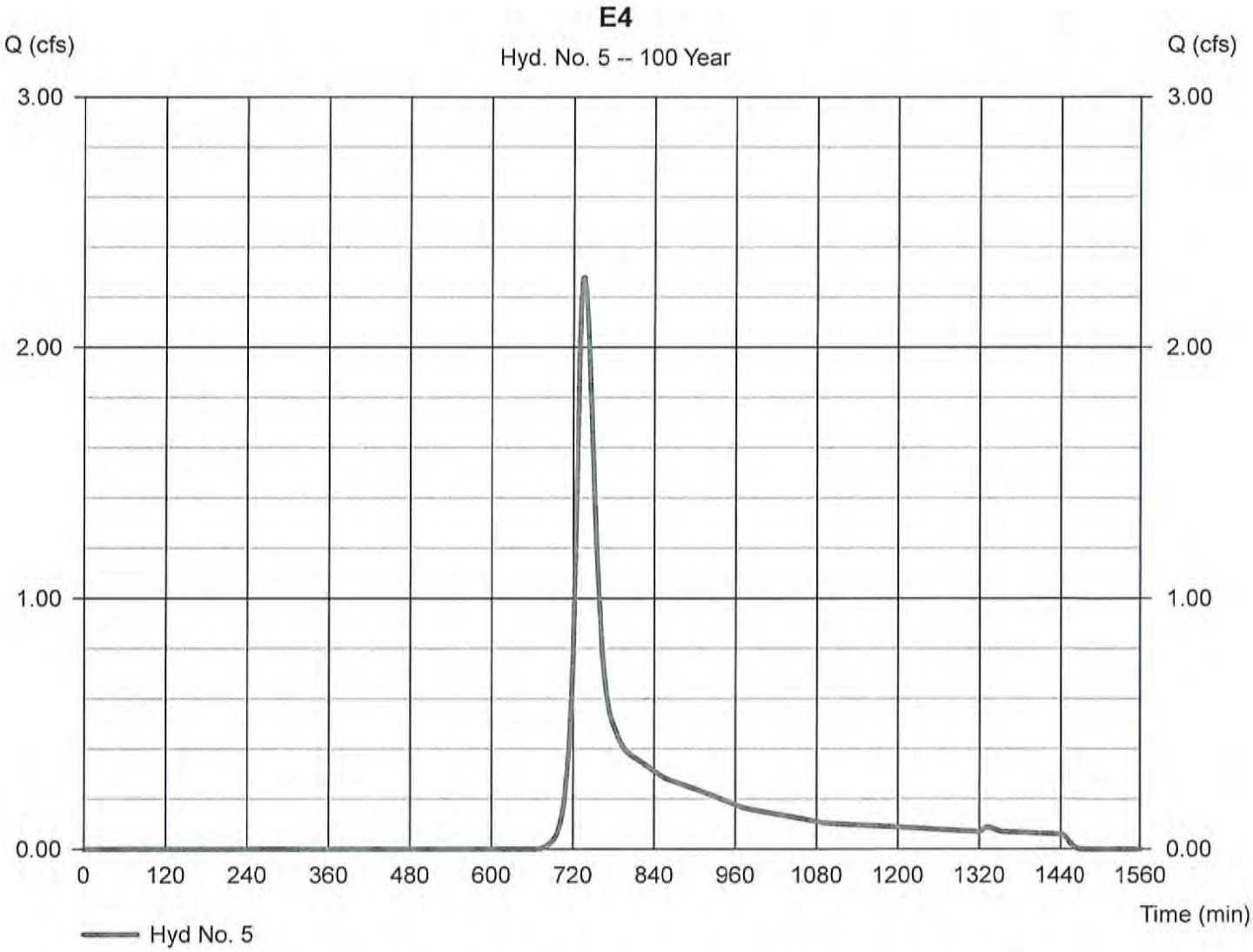
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 5

E4

Hydrograph type	= SCS Runoff	Peak discharge	= 2.279 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 11,072 cuft
Drainage area	= 1.740 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.70 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			1.74	95.62
				Totals =	1.74	95.62

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{95.62}{1.74} = 55.00$; Use CN = 55.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.22	0.74	1.75
Runoff, Q.....	cf	1402	4685	11062

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present Developed Subcatchment E-4
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.02			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	127			
9. Watercourse slope, s		ft/ft	0.11			
10. Average Velocity, V (figure 3-1)		ft/s	5.35			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.30
min 17.7

(210-VI-TR-55, Second Ed., June 1986)

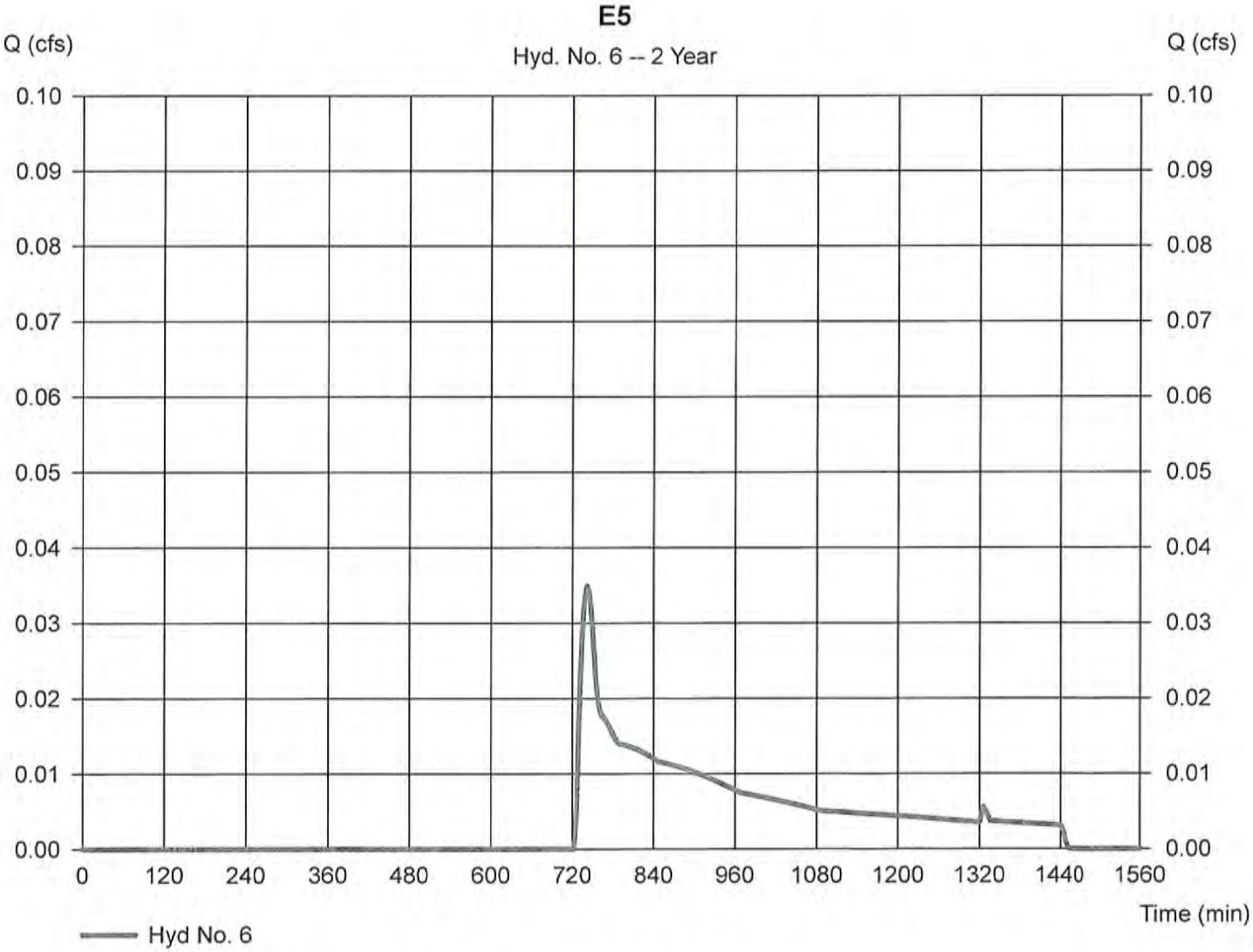
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 6

E5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.035 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 330 cuft
Drainage area	= 0.410 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 9.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



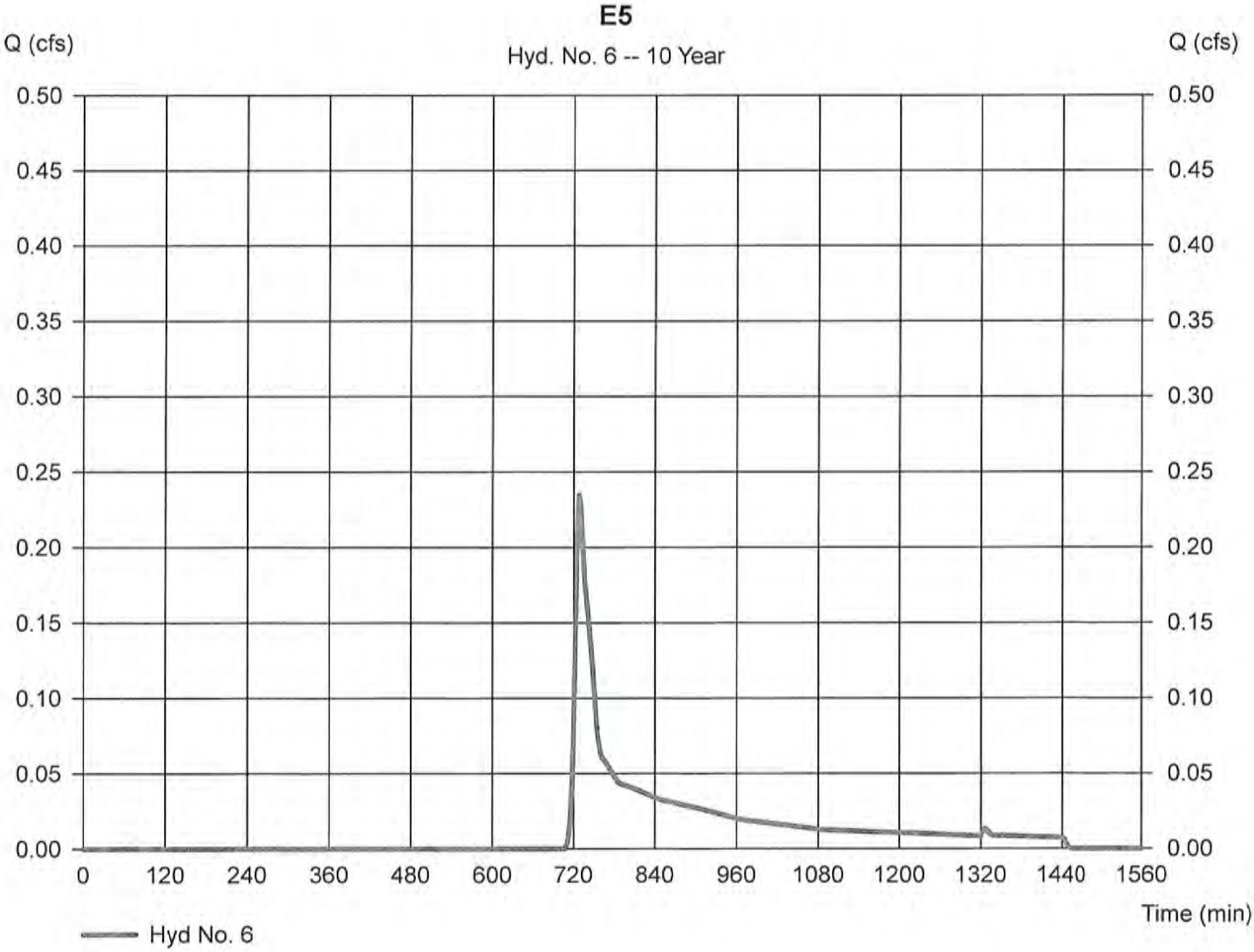
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Monday, Nov 28, 2016

Hyd. No. 6

E5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.234 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 1,105 cuft
Drainage area	= 0.410 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 9.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



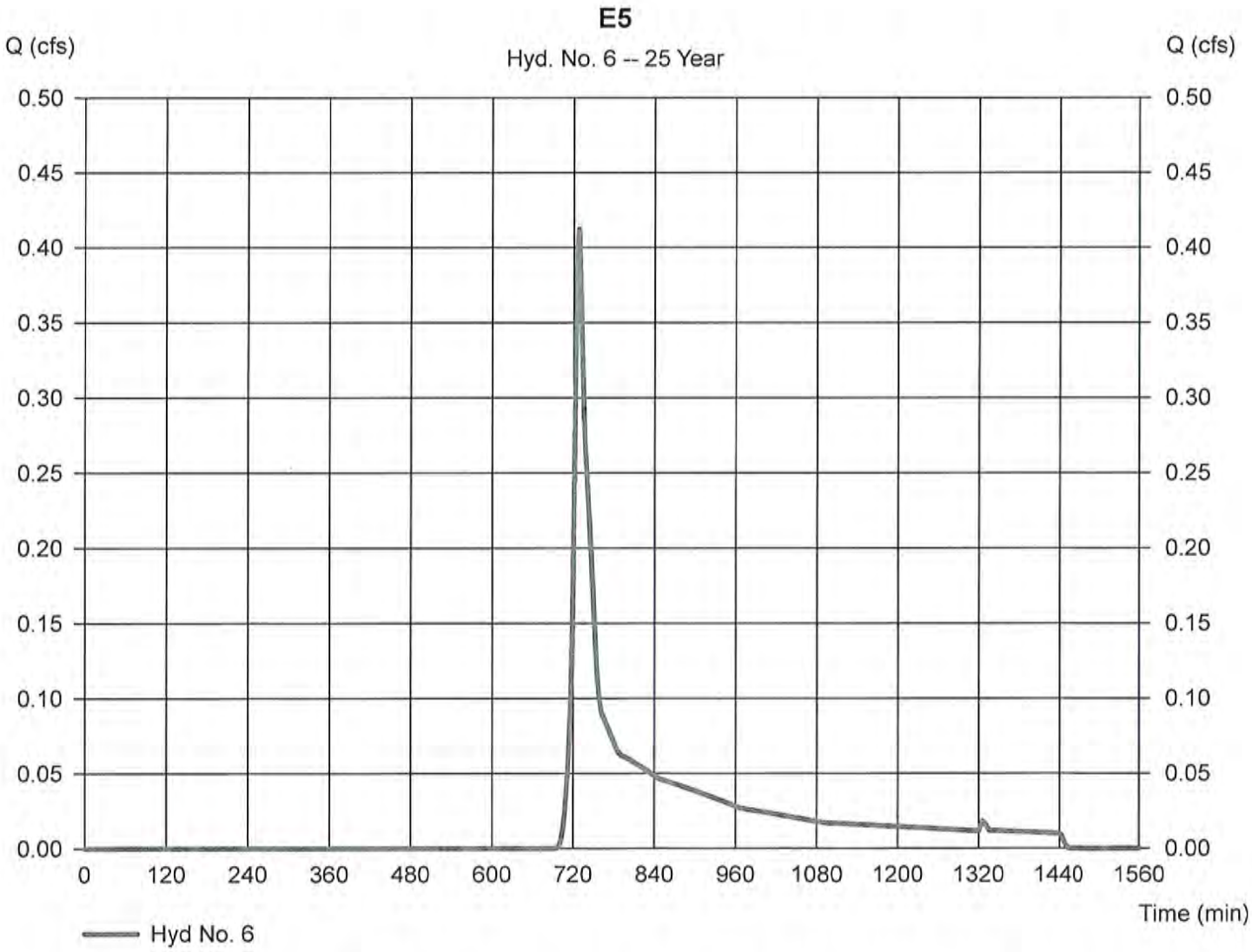
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 6

E5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.412 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 1,686 cuft
Drainage area	= 0.410 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 9.20 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



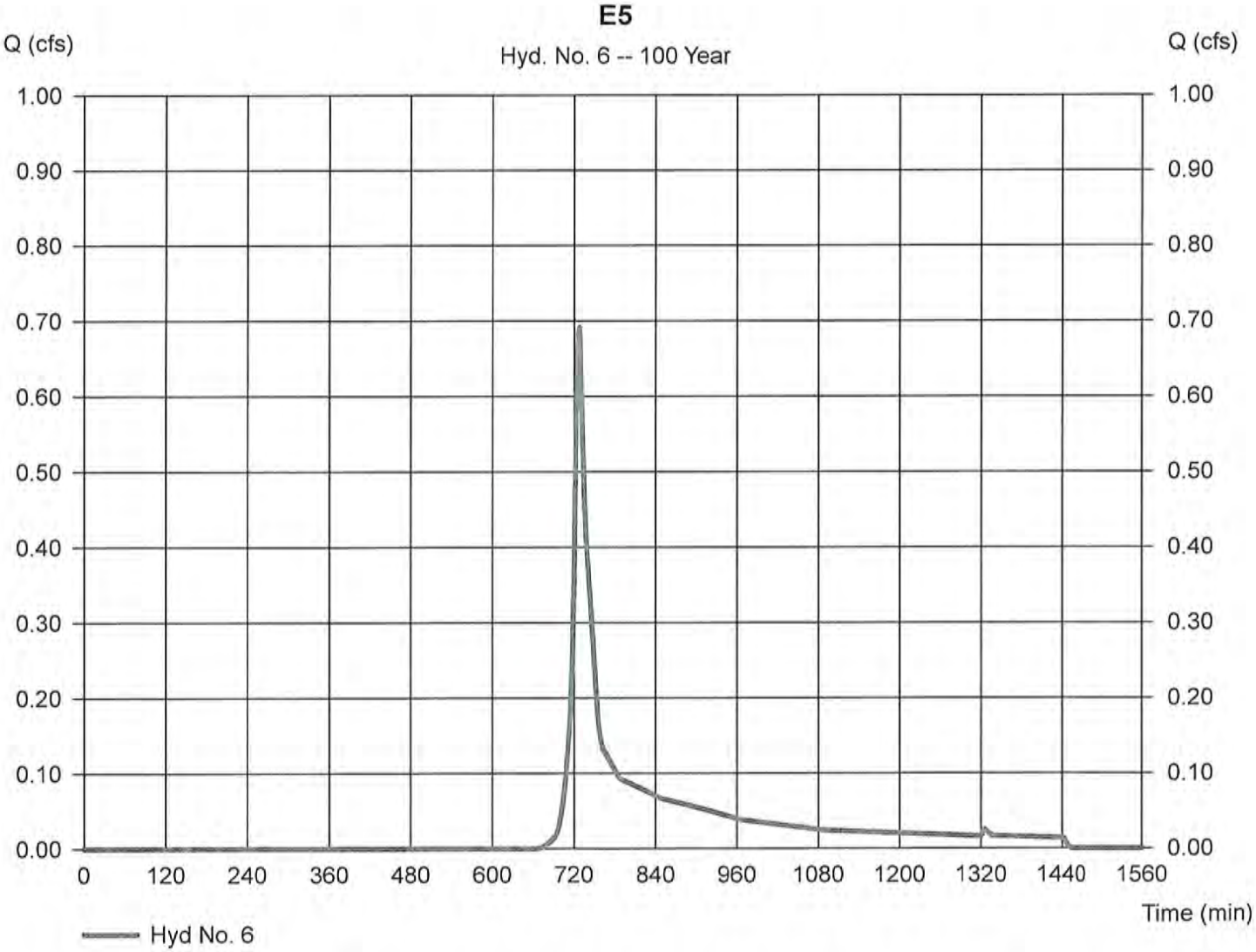
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 6

E5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.691 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 2,609 cuft
Drainage area	= 0.410 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 9.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: [Present] Developed Subcatchment E-5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			0.41	22.54
				Totals =	0.41	22.54

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{22.54}{0.41} =$ 55.00 ; Use CN = 55.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.22	0.74	1.75
Runoff, Q.....	cf	330	1104	2608

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 9/23/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed Subcatchment E-5
Circle one: Tc | Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Woods			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.106			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.15			0.15

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	89			
9. Watercourse slope, s		ft/ft	0.109			
10. Average Velocity, V (figure 3-1)		ft/s	5.33			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.15
min 9.2

(210-VI-TR-55, Second Ed., June 1986)

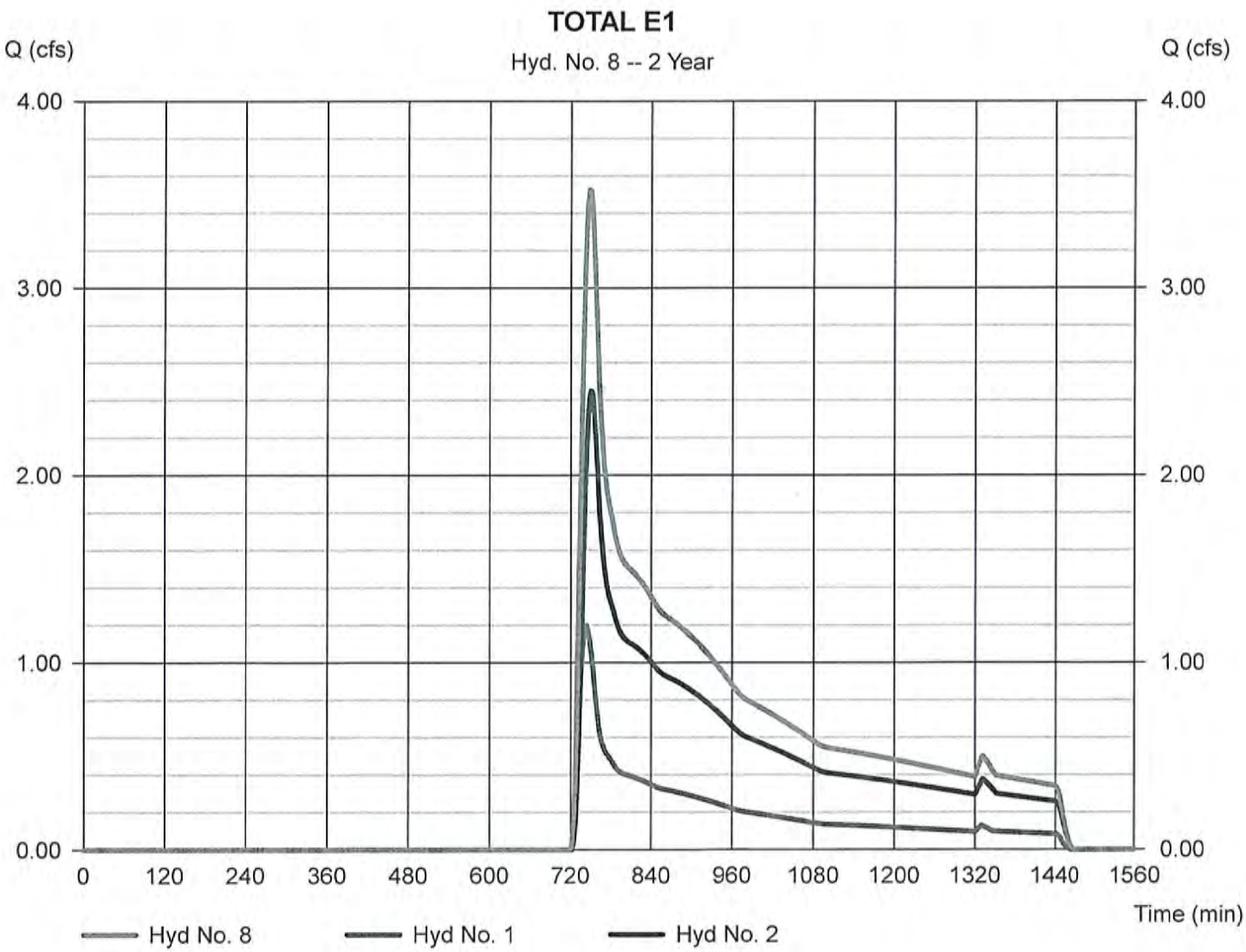
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Monday, Nov 28, 2016

Hyd. No. 8

TOTAL E1

Hydrograph type	= Combine	Peak discharge	= 3.523 cfs
Storm frequency	= 2 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 36,394 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 43.900 ac



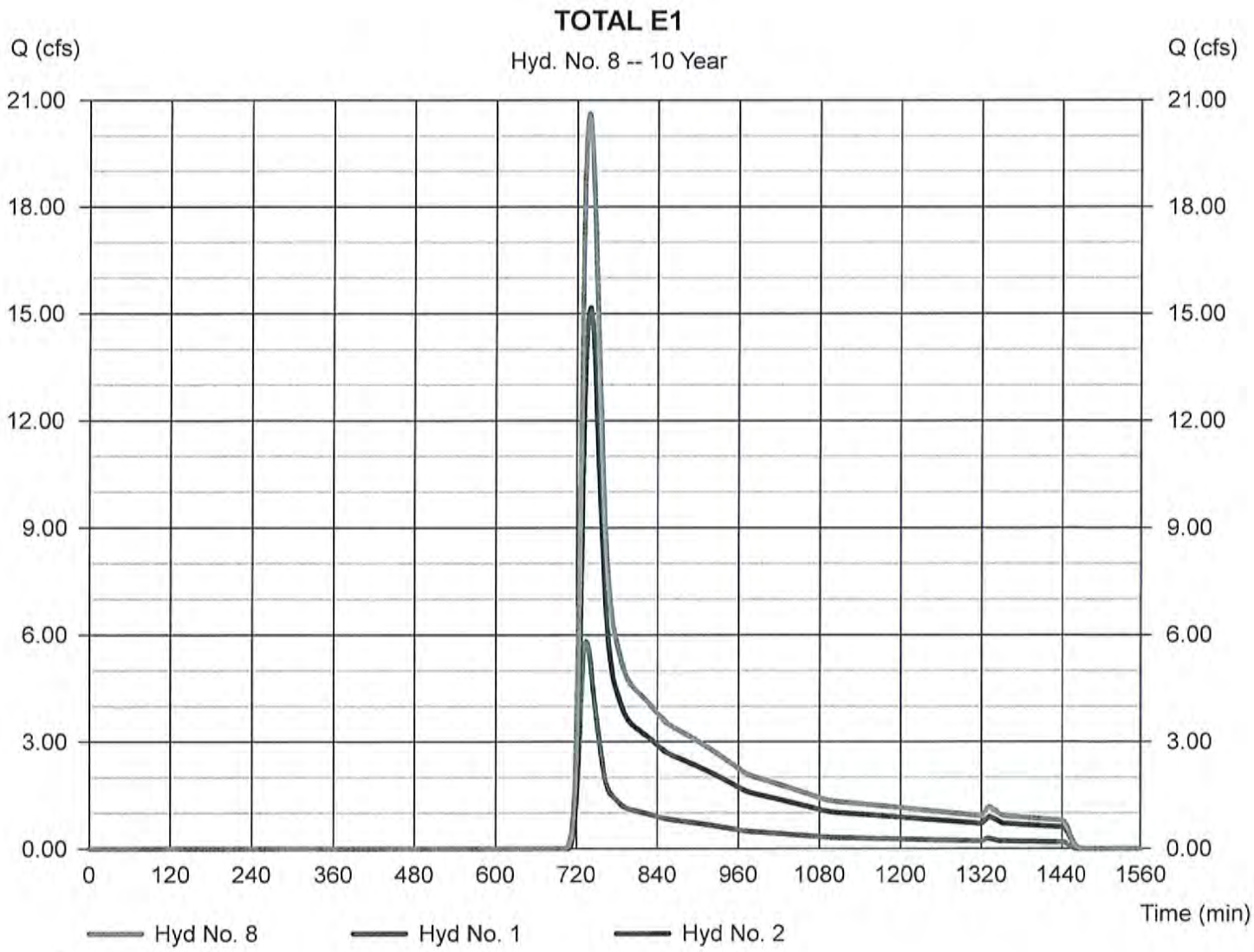
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 8

TOTAL E1

Hydrograph type	= Combine	Peak discharge	= 20.61 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 119,928 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 43.900 ac



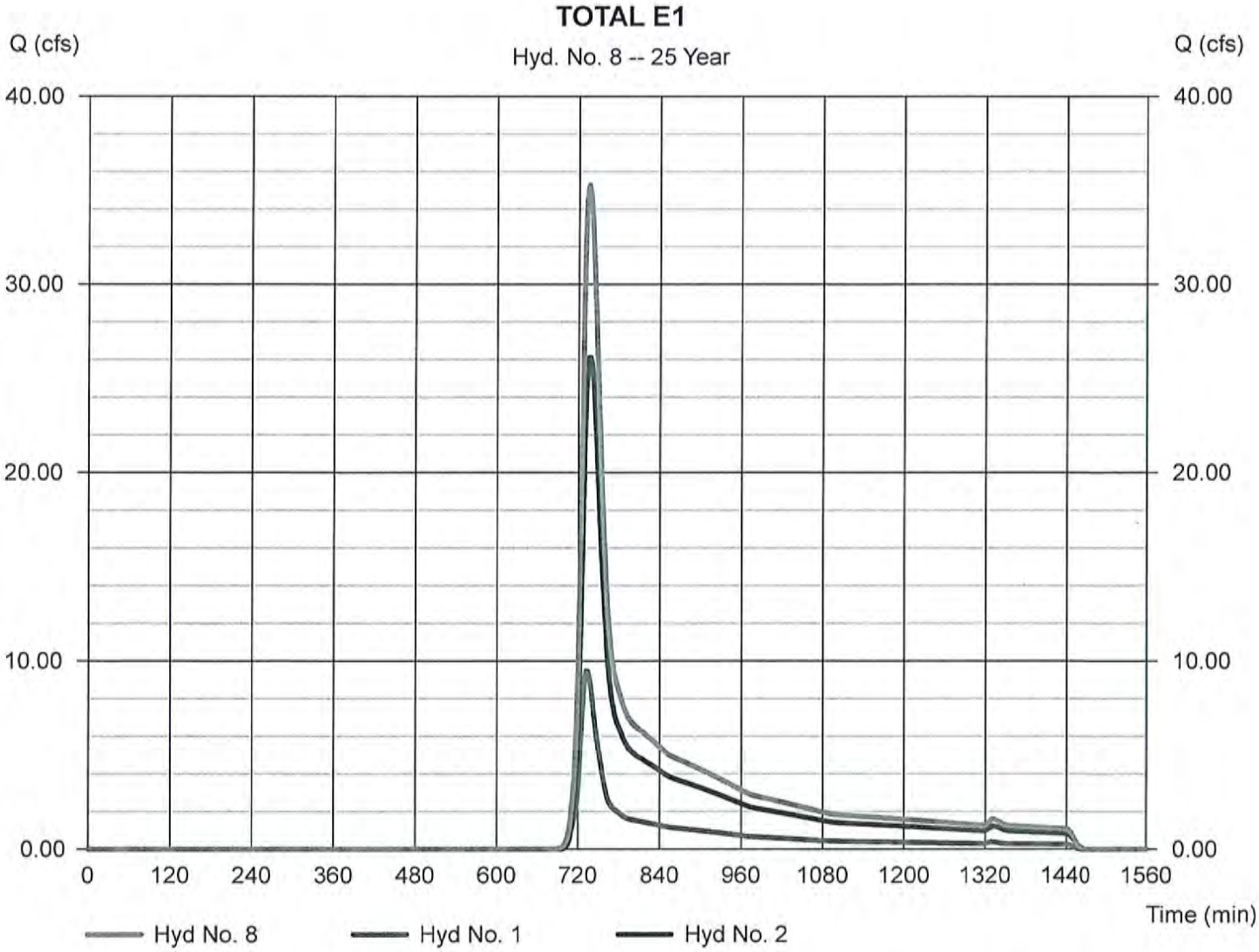
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 8

TOTAL E1

Hydrograph type	= Combine	Peak discharge	= 35.27 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 182,423 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 43.900 ac



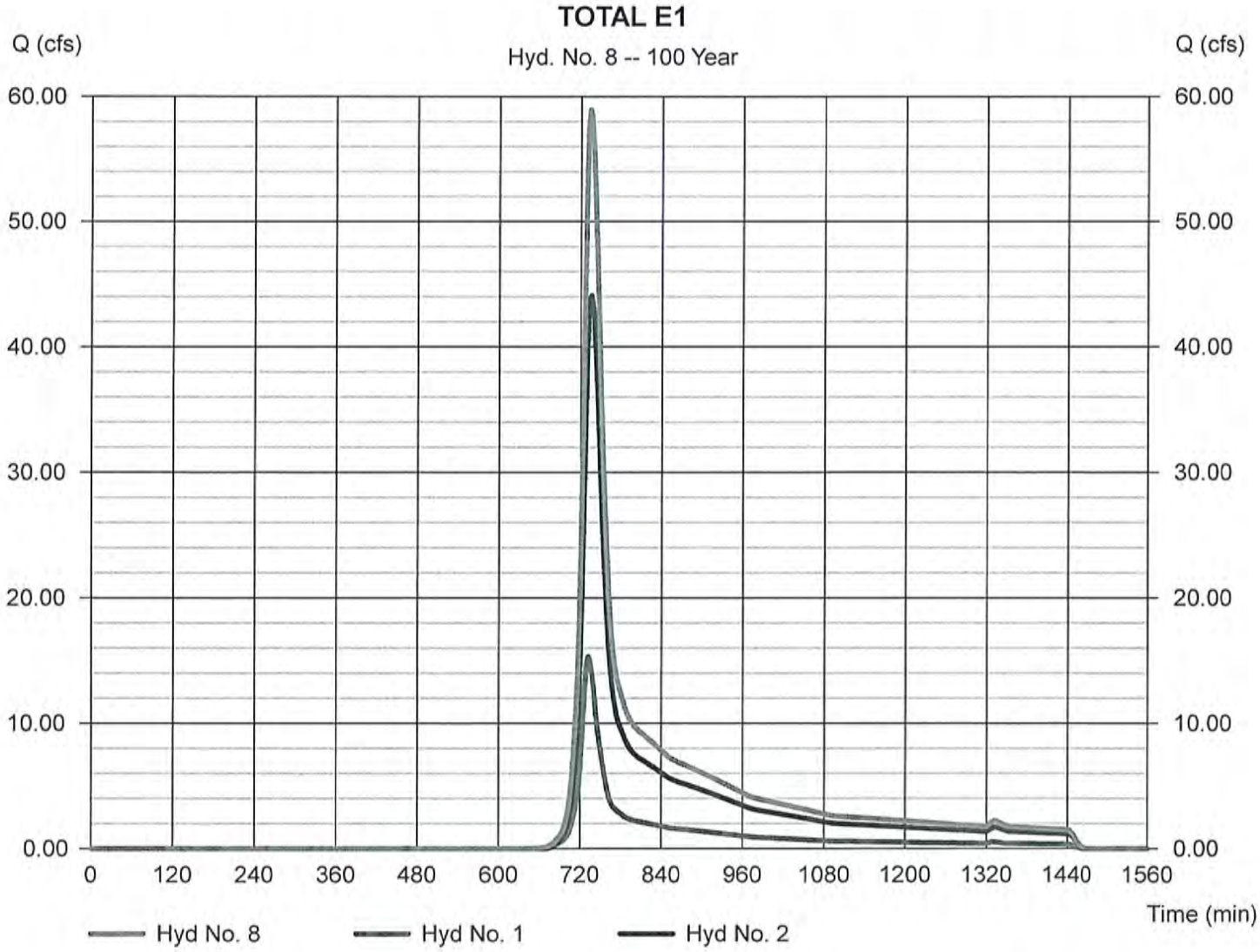
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Nov 28, 2016

Hyd. No. 8

TOTAL E1

Hydrograph type	= Combine	Peak discharge	= 58.93 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 281,381 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 43.900 ac



Post-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.840	2	742	6,937	----	------	------	P1A
2	SCS Runoff	1.996	2	724	6,107	----	------	------	P2A
3	Reservoir	0.000	2	714	0	2	323.10	3,524	SMA 1
4	SCS Runoff	0.287	2	744	2,392	----	------	------	P2B
5	SCS Runoff	3.645	2	724	11,170	----	------	------	P1C
6	Reservoir	0.014	2	806	84	5	314.25	5,066	SMA 2
7	SCS Runoff	2.154	2	736	13,597	----	------	------	P1B
8	SCS Runoff	1.780	2	724	6,102	----	------	------	P1D
9	Reservoir	0.000	2	1076	0	8	308.46	2,544	SMA 3
10	SCS Runoff	4.720	2	726	18,992	----	------	------	P1E
11	SCS Runoff	1.624	2	724	5,465	----	------	------	4 ROOFS
12	Reservoir	0.000	2	480	0	11	2.56	2,347	RD 2
13	Combine	4.720	2	726	18,992	10, 12	------	------	TOTAL TO SMA 4
14	Reservoir	0.312	2	774	6,146	13	314.22	4,996	SMA 4
15	SCS Runoff	1.288	2	724	3,851	----	------	------	P1F
16	Reservoir	0.000	2	930	0	15	326.14	1,697	SMA 5
17	SCS Runoff	3.137	2	728	12,211	----	------	------	PIG
18	Reservoir	0.000	2	738	0	17	319.39	3,730	SMA 6
19	SCS Runoff	6.052	2	724	18,315	----	------	------	P1H
20	Reservoir	0.000	2	684	0	19	312.10	7,960	SMA 7
21	SCS Runoff	3.712	2	724	12,035	----	------	------	P1I
22	Reservoir	0.000	2	736	0	21	312.66	3,734	SMA 8
23	SCS Runoff	0.127	2	744	1,204	----	------	------	P3
24	SCS Runoff	0.127	2	744	910	----	------	------	P4
25	SCS Runoff	0.012	2	738	98	----	------	------	P5
28	Combine	3.210	2	738	26,764	1, 6, 7, 9, 14, 18,	------	------	<no description>
29	Combine	3.210	2	738	26,764	20, 22, 28	------	------	TOTAL P1
30	Combine	0.287	2	744	2,392	3, 4,	------	------	TOTAL P2
33	SCS Runoff	1.942	2	724	6,539	----	------	------	6 ROOFS
34	Reservoir	0.000	2	604	0	33	316.51	2,791	RD 1
36	SCS Runoff	0.319	2	724	1,074	----	------	------	1 ROOF
37	Reservoir	0.000	2	1268	0	36	2.43	512	INDIV. RD

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	4.373	2	732	21,353	----	------	------	P1A
2	SCS Runoff	3.911	2	724	11,697	----	------	------	P2A
3	Reservoir	0.082	2	884	1,484	2	323.83	6,947	SMA 1
4	SCS Runoff	1.429	2	734	7,334	----	------	------	P2B
5	SCS Runoff	7.172	2	724	21,456	----	------	------	P1C
6	Reservoir	0.552	2	756	5,111	5	314.96	9,573	SMA 2
7	SCS Runoff	8.310	2	730	36,779	----	------	------	P1B
8	SCS Runoff	4.339	2	724	13,378	----	------	------	P1D
9	Reservoir	0.281	2	760	2,610	8	308.98	5,405	SMA 3
10	SCS Runoff	14.28	2	724	46,163	----	------	------	P1E
11	SCS Runoff	2.373	2	724	8,126	----	------	------	4 ROOFS
12	Reservoir	0.000	2	394	0	11	3.95	3,900	RD 2
13	Combine	14.28	2	724	46,163	10, 12	------	------	TOTAL TO SMA 4
14	Reservoir	1.054	2	774	20,059	13	315.15	16,665	SMA 4
15	SCS Runoff	2.191	2	724	6,622	----	------	------	P1F
16	Reservoir	0.000	2	1216	0	15	326.66	3,260	SMA 5
17	SCS Runoff	7.515	2	726	26,624	----	------	------	PIG
18	Reservoir	0.604	2	756	2,744	17	320.66	9,419	SMA 6
19	SCS Runoff	11.43	2	724	34,153	----	------	------	P1H
20	Reservoir	0.297	2	810	1,466	19	313.88	16,774	SMA 7
21	SCS Runoff	8.260	2	724	25,062	----	------	------	P1I
22	Reservoir	0.636	2	750	2,317	21	313.63	8,676	SMA 8
23	SCS Runoff	0.768	2	732	3,973	----	------	------	P3
24	SCS Runoff	0.489	2	736	2,525	----	------	------	P4
25	SCS Runoff	0.079	2	726	308	----	------	------	P5
28	Combine	13.67	2	732	88,656	1, 6, 7, 9, 14, 18,	------	------	<no description>
29	Combine	15.61	2	732	93,756	20, 22, 28	------	------	TOTAL P1
30	Combine	1.429	2	734	8,818	3, 4,	------	------	TOTAL P2
33	SCS Runoff	2.840	2	724	9,722	----	------	------	6 ROOFS
34	Reservoir	0.000	2	524	0	33	317.86	4,640	RD 1
36	SCS Runoff	0.466	2	724	1,596	----	------	------	1 ROOF
37	Reservoir	0.000	2	496	0	36	3.79	798	INDIV. RD

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	7.251	2	730	31,915	----	------	------	P1A
2	SCS Runoff	5.072	2	724	15,157	----	------	------	P2A
3	Reservoir	0.211	2	824	4,102	2	324.12	8,467	SMA 1
4	SCS Runoff	2.347	2	732	10,950	----	------	------	P2B
5	SCS Runoff	9.313	2	724	27,830	----	------	------	P1C
6	Reservoir	1.614	2	748	9,550	5	315.19	11,782	SMA 2
7	SCS Runoff	12.78	2	730	53,091	----	------	------	P1B
8	SCS Runoff	5.987	2	724	18,129	----	------	------	P1D
9	Reservoir	0.612	2	754	5,488	8	309.26	7,396	SMA 3
10	SCS Runoff	20.75	2	724	64,594	----	------	------	P1E
11	SCS Runoff	2.801	2	724	9,648	----	------	------	4 ROOFS
12	Reservoir	0.000	2	422	0	11	4.86	4,825	RD 2
13	Combine	20.75	2	724	64,594	10, 12	------	------	TOTAL TO SMA 4
14	Reservoir	2.058	2	762	32,673	13	315.61	24,431	SMA 4
15	SCS Runoff	2.712	2	724	8,268	----	------	------	P1F
16	Reservoir	0.000	2	682	0	15	326.98	4,231	SMA 5
17	SCS Runoff	10.37	2	726	36,015	----	------	------	PIG
18	Reservoir	0.952	2	754	6,670	17	321.27	13,116	SMA 6
19	SCS Runoff	14.65	2	724	43,853	----	------	------	P1H
20	Reservoir	1.866	2	752	8,505	19	314.38	19,025	SMA 7
21	SCS Runoff	11.12	2	724	33,399	----	------	------	P1I
22	Reservoir	1.422	2	748	6,080	21	314.08	11,499	SMA 8
23	SCS Runoff	1.324	2	730	6,043	----	------	------	P3
24	SCS Runoff	0.757	2	736	3,670	----	------	------	P4
25	SCS Runoff	0.133	2	724	462	----	------	------	P5
28	Combine	22.56	2	732	139,386	1, 6, 7, 9, 14, 18,	------	------	<no description>
29	Combine	26.47	2	732	153,344	20, 22, 28	------	------	TOTAL P1
30	Combine	2.381	2	734	15,052	3, 4,	------	------	TOTAL P2
33	SCS Runoff	3.351	2	724	11,544	----	------	------	6 ROOFS
34	Reservoir	0.000	2	496	0	33	318.75	5,745	RD 1
36	SCS Runoff	0.550	2	724	1,895	----	------	------	1 ROOF
37	Reservoir	0.000	2	580	0	36	4.61	970	INDIV. RD

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	11.78	2	730	48,467	----	------	------	P1A
2	SCS Runoff	6.705	2	724	20,111	----	------	------	P2A
3	Reservoir	0.440	2	782	8,252	2	324.51	10,823	SMA 1
4	SCS Runoff	3.809	2	732	16,615	----	------	------	P2B
5	SCS Runoff	12.33	2	724	36,961	----	------	------	P1C
6	Reservoir	3.572	2	740	16,521	5	315.40	14,048	SMA 2
7	SCS Runoff	19.57	2	730	78,126	----	------	------	P1B
8	SCS Runoff	8.386	2	724	25,132	----	------	------	P1D
9	Reservoir	2.169	2	744	10,760	8	309.52	9,326	SMA 3
10	SCS Runoff	30.40	2	724	92,331	----	------	------	P1E
11	SCS Runoff	3.387	2	724	11,742	----	------	------	4 ROOFS
12	Reservoir	0.000	2	316	0	11	6.69	6,085	RD 2
13	Combine	30.40	2	724	92,331	10, 12	------	------	TOTAL TO SMA 4
14	Reservoir	8.612	2	744	55,270	13	316.02	31,310	SMA 4
15	SCS Runoff	3.429	2	724	10,573	----	------	------	P1F
16	Reservoir	0.000	2	736	0	15	327.27	5,543	SMA 5
17	SCS Runoff	14.53	2	726	49,840	----	------	------	PIG
18	Reservoir	3.528	2	748	14,314	17	321.87	17,373	SMA 6
19	SCS Runoff	19.15	2	724	57,660	----	------	------	P1H
20	Reservoir	3.288	2	748	19,007	19	315.59	23,892	SMA 7
21	SCS Runoff	15.24	2	724	45,554	----	------	------	P1I
22	Reservoir	3.616	2	742	12,805	21	314.51	14,818	SMA 8
23	SCS Runoff	2.223	2	730	9,320	----	------	------	P3
24	SCS Runoff	1.175	2	734	5,435	----	------	------	P4
25	SCS Runoff	0.219	2	724	704	----	------	------	P5
28	Combine	39.72	2	736	223,458	1, 6, 7, 9, 14, 18,	------	------	<no description>
29	Combine	49.72	2	736	255,713	20, 22, 28	------	------	TOTAL P1
30	Combine	4.021	2	732	24,866	3, 4,	------	------	TOTAL P2
33	SCS Runoff	4.053	2	724	14,049	----	------	------	6 ROOFS
34	Reservoir	0.000	2	438	0	33	320.43	7,260	RD 1
36	SCS Runoff	0.665	2	724	2,307	----	------	------	1 ROOF
37	Reservoir	0.000	2	1756	0	36	5.78	1,216	INDIV. RD

Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 2 - SMA 1

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 322.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	322.00	2,342	0	0
1.00	323.00	3,841	3,060	3,060
2.00	324.00	5,594	4,690	7,750
3.00	325.00	6,467	6,025	13,775
4.00	326.00	8,519	7,469	21,243

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 322.00	0.00	0.00	0.00
Length (ft)	= 150.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

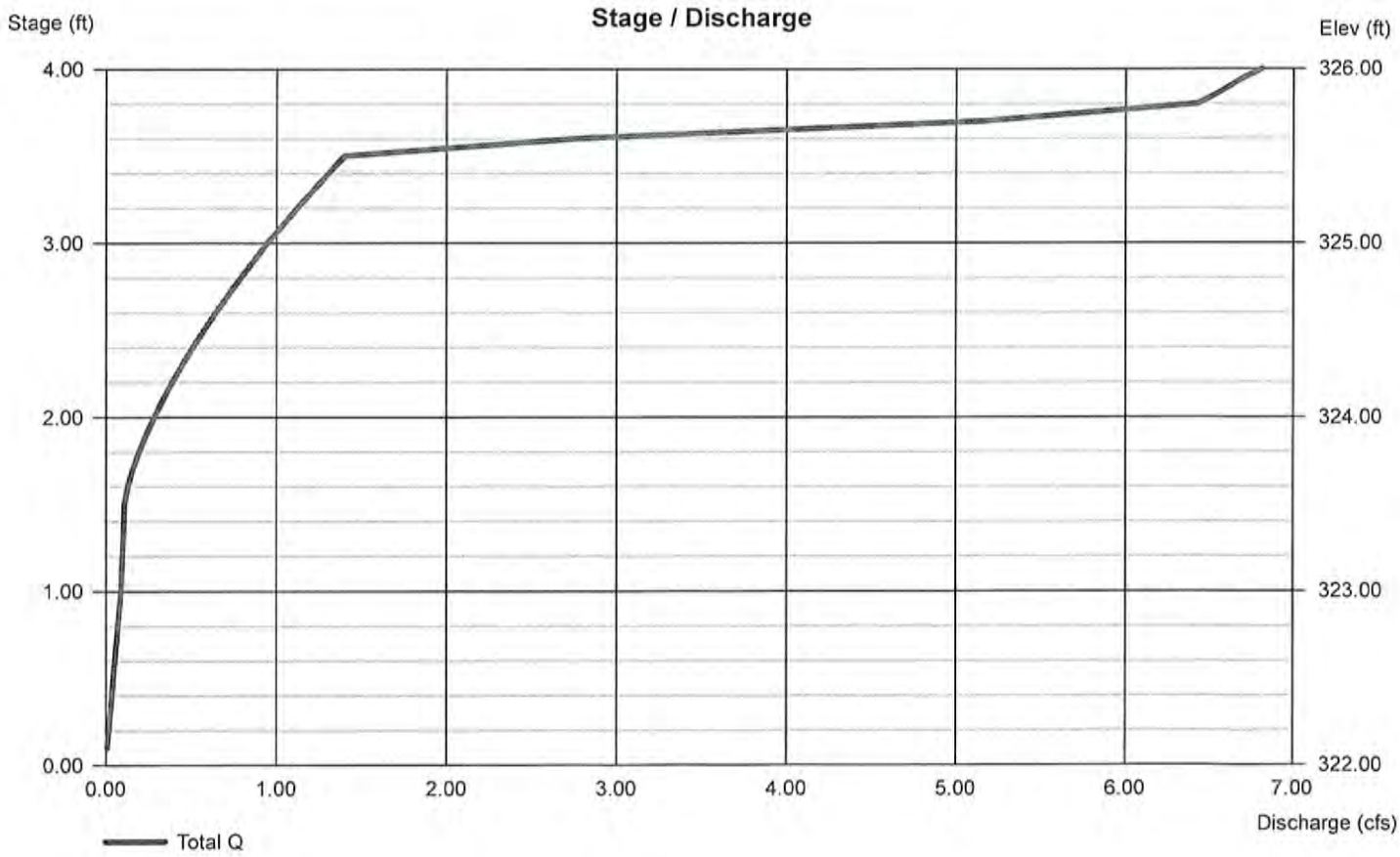
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.13	0.00	0.00
Crest El. (ft)	= 325.50	323.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 1.020 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 17 - SMA 2

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 313.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	313.00	2,287	0	0
1.00	314.00	4,746	3,442	3,442
2.00	315.00	8,187	6,388	9,830
3.00	316.00	12,883	10,446	20,276
4.00	317.00	14,586	13,724	34,000

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 313.00	0.00	0.00	0.00
Length (ft)	= 33.00	0.00	0.00	0.00
Slope (%)	= 9.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

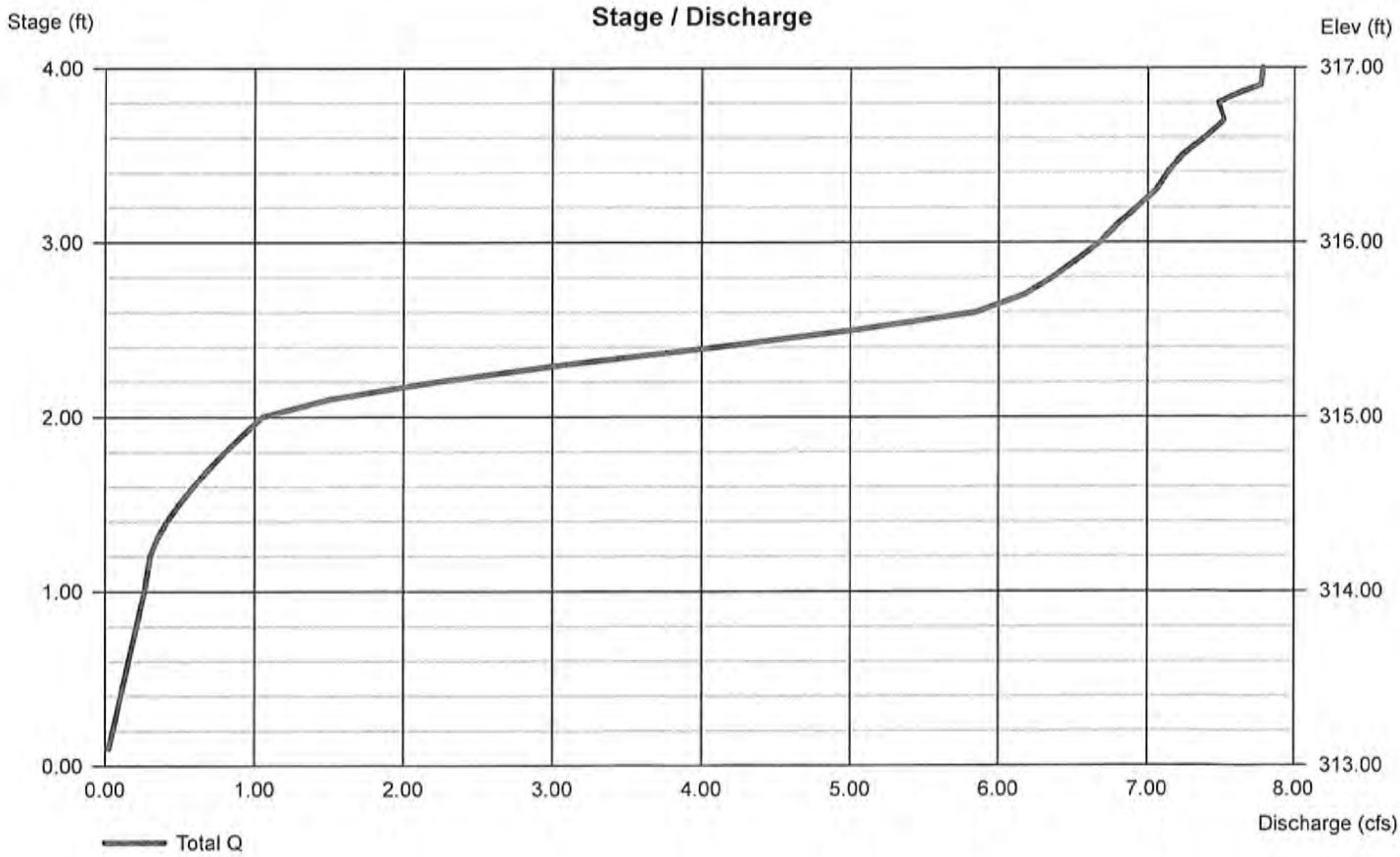
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.25	3.75	0.00
Crest El. (ft)	= 315.50	314.20	315.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= Riser	Rect	Broad	---
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 2.410 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 12 - SMA 3

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 308.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	308.00	4,580	0	0
1.00	309.00	6,466	5,495	5,495
2.00	310.00	8,356	7,390	12,886
3.00	311.00	9,950	9,141	22,026
4.00	312.00	11,553	10,740	32,766

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 308.00	0.00	0.00	0.00
Length (ft)	= 32.00	0.00	0.00	0.00
Slope (%)	= 6.30	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

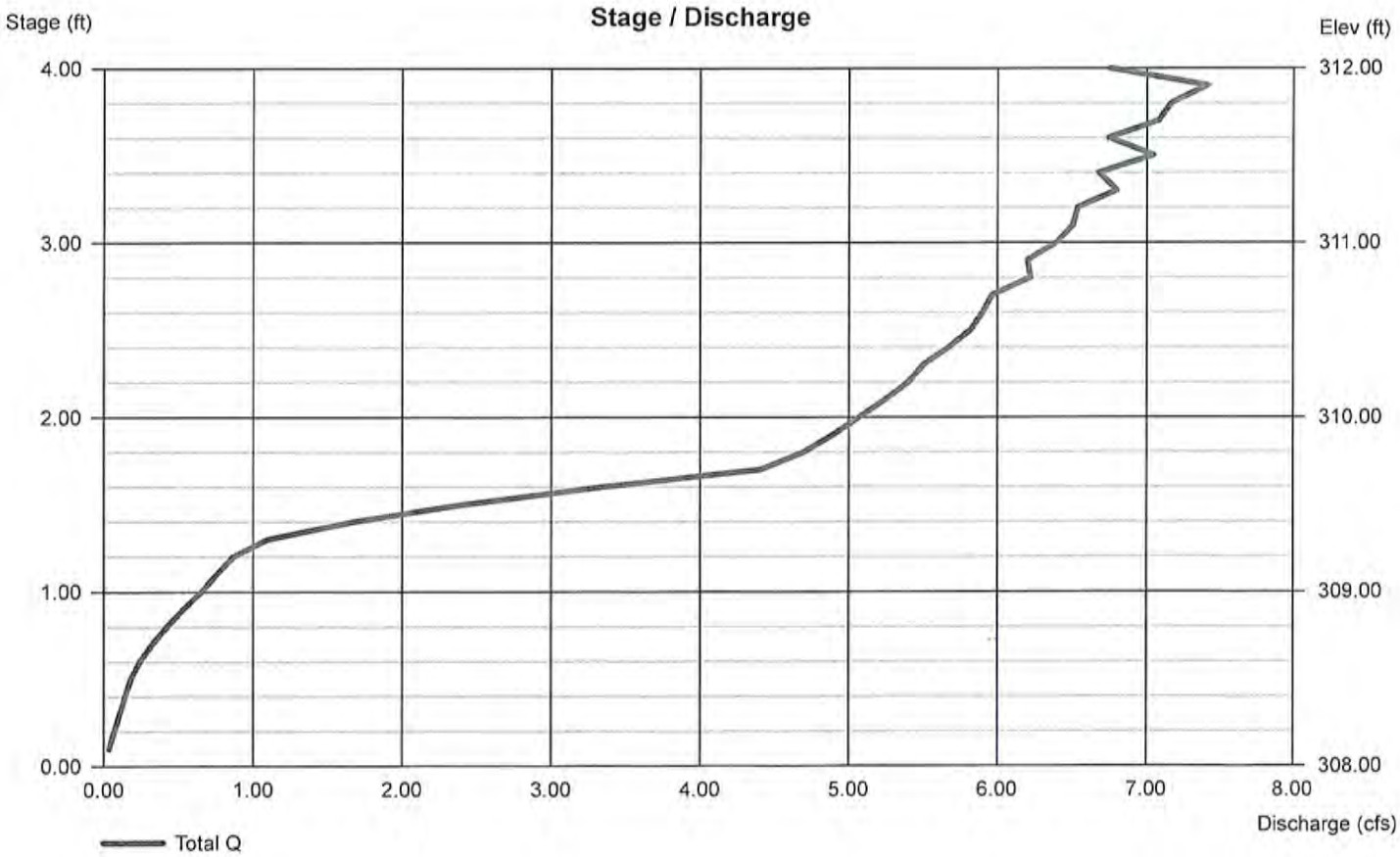
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.25	3.75	0.00
Crest El. (ft)	= 309.58	308.50	309.25	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= Riser	Rect	Broad	---
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 2.410 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 9 - RD 2

Pond Data

UG Chambers - Invert elev. = 1.00 ft, Rise x Span = 5.00 x 8.33 ft, Barrel Len = 34.64 ft, No. Barrels = 4, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 0.00 ft, Width = 9.08 ft, Height = 7.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	0.00	n/a	0	0
0.70	0.70	n/a	352	352
1.40	1.40	n/a	629	981
2.10	2.10	n/a	831	1,813
2.80	2.80	n/a	816	2,629
3.50	3.50	n/a	790	3,418
4.20	4.20	n/a	750	4,168
4.90	4.90	n/a	693	4,861
5.60	5.60	n/a	605	5,466
6.30	6.30	n/a	425	5,891
7.00	7.00	n/a	352	6,244

Culvert / Orifice Structures

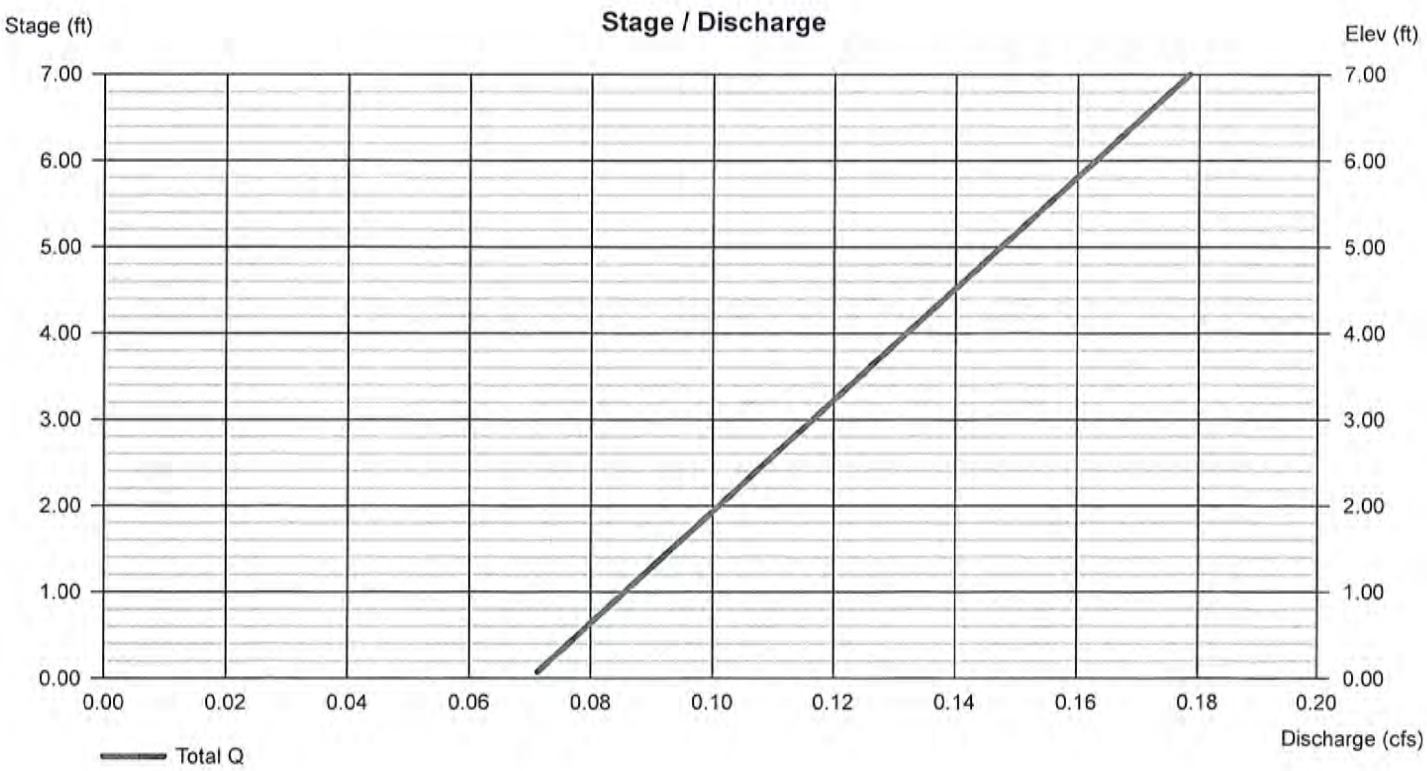
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	4	0	0
Invert El. (ft)	= 321.00	323.76	0.00	0.00
Length (ft)	= 24.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.410 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 14 - SMA 4

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 313.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	313.50	2,034	0	0
0.50	314.00	8,577	2,464	2,464
1.50	315.00	15,058	11,665	14,130
2.50	316.00	18,756	16,872	31,001
3.50	317.00	21,855	20,284	51,285

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	4.00	0.00	0.00
Span (in)	= 18.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 313.00	313.50	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

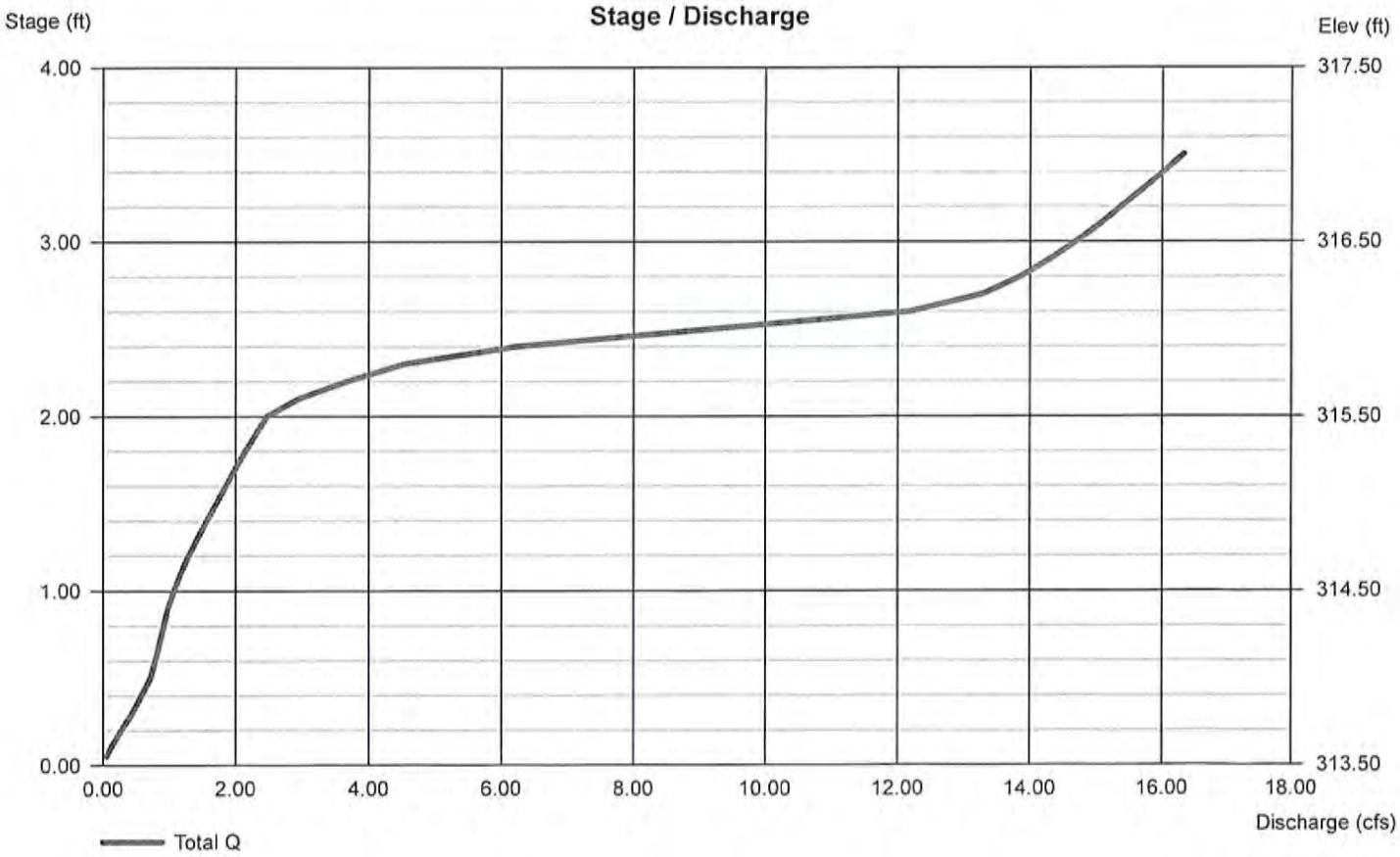
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.25	3.75	0.00
Crest El. (ft)	= 315.83	314.40	315.50	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= Riser	Rect	Broad	---
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 2.410 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 15 - SMA 5

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 325.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	325.00	254	0	0
1.00	326.00	2,697	1,259	1,259
2.00	327.00	3,408	3,045	4,305
3.00	328.00	5,878	4,587	8,891

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

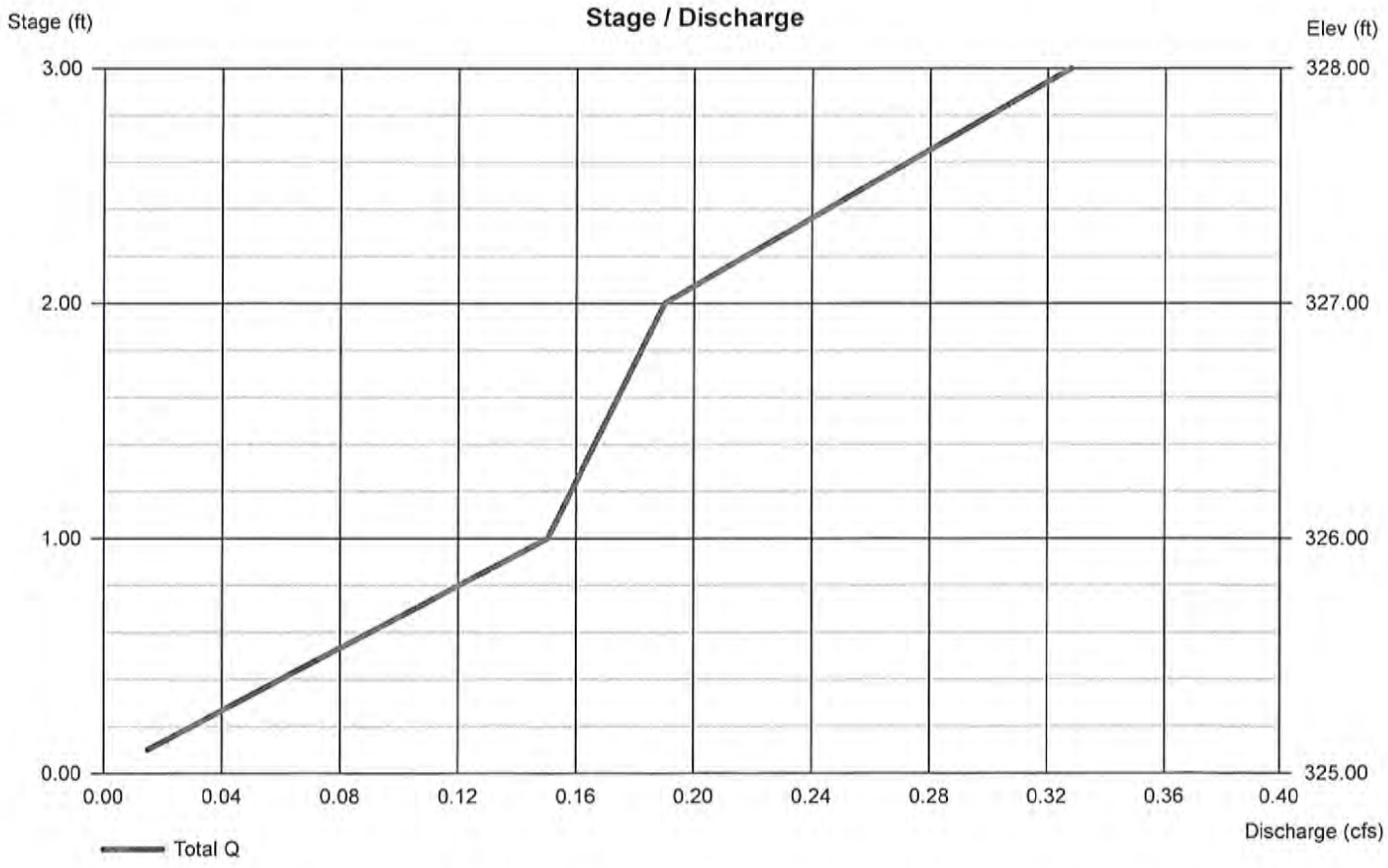
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.410 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 24 - SMA 6

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 318.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	318.00	2,004	0	0
1.00	319.00	2,762	2,373	2,373
2.00	320.00	4,340	3,521	5,894
3.00	321.00	6,415	5,343	11,237
4.00	322.00	7,764	7,078	18,315

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 318.00	320.00	0.00	0.00
Length (ft)	= 75.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

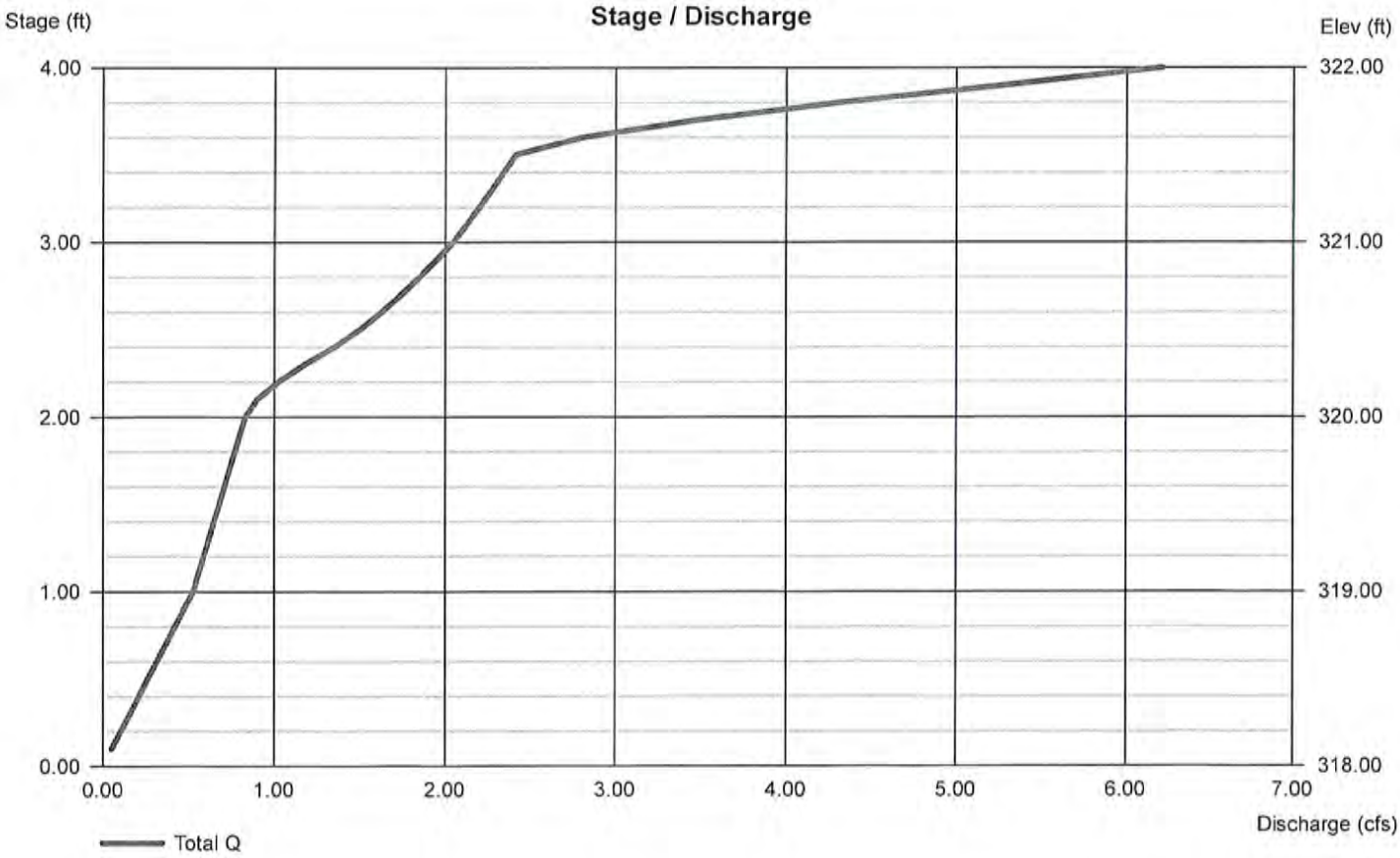
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	4.00	0.00	0.00
Crest El. (ft)	= 322.00	321.50	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Riser	Broad	---	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 8.270 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 5 - SMA 7

Pond Data

UG Chambers - Invert elev. = 311.00 ft, Rise x Span = 5.00 x 8.33 ft, Barrel Len = 101.13 ft, No. Barrels = 6, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 310.00 ft, Width = 9.08 ft, Height = 7.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	310.00	n/a	0	0
0.70	310.70	n/a	1,543	1,543
1.40	311.40	n/a	2,755	4,298
2.10	312.10	n/a	3,640	7,938
2.80	312.80	n/a	3,573	11,512
3.50	313.50	n/a	3,458	14,969
4.20	314.20	n/a	3,284	18,254
4.90	314.90	n/a	3,033	21,287
5.60	315.60	n/a	2,649	23,936
6.30	316.30	n/a	1,863	25,799
7.00	317.00	n/a	1,543	27,342

Culvert / Orifice Structures

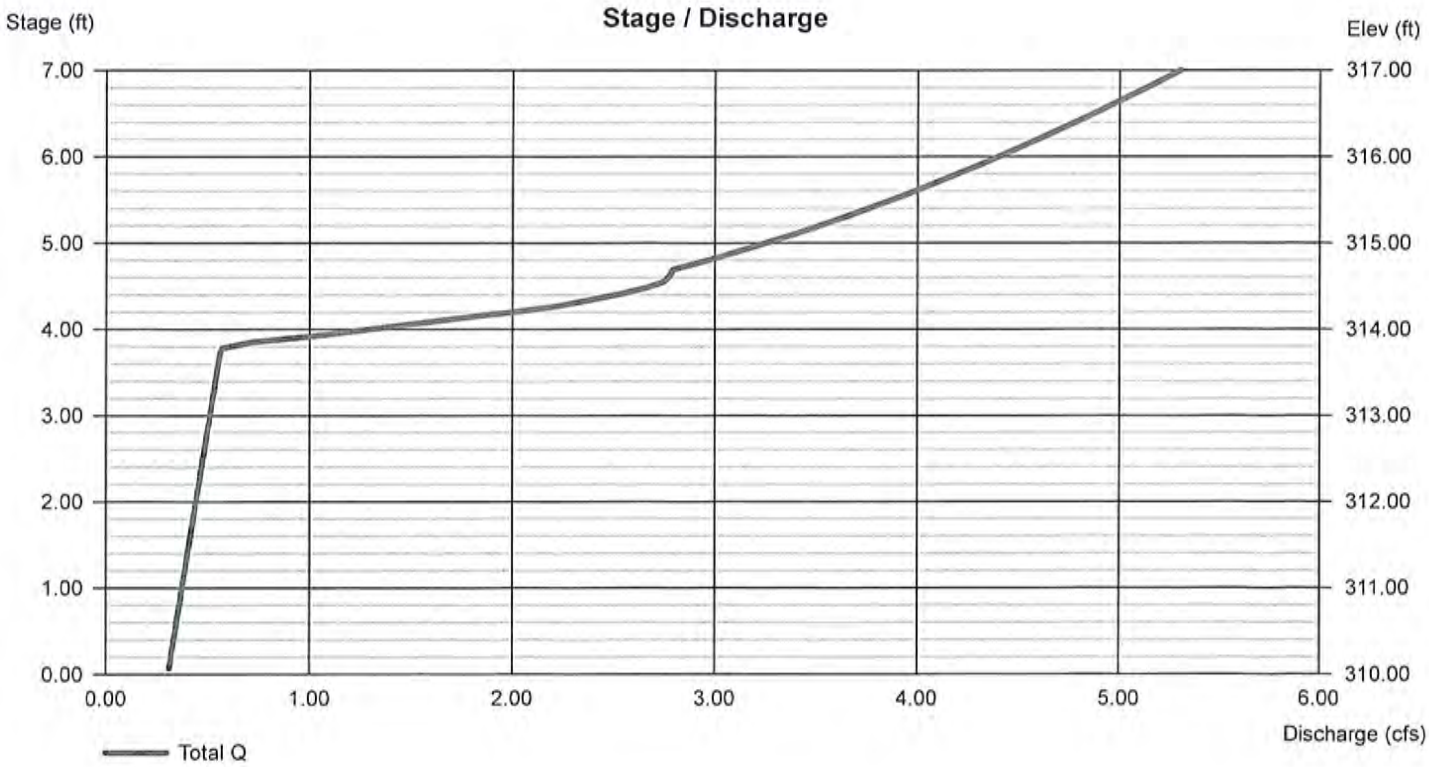
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	6	0	0
Invert El. (ft)	= 313.50	313.76	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.410 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 25 - SMA 8

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 311.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	311.00	1,042	0	0
1.00	312.00	1,938	1,467	1,467
2.00	313.00	5,216	3,444	4,911
3.00	314.00	6,750	5,966	10,877
4.00	315.00	8,706	7,707	18,583

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 310.00	0.00	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 3.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

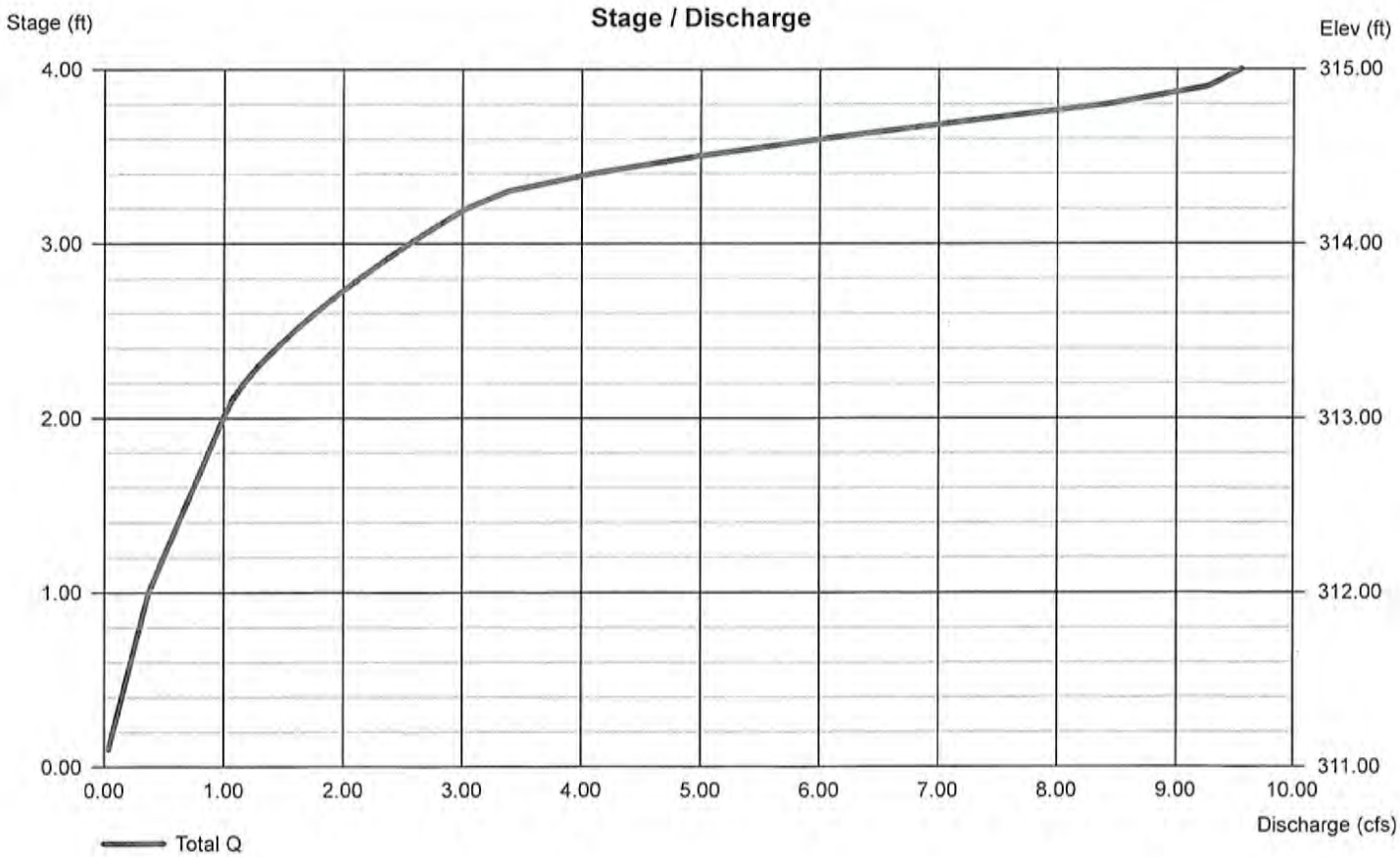
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.38	3.62	0.00
Crest El. (ft)	= 314.75	313.00	314.25	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= Riser	Rect	Broad	---
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 8.270 (by Contour)

TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 16 - RD 1

Pond Data

UG Chambers - Invert elev. = 315.00 ft, Rise x Span = 5.00 x 8.33 ft, Barrel Len = 56.29 ft, No. Barrels = 3, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 314.00 ft, Width = 9.08 ft, Height = 7.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	314.00	n/a	0	0
0.70	314.70	n/a	429	429
1.40	315.40	n/a	767	1,196
2.10	316.10	n/a	1,013	2,209
2.80	316.80	n/a	994	3,204
3.50	317.50	n/a	962	4,166
4.20	318.20	n/a	914	5,080
4.90	318.90	n/a	844	5,924
5.60	319.60	n/a	737	6,662
6.30	320.30	n/a	518	7,180
7.00	321.00	n/a	429	7,609

Culvert / Orifice Structures

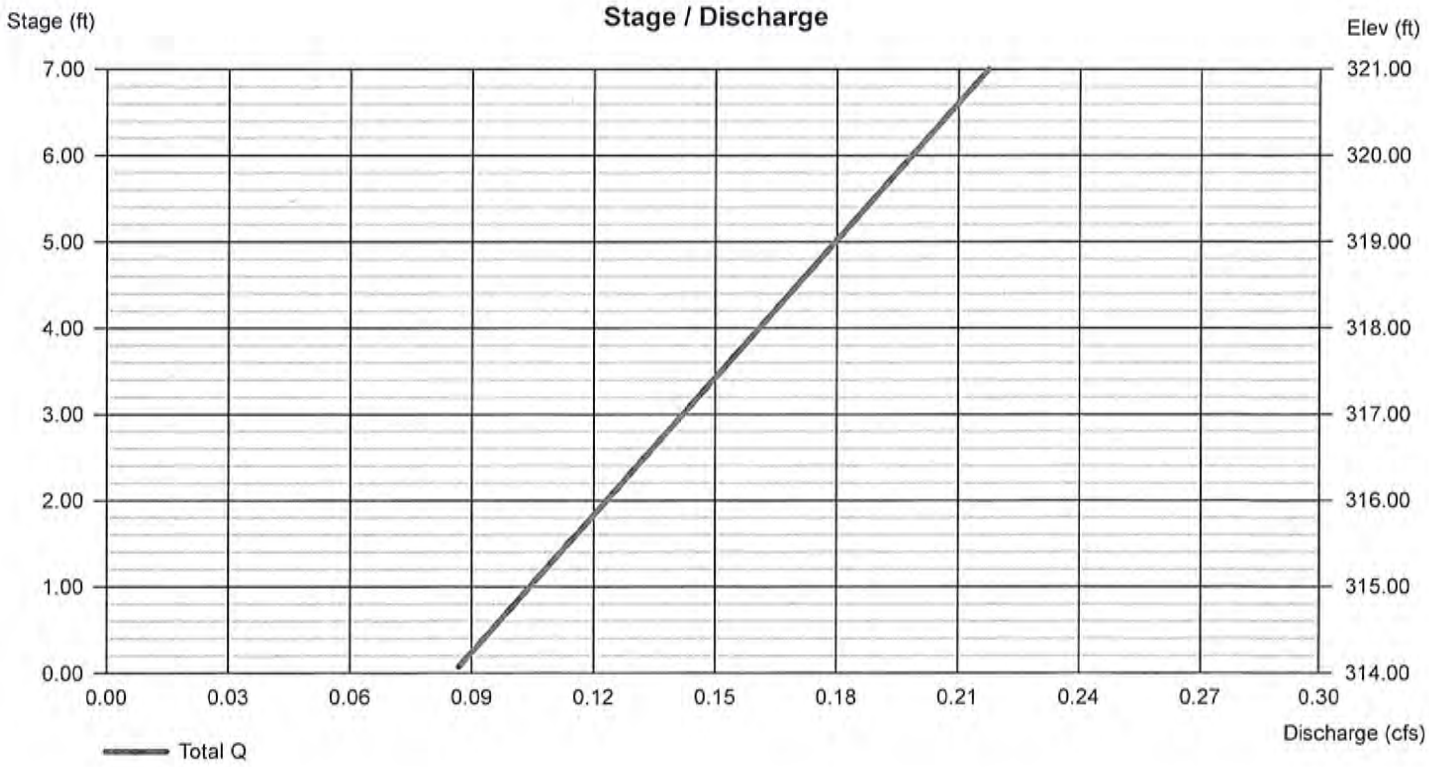
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.410 (by Wet area)
TW Elev. (ft) = 0.00

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



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Pond No. 19 - INDIV. RD

Pond Data

UG Chambers - Invert elev. = 1.00 ft, Rise x Span = 5.00 x 8.33 ft, Barrel Len = 30.31 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 0.00 ft, Width = 10.33 ft, Height = 70.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	0.00	n/a	0	0
7.00	7.00	n/a	1,472	1,472
14.00	14.00	n/a	877	2,349
21.00	21.00	n/a	877	3,226
28.00	28.00	n/a	877	4,102
35.00	35.00	n/a	877	4,979
42.00	42.00	n/a	877	5,856
49.00	49.00	n/a	877	6,733
56.00	56.00	n/a	877	7,610
63.00	63.00	n/a	877	8,487
70.00	70.00	n/a	877	9,364

Culvert / Orifice Structures

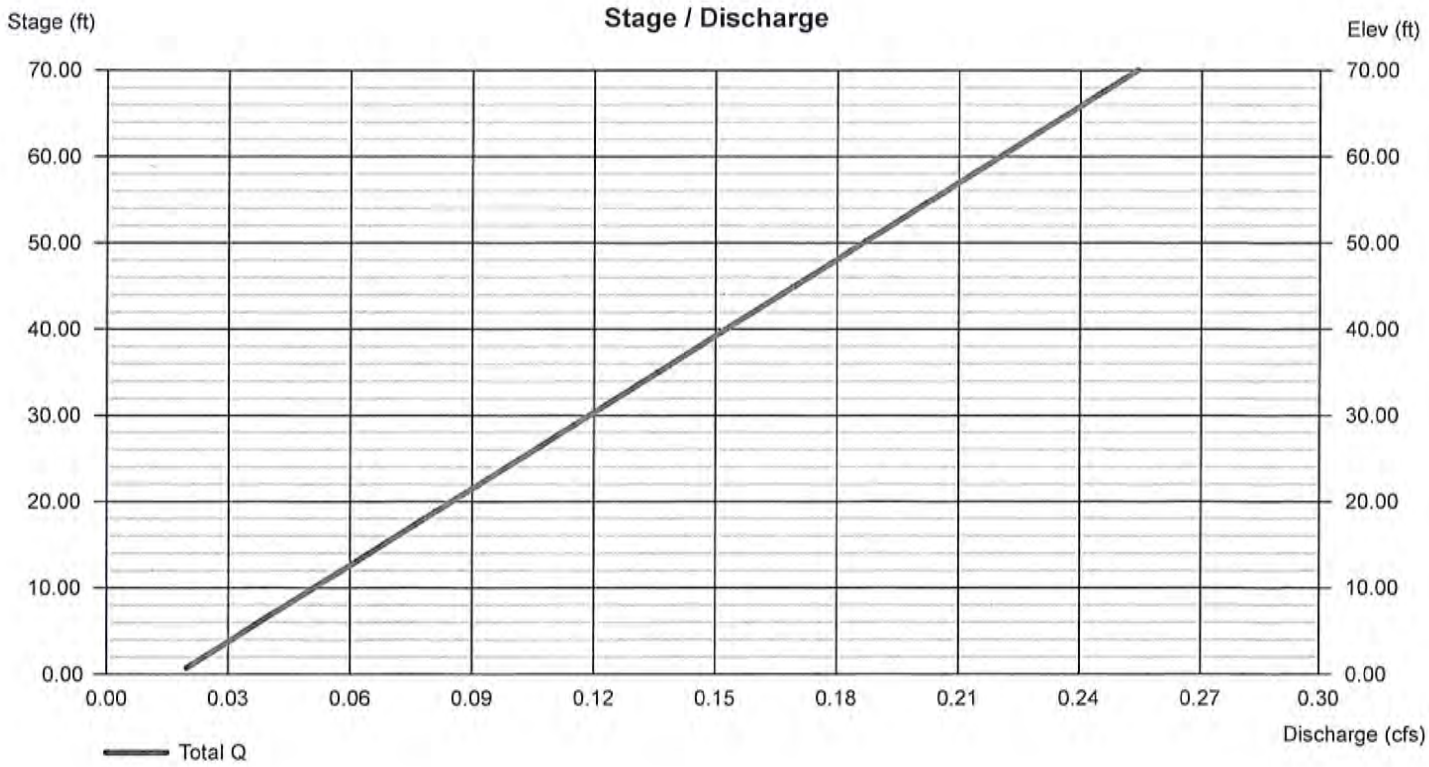
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 2.410 (by Wet area)
TW Elev. (ft) = 0.00

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



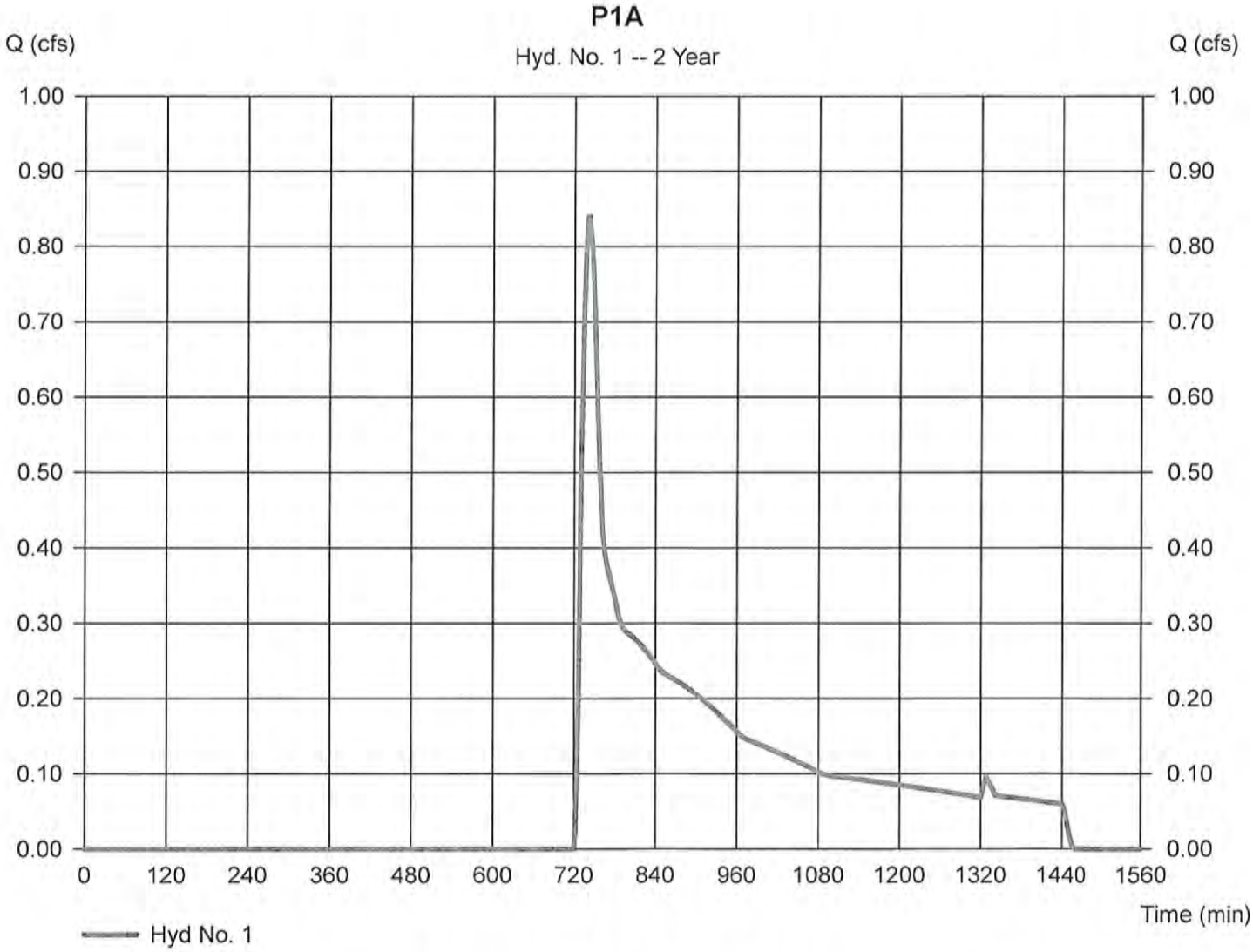
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.840 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 6,937 cuft
Drainage area	= 6.760 ac	Curve number	= 56.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.90 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



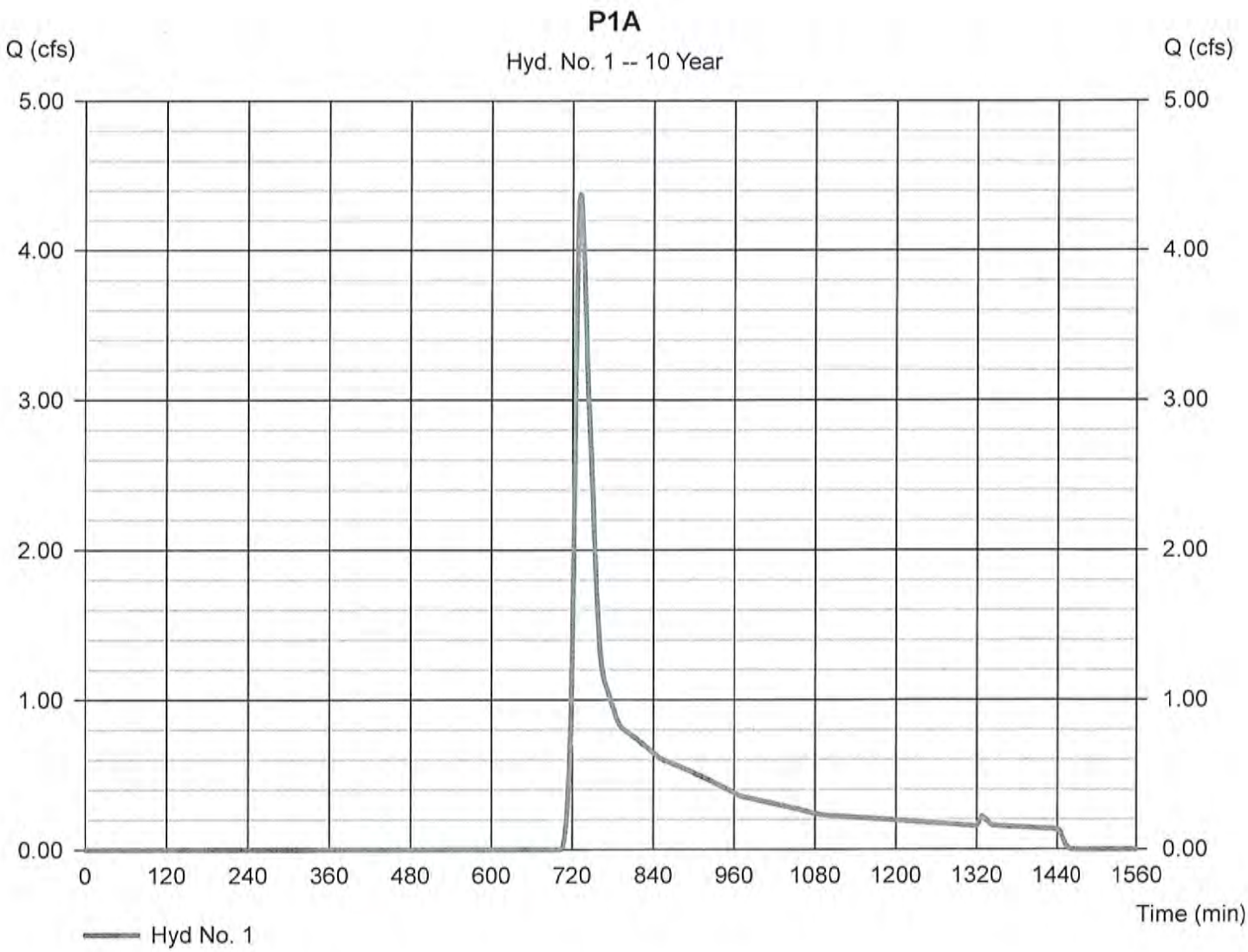
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 4.373 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 21,353 cuft
Drainage area	= 6.760 ac	Curve number	= 56.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.90 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



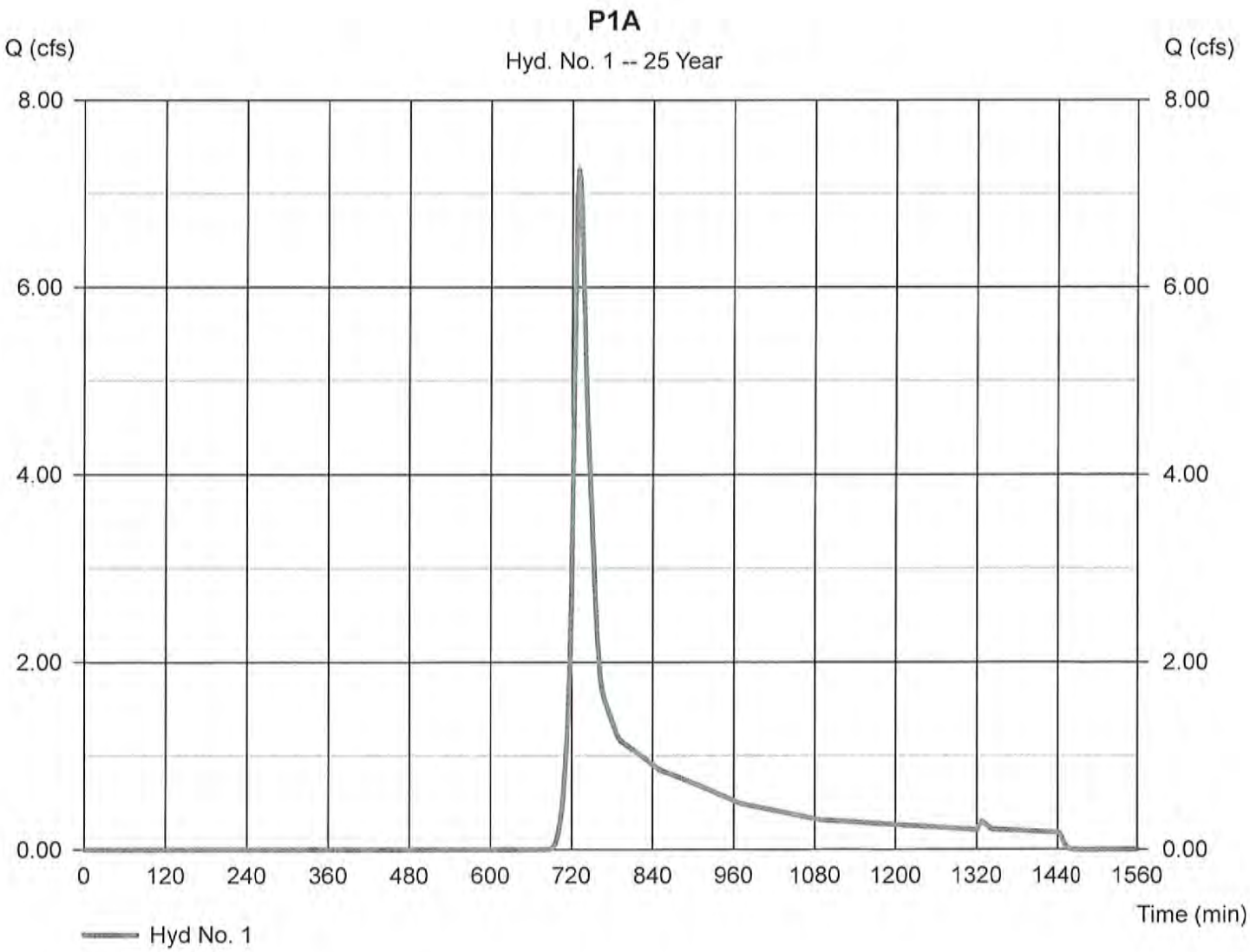
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 7.251 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 31,915 cuft
Drainage area	= 6.760 ac	Curve number	= 56.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.90 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



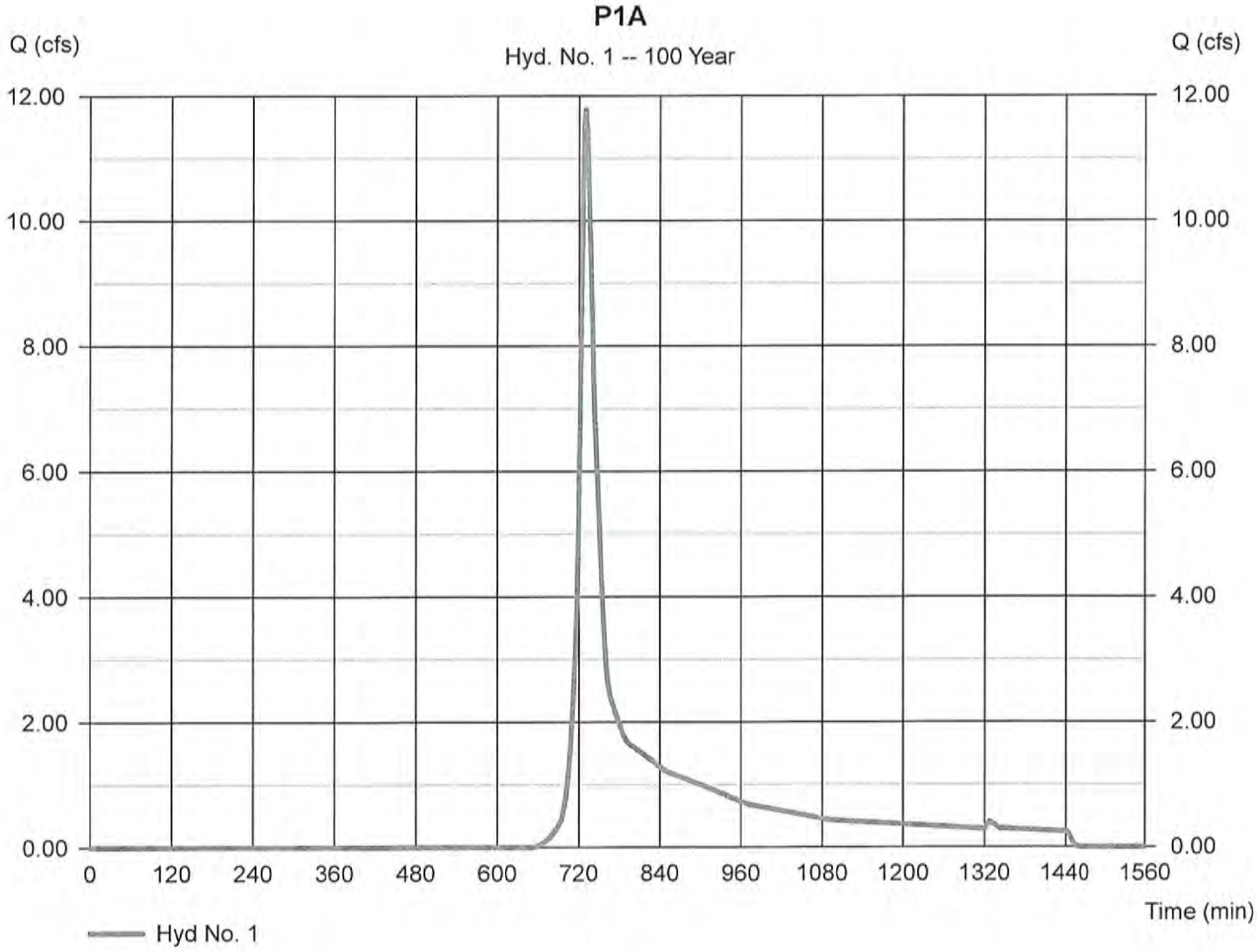
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 1

P1A

Hydrograph type	= SCS Runoff	Peak discharge	= 11.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 48,467 cuft
Drainage area	= 6.760 ac	Curve number	= 56.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.90 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2069**

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			4.09	225.04
B	Brush- Good Condition	48			1.40	67.34
C	Woods- Good Condition	70			1.11	77.52
C	Open- Good Condition	74			0.02	1.26
D	Woods- Good Condition	77			0.00	0.24
	Impervious	98			0.10	9.84
B	Gravel	85			0.04	3.42
				Totals =	6.76	384.66

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{384.66}{6.76} = 56.88$; Use CN = 56.9

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.27	0.84	1.91
Runoff, Q.....	cf	6719	20686	46973

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed
Circle one: Tc | Tt through subarea

SubcatchmentP P-1A

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.055			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.19			0.19
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	116			
9. Watercourse slope, s		ft/ft	0.1			
10. Average Velocity, V (figure 3-1)		ft/s	5.10			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.20
min 11.9

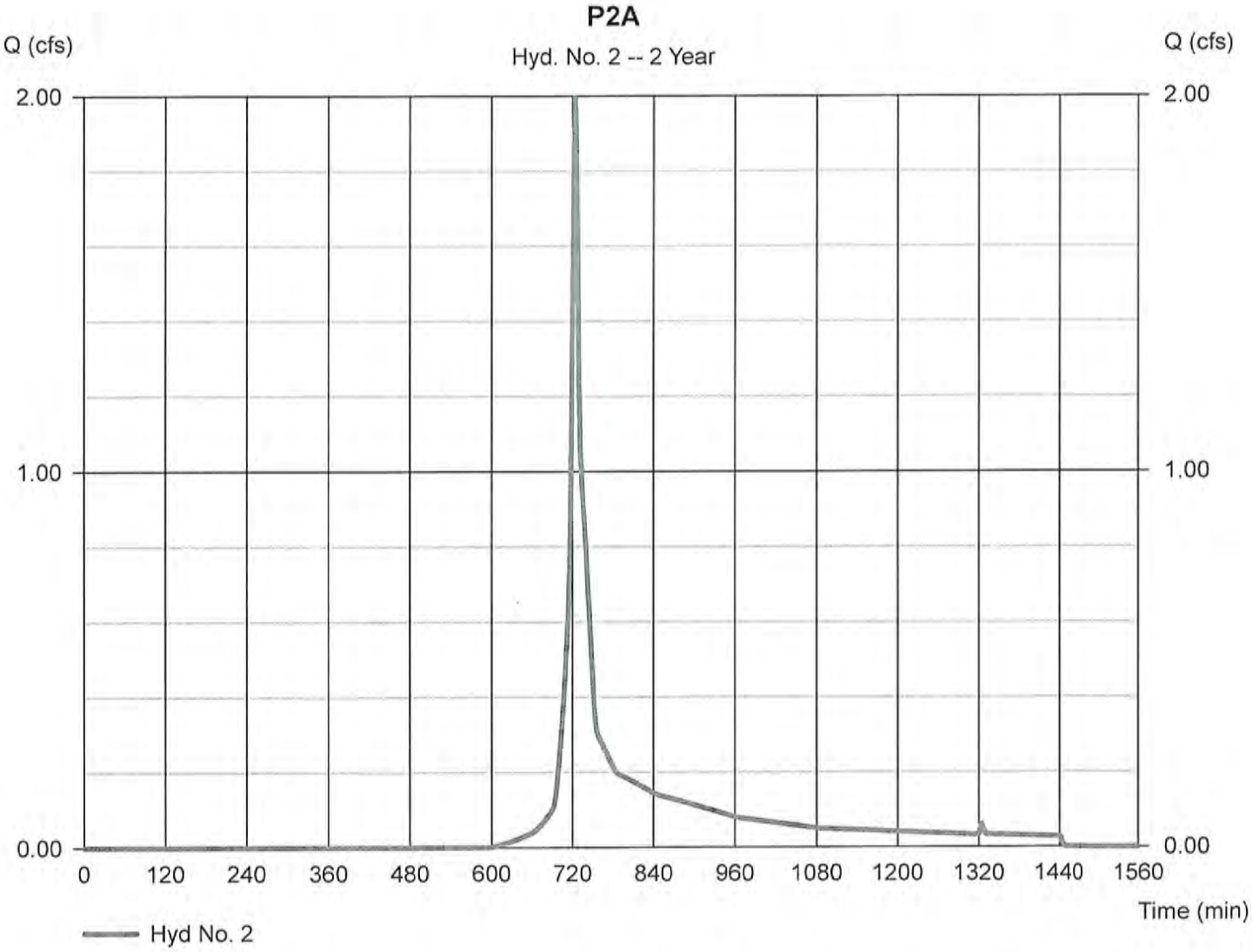
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 2

P2A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.996 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,107 cuft
Drainage area	= 1.510 ac	Curve number	= 77.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



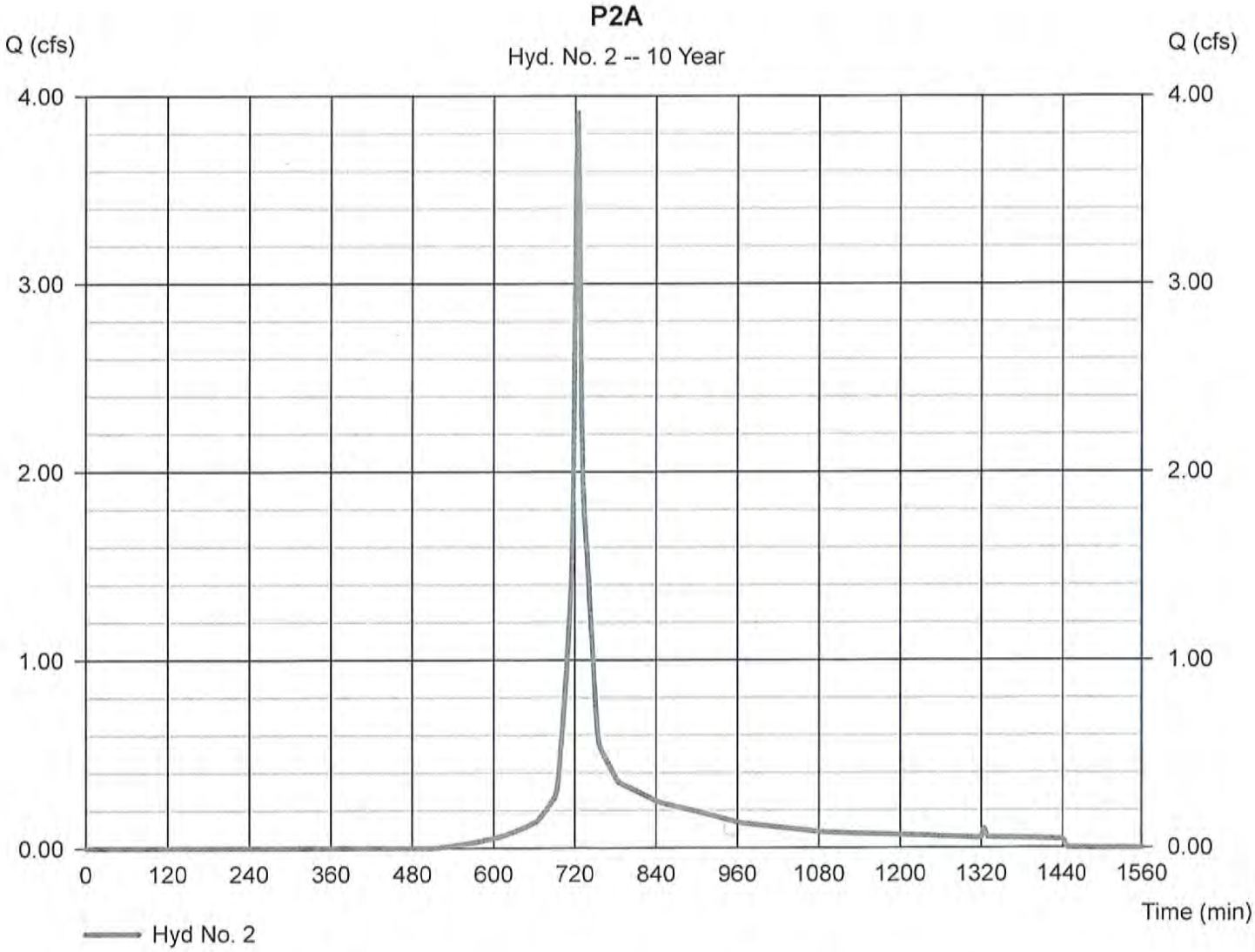
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 2

P2A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.911 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,697 cuft
Drainage area	= 1.510 ac	Curve number	= 77.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



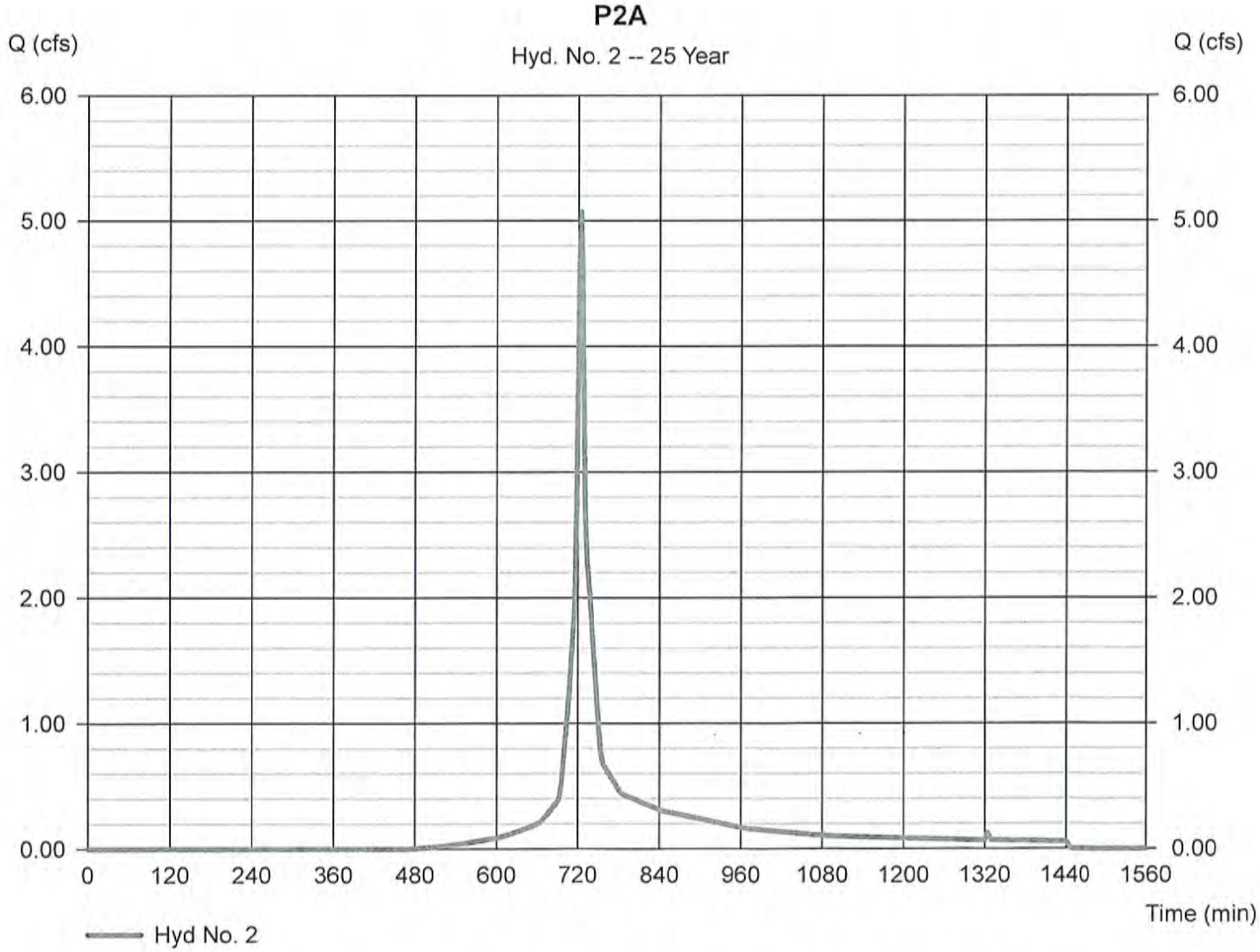
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 2

P2A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.072 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 15,157 cuft
Drainage area	= 1.510 ac	Curve number	= 77.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



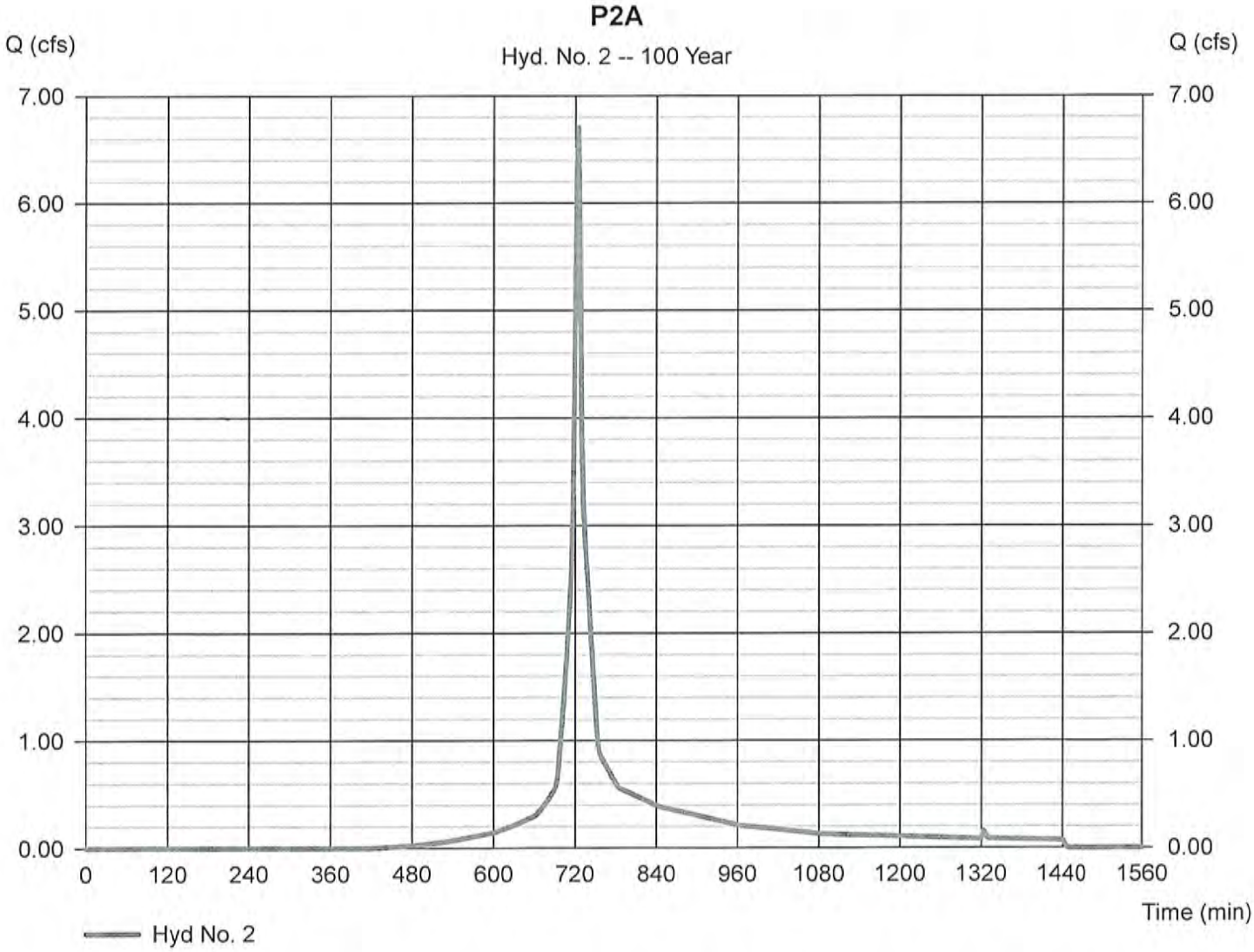
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 2

P2A

Hydrograph type	= SCS Runoff	Peak discharge	= 6.705 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 20,111 cuft
Drainage area	= 1.510 ac	Curve number	= 77.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-2A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.65	64.10
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			0.81	49.41
	Gravel	85			0.04	3.79
				Totals =	1.51	117.30

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{117.30}{1.51} = 77.75$; Use CN = 77.8

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.19	2.27	3.91
Runoff, Q.....	cf	6493	12444	21405

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

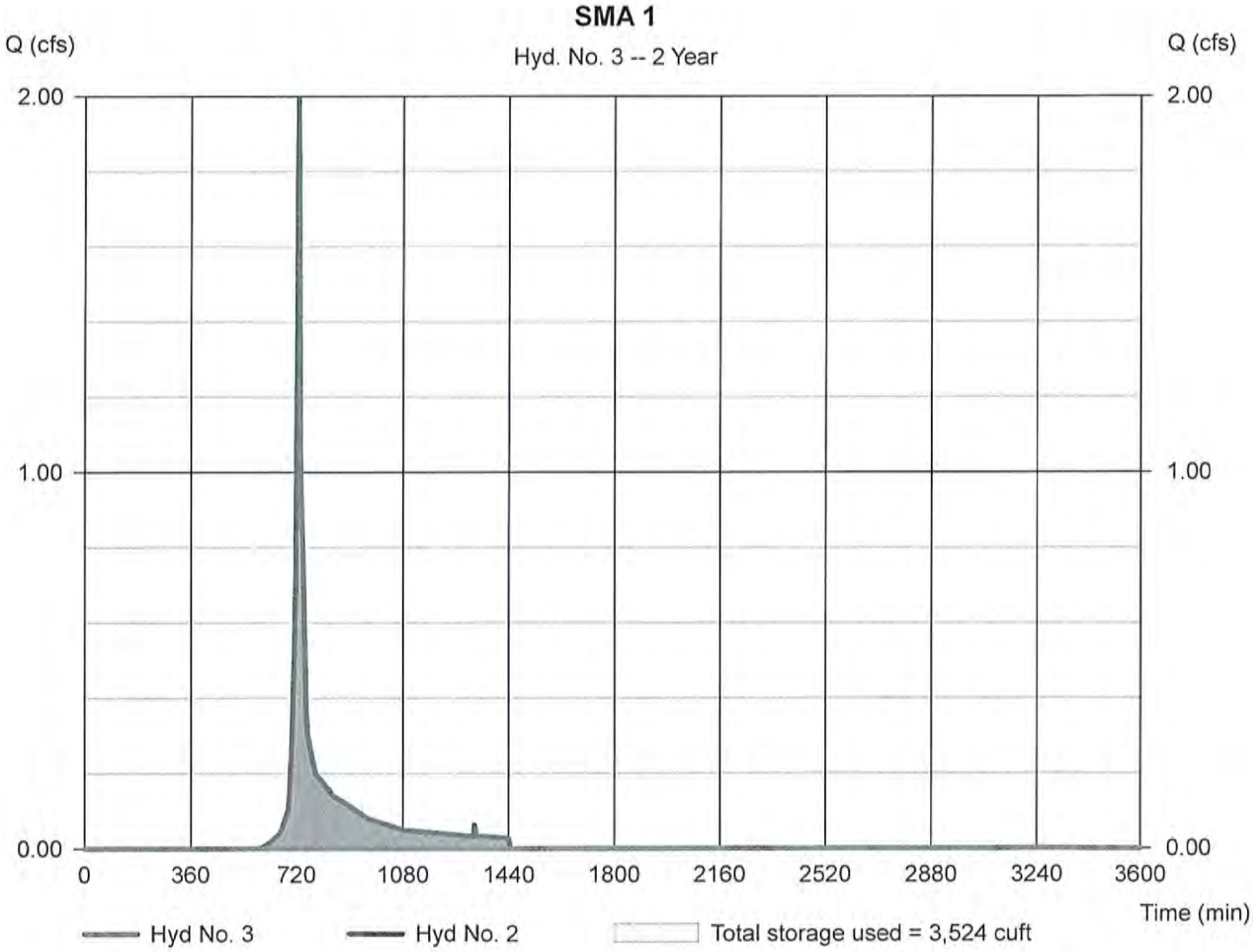
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 3

SMA 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 714 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - P2A	Max. Elevation	= 323.10 ft
Reservoir name	= SMA 1	Max. Storage	= 3,524 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

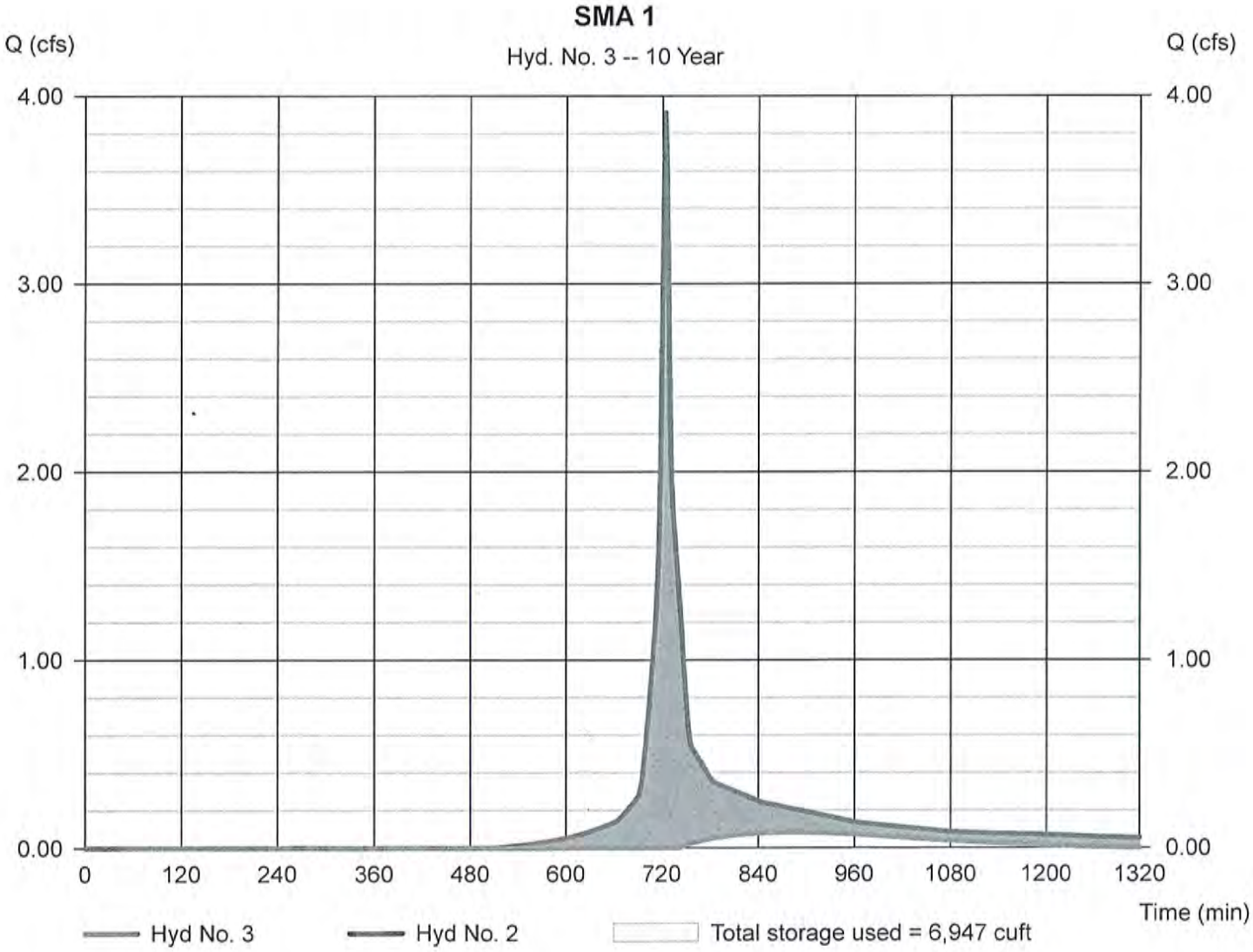
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 3

SMA 1

Hydrograph type	= Reservoir	Peak discharge	= 0.082 cfs
Storm frequency	= 10 yrs	Time to peak	= 884 min
Time interval	= 2 min	Hyd. volume	= 1,484 cuft
Inflow hyd. No.	= 2 - P2A	Max. Elevation	= 323.83 ft
Reservoir name	= SMA 1	Max. Storage	= 6,947 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

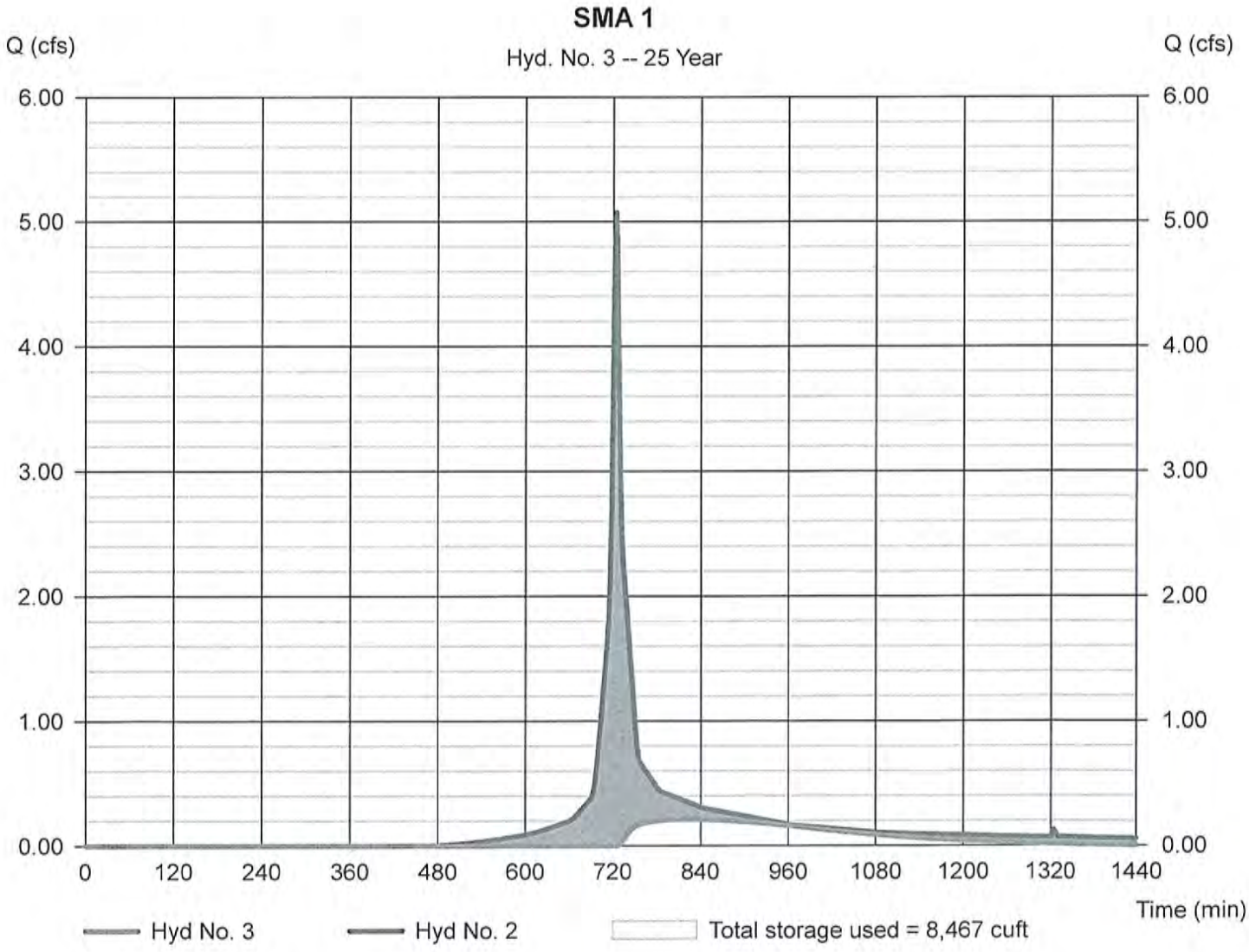
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 3

SMA 1

Hydrograph type	= Reservoir	Peak discharge	= 0.211 cfs
Storm frequency	= 25 yrs	Time to peak	= 824 min
Time interval	= 2 min	Hyd. volume	= 4,102 cuft
Inflow hyd. No.	= 2 - P2A	Max. Elevation	= 324.12 ft
Reservoir name	= SMA 1	Max. Storage	= 8,467 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

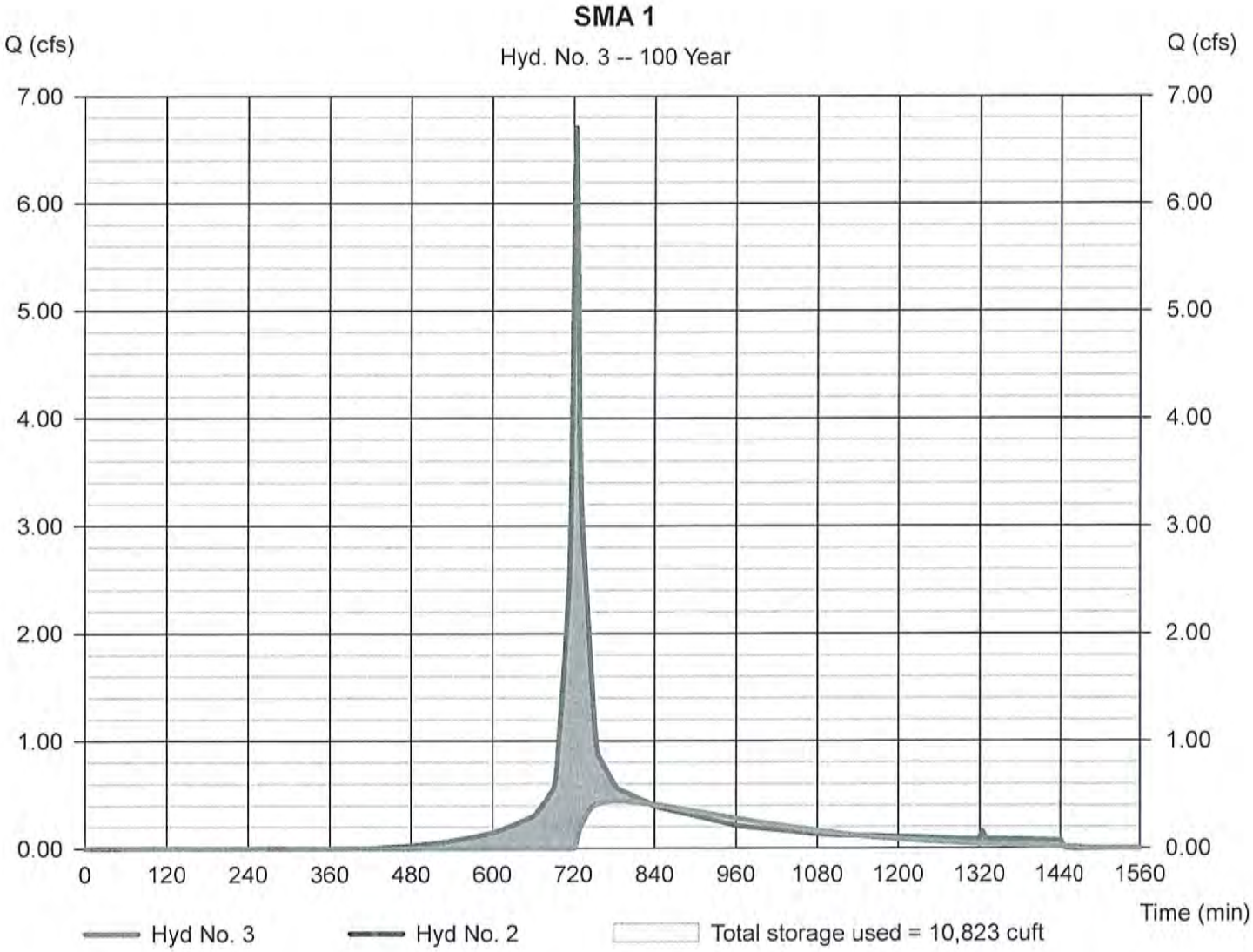
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 3

SMA 1

Hydrograph type	= Reservoir	Peak discharge	= 0.440 cfs
Storm frequency	= 100 yrs	Time to peak	= 782 min
Time interval	= 2 min	Hyd. volume	= 8,252 cuft
Inflow hyd. No.	= 2 - P2A	Max. Elevation	= 324.51 ft
Reservoir name	= SMA 1	Max. Storage	= 10,823 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



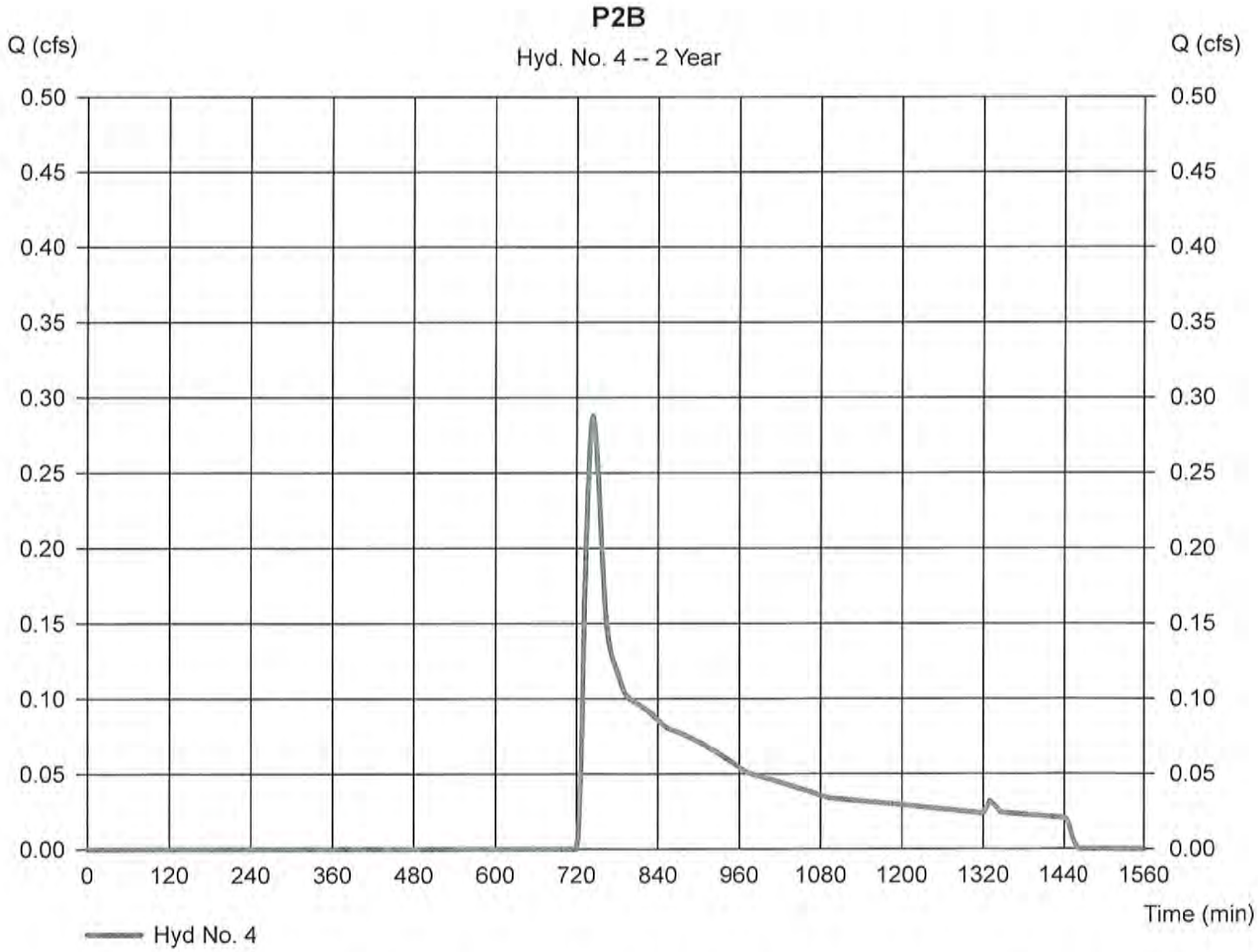
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 4

P2B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.287 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 2,392 cuft
Drainage area	= 2.440 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.40 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



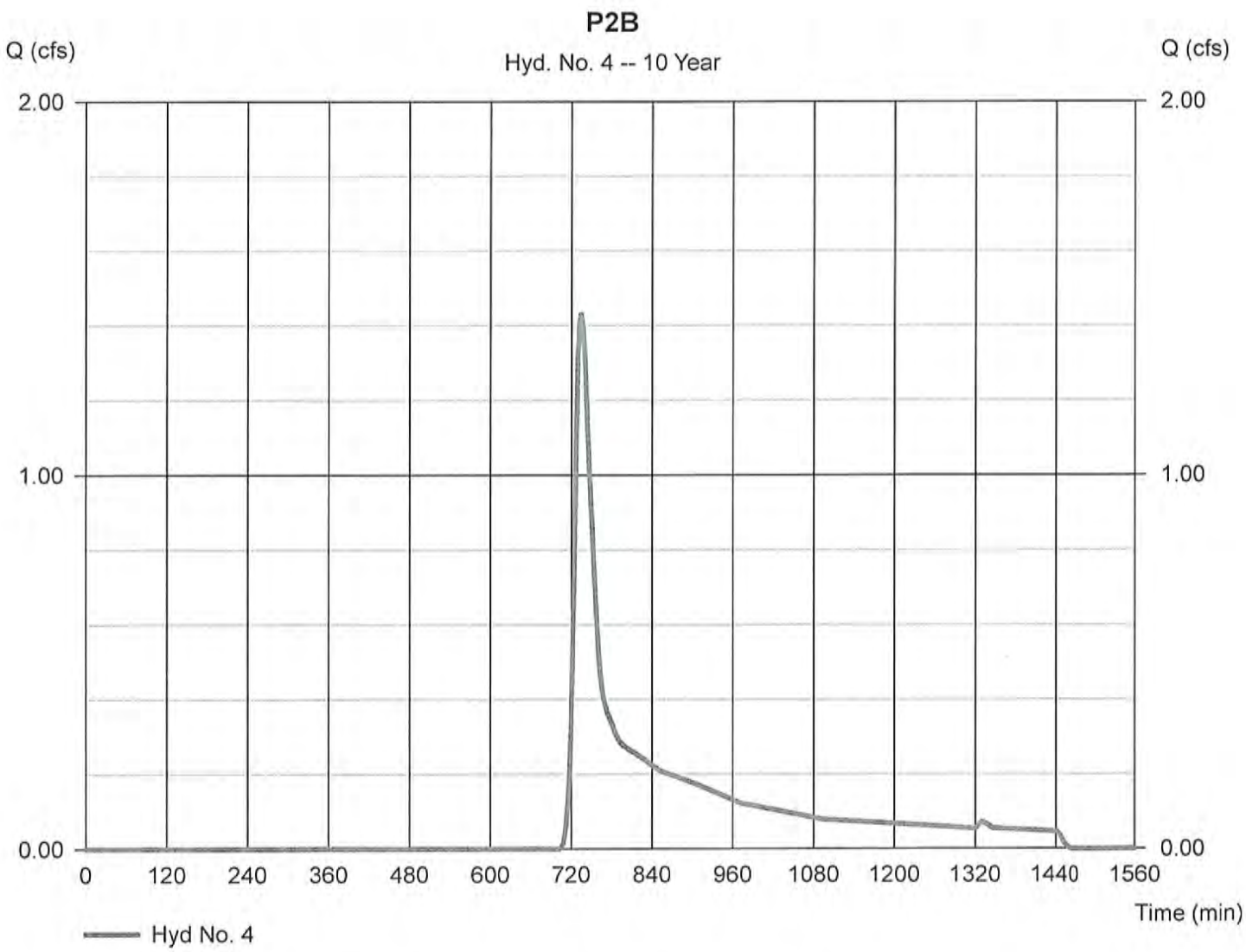
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 4

P2B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.429 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 7,334 cuft
Drainage area	= 2.440 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.40 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



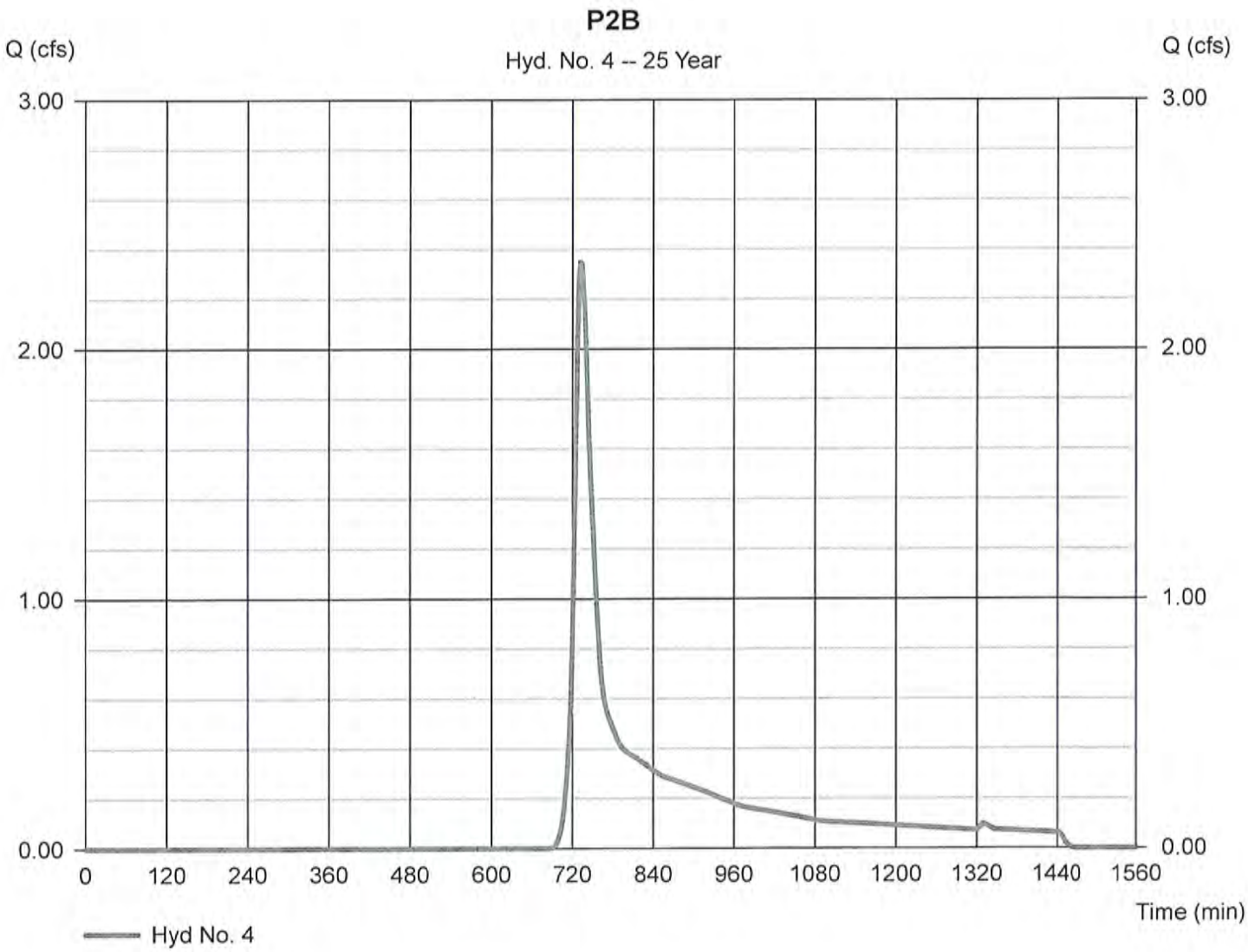
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 4

P2B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.347 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 10,950 cuft
Drainage area	= 2.440 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.40 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



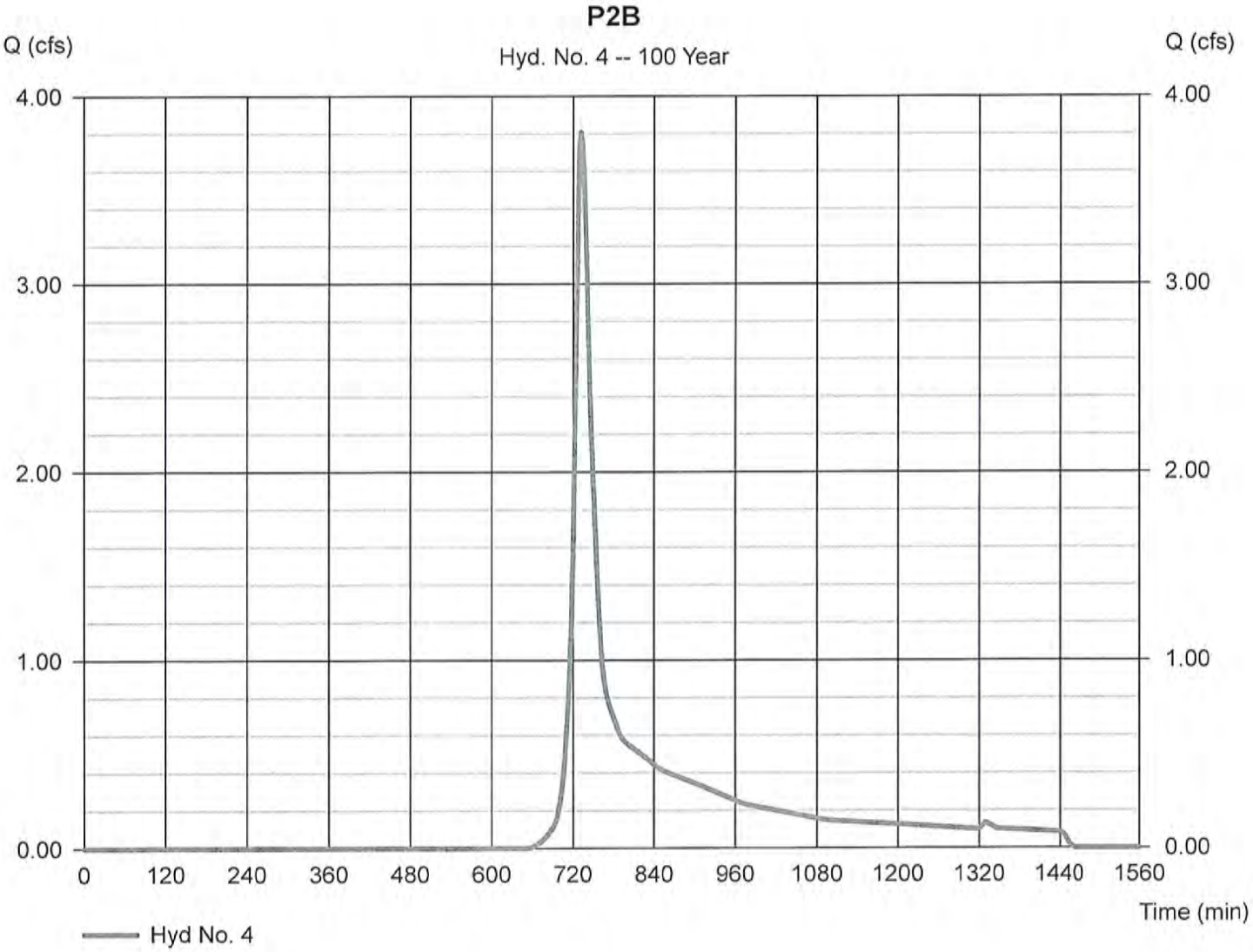
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 4

P2B

Hydrograph type	= SCS Runoff	Peak discharge	= 3.809 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 16,615 cuft
Drainage area	= 2.440 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.40 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-2B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.00	0.00
B	Woods- Good Condition	55			1.63	89.63
B	Open Space-Good Condition	61			0.81	49.54
					Totals =	2.44	139.17

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{139.17}{2.44} =$ 57.00 ; Use CN = 57.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.28	0.85	1.92
Runoff, Q.....	cf	2456	7526	17049

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed

Circle one: Tc | Tt through subarea SubcatchmentPP-2B

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.04			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.22			0.22

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	67			
9. Watercourse slope, s		ft/ft	0.075			
10. Average Velocity, V (figure 3-1)		ft/s	4.42			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.22
min 13.4

(210-VI-TR-55, Second Ed., June 1986)

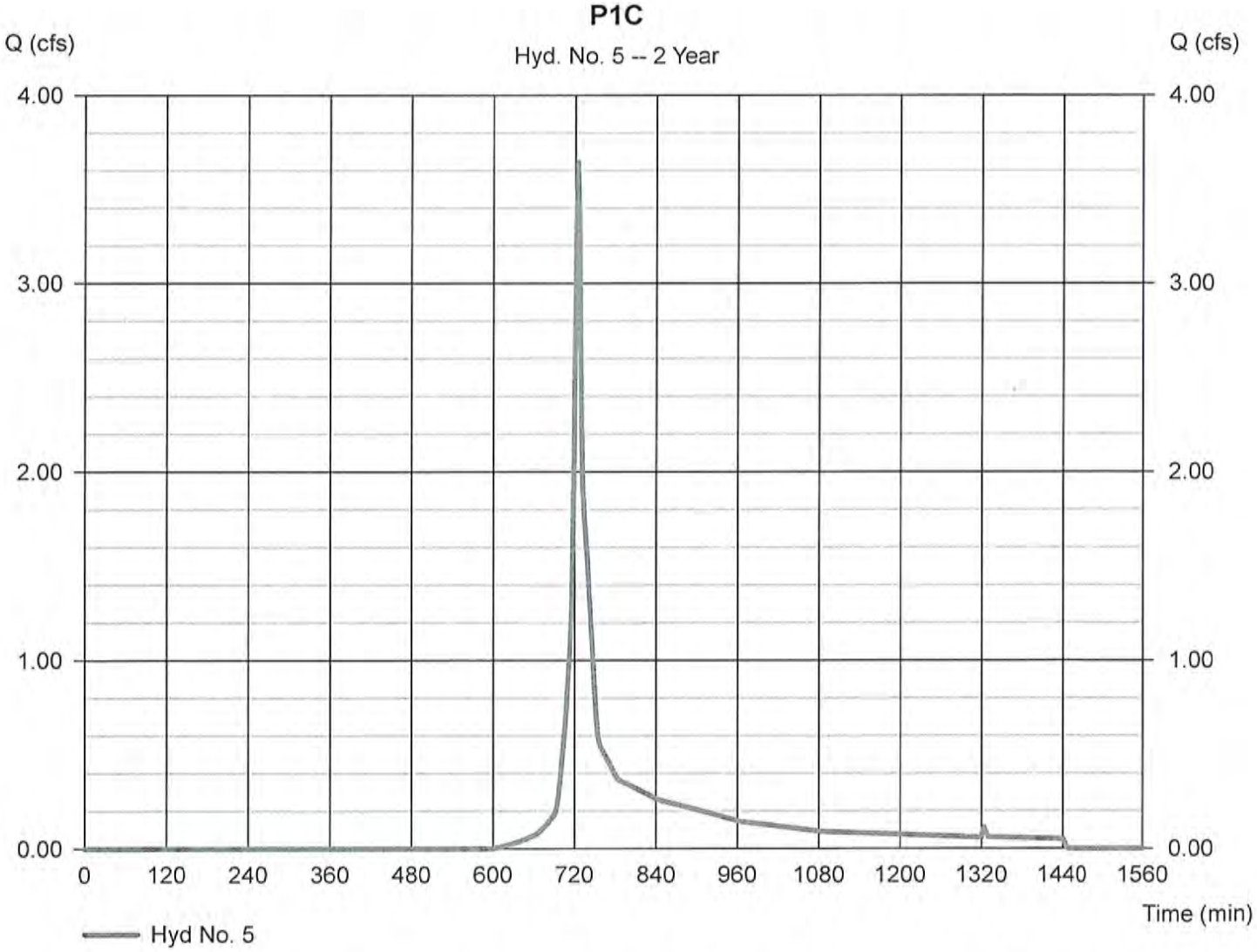
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 5

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 3.645 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,170 cuft
Drainage area	= 2.790 ac	Curve number	= 77.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



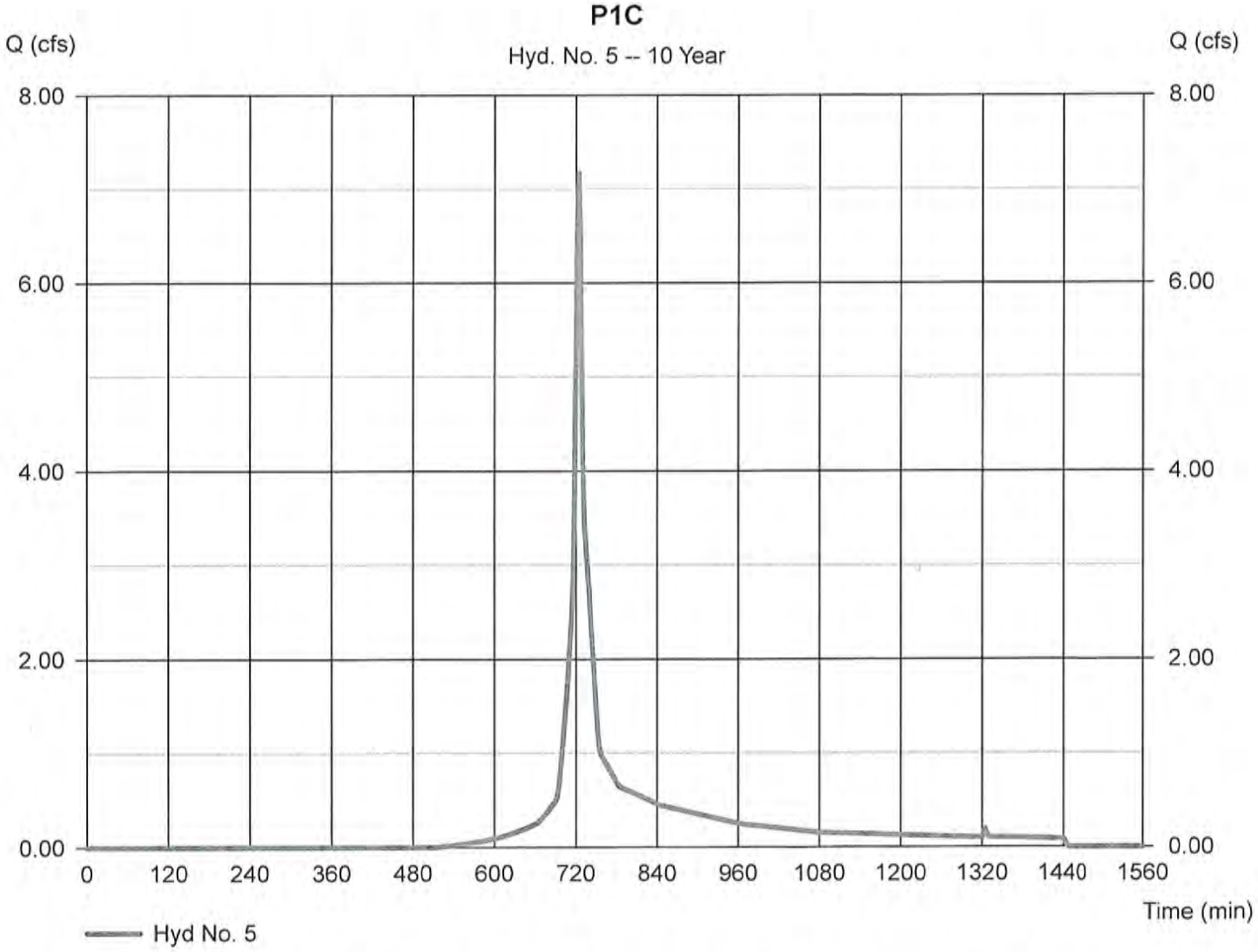
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 5

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 7.172 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 21,456 cuft
Drainage area	= 2.790 ac	Curve number	= 77.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



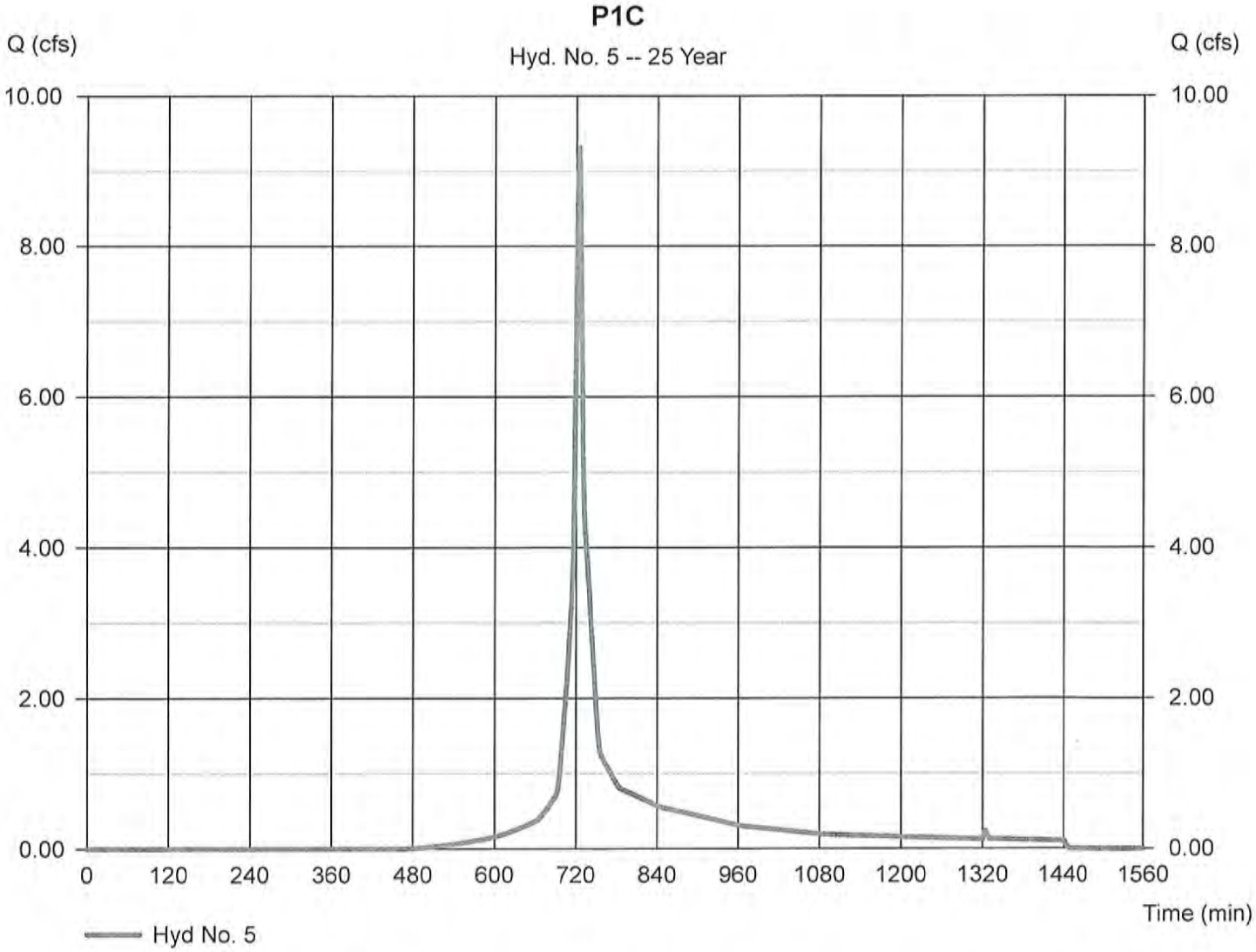
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 5

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 9.313 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 27,830 cuft
Drainage area	= 2.790 ac	Curve number	= 77.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



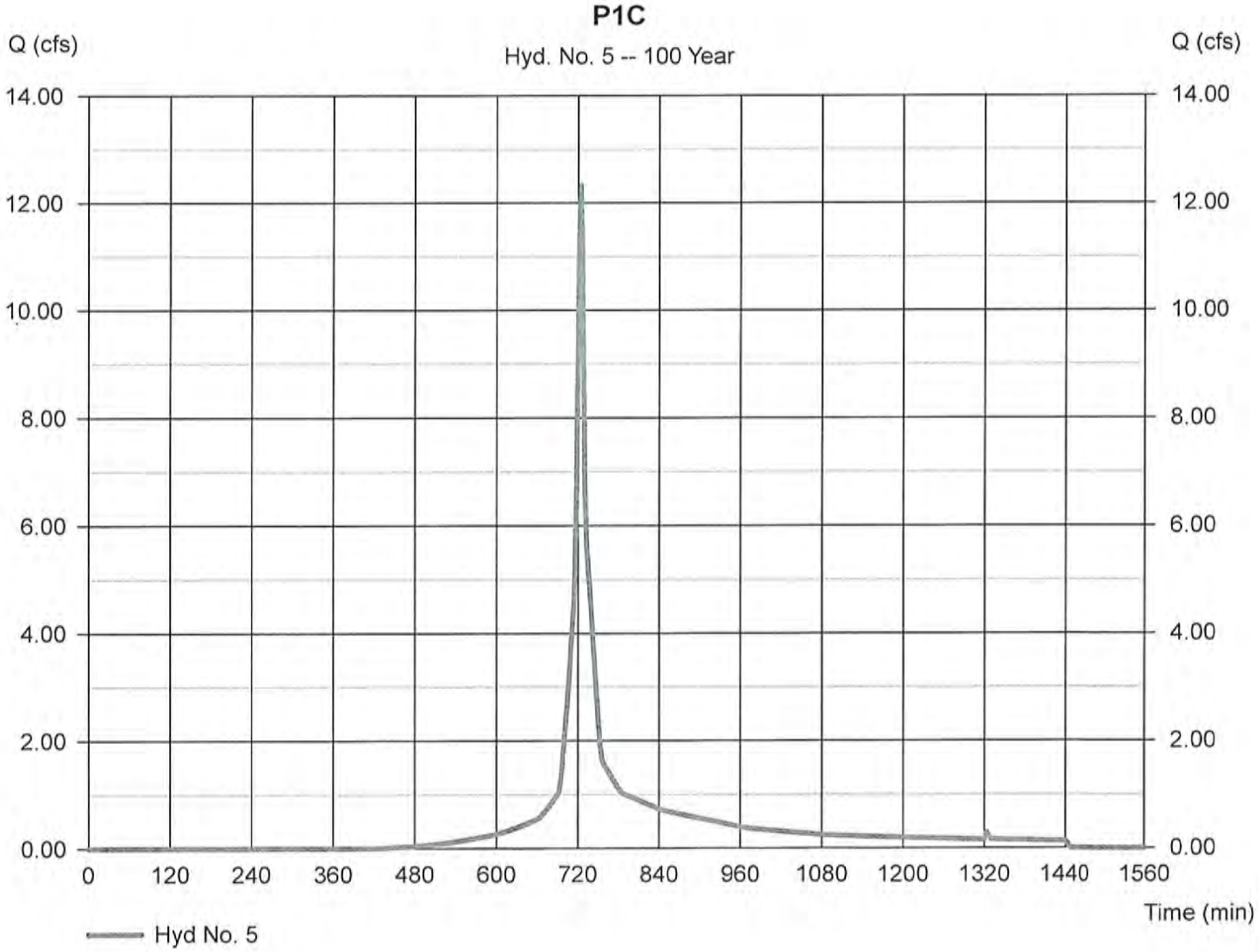
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 5

P1C

Hydrograph type	= SCS Runoff	Peak discharge	= 12.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 36,961 cuft
Drainage area	= 2.790 ac	Curve number	= 77.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1C

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			1.23	120.87
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			1.53	93.14
B	Gravel	85			0.03	2.22
				Totals =	2.79	216.23

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{216.23}{2.79} = 77.60$; Use CN = 77.6

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.18	2.26	3.89
Runoff, Q.....	cf	11901	22859	39376

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

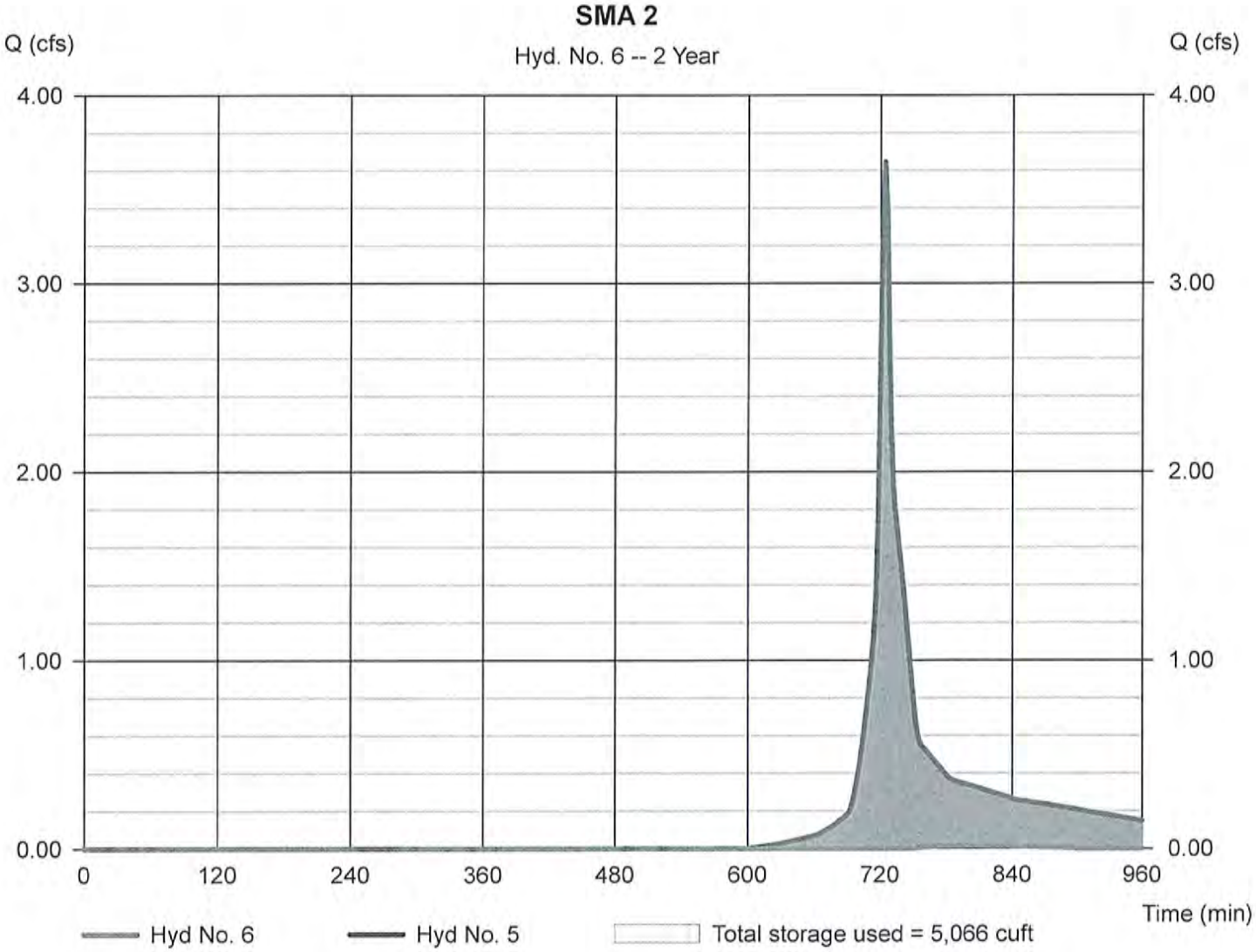
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 6

SMA 2

Hydrograph type	= Reservoir	Peak discharge	= 0.014 cfs
Storm frequency	= 2 yrs	Time to peak	= 806 min
Time interval	= 2 min	Hyd. volume	= 84 cuft
Inflow hyd. No.	= 5 - P1C	Max. Elevation	= 314.25 ft
Reservoir name	= SMA 2	Max. Storage	= 5,066 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

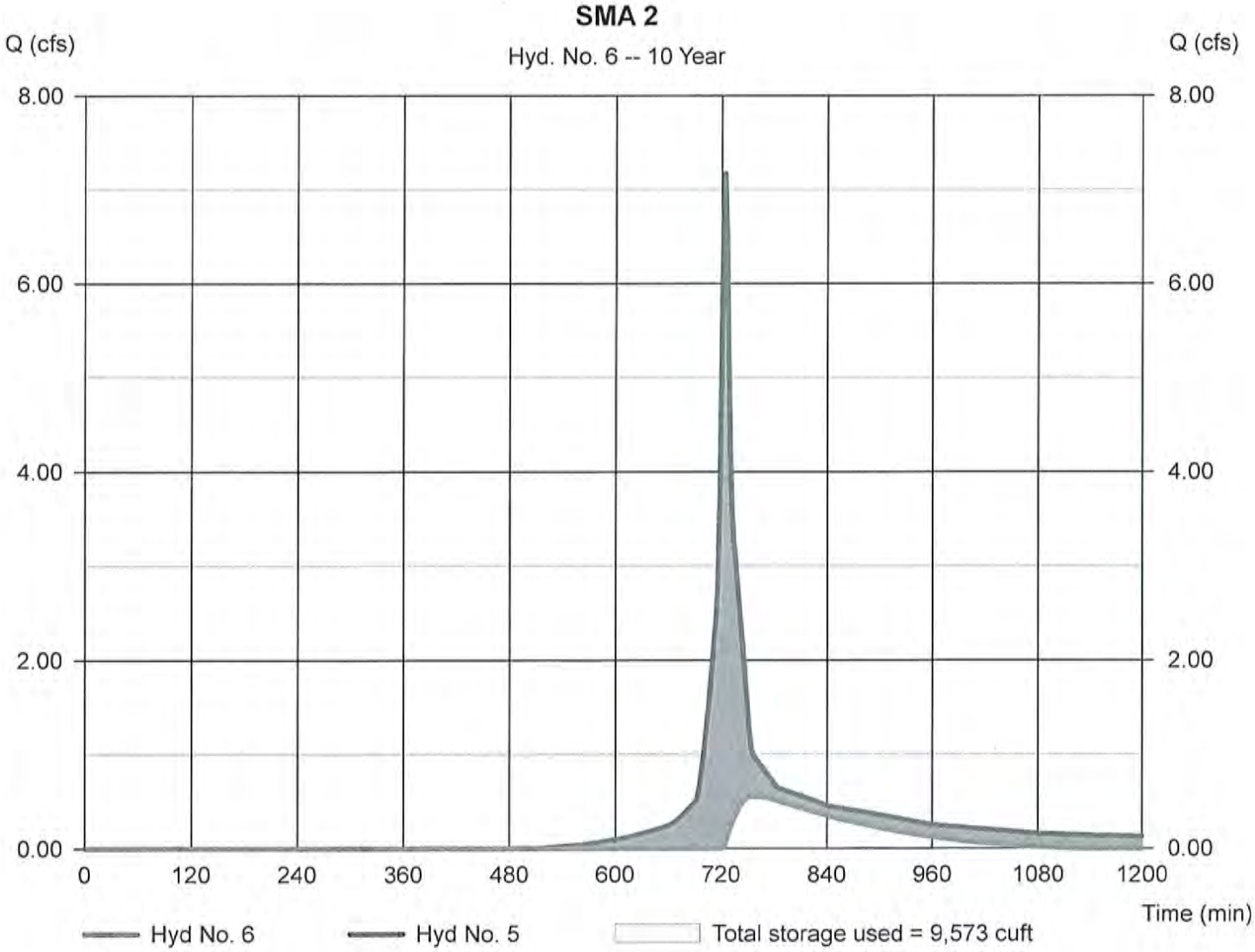
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 6

SMA 2

Hydrograph type	= Reservoir	Peak discharge	= 0.552 cfs
Storm frequency	= 10 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 5,111 cuft
Inflow hyd. No.	= 5 - P1C	Max. Elevation	= 314.96 ft
Reservoir name	= SMA 2	Max. Storage	= 9,573 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

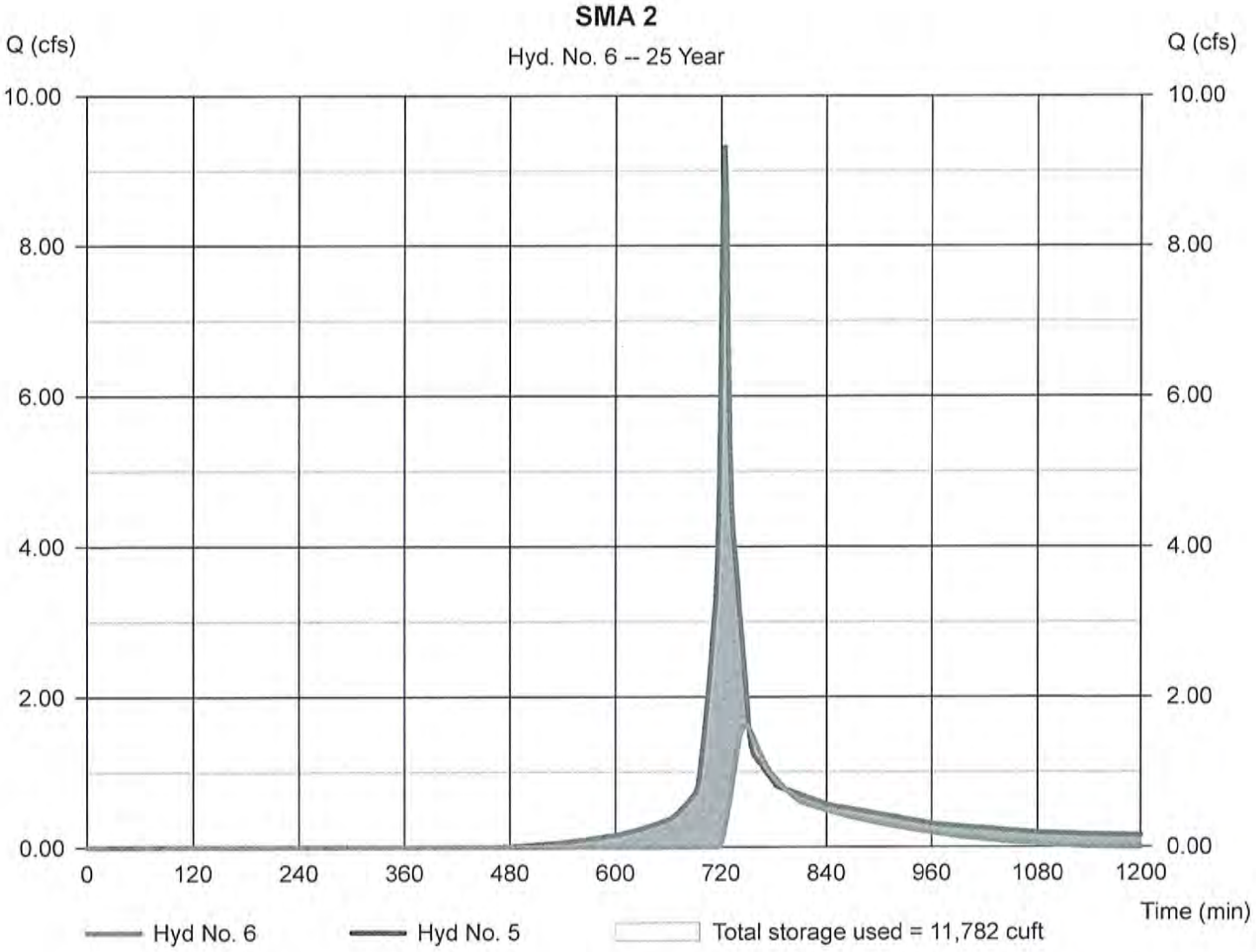
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 6

SMA 2

Hydrograph type	= Reservoir	Peak discharge	= 1.614 cfs
Storm frequency	= 25 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 9,550 cuft
Inflow hyd. No.	= 5 - P1C	Max. Elevation	= 315.19 ft
Reservoir name	= SMA 2	Max. Storage	= 11,782 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

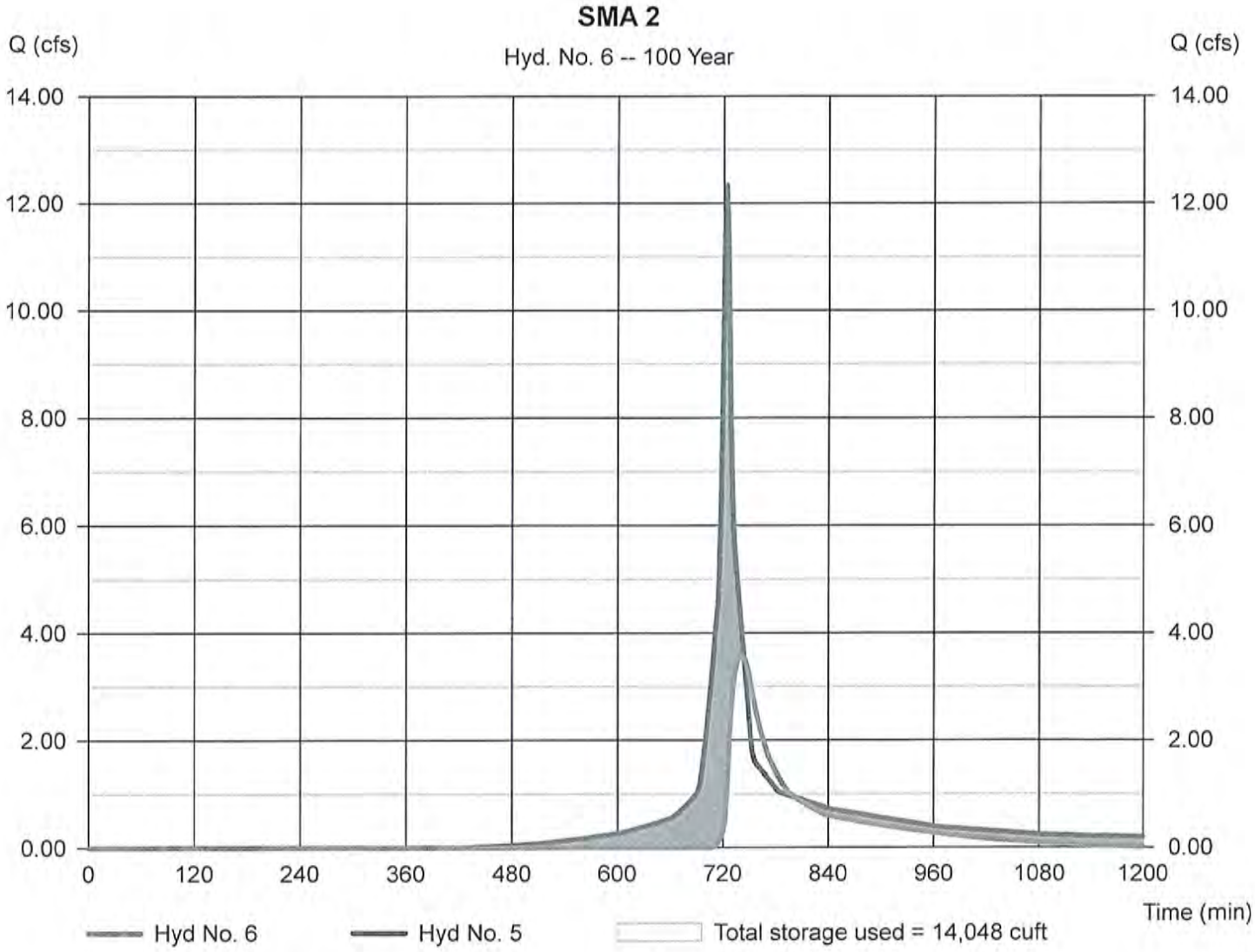
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 6

SMA 2

Hydrograph type	= Reservoir	Peak discharge	= 3.572 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 16,521 cuft
Inflow hyd. No.	= 5 - P1C	Max. Elevation	= 315.40 ft
Reservoir name	= SMA 2	Max. Storage	= 14,048 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



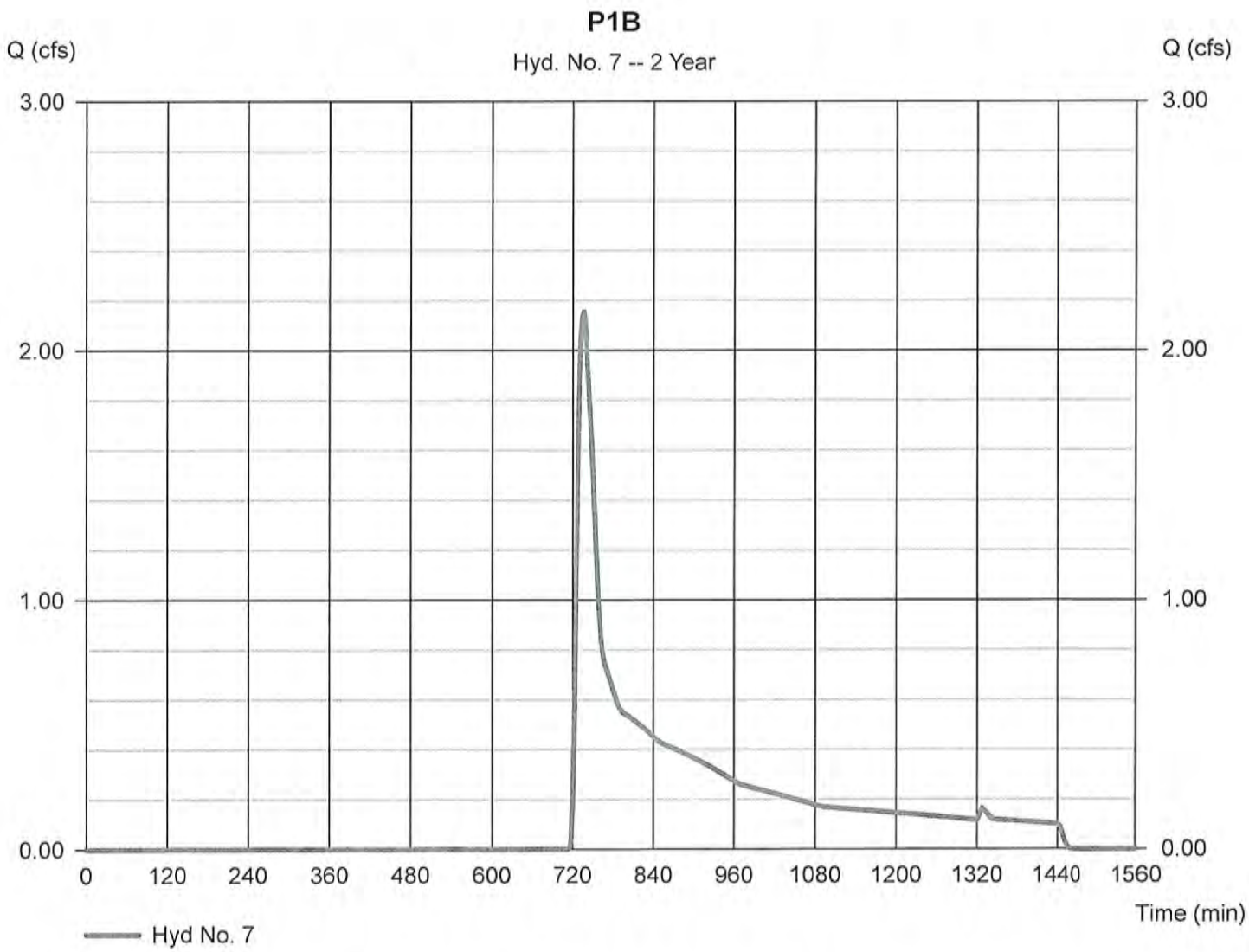
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 7

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 2.154 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 13,597 cuft
Drainage area	= 9.310 ac	Curve number	= 60.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.40 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



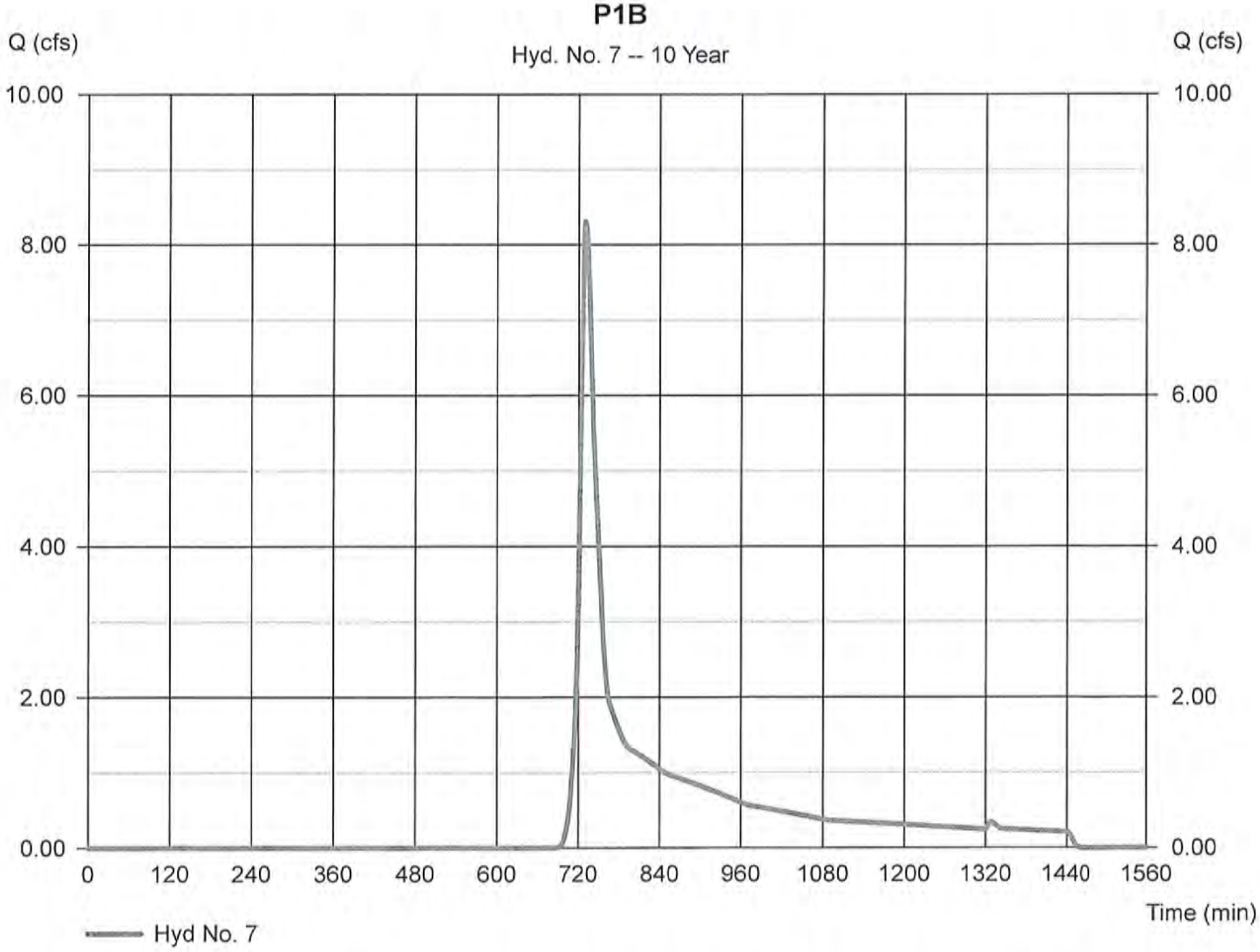
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 7

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 8.310 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 36,779 cuft
Drainage area	= 9.310 ac	Curve number	= 60.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.40 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



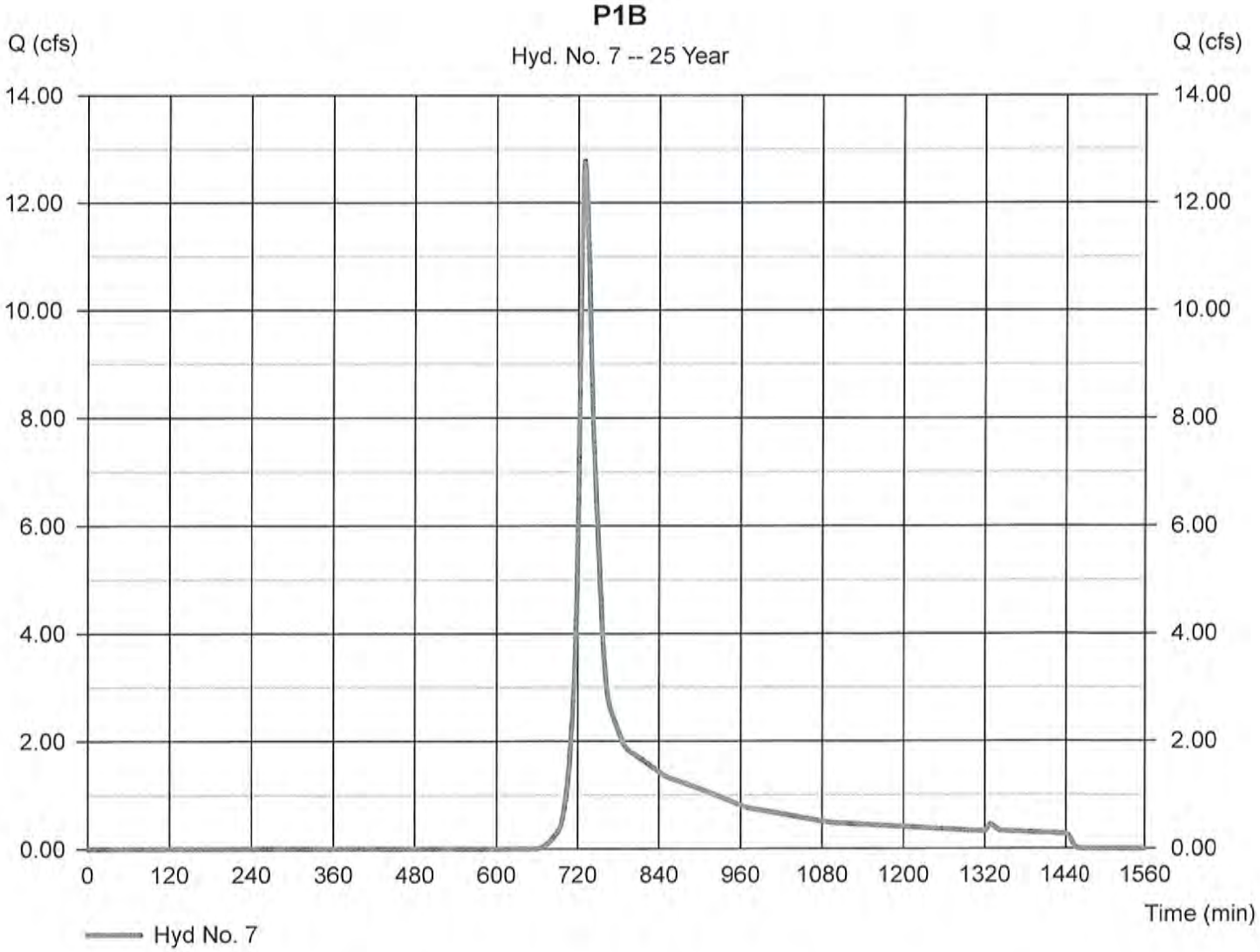
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 7

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 12.78 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 53,091 cuft
Drainage area	= 9.310 ac	Curve number	= 60.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.40 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



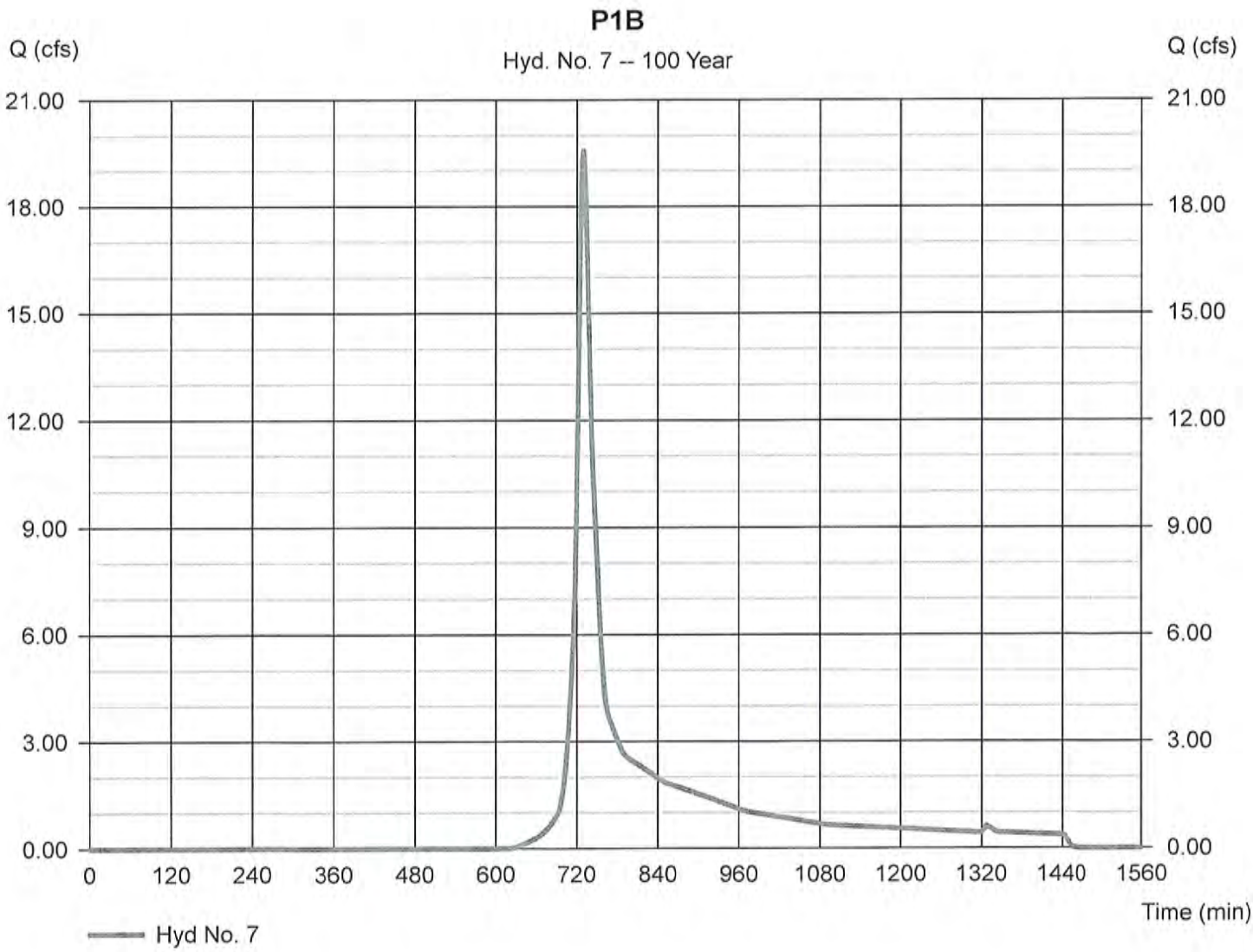
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 7

P1B

Hydrograph type	= SCS Runoff	Peak discharge	= 19.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 78,126 cuft
Drainage area	= 9.310 ac	Curve number	= 60.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 11.40 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.72	70.40
B	Woods- Good Condition	55			3.23	177.86
B	Open Space-Good Condition	61			1.04	63.24
A	Open Space-Good Condition	39			1.30	50.81
A	Woods- Good Condition	30			0.41	12.30
C	Open Space-Good Condition	74			1.43	105.74
C	Woods- Good Condition	70			1.00	69.95
C	Open Space-Fair Condition	79			0.18	14.55
				Totals =	9.31	564.85

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{564.85}{9.31} = 60.64$; Use CN = 60.6

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	100
Rainfall, P (24-hour)	in	3.1	4.5	6.4
Runoff, Q (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.39	1.06	2.25
Runoff, Q	cf	13242	35770	75928

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed
Circle one: Tc | Tt through subarea SubcatchmentP P-1B

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.06			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.19			0.19
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	66			
9. Watercourse slope, s		ft/ft	0.11			
10. Average Velocity, V (figure 3-1)		ft/s	5.35			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.19
min 11.4

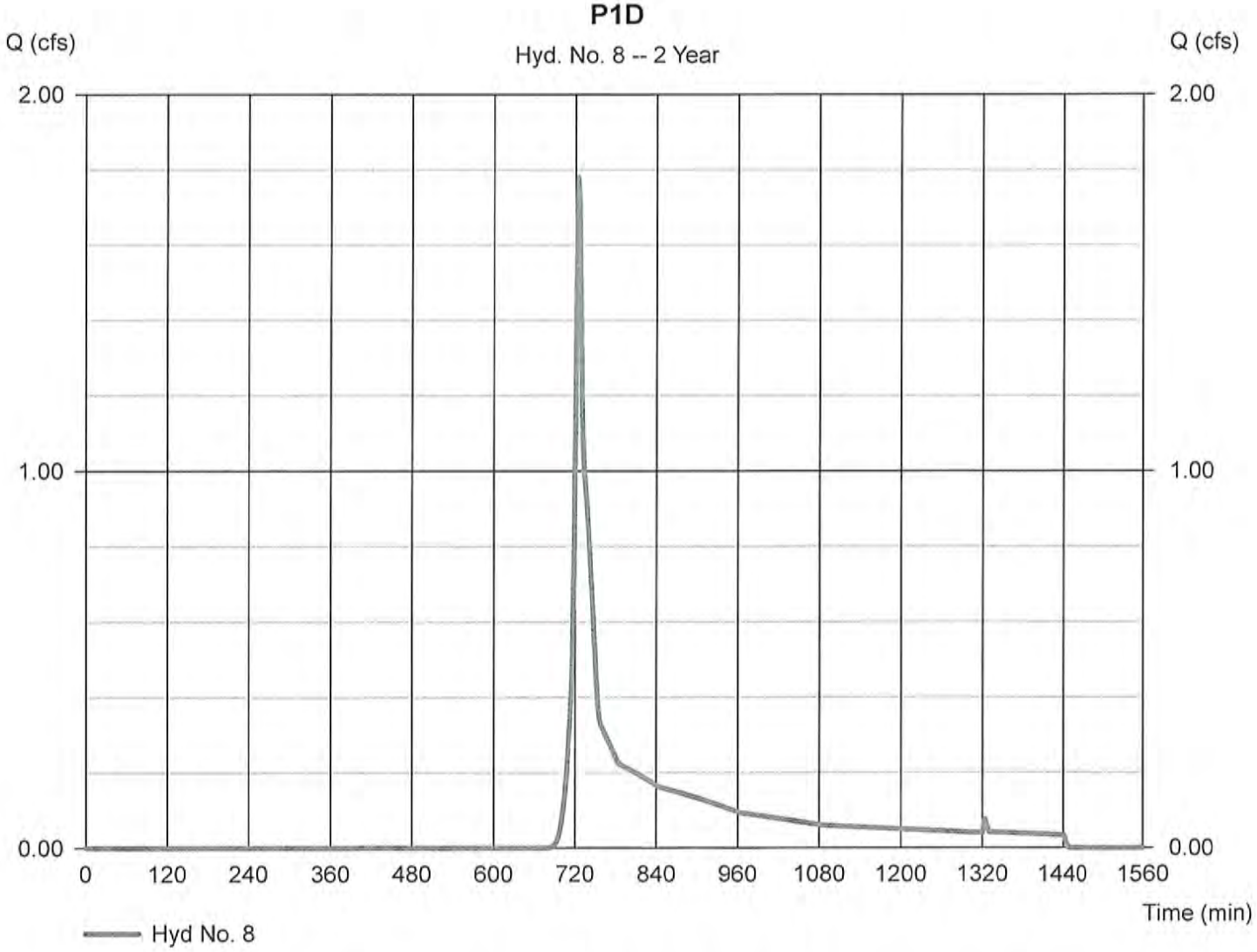
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 8

P1D

Hydrograph type	= SCS Runoff	Peak discharge	= 1.780 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,102 cuft
Drainage area	= 2.400 ac	Curve number	= 69.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



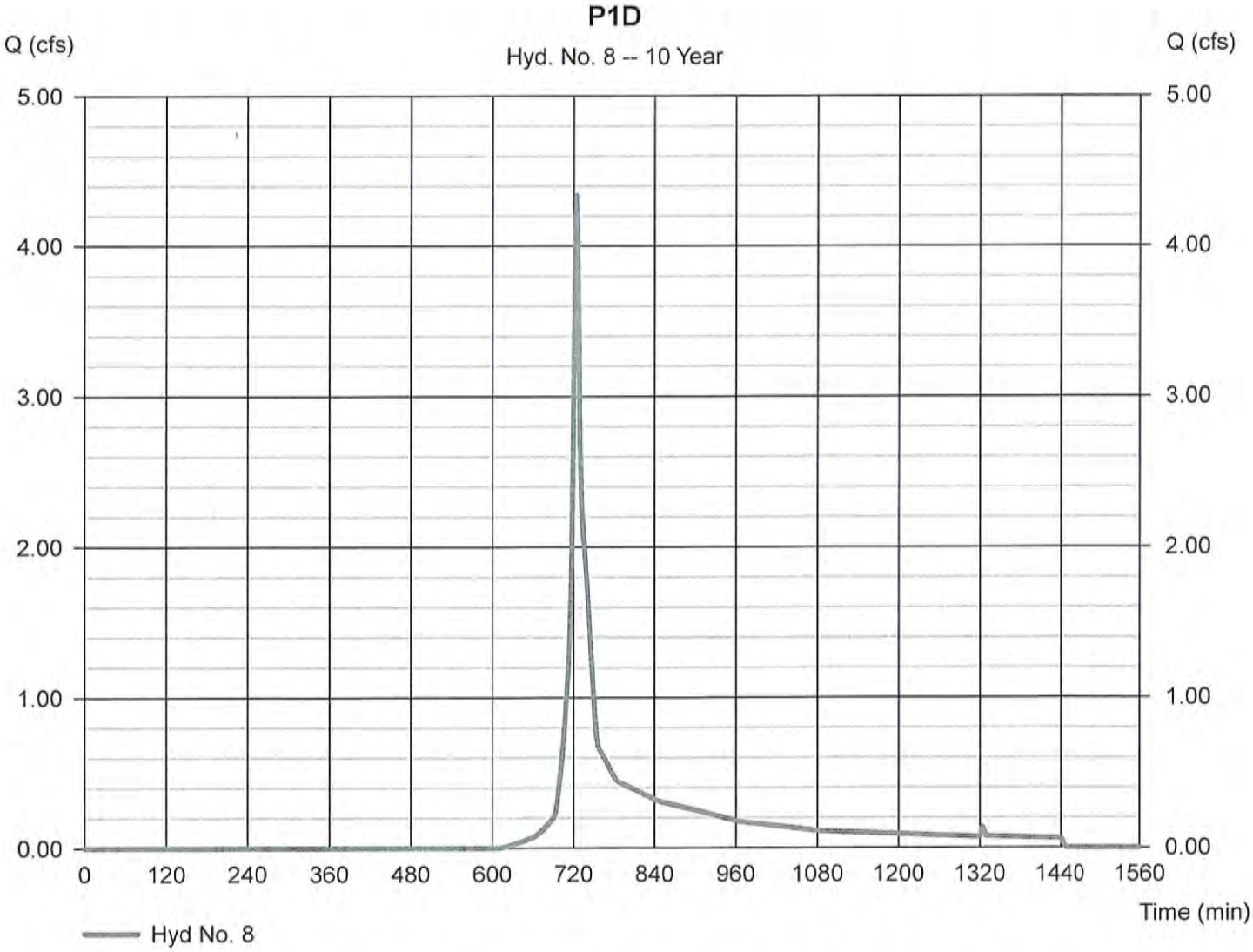
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 8

P1D

Hydrograph type	= SCS Runoff	Peak discharge	= 4.339 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,378 cuft
Drainage area	= 2.400 ac	Curve number	= 69.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



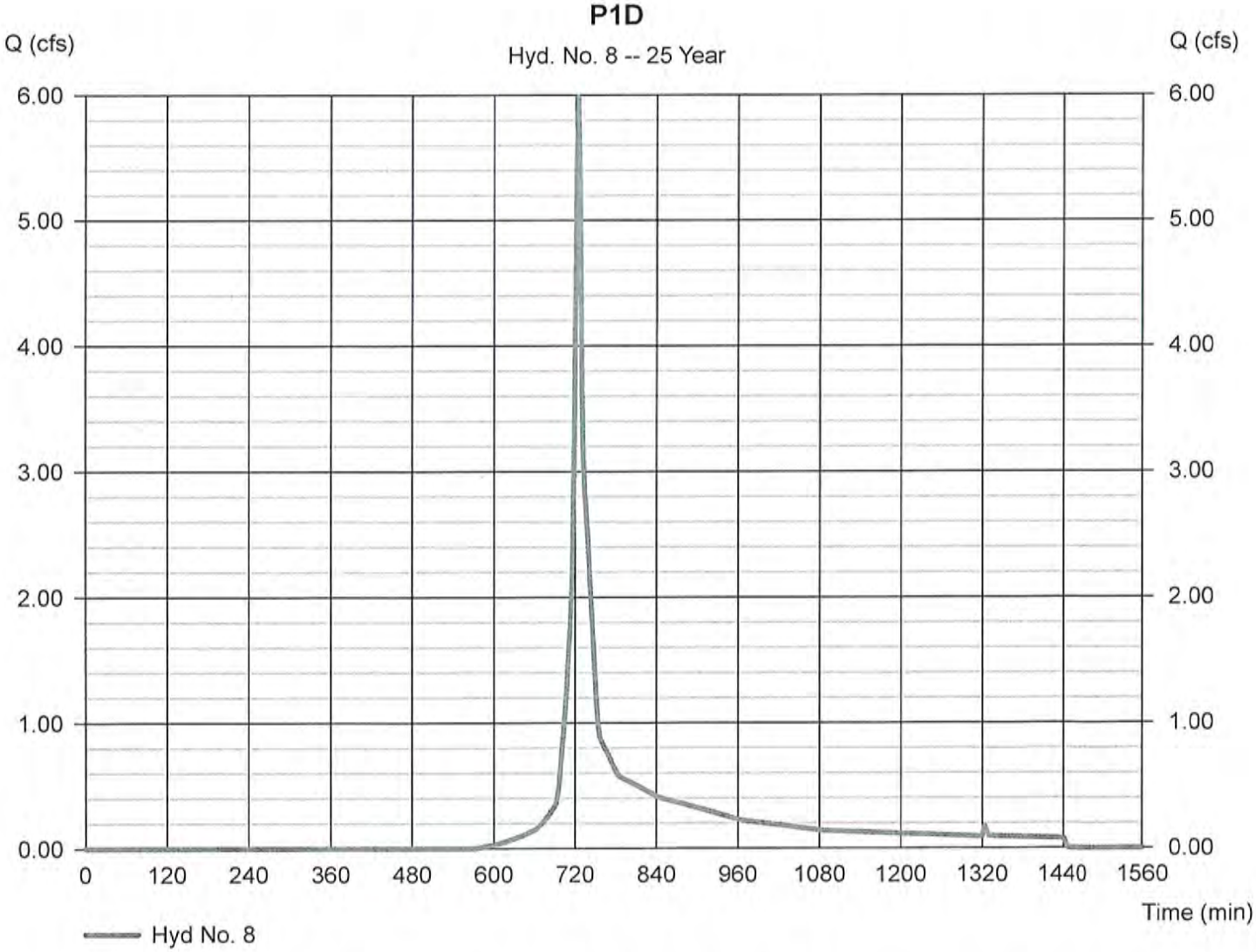
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 8

P1D

Hydrograph type	= SCS Runoff	Peak discharge	= 5.987 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,129 cuft
Drainage area	= 2.400 ac	Curve number	= 69.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



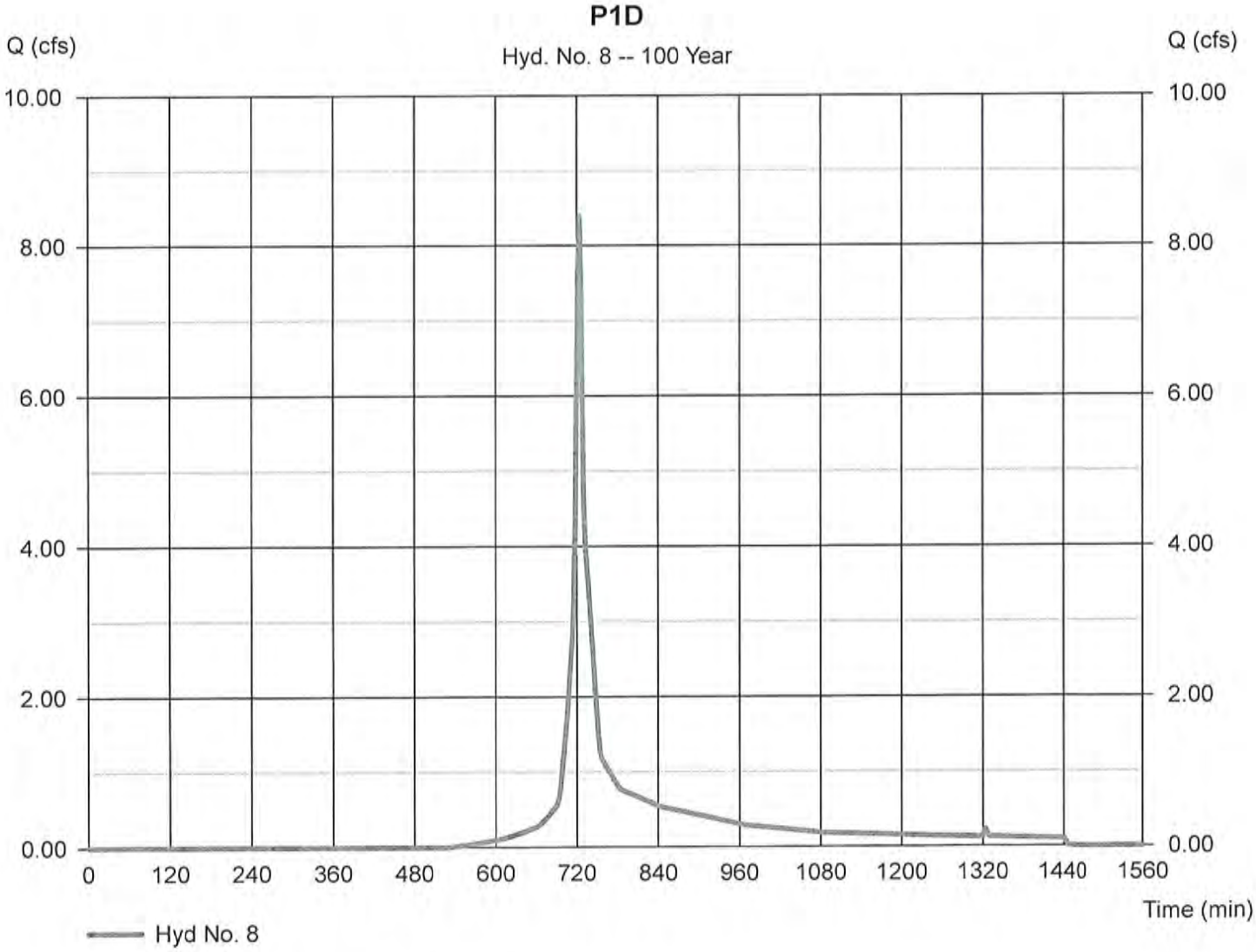
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 8

P1D

Hydrograph type	= SCS Runoff	Peak discharge	= 8.386 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 25,132 cuft
Drainage area	= 2.400 ac	Curve number	= 69.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1D

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.55	53.81
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			1.85	112.63
					Totals =	2.40	166.44

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{166.44}{2.40} = 69.48$; Use CN = 69.5

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.75	1.64	3.08
Runoff, Q.....	cf	6489	14231	26741

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

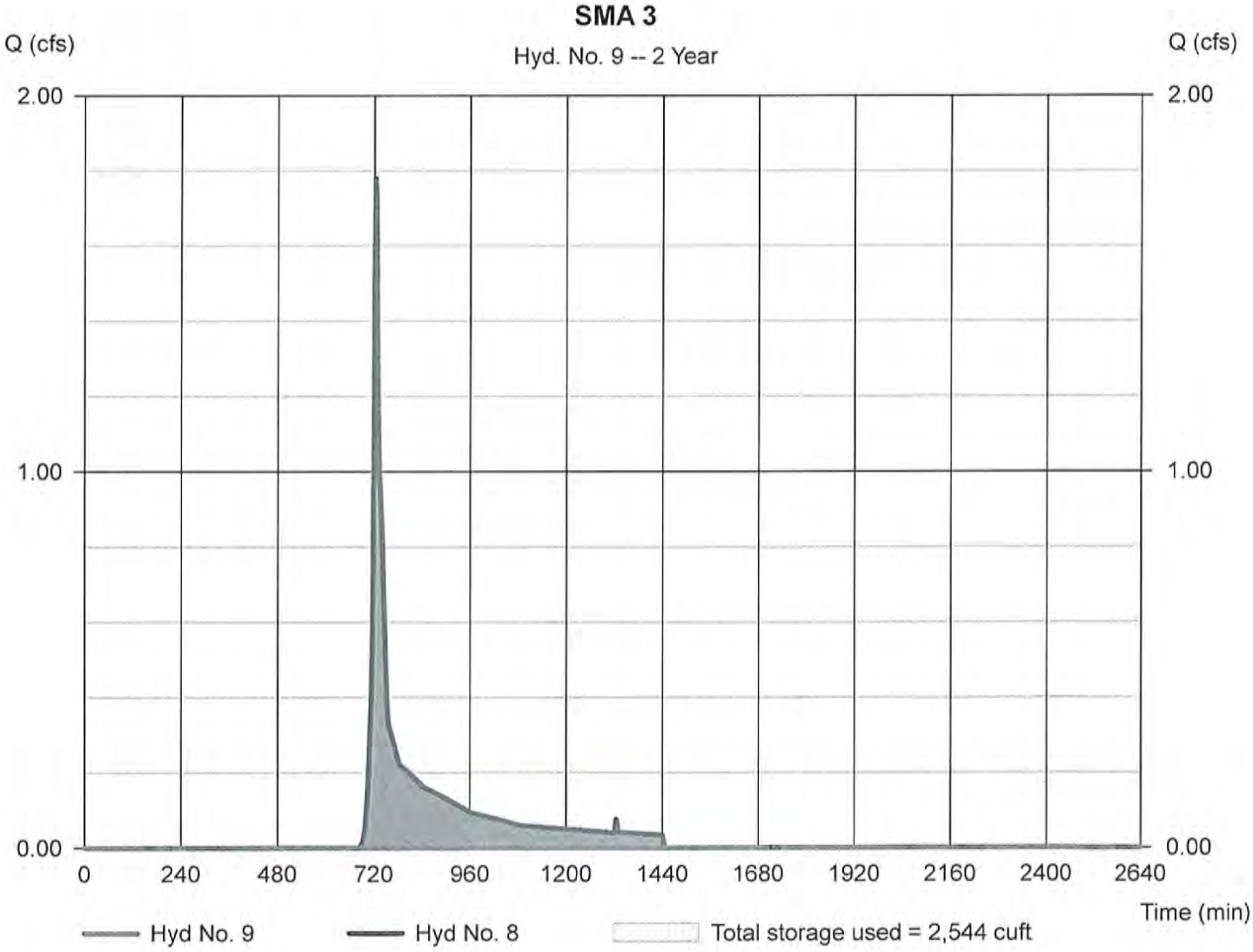
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 9

SMA 3

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1076 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 8 - P1D	Max. Elevation	= 308.46 ft
Reservoir name	= SMA 3	Max. Storage	= 2,544 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

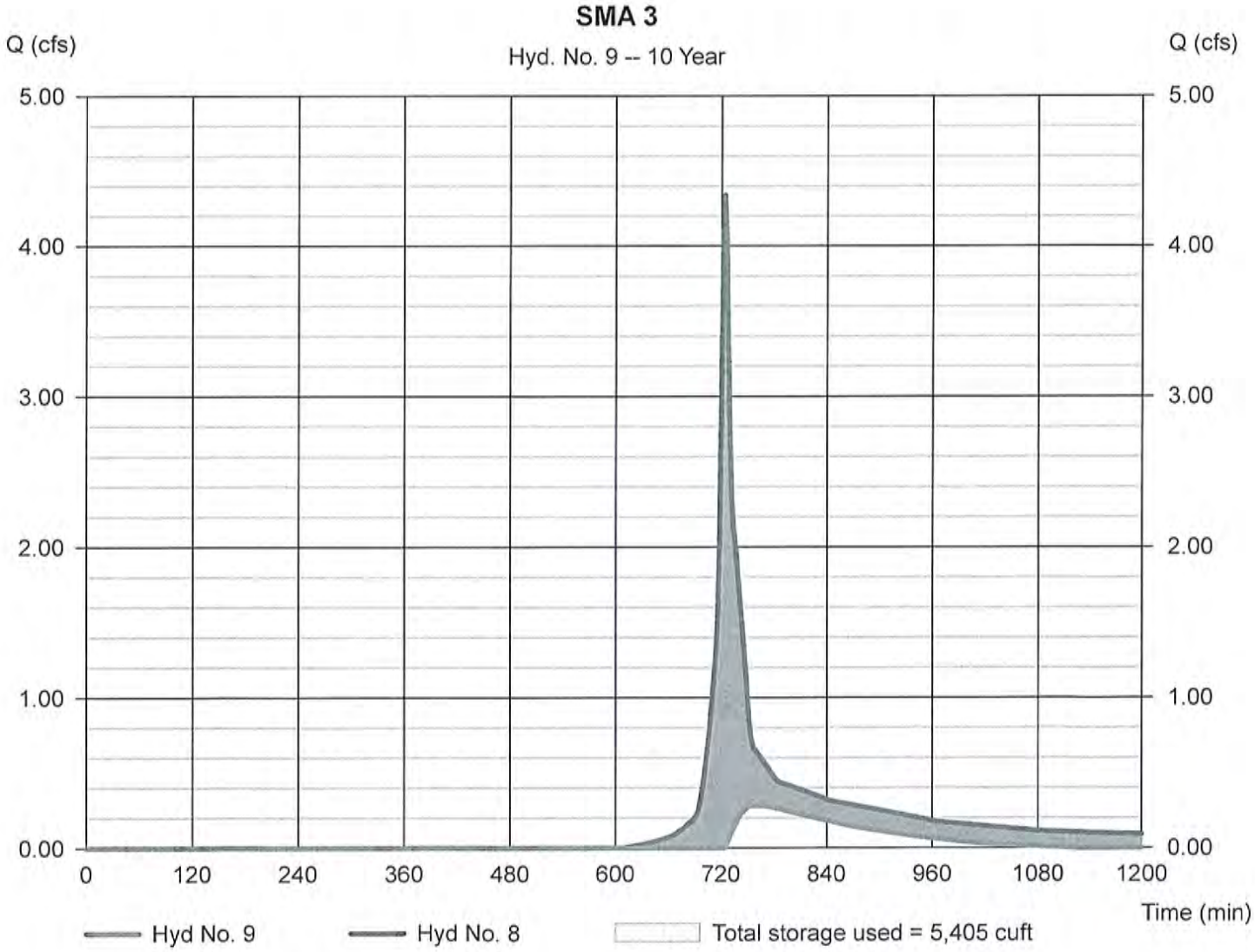
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 9

SMA 3

Hydrograph type	= Reservoir	Peak discharge	= 0.281 cfs
Storm frequency	= 10 yrs	Time to peak	= 760 min
Time interval	= 2 min	Hyd. volume	= 2,610 cuft
Inflow hyd. No.	= 8 - P1D	Max. Elevation	= 308.98 ft
Reservoir name	= SMA 3	Max. Storage	= 5,405 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

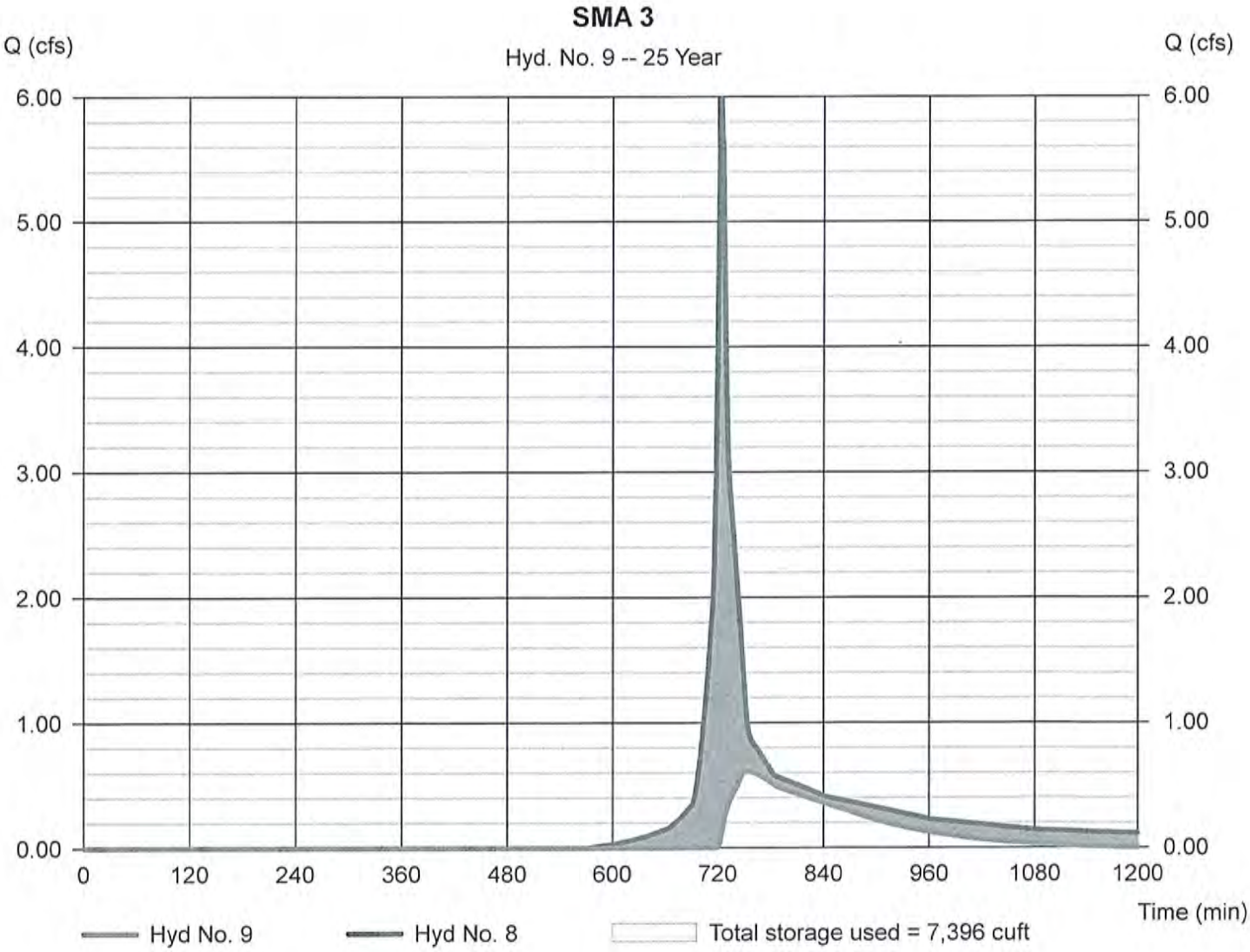
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 9

SMA 3

Hydrograph type	= Reservoir	Peak discharge	= 0.612 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 5,488 cuft
Inflow hyd. No.	= 8 - P1D	Max. Elevation	= 309.26 ft
Reservoir name	= SMA 3	Max. Storage	= 7,396 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

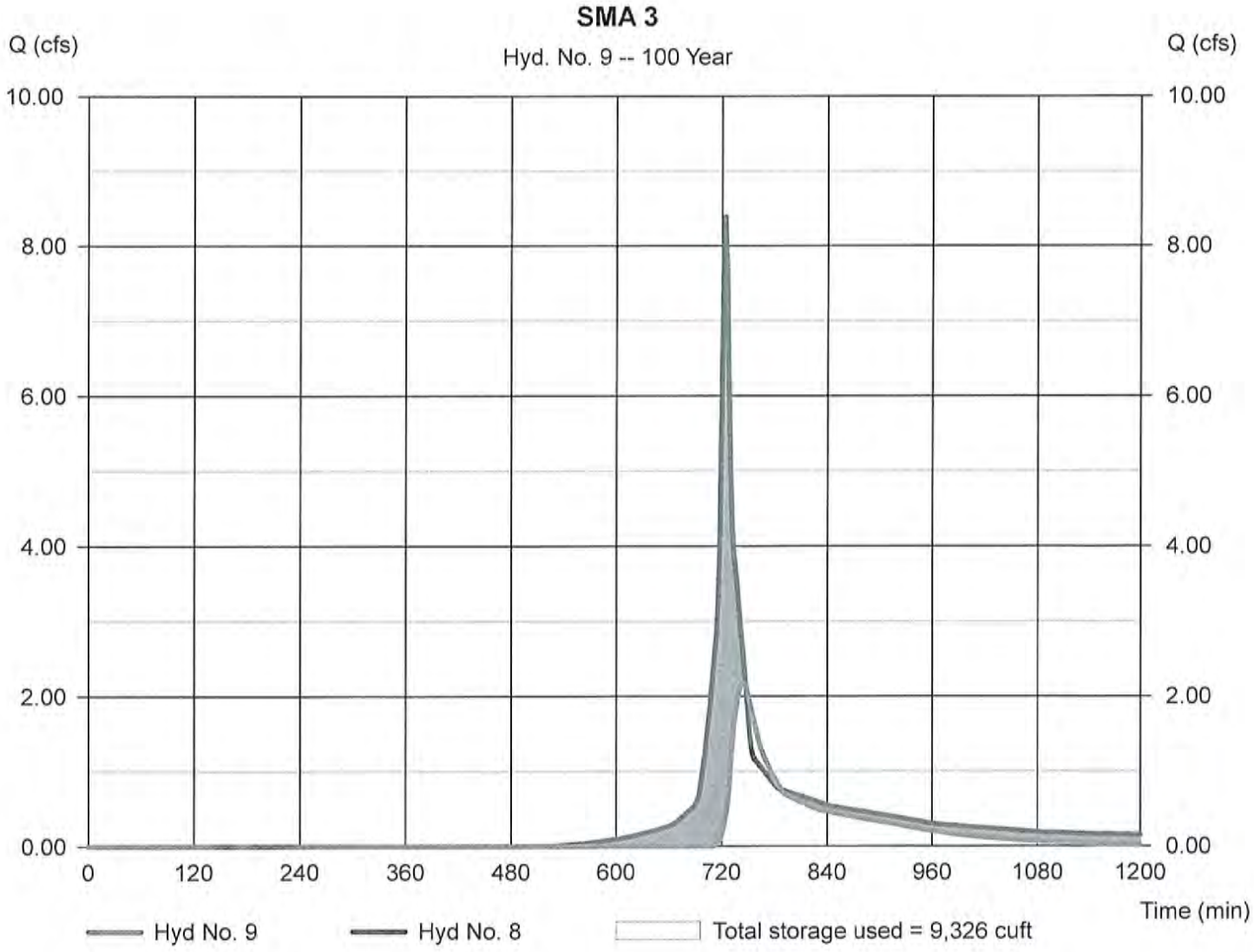
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 9

SMA 3

Hydrograph type	= Reservoir	Peak discharge	= 2.169 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 10,760 cuft
Inflow hyd. No.	= 8 - P1D	Max. Elevation	= 309.52 ft
Reservoir name	= SMA 3	Max. Storage	= 9,326 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



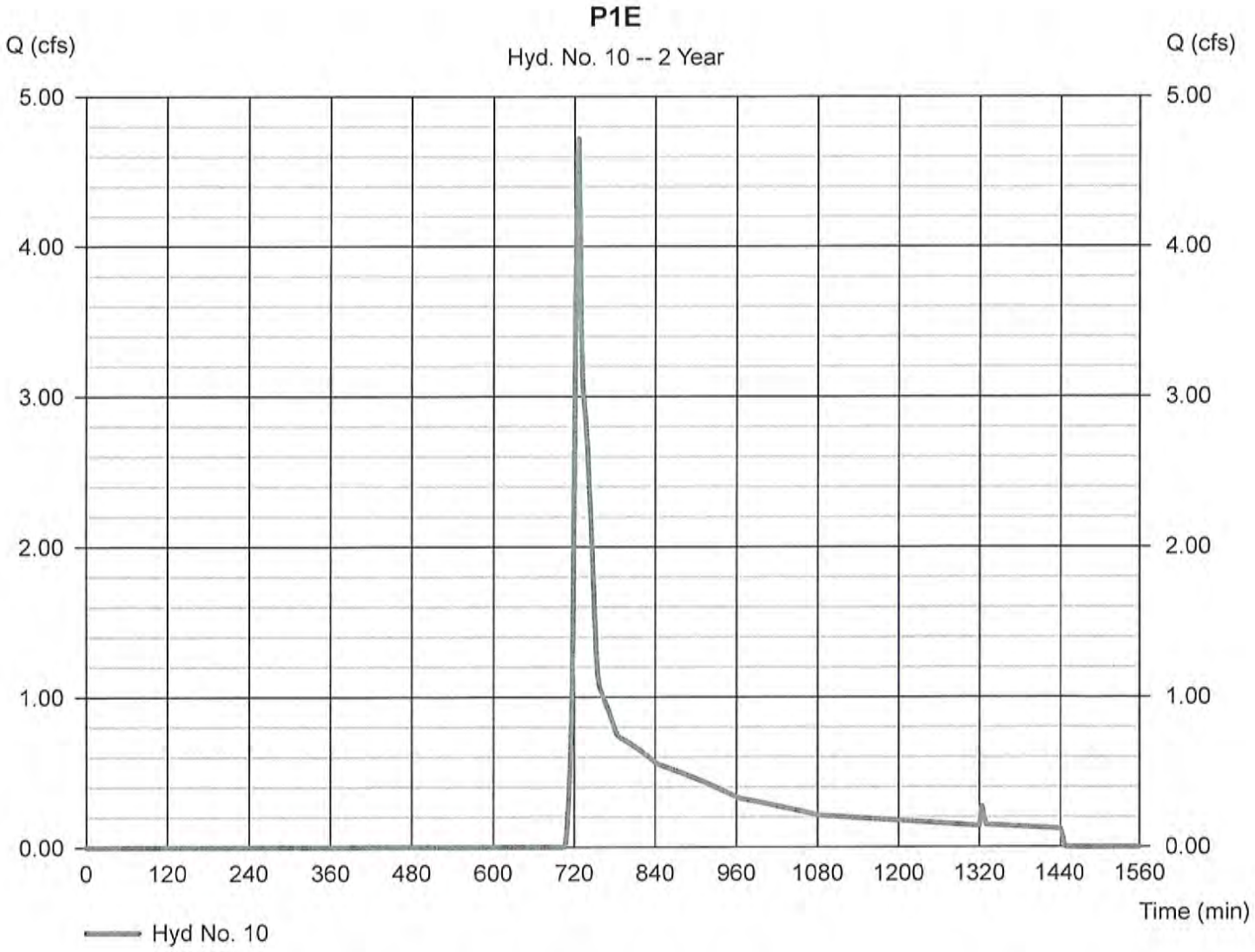
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 10

P1E

Hydrograph type	= SCS Runoff	Peak discharge	= 4.720 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 18,992 cuft
Drainage area	= 10.400 ac	Curve number	= 64.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



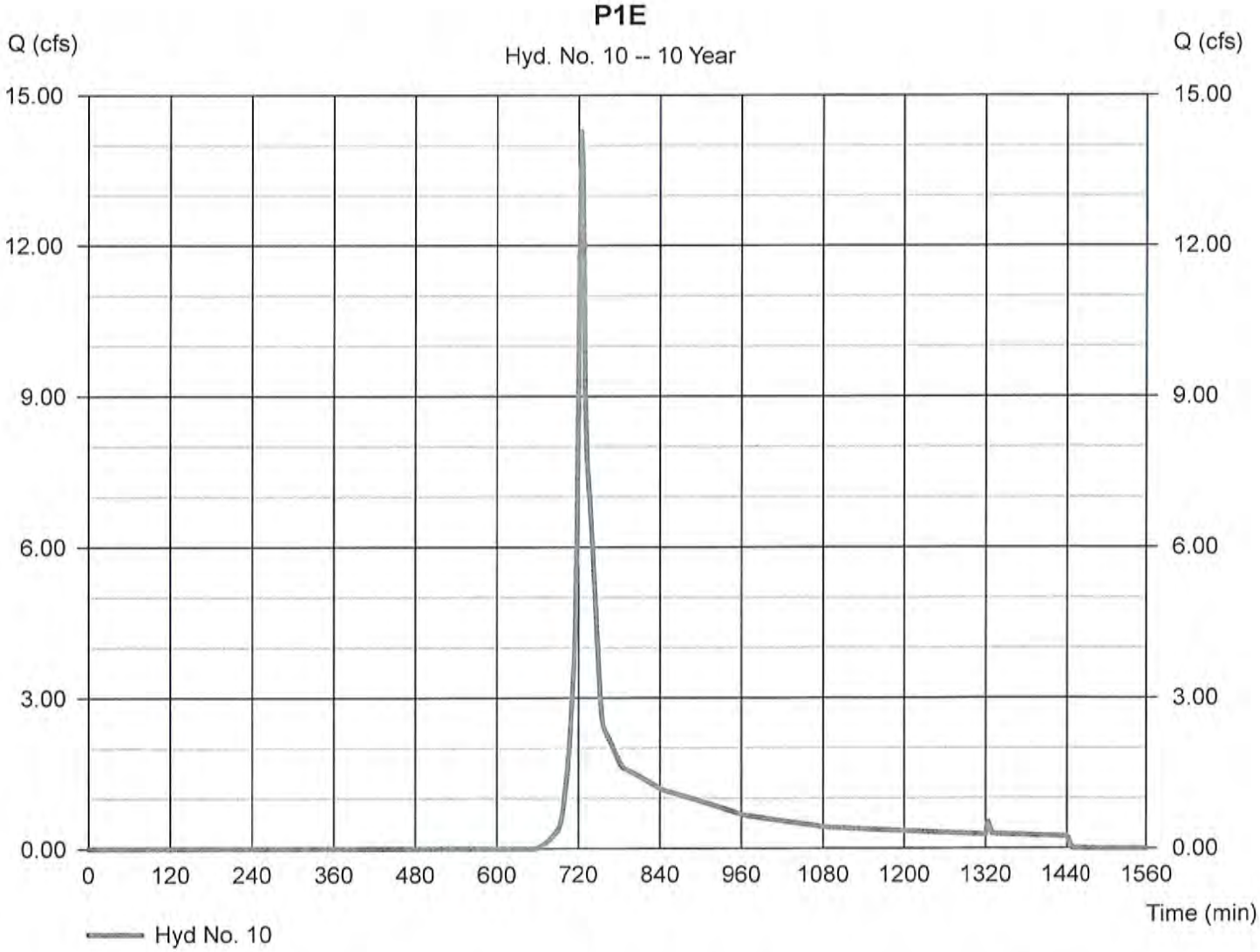
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 10

P1E

Hydrograph type	= SCS Runoff	Peak discharge	= 14.28 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 46,163 cuft
Drainage area	= 10.400 ac	Curve number	= 64.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



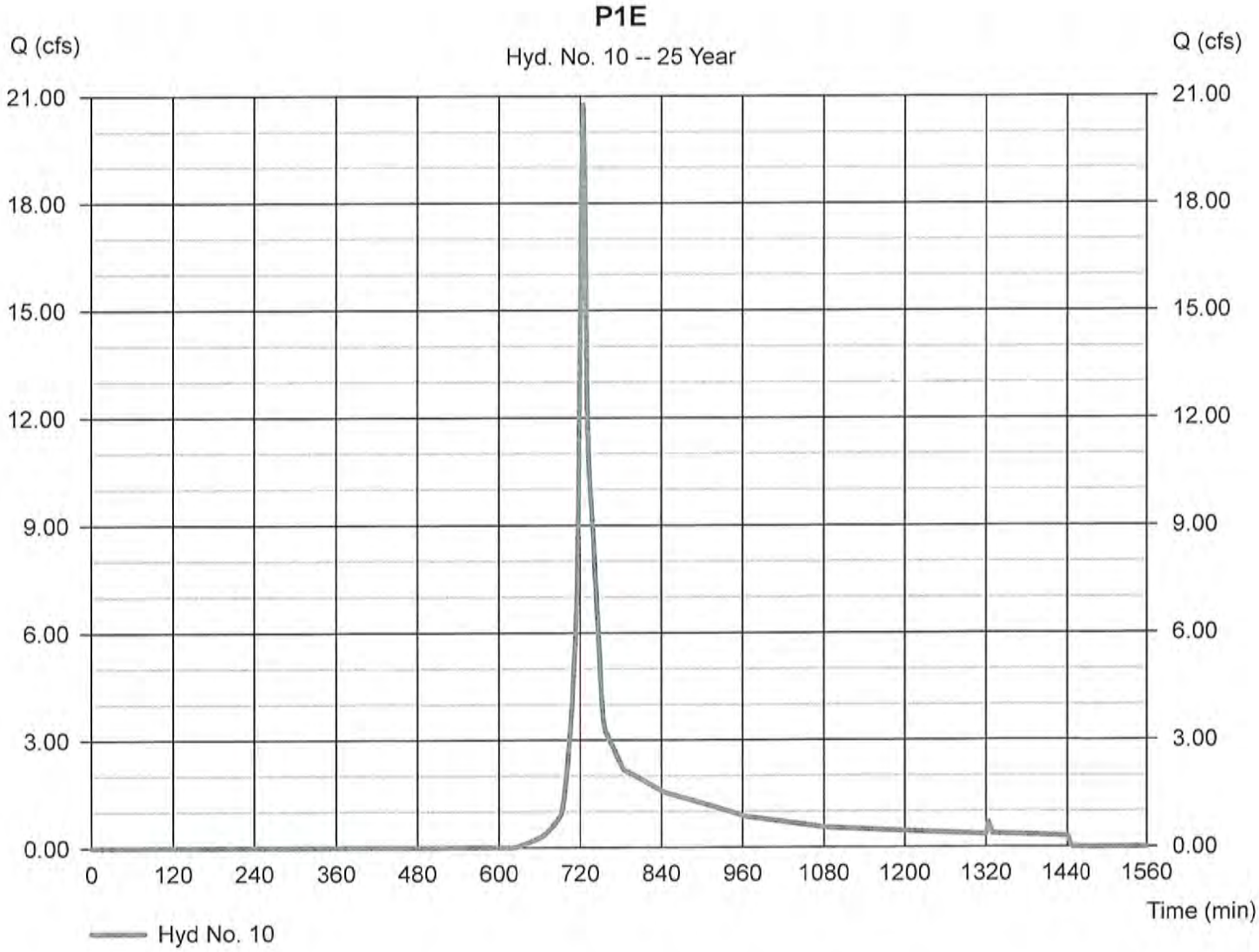
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 10

P1E

Hydrograph type	= SCS Runoff	Peak discharge	= 20.75 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 64,594 cuft
Drainage area	= 10.400 ac	Curve number	= 64.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



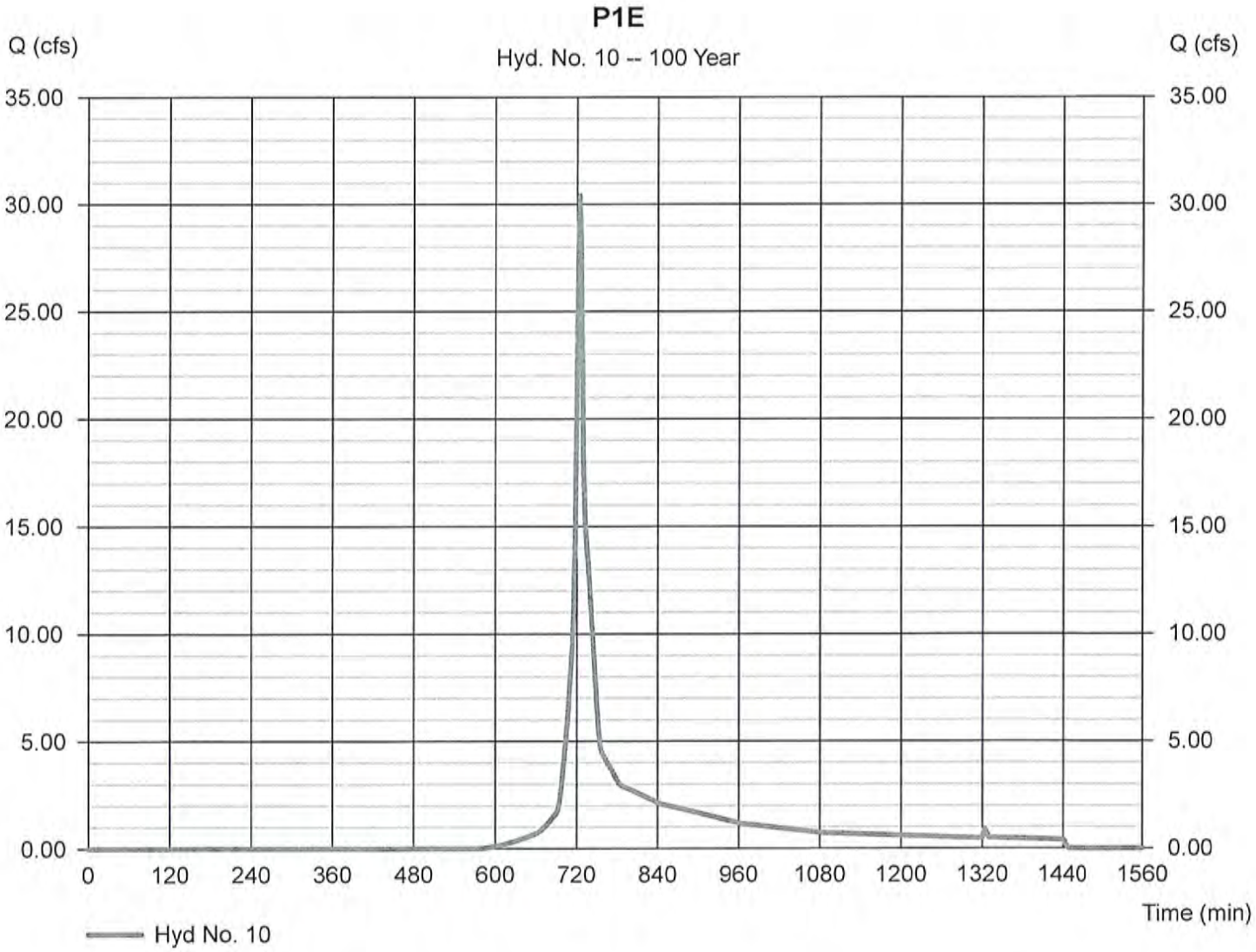
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 10

P1E

Hydrograph type	= SCS Runoff	Peak discharge	= 30.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 92,331 cuft
Drainage area	= 10.400 ac	Curve number	= 64.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1E

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			1.70	166.95
B	Woods- Good Condition	55			3.77	207.53
B	Open Space-Good Condition	61			4.76	290.52
A	Open Space-Good Condition	39			0.16	6.08
					Totals =	10.40	671.08

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{671.08}{10.40} = 64.56$; Use CN = 64.6

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.53	1.30	2.60
Runoff, Q.....	cf	20184	49110	98286

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed

Circle one: Tc | Tt through subarea SubcatchmentPP-1E

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.08			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.08			0.08
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	246			
9. Watercourse slope, s		ft/ft	0.075			
10. Average Velocity, V (figure 3-1)		ft/s	4.42			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.10
min 6.0

(210-VI-TR-55, Second Ed., June 1986)

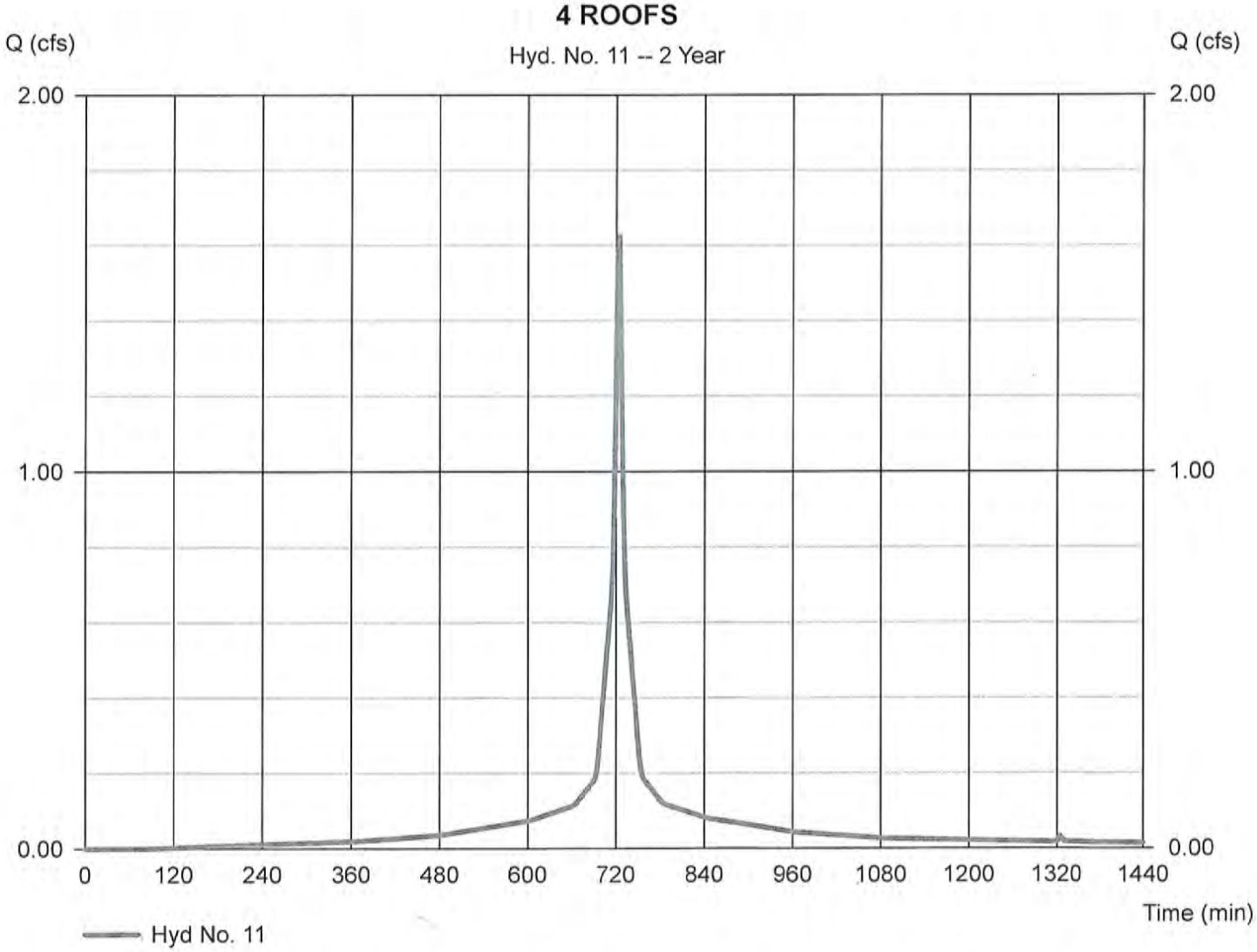
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 11

4 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 1.624 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,465 cuft
Drainage area	= 0.560 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



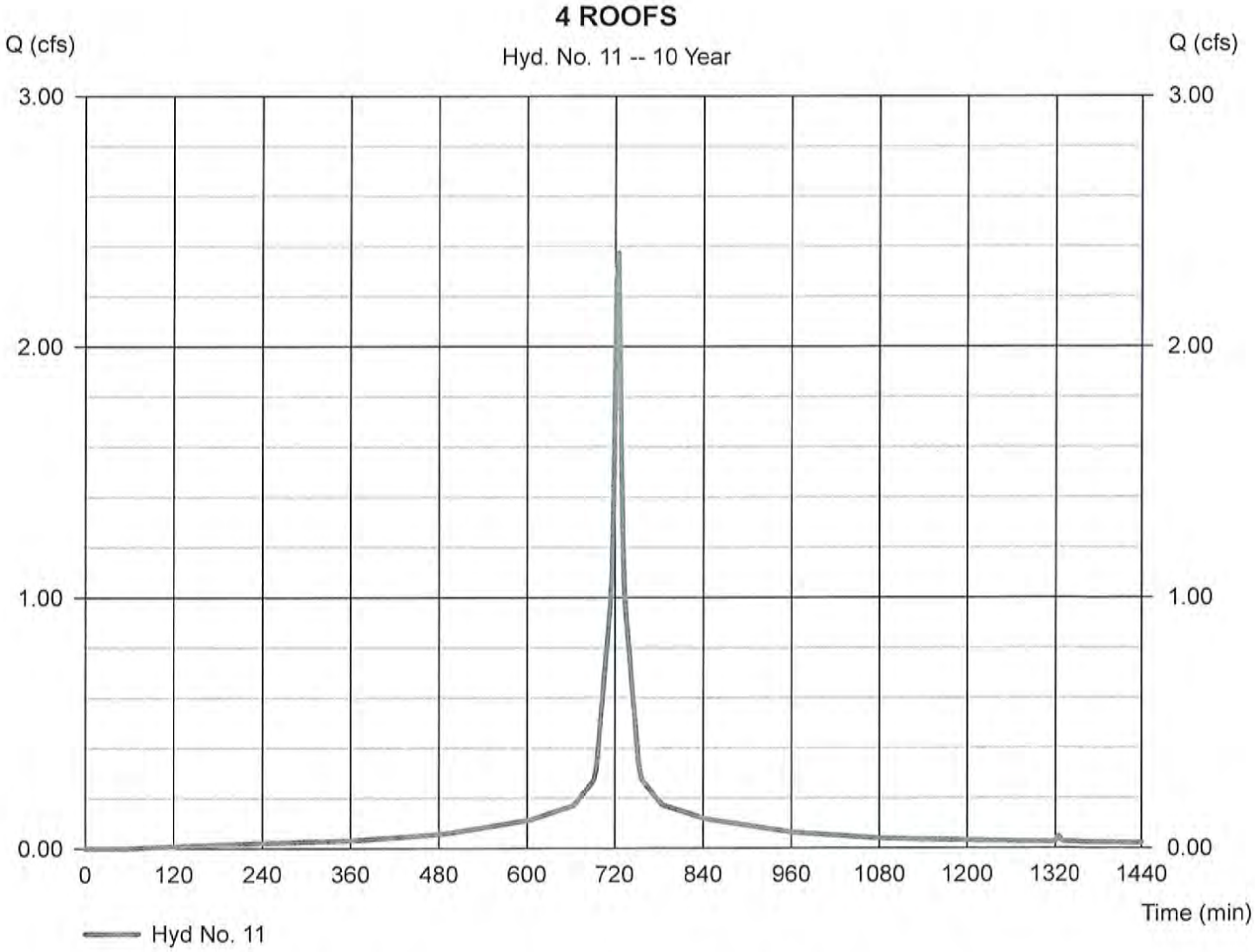
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 11

4 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 2.373 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 8,126 cuft
Drainage area	= 0.560 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



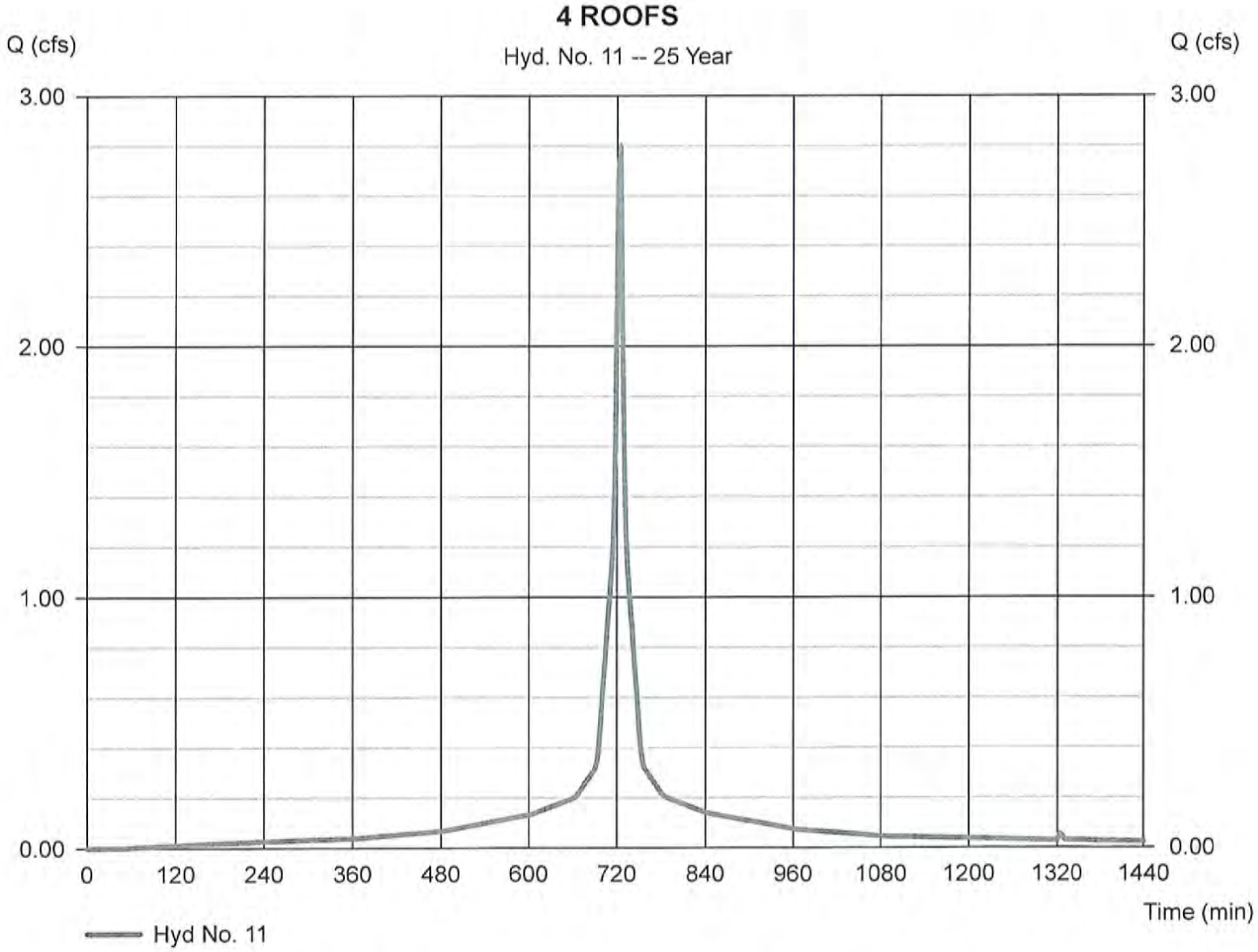
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 11

4 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 2.801 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 9,648 cuft
Drainage area	= 0.560 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



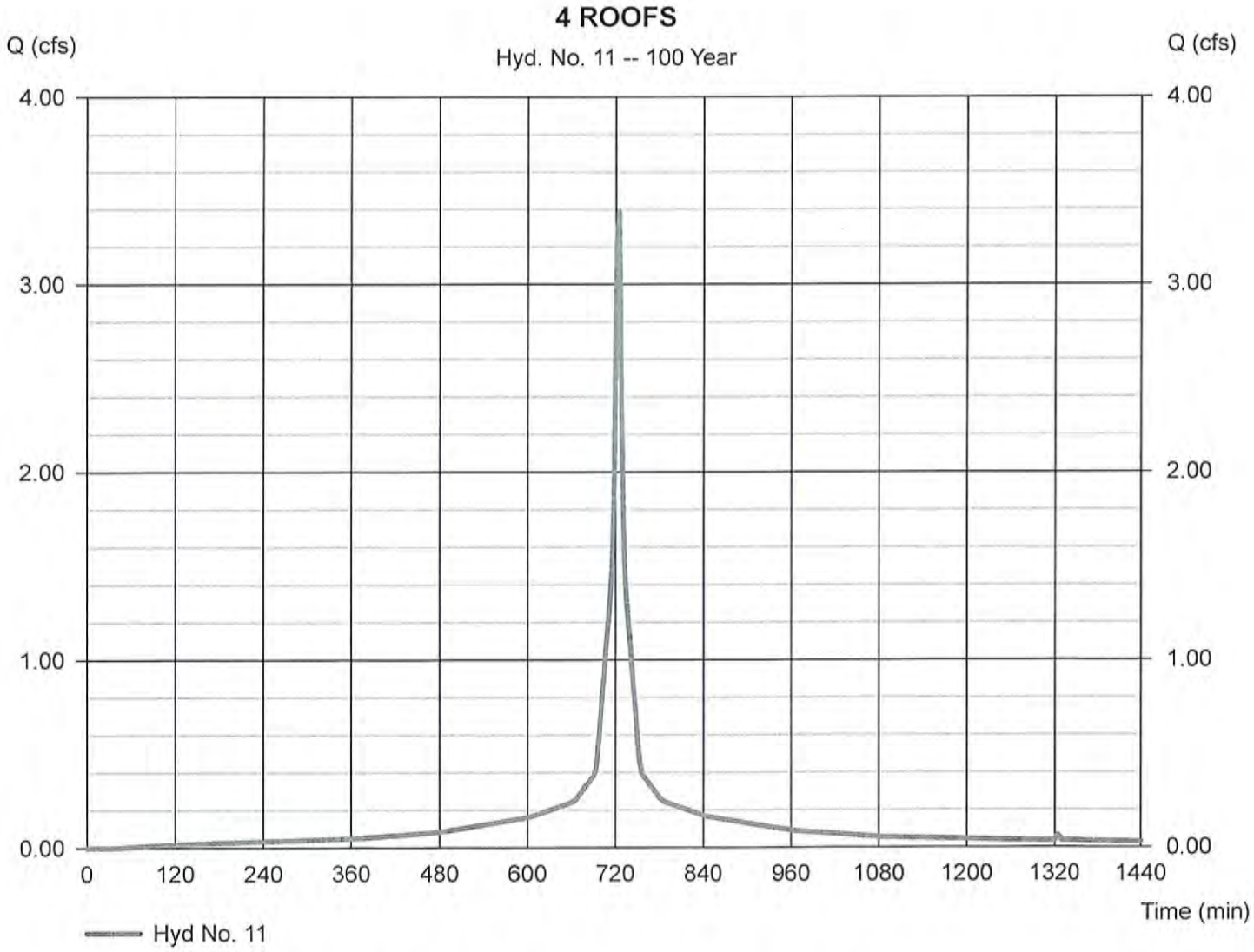
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 11

4 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 3.387 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,742 cuft
Drainage area	= 0.560 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

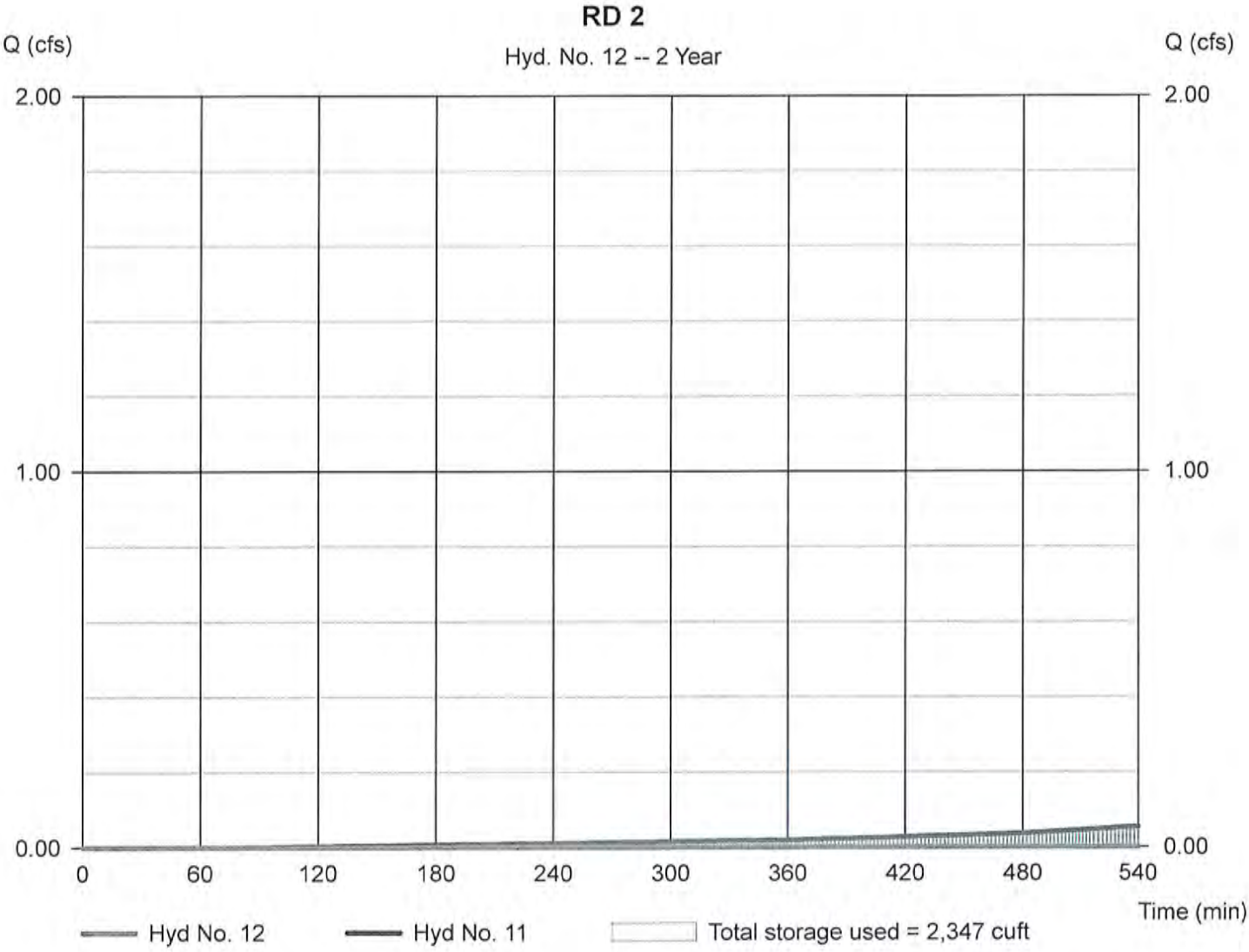
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 12

RD 2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 480 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 11 - 4 ROOFS	Max. Elevation	= 2.56 ft
Reservoir name	= RD 2	Max. Storage	= 2,347 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

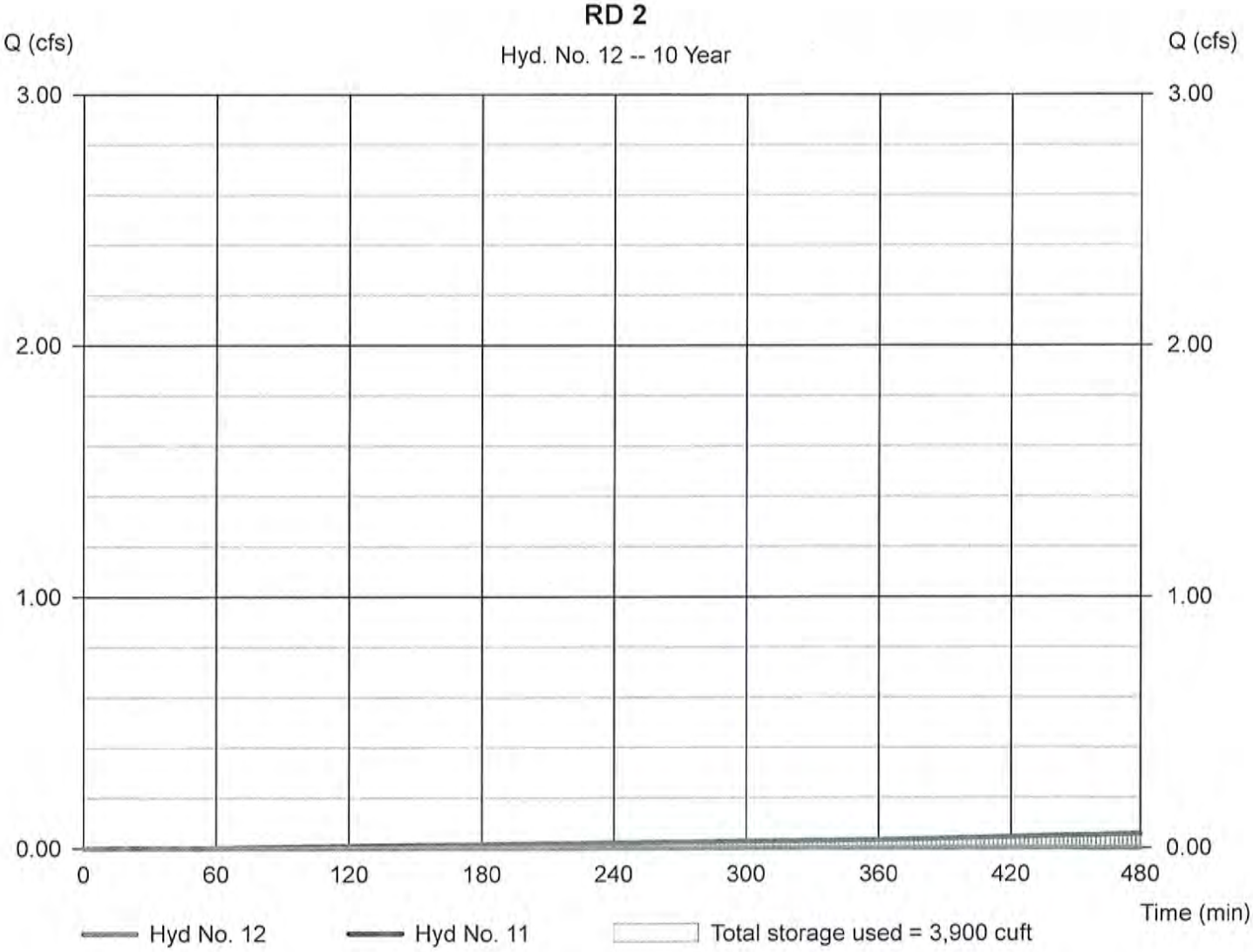
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 12

RD 2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 394 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 11 - 4 ROOFS	Max. Elevation	= 3.95 ft
Reservoir name	= RD 2	Max. Storage	= 3,900 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

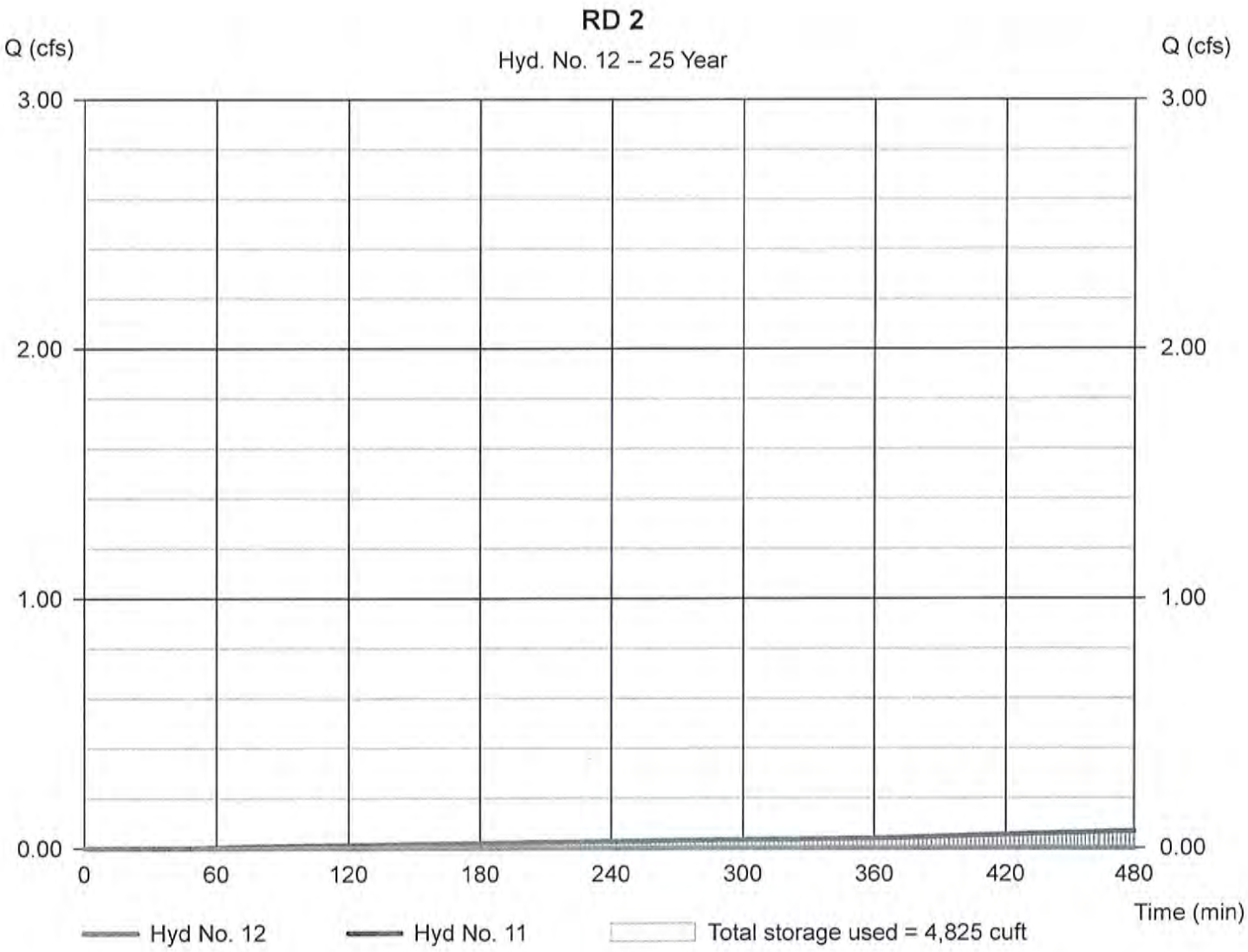
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 12

RD 2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 422 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 11 - 4 ROOFS	Max. Elevation	= 4.86 ft
Reservoir name	= RD 2	Max. Storage	= 4,825 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

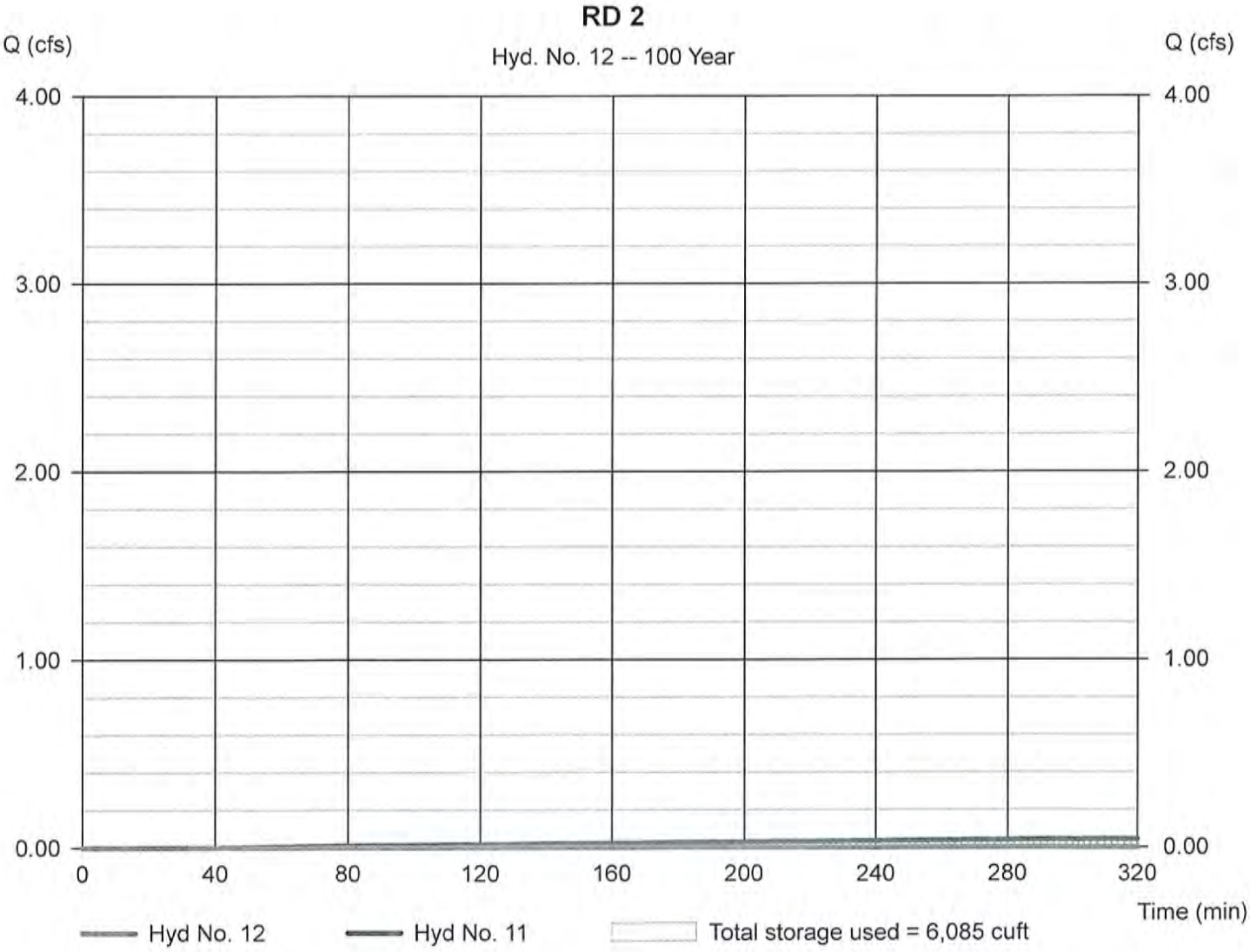
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 12

RD 2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 316 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 11 - 4 ROOFS	Max. Elevation	= 6.69 ft
Reservoir name	= RD 2	Max. Storage	= 6,085 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



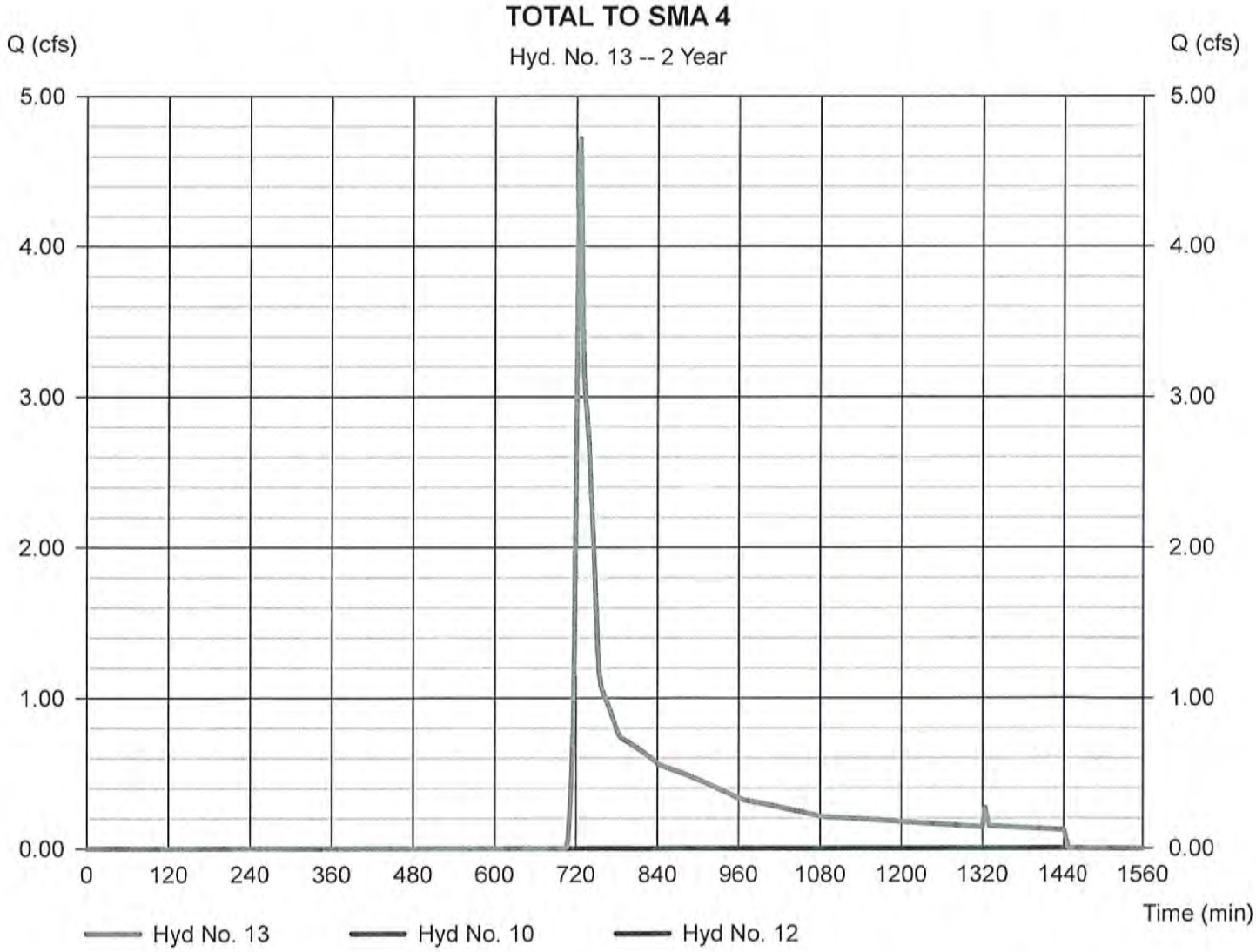
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 13

TOTAL TO SMA 4

Hydrograph type	= Combine	Peak discharge	= 4.720 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 18,992 cuft
Inflow hyds.	= 10, 12	Contrib. drain. area	= 10.400 ac



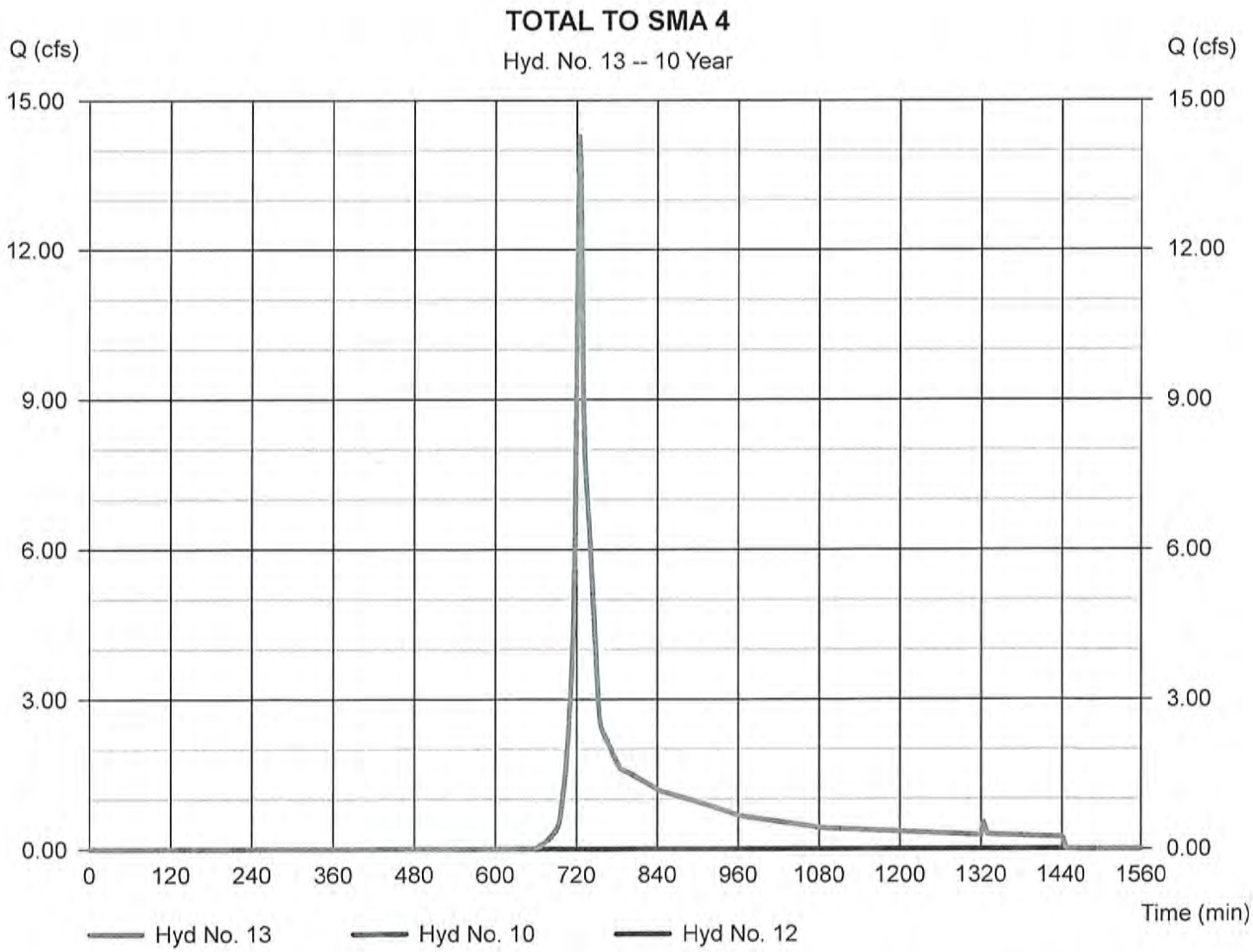
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 13

TOTAL TO SMA 4

Hydrograph type	= Combine	Peak discharge	= 14.28 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 46,163 cuft
Inflow hyds.	= 10, 12	Contrib. drain. area	= 10.400 ac



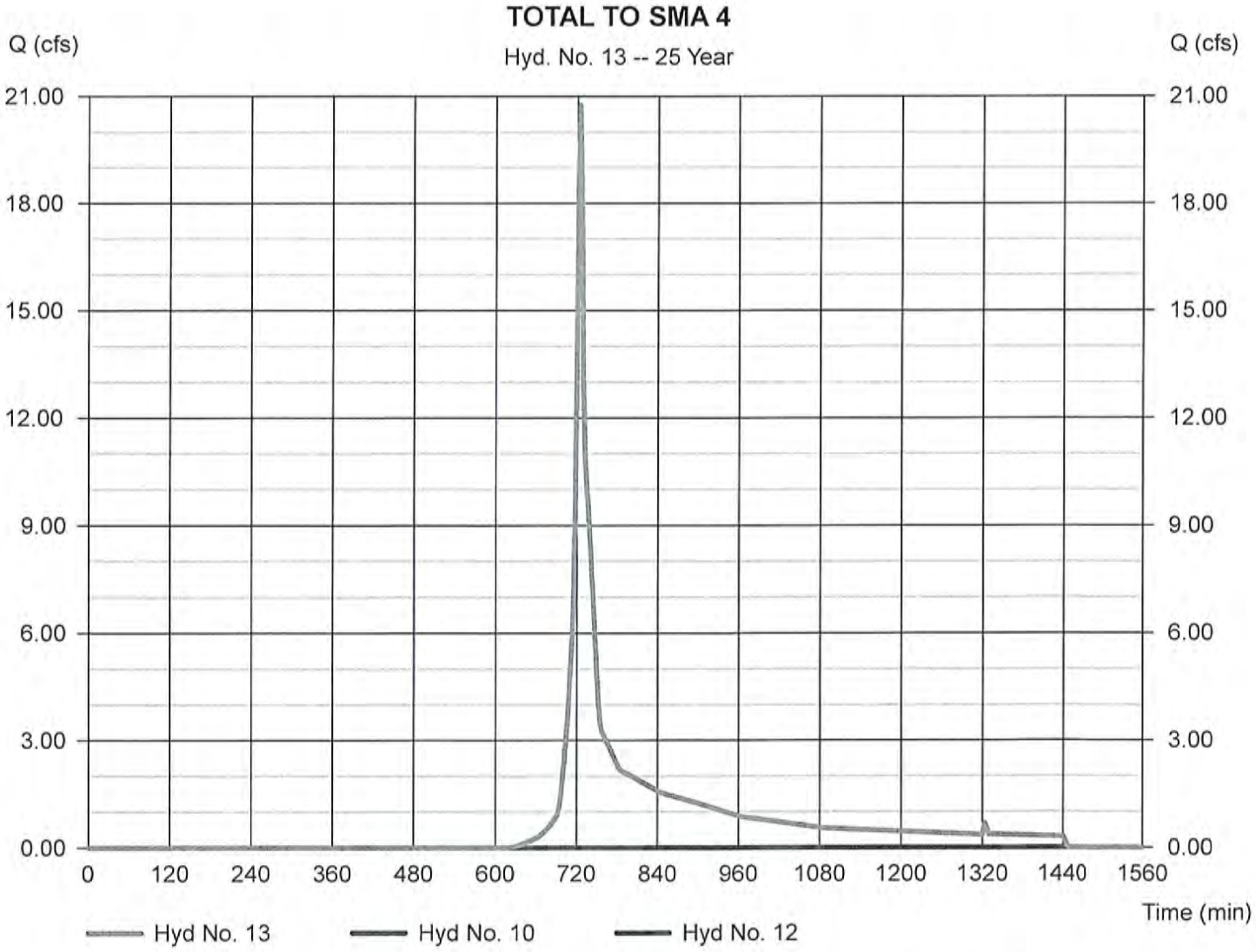
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 13

TOTAL TO SMA 4

Hydrograph type	= Combine	Peak discharge	= 20.75 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 64,594 cuft
Inflow hyds.	= 10, 12	Contrib. drain. area	= 10.400 ac



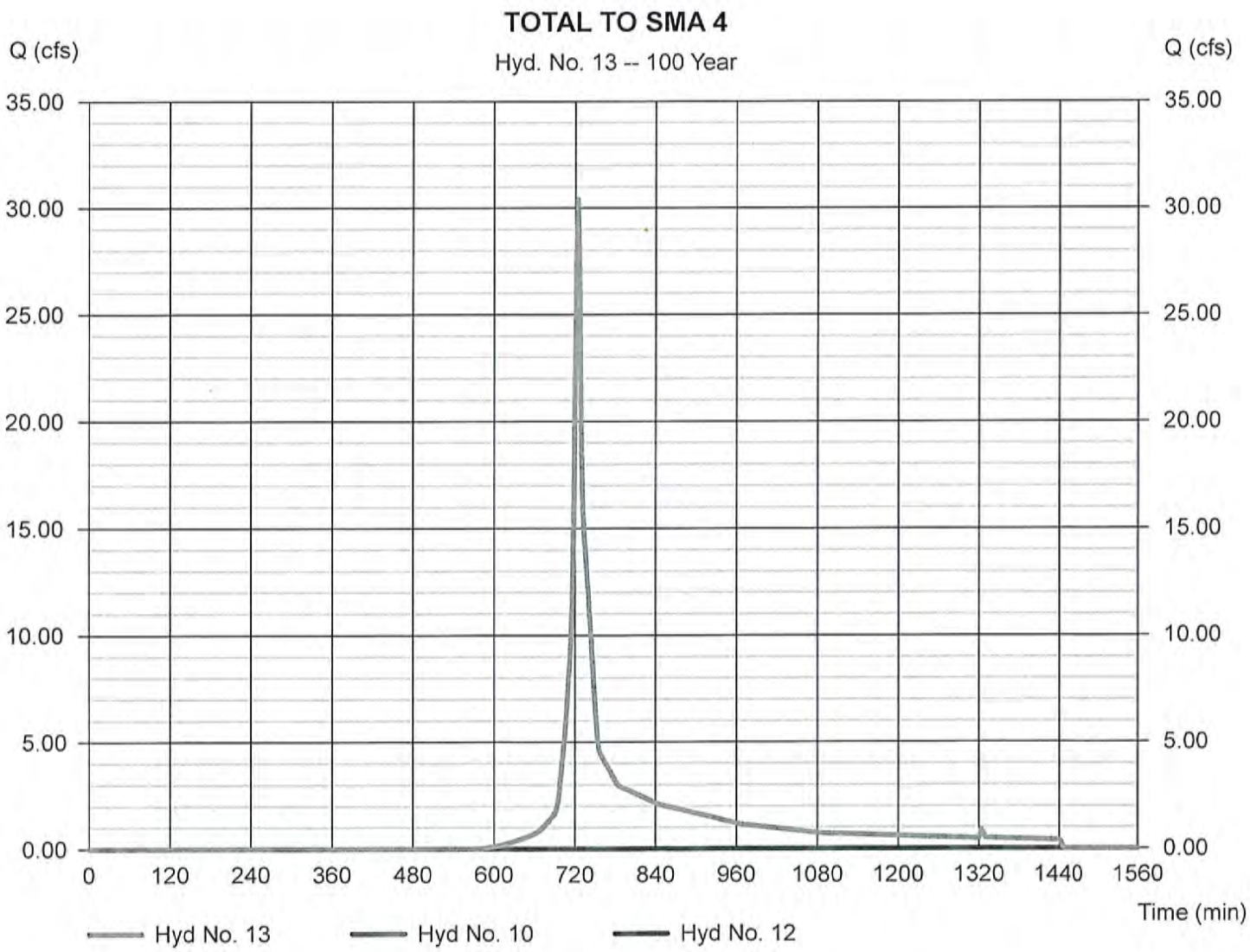
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 13

TOTAL TO SMA 4

Hydrograph type	= Combine	Peak discharge	= 30.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 92,331 cuft
Inflow hyds.	= 10, 12	Contrib. drain. area	= 10.400 ac



Hydrograph Report

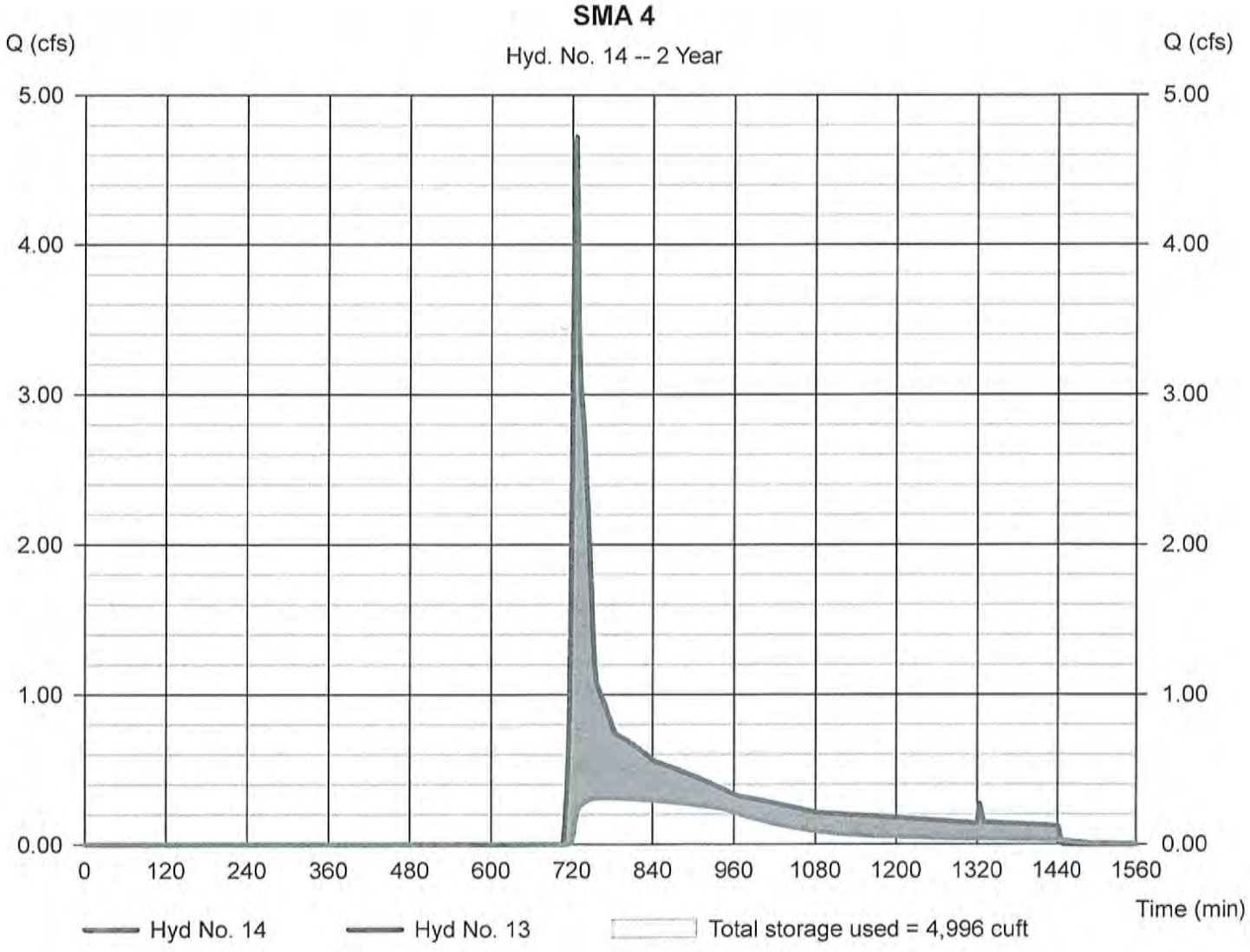
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 14

SMA 4

Hydrograph type	= Reservoir	Peak discharge	= 0.312 cfs
Storm frequency	= 2 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 6,146 cuft
Inflow hyd. No.	= 13 - TOTAL TO SMA 4	Max. Elevation	= 314.22 ft
Reservoir name	= SMA 4	Max. Storage	= 4,996 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

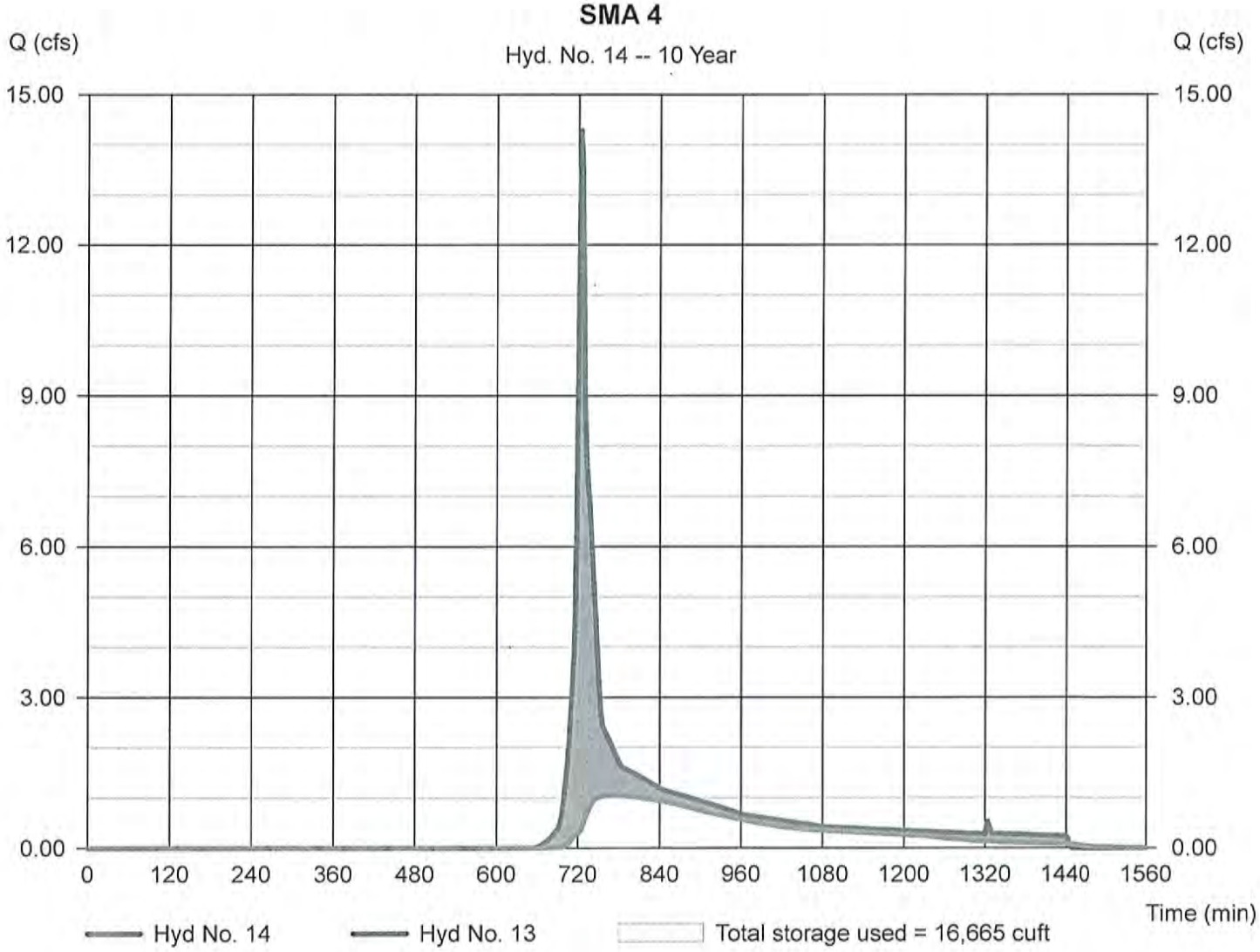
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 14

SMA 4

Hydrograph type	= Reservoir	Peak discharge	= 1.054 cfs
Storm frequency	= 10 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 20,059 cuft
Inflow hyd. No.	= 13 - TOTAL TO SMA 4	Max. Elevation	= 315.15 ft
Reservoir name	= SMA 4	Max. Storage	= 16,665 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

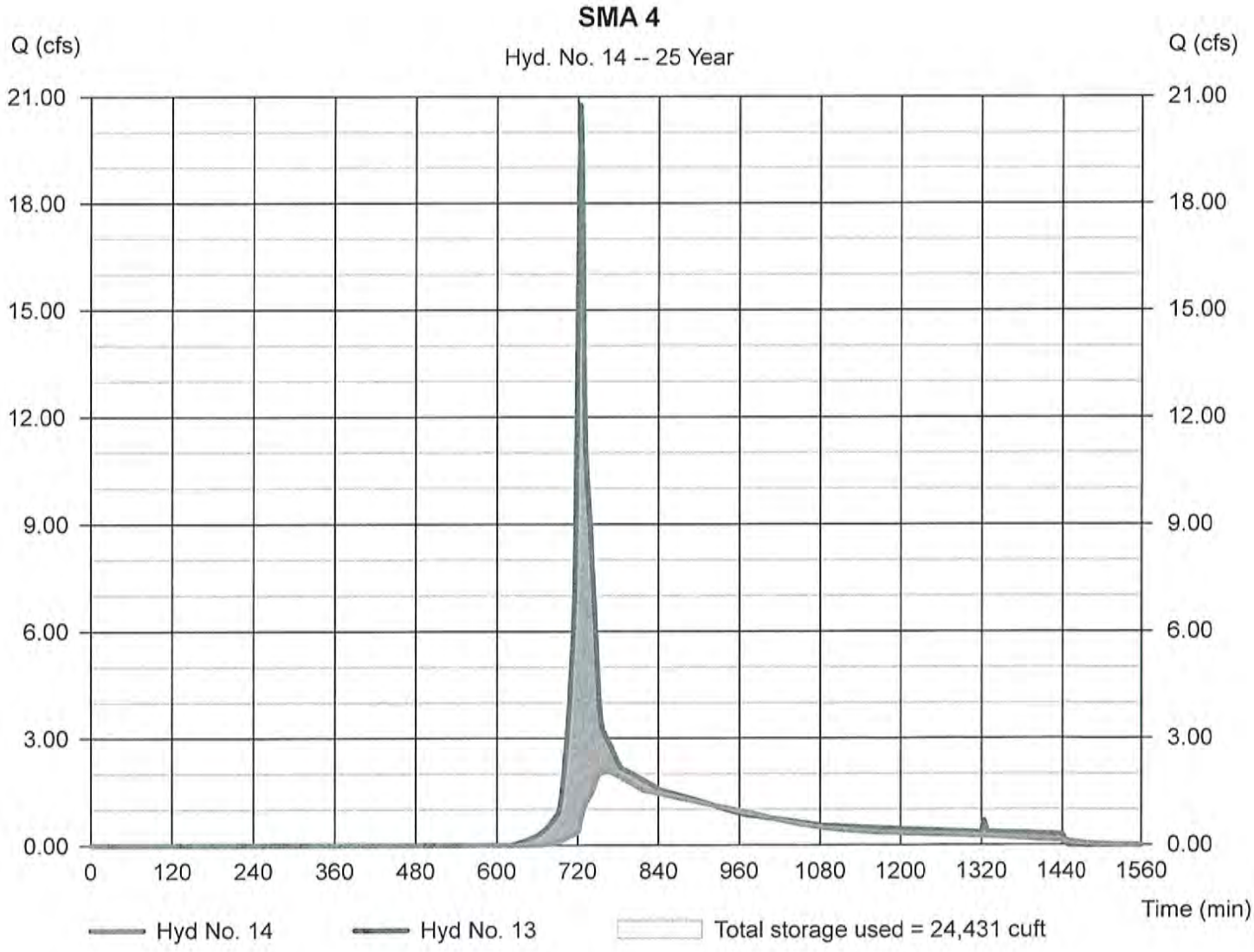
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 14

SMA 4

Hydrograph type	= Reservoir	Peak discharge	= 2.058 cfs
Storm frequency	= 25 yrs	Time to peak	= 762 min
Time interval	= 2 min	Hyd. volume	= 32,673 cuft
Inflow hyd. No.	= 13 - TOTAL TO SMA 4	Max. Elevation	= 315.61 ft
Reservoir name	= SMA 4	Max. Storage	= 24,431 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

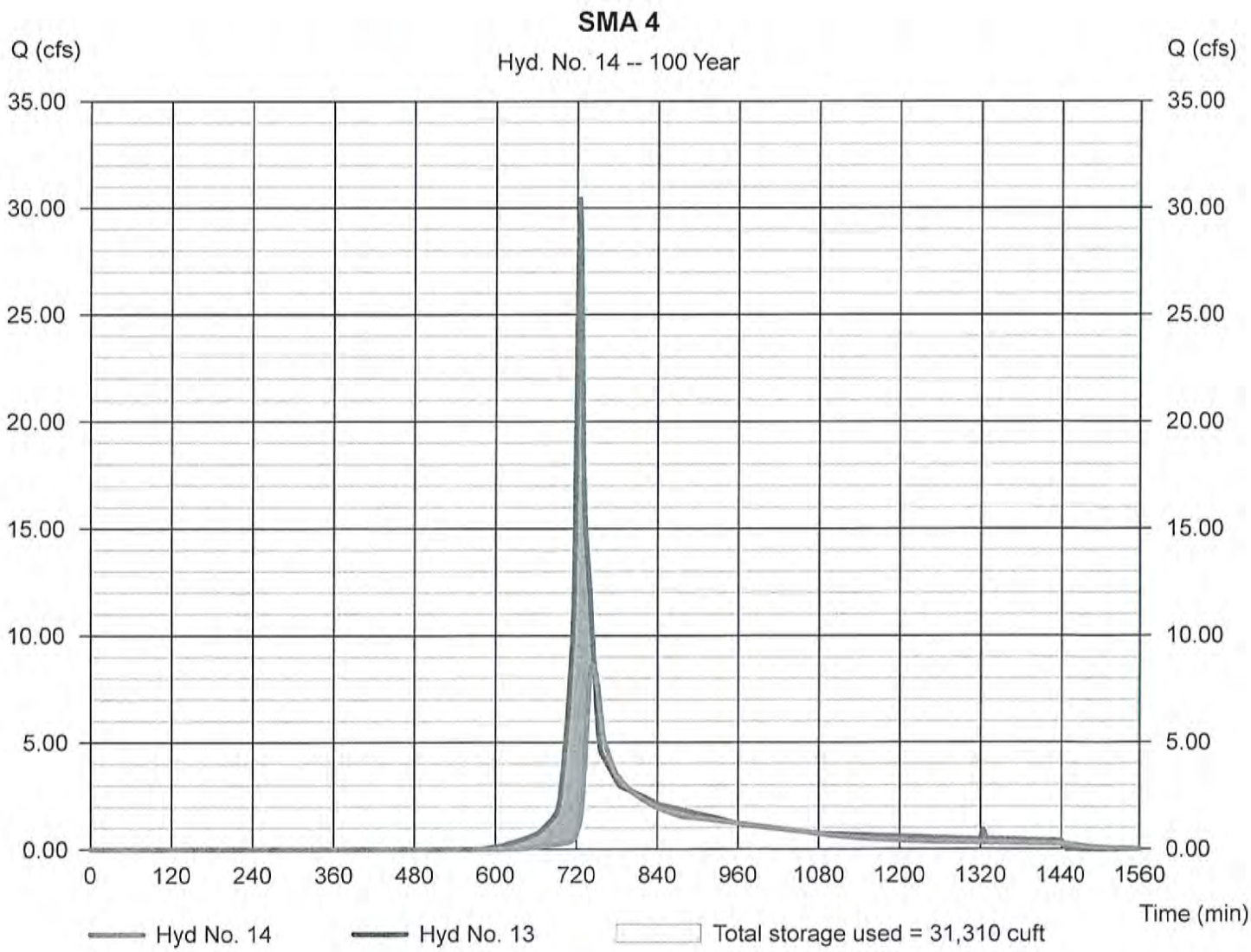
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 14

SMA 4

Hydrograph type	= Reservoir	Peak discharge	= 8.612 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 55,270 cuft
Inflow hyd. No.	= 13 - TOTAL TO SMA 4	Max. Elevation	= 316.02 ft
Reservoir name	= SMA 4	Max. Storage	= 31,310 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



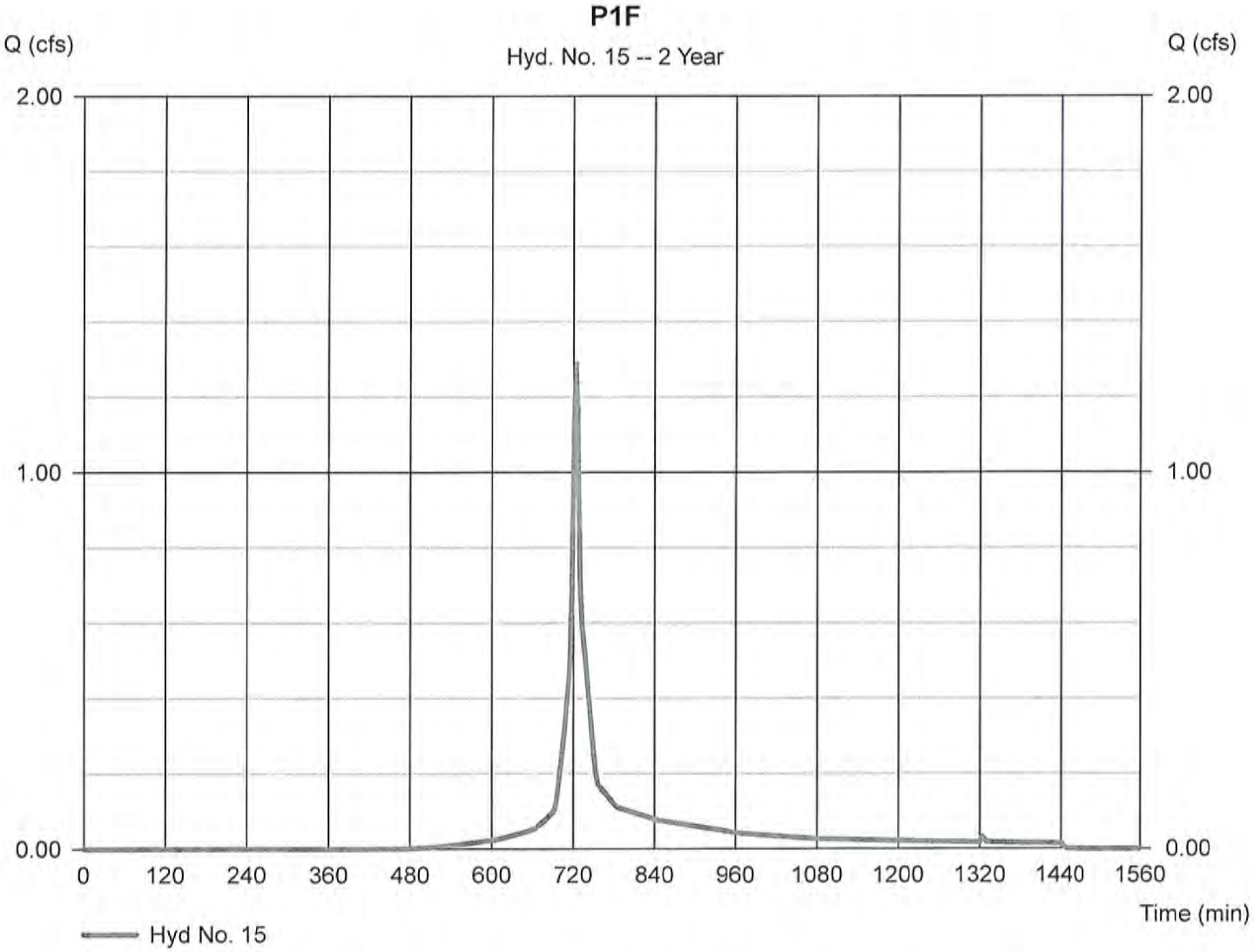
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 15

P1F

Hydrograph type	= SCS Runoff	Peak discharge	= 1.288 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,851 cuft
Drainage area	= 0.650 ac	Curve number	= 85.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



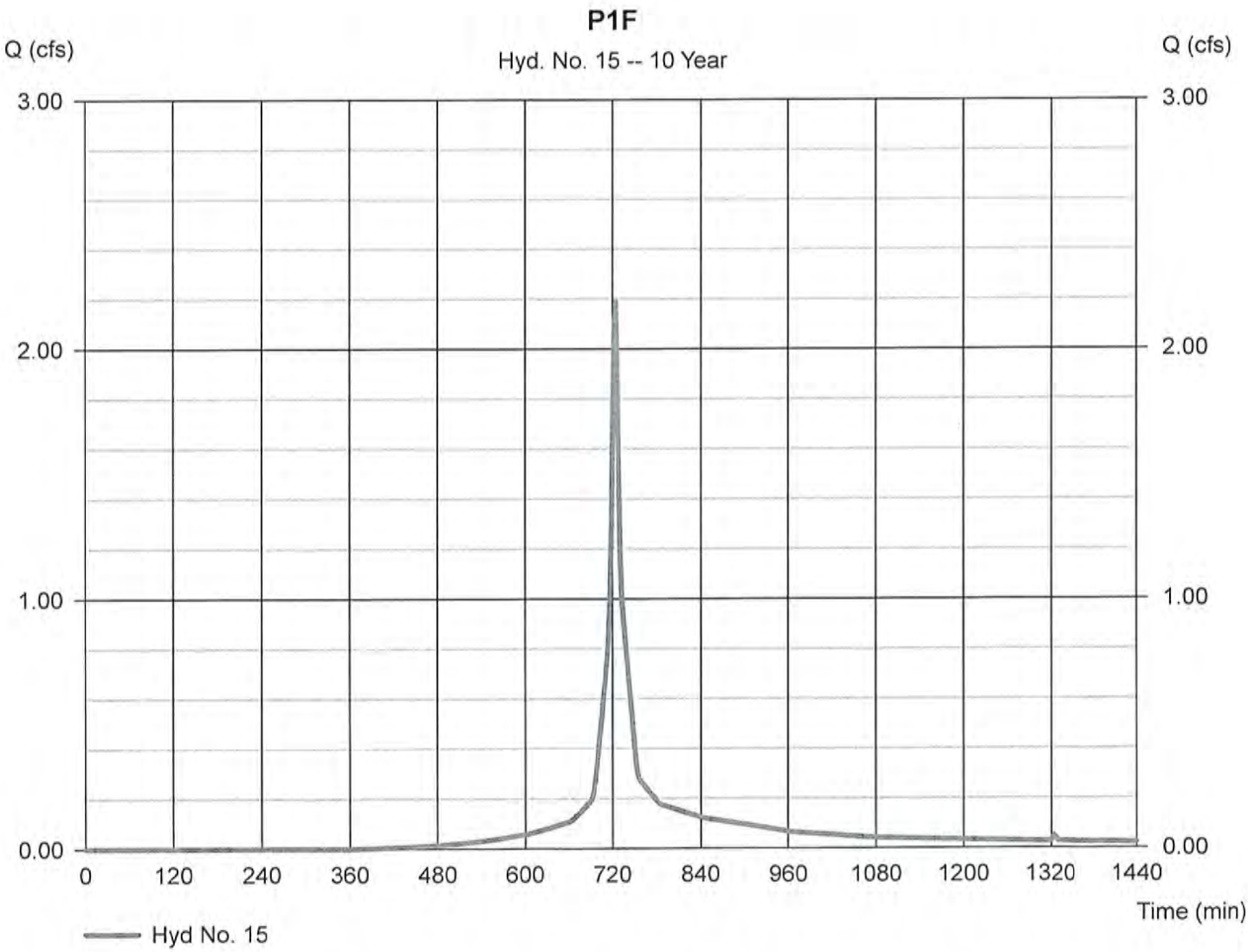
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 15

P1F

Hydrograph type	= SCS Runoff	Peak discharge	= 2.191 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,622 cuft
Drainage area	= 0.650 ac	Curve number	= 85.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



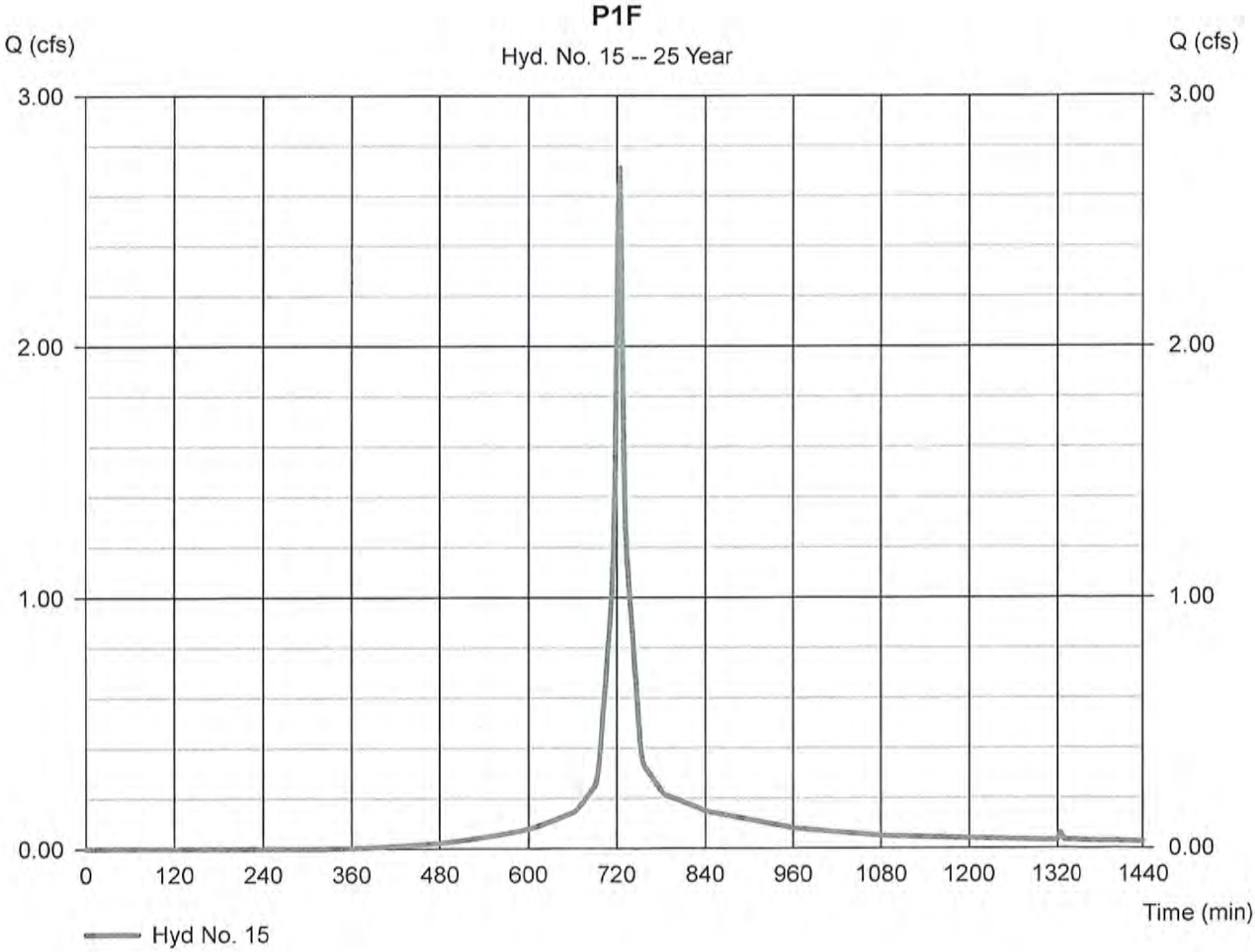
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 15

P1F

Hydrograph type	= SCS Runoff	Peak discharge	= 2.712 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 8,268 cuft
Drainage area	= 0.650 ac	Curve number	= 85.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



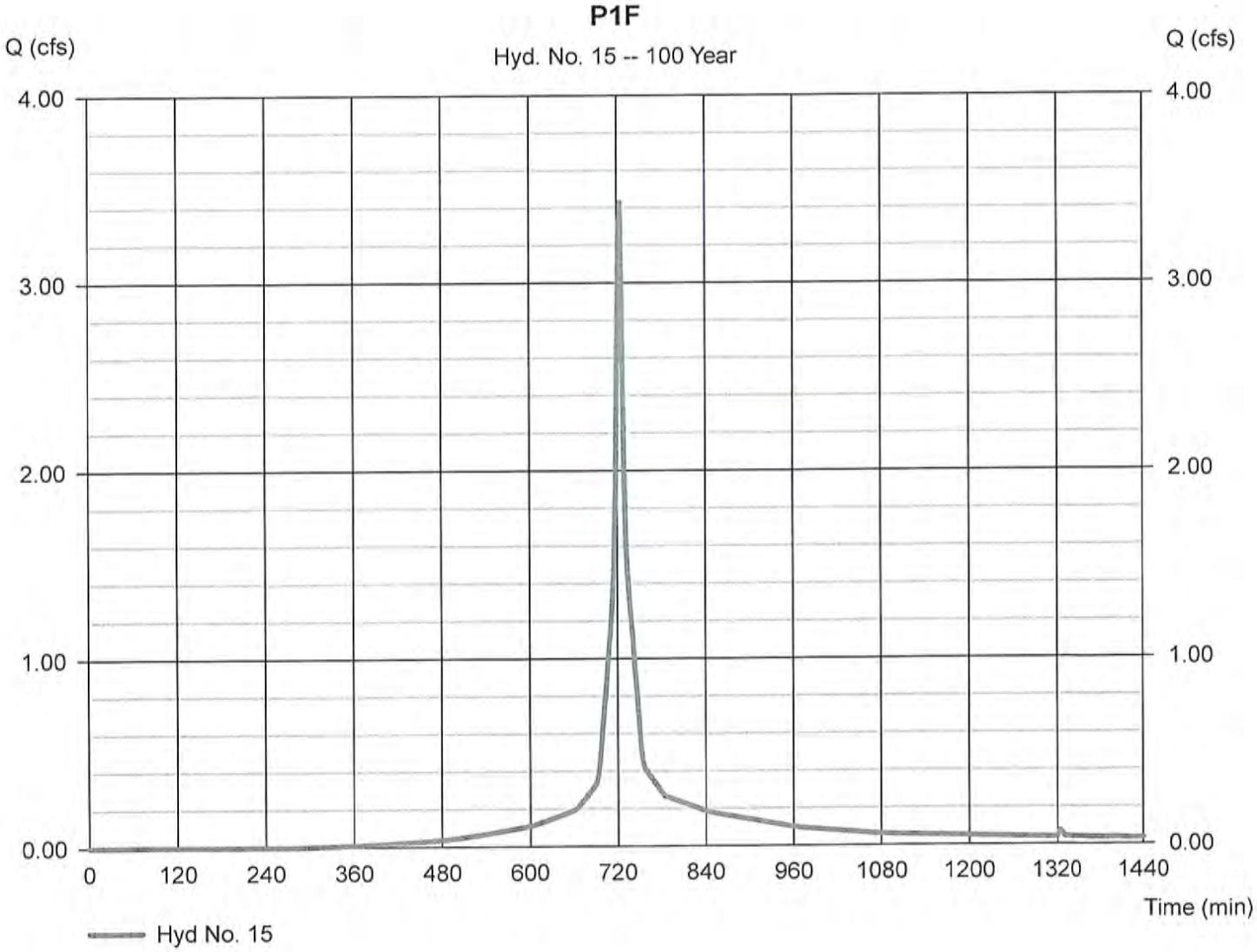
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 15

P1F

Hydrograph type	= SCS Runoff	Peak discharge	= 3.429 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 10,573 cuft
Drainage area	= 0.650 ac	Curve number	= 85.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P1F

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.45	43.65
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			0.19	11.41
A	Open Space-Good Condition	39			0.02	0.62
				Totals =	0.65	55.68

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{55.68}{0.65} = 85.89$; Use CN = 85.9

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.74	2.99	4.78
Runoff, Q.....	cf	4094	7043	11245

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

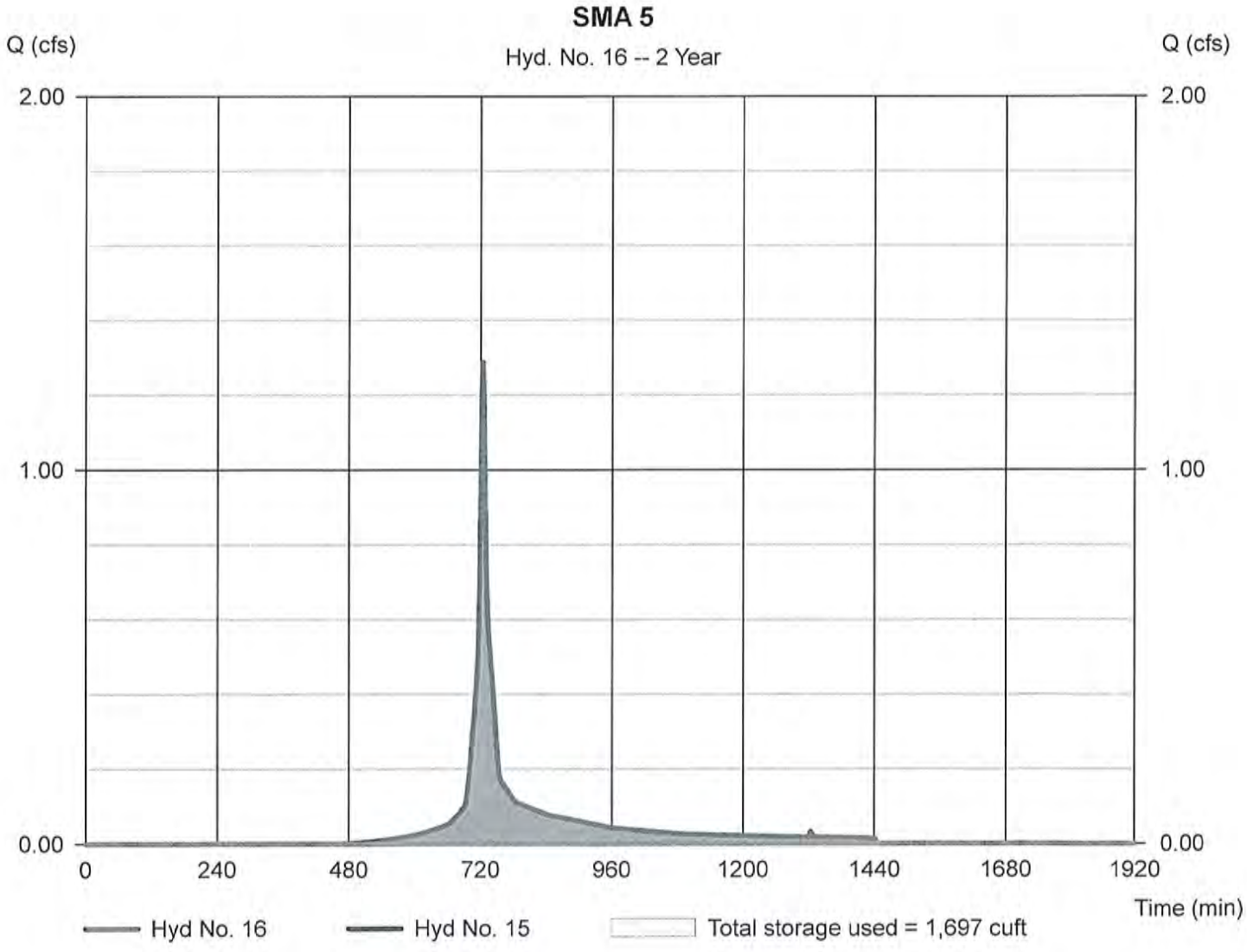
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 16

SMA 5

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 930 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 15 - P1F	Max. Elevation	= 326.14 ft
Reservoir name	= SMA 5	Max. Storage	= 1,697 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

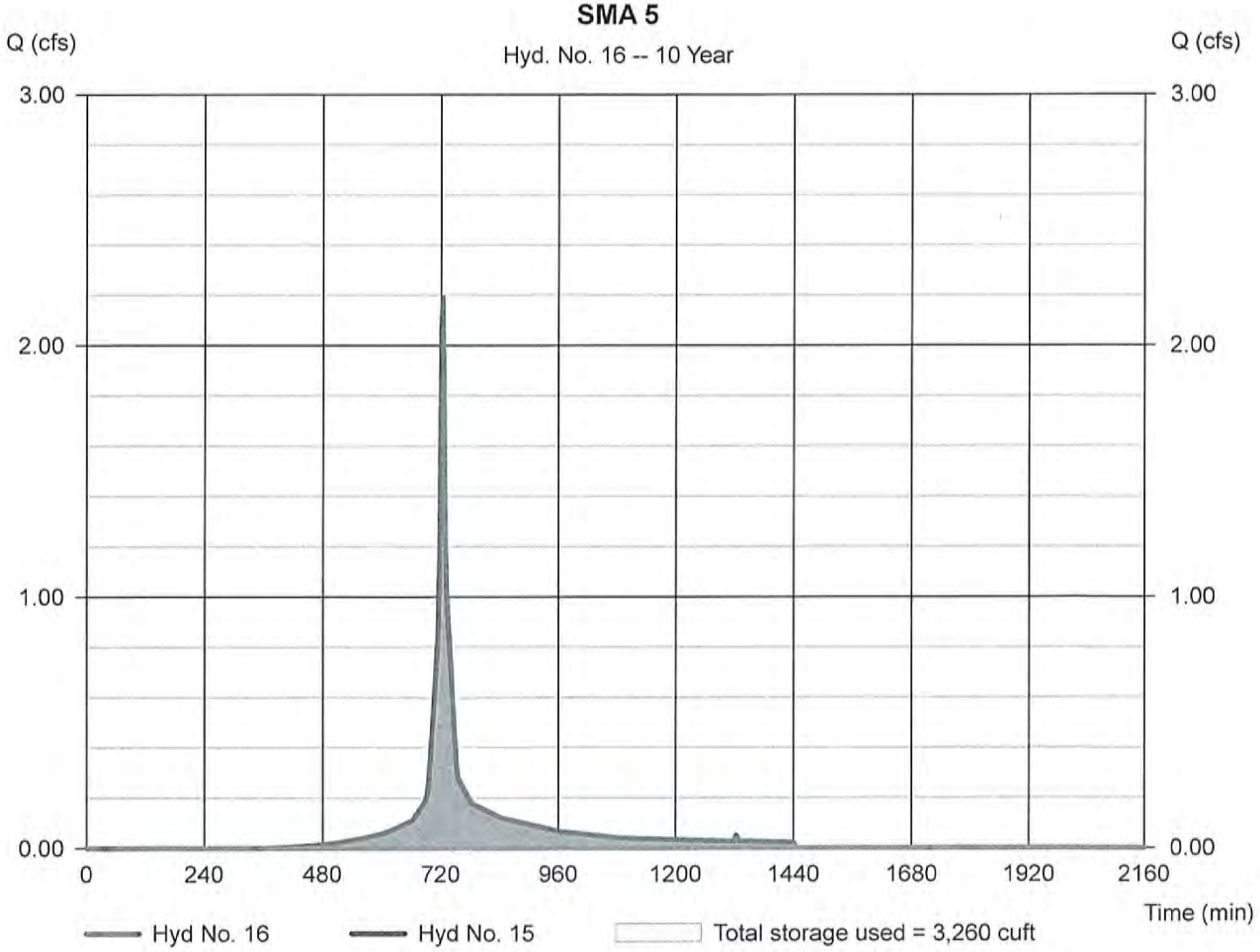
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 16

SMA 5

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 1216 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 15 - P1F	Max. Elevation	= 326.66 ft
Reservoir name	= SMA 5	Max. Storage	= 3,260 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

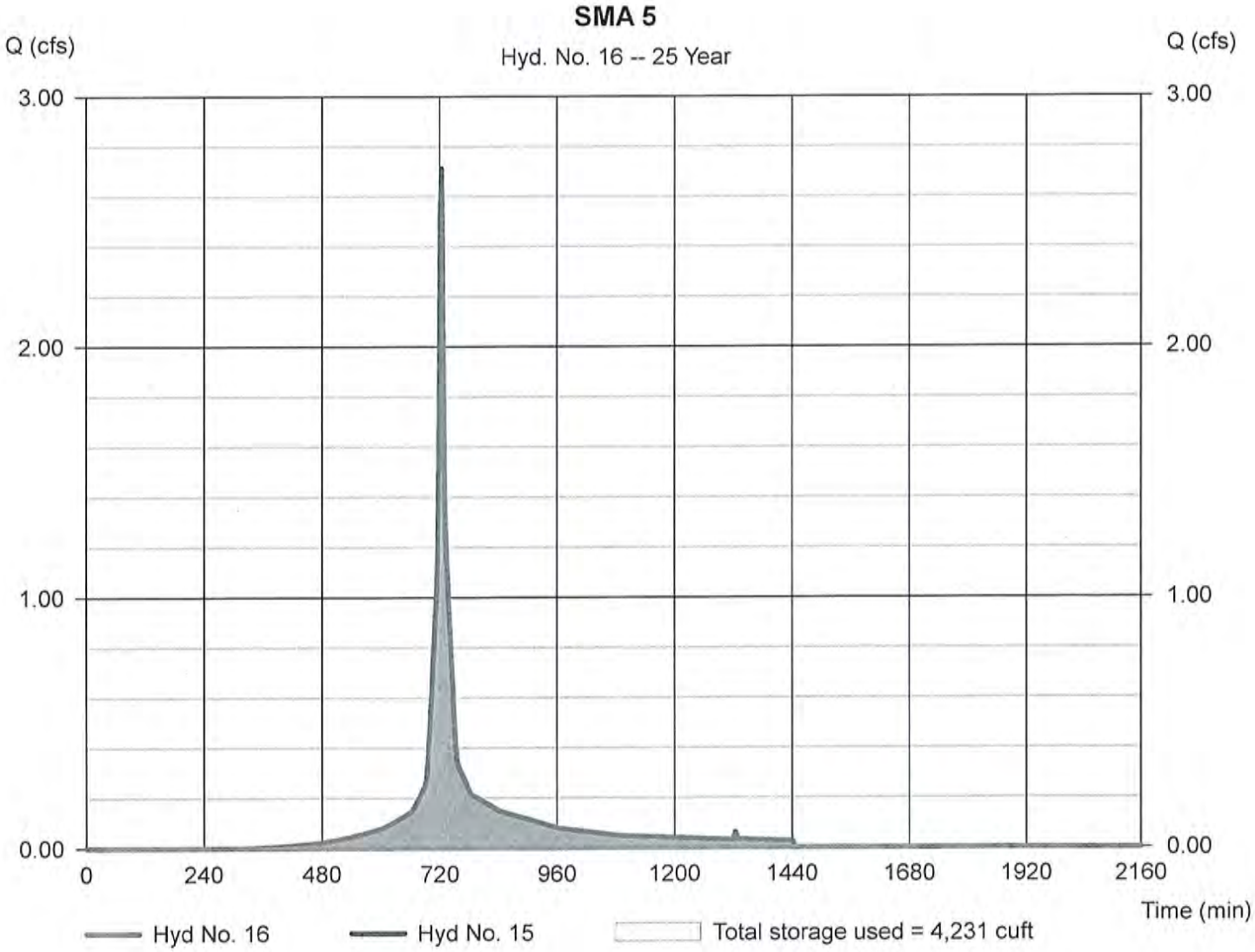
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 16

SMA 5

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 682 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 15 - P1F	Max. Elevation	= 326.98 ft
Reservoir name	= SMA 5	Max. Storage	= 4,231 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

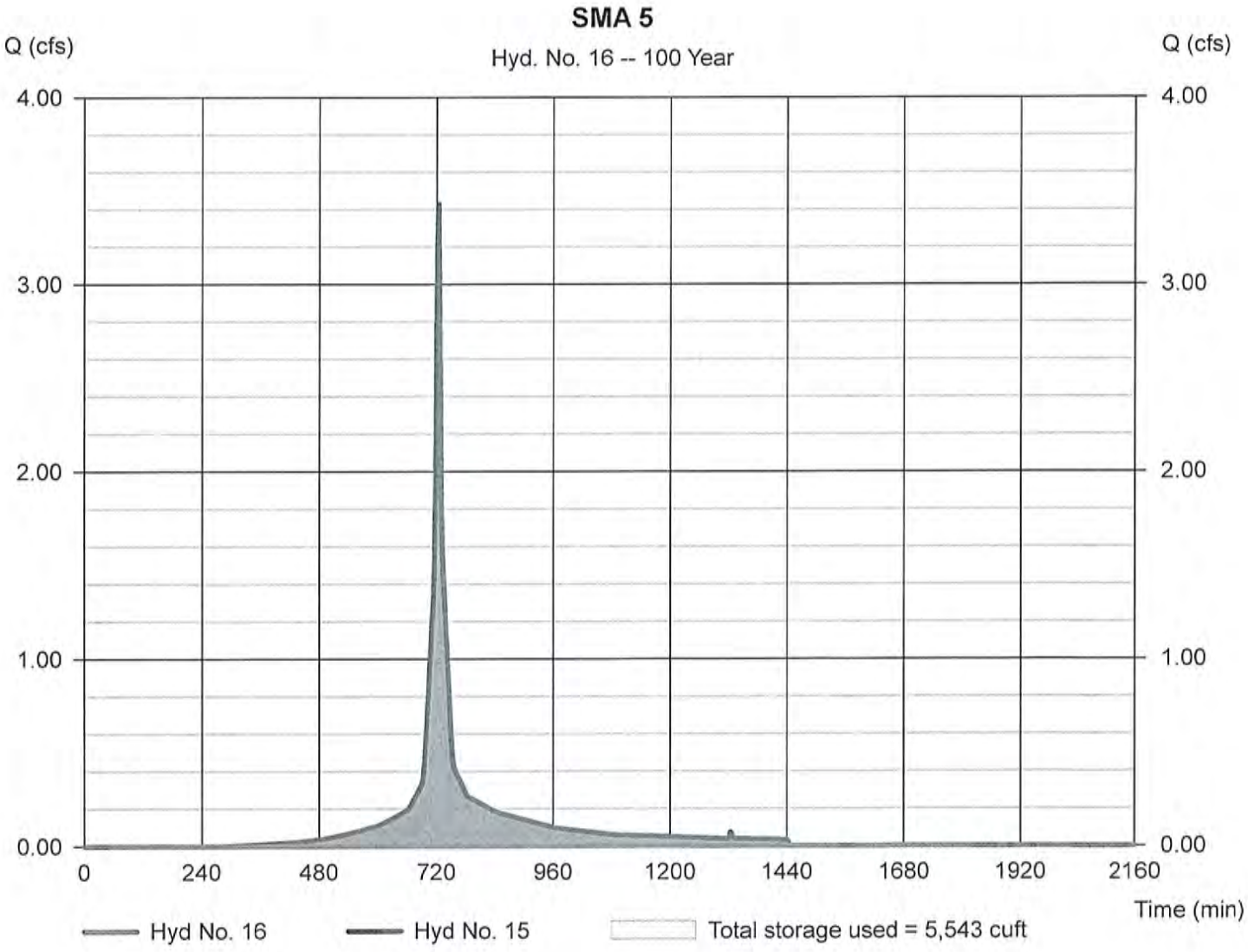
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 16

SMA 5

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 15 - P1F	Max. Elevation	= 327.27 ft
Reservoir name	= SMA 5	Max. Storage	= 5,543 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



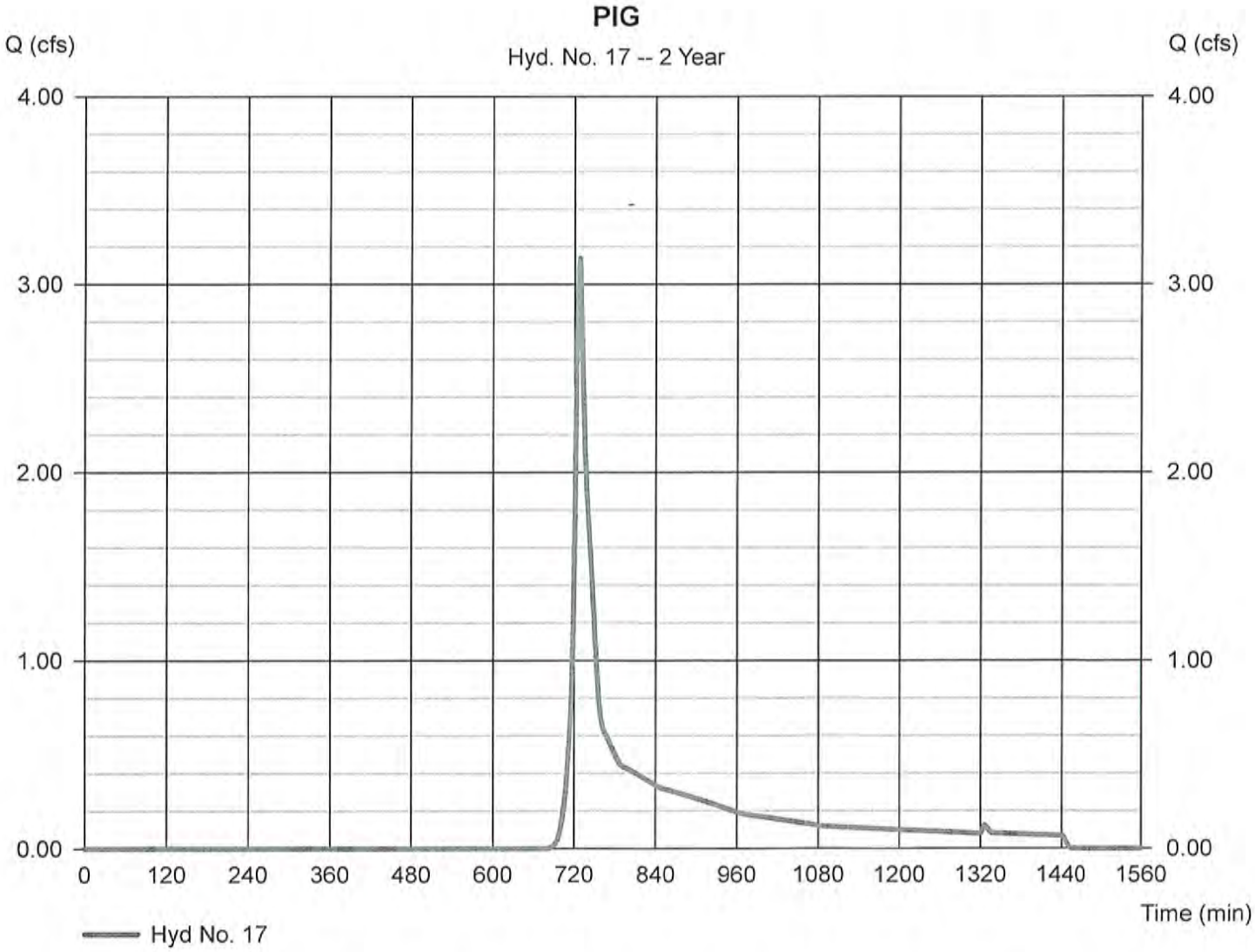
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 17

PIG

Hydrograph type	= SCS Runoff	Peak discharge	= 3.137 cfs
Storm frequency	= 2 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 12,211 cuft
Drainage area	= 4.420 ac	Curve number	= 69.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



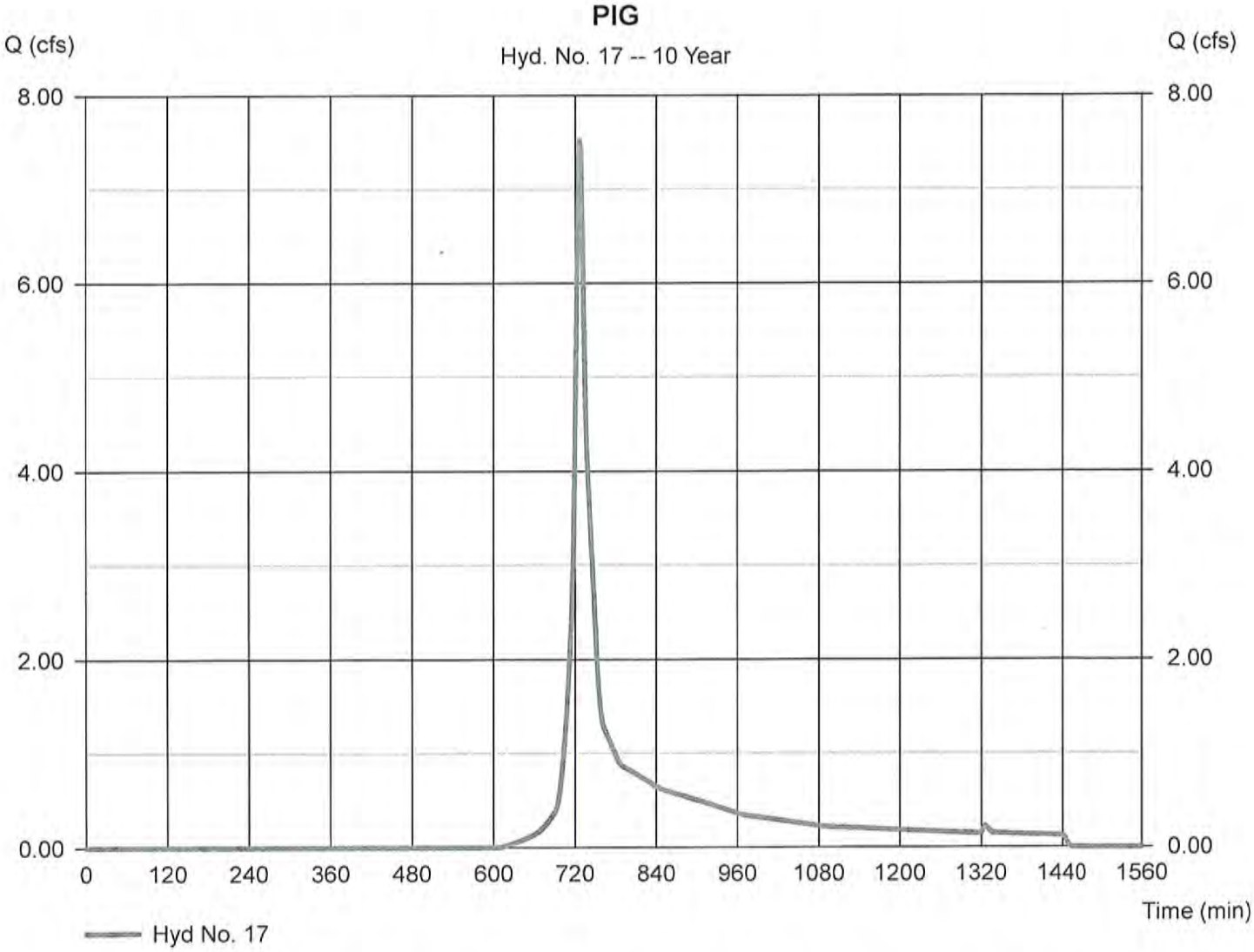
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 17

PIG

Hydrograph type	= SCS Runoff	Peak discharge	= 7.515 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 26,624 cuft
Drainage area	= 4.420 ac	Curve number	= 69.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



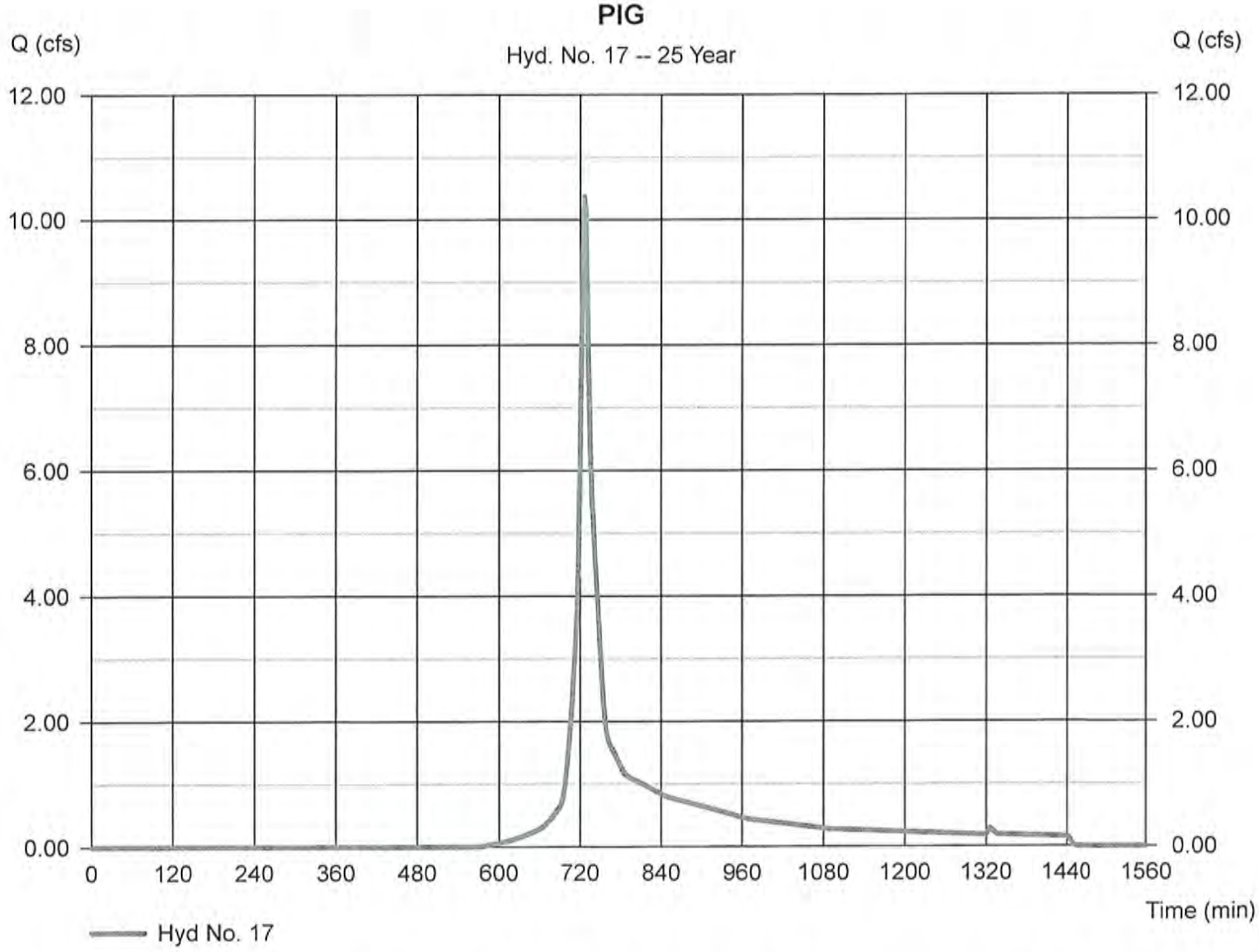
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 17

PIG

Hydrograph type	= SCS Runoff	Peak discharge	= 10.37 cfs
Storm frequency	= 25 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 36,015 cuft
Drainage area	= 4.420 ac	Curve number	= 69.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.20 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



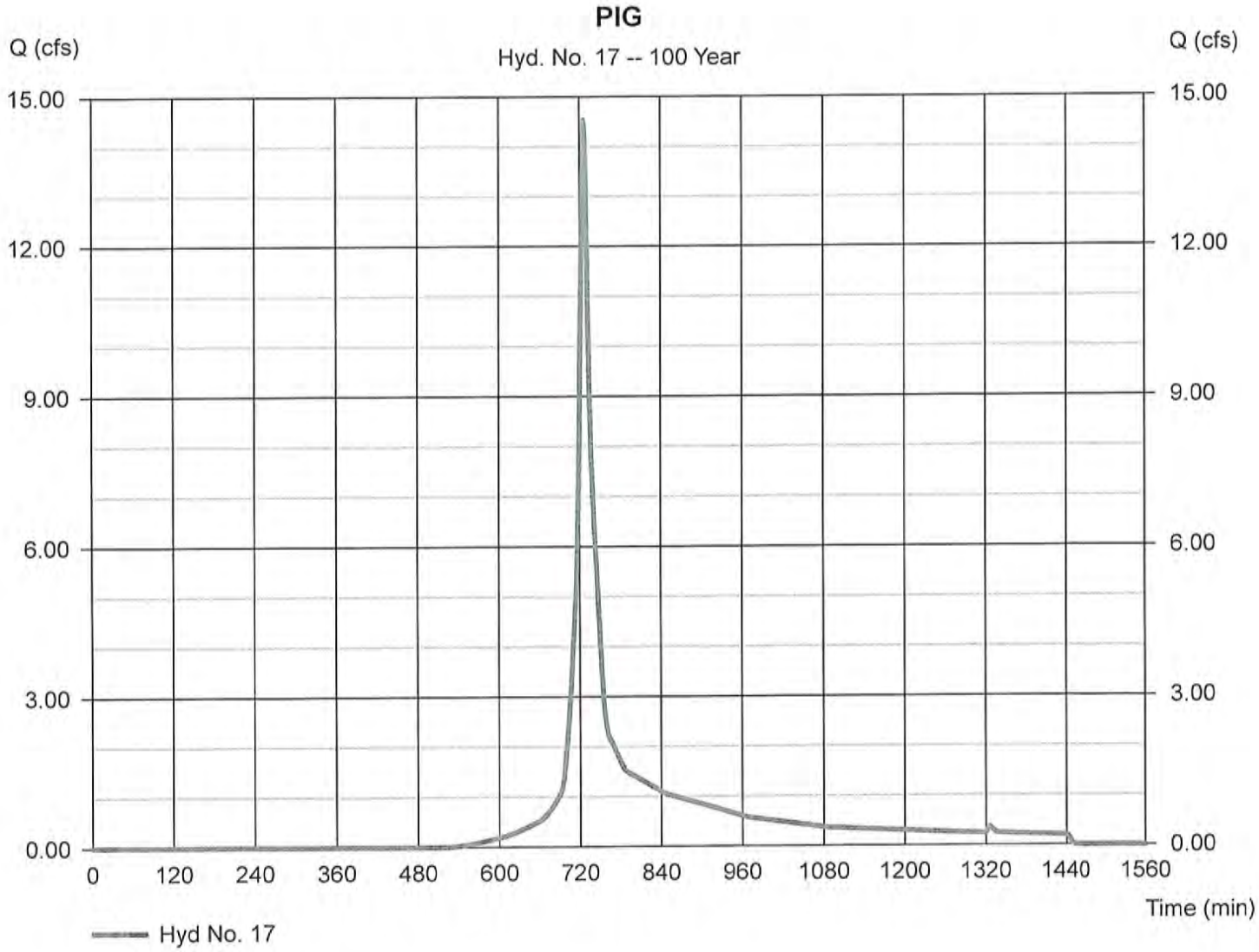
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Wednesday, Dec 21, 2016

Hyd. No. 17

PIG

Hydrograph type	= SCS Runoff	Peak discharge	= 14.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 49,840 cuft
Drainage area	= 4.420 ac	Curve number	= 69.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 7.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1G

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			1.48	144.92
B	Woods- Good Condition	55			0.24	12.98
B	Open Space-Good Condition	61			2.05	125.31
A	Open Space-Good Condition	39			0.65	25.27
				Totals =	4.42	308.49

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{308.49}{4.42} = 69.84$; Use CN = 69.8

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.76	1.66	3.11
Runoff, Q.....	cf	12233	26652	49869

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed
Circle one: Tc | Tt through subarea SubcatchmentPP-1G

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.05			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.10			0.10

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	273			
9. Watercourse slope, s		ft/ft	0.04			
10. Average Velocity, V (figure 3-1)		ft/s	3.23			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.12
min 7.2

(210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

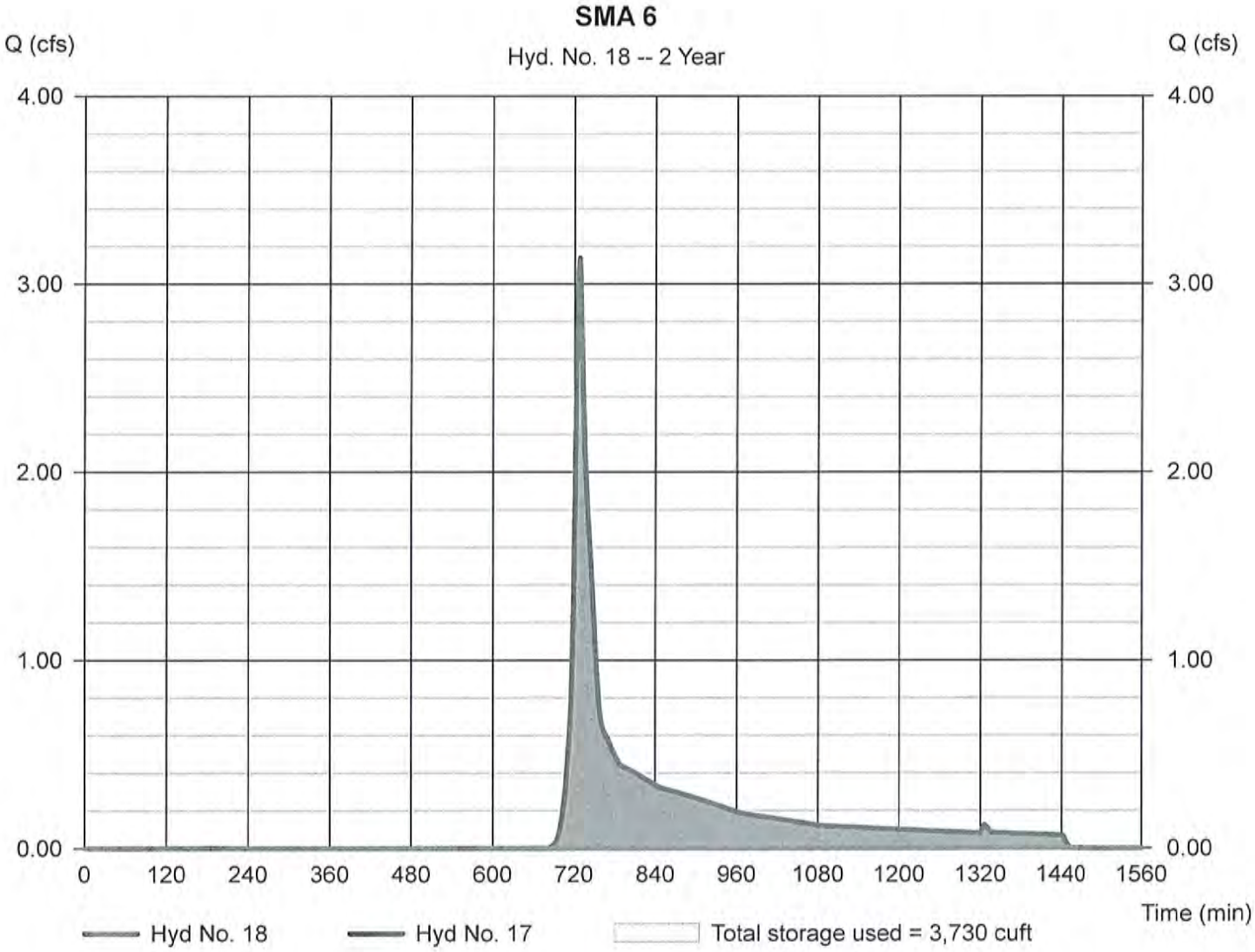
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 18

SMA 6

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 17 - PIG	Max. Elevation	= 319.39 ft
Reservoir name	= SMA 6	Max. Storage	= 3,730 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

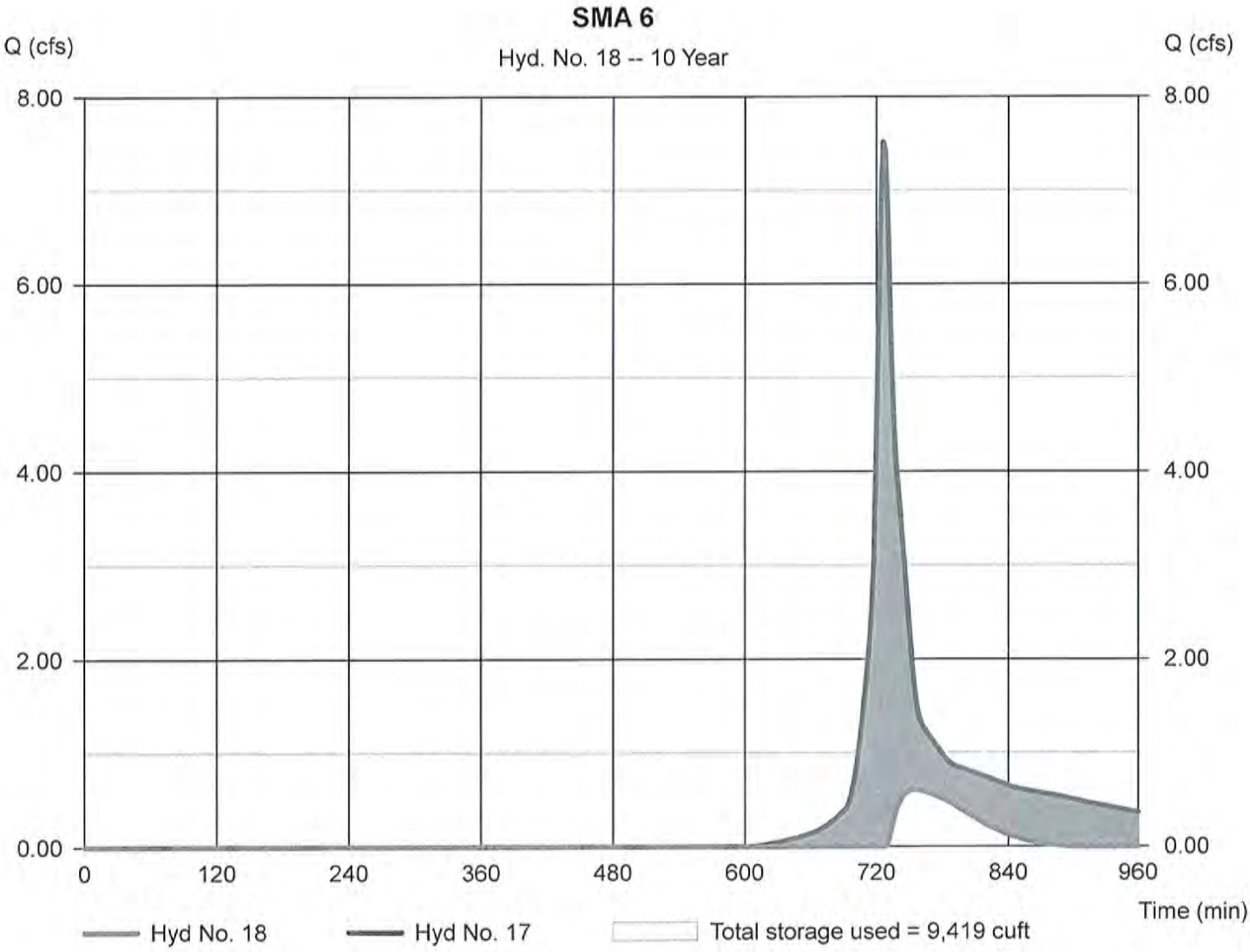
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 18

SMA 6

Hydrograph type	= Reservoir	Peak discharge	= 0.604 cfs
Storm frequency	= 10 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 2,744 cuft
Inflow hyd. No.	= 17 - PIG	Max. Elevation	= 320.66 ft
Reservoir name	= SMA 6	Max. Storage	= 9,419 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

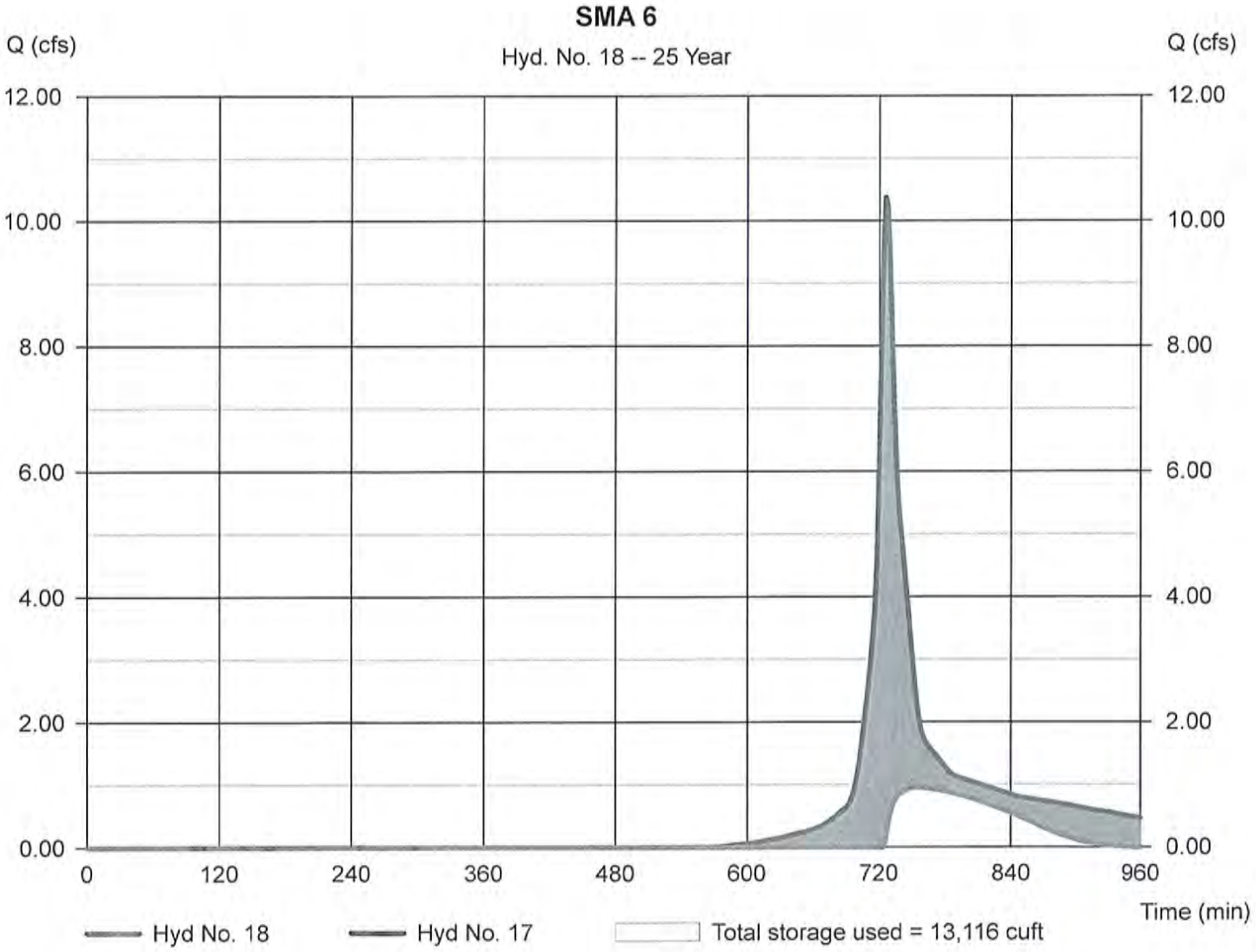
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 18

SMA 6

Hydrograph type	= Reservoir	Peak discharge	= 0.952 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 6,670 cuft
Inflow hyd. No.	= 17 - PIG	Max. Elevation	= 321.27 ft
Reservoir name	= SMA 6	Max. Storage	= 13,116 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

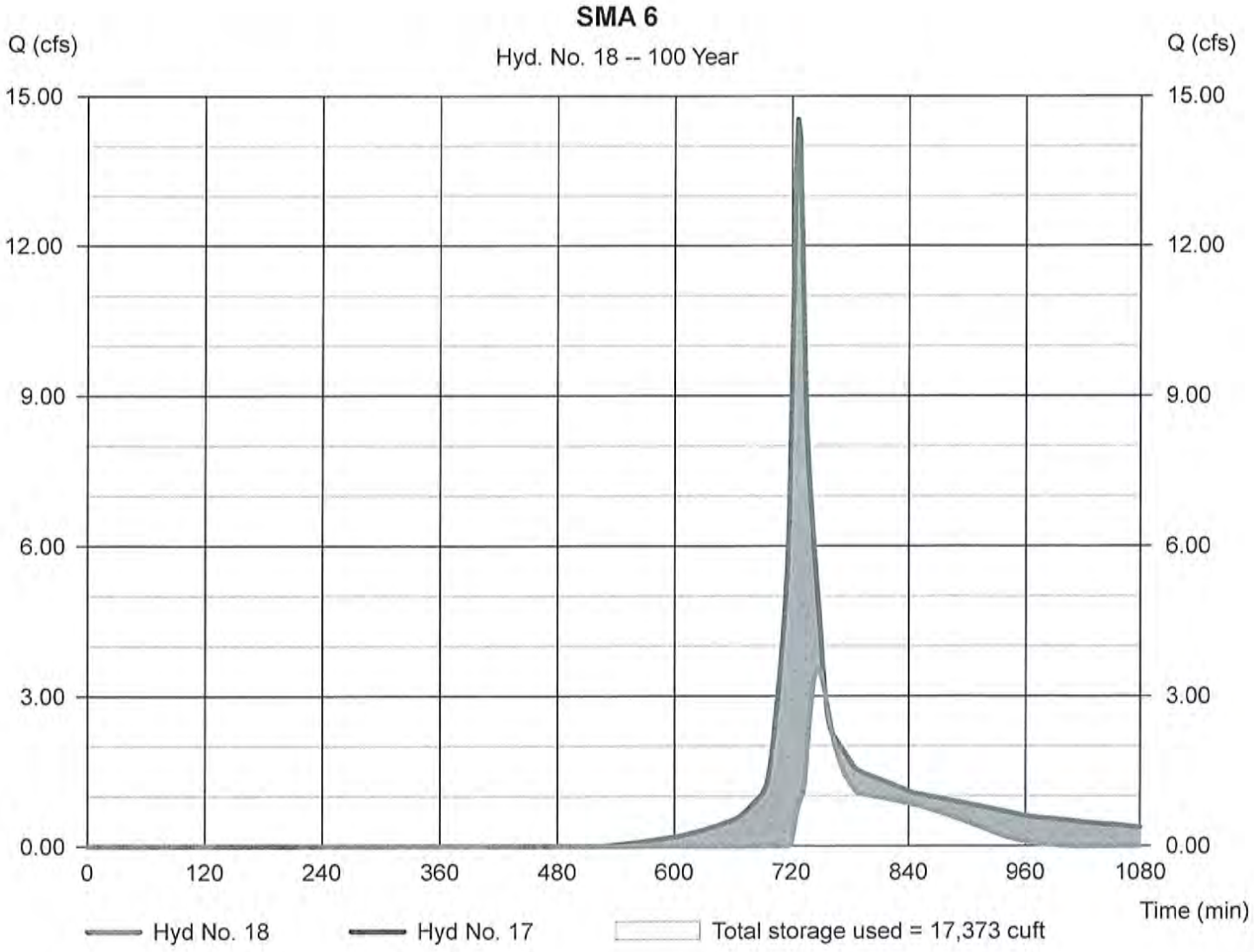
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 18

SMA 6

Hydrograph type	= Reservoir	Peak discharge	= 3.528 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 14,314 cuft
Inflow hyd. No.	= 17 - PIG	Max. Elevation	= 321.87 ft
Reservoir name	= SMA 6	Max. Storage	= 17,373 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



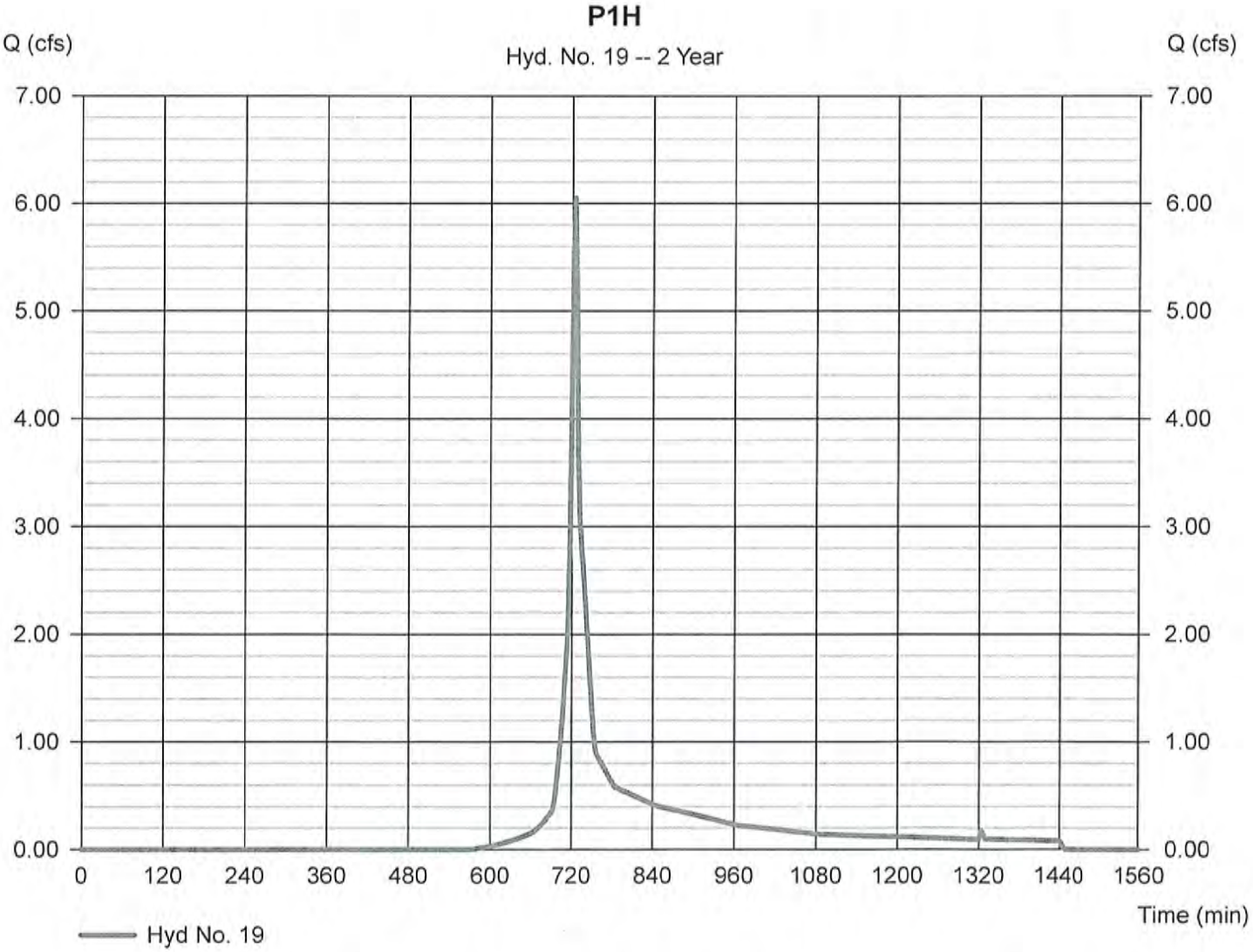
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 19

P1H

Hydrograph type	= SCS Runoff	Peak discharge	= 6.052 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,315 cuft
Drainage area	= 4.120 ac	Curve number	= 79.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



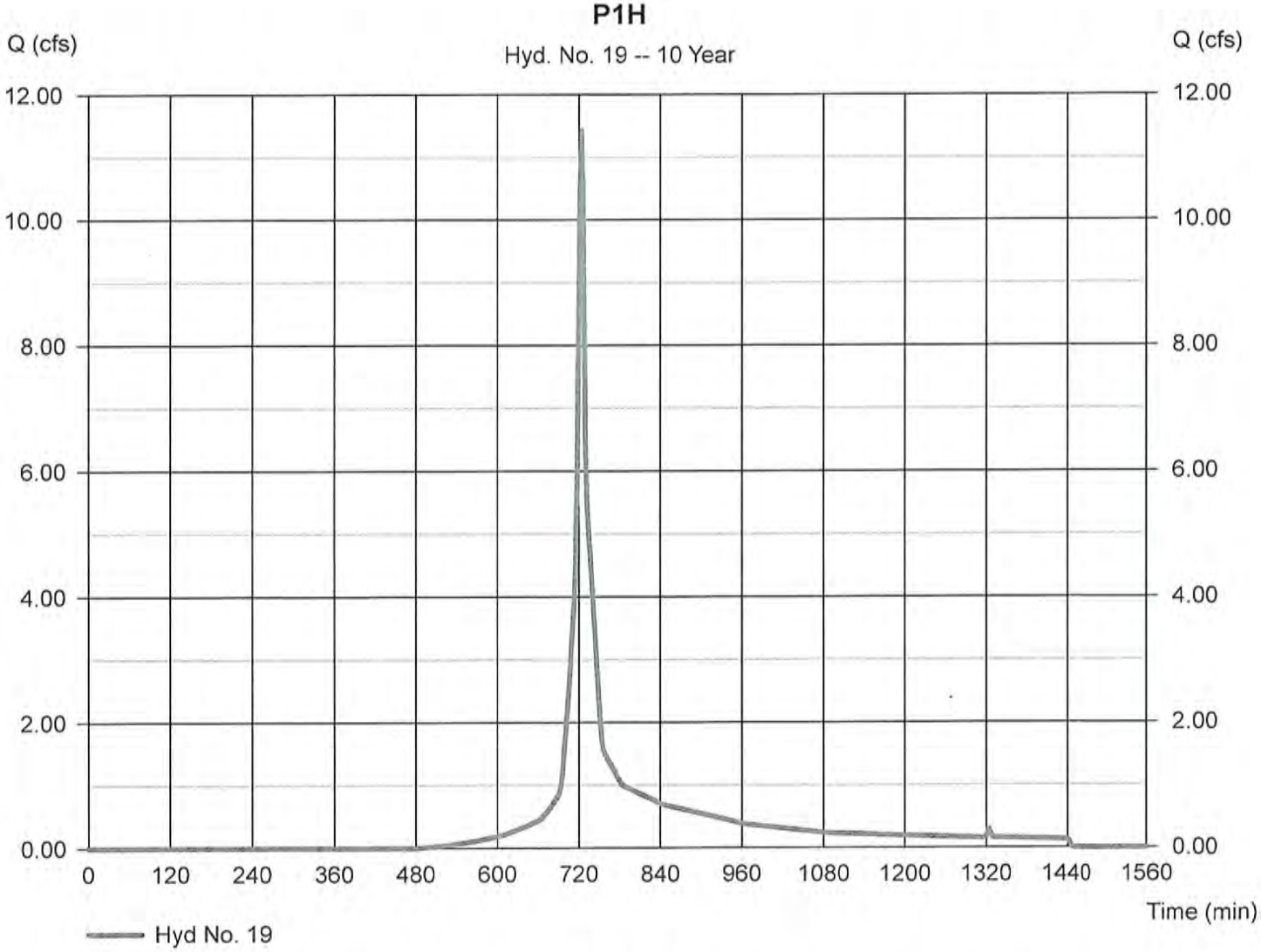
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 19

P1H

Hydrograph type	= SCS Runoff	Peak discharge	= 11.43 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 34,153 cuft
Drainage area	= 4.120 ac	Curve number	= 79.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



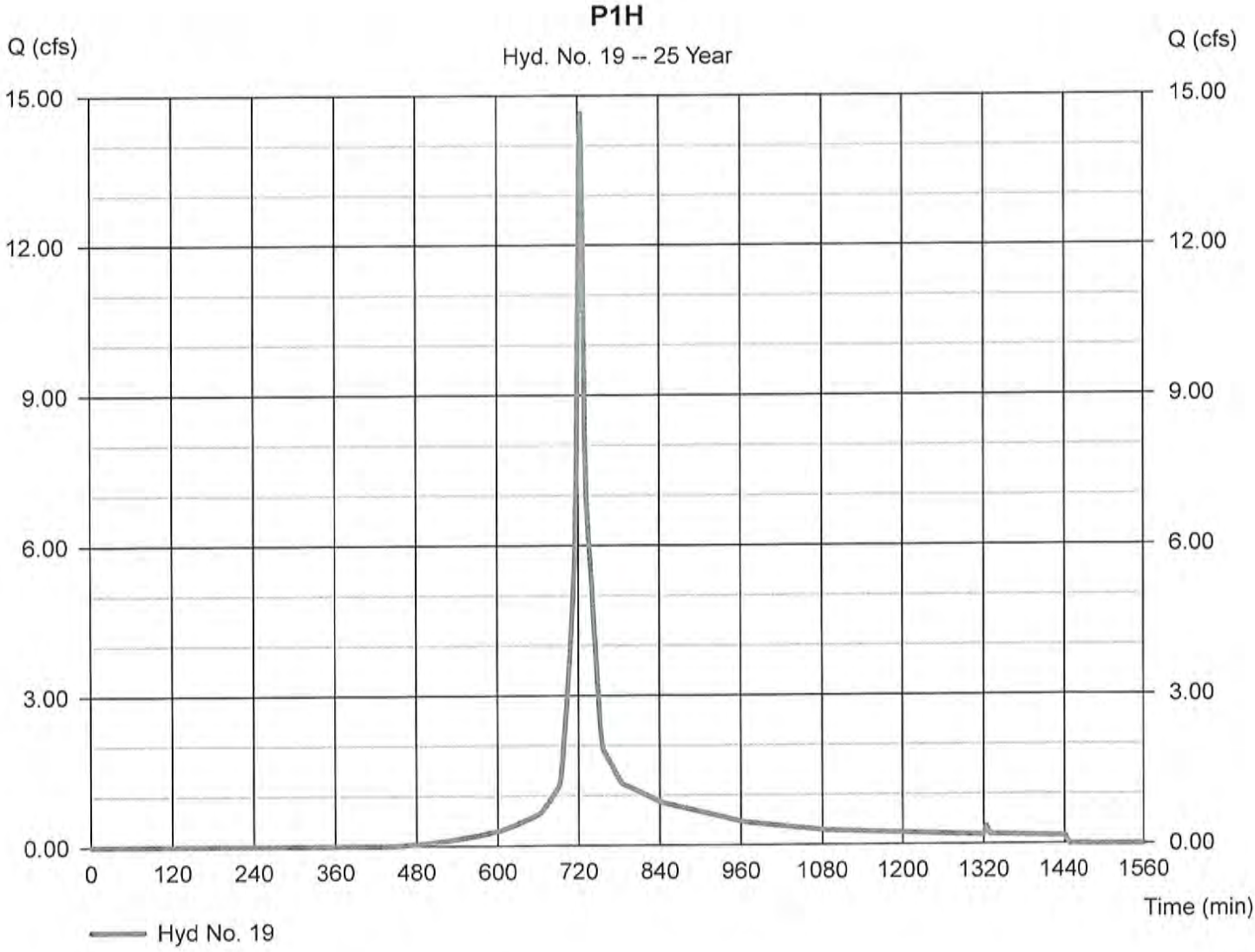
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 19

P1H

Hydrograph type	= SCS Runoff	Peak discharge	= 14.65 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 43,853 cuft
Drainage area	= 4.120 ac	Curve number	= 79.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



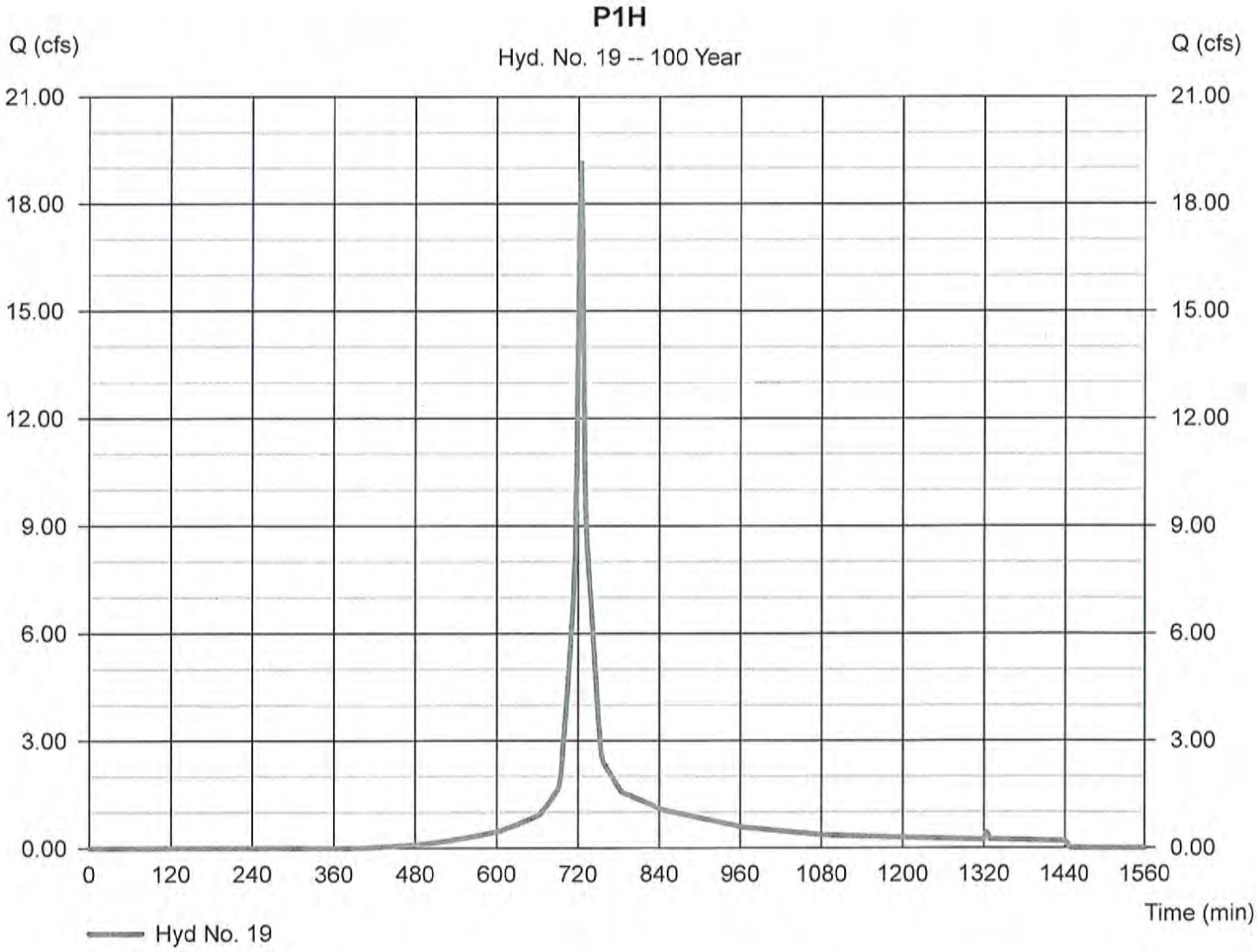
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 19

P1H

Hydrograph type	= SCS Runoff	Peak discharge	= 19.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 57,660 cuft
Drainage area	= 4.120 ac	Curve number	= 79.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1H

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			2.14	209.58
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			1.88	114.79
A	Open Space-Good Condition	39			0.10	3.96
				Totals =	4.12	328.32

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{328.32}{4.12} = 79.66$; Use CN = 79.7

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	1.30	2.43	4.11
Runoff, Q.....	cf	19502	36389	61460

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

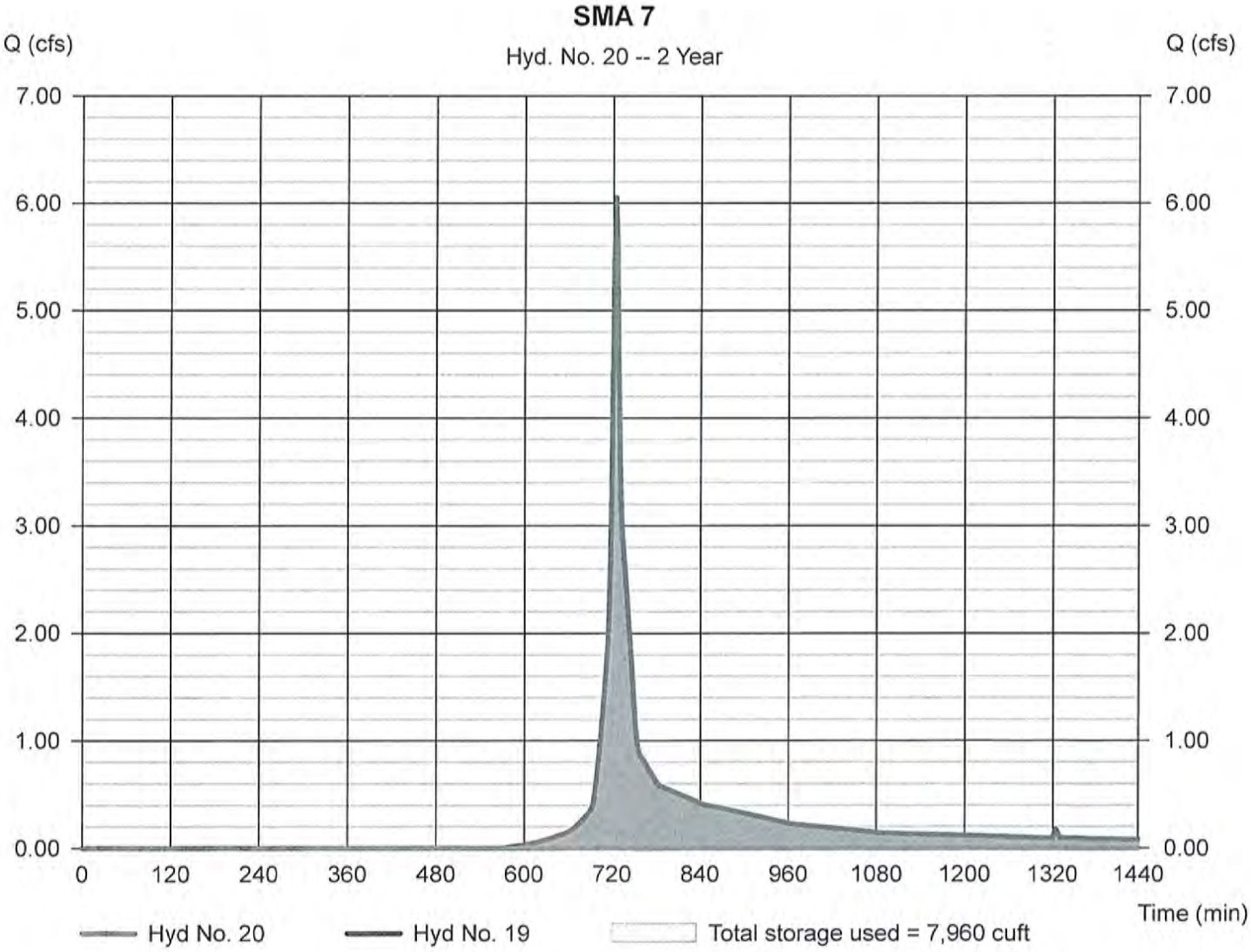
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 20

SMA 7

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 684 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 19 - P1H	Max. Elevation	= 312.10 ft
Reservoir name	= SMA 7	Max. Storage	= 7,960 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

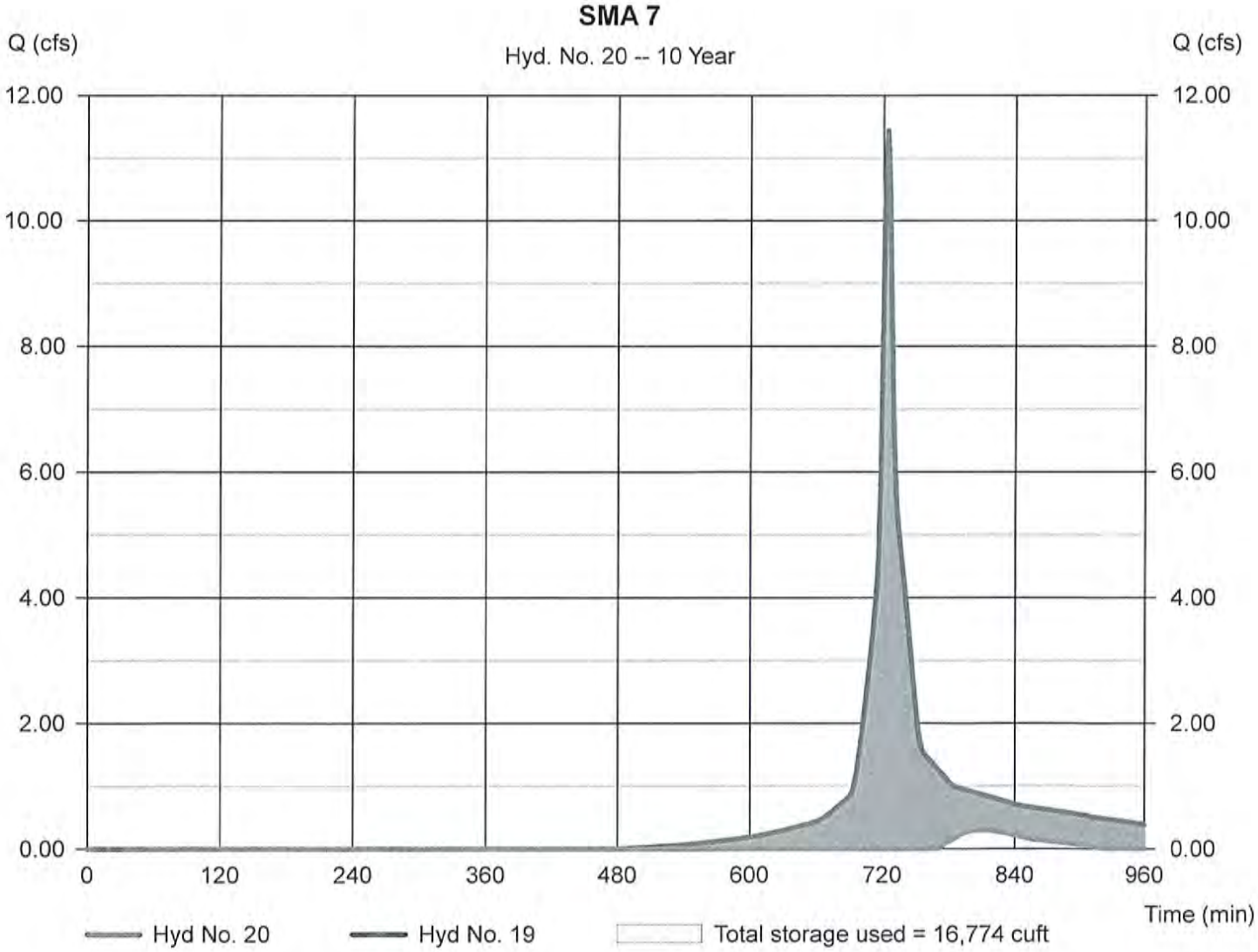
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 20

SMA 7

Hydrograph type	= Reservoir	Peak discharge	= 0.297 cfs
Storm frequency	= 10 yrs	Time to peak	= 810 min
Time interval	= 2 min	Hyd. volume	= 1,466 cuft
Inflow hyd. No.	= 19 - P1H	Max. Elevation	= 313.88 ft
Reservoir name	= SMA 7	Max. Storage	= 16,774 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

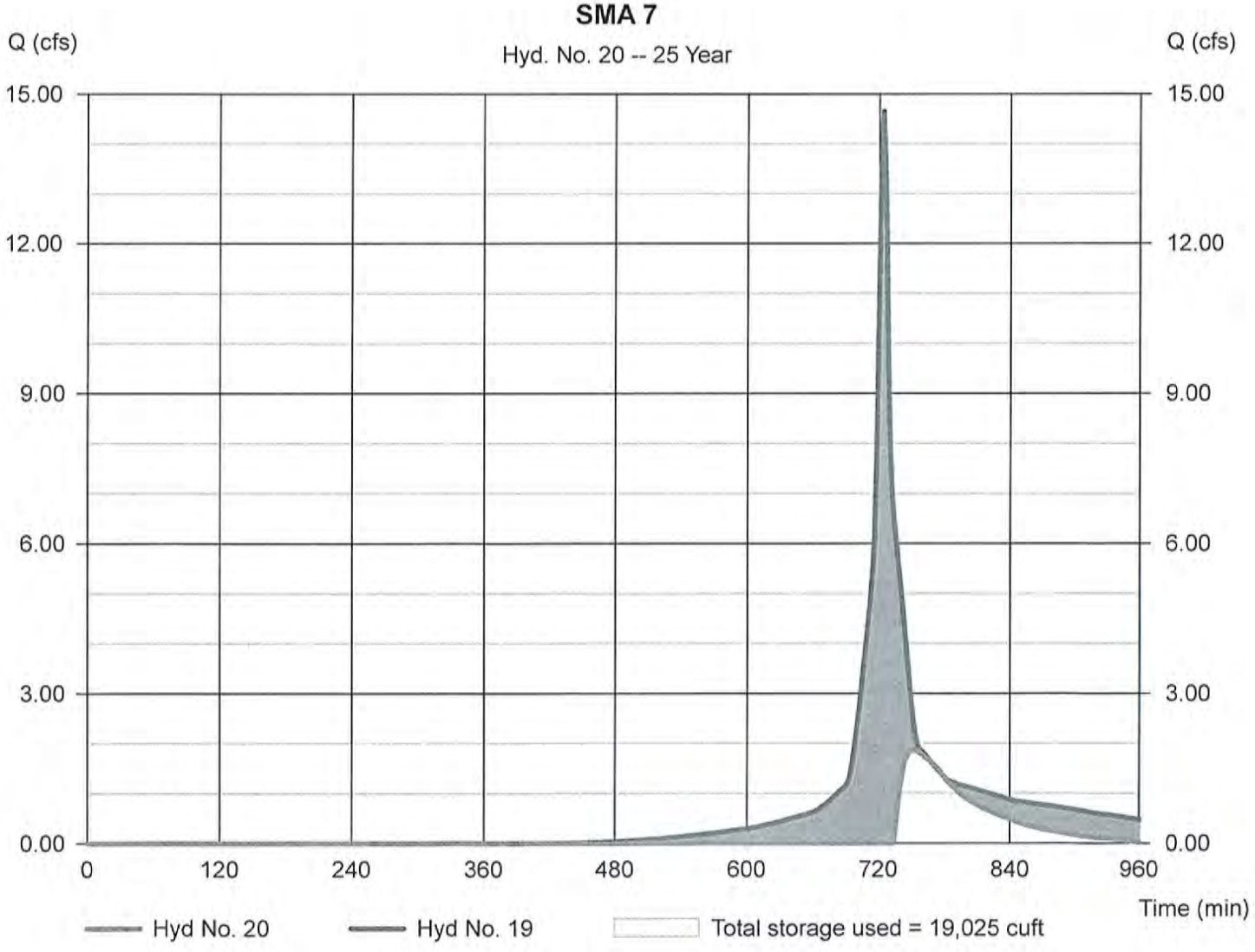
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 20

SMA 7

Hydrograph type	= Reservoir	Peak discharge	= 1.866 cfs
Storm frequency	= 25 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 8,505 cuft
Inflow hyd. No.	= 19 - P1H	Max. Elevation	= 314.38 ft
Reservoir name	= SMA 7	Max. Storage	= 19,025 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

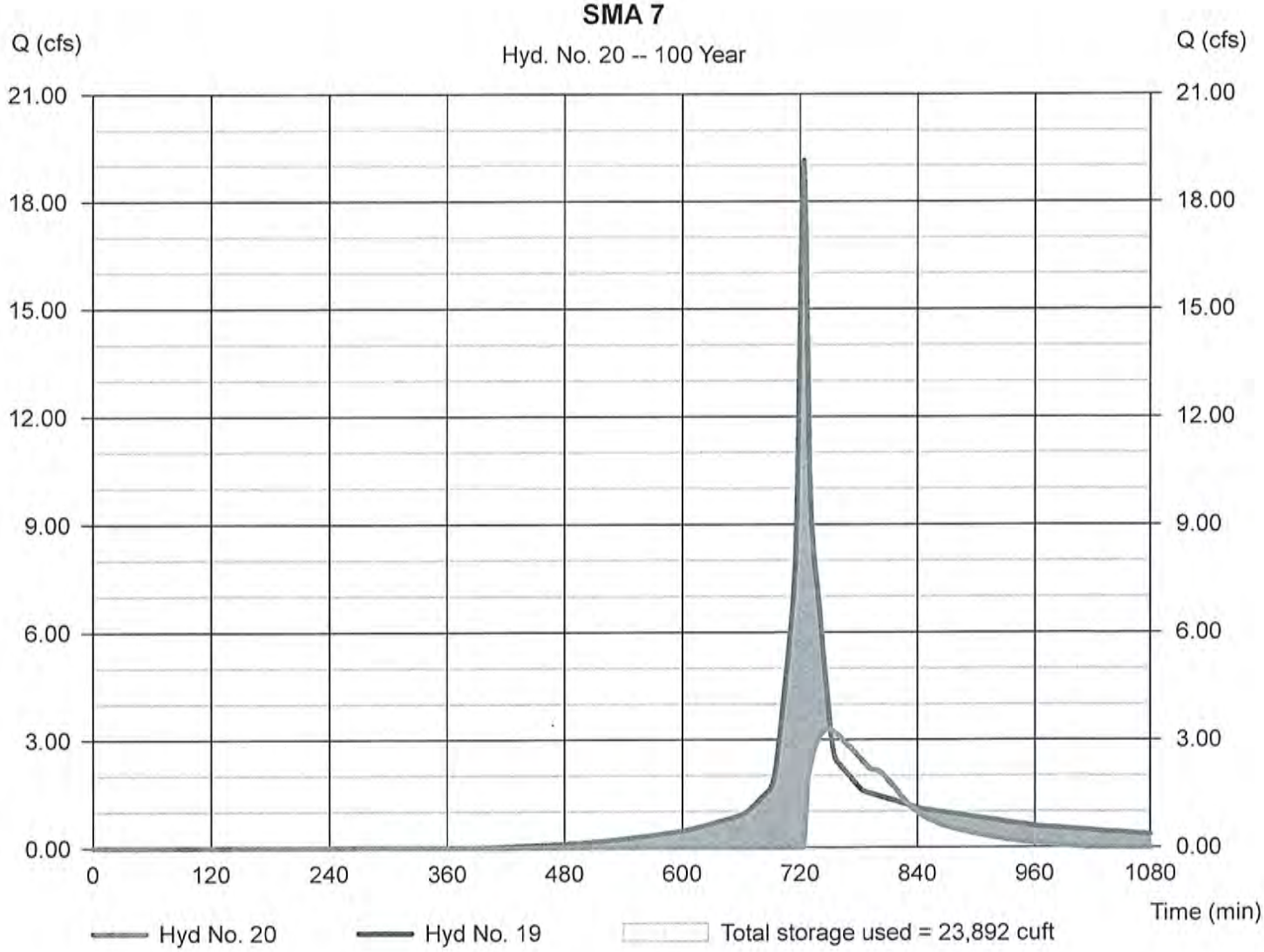
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 20

SMA 7

Hydrograph type	= Reservoir	Peak discharge	= 3.288 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 19,007 cuft
Inflow hyd. No.	= 19 - P1H	Max. Elevation	= 315.59 ft
Reservoir name	= SMA 7	Max. Storage	= 23,892 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



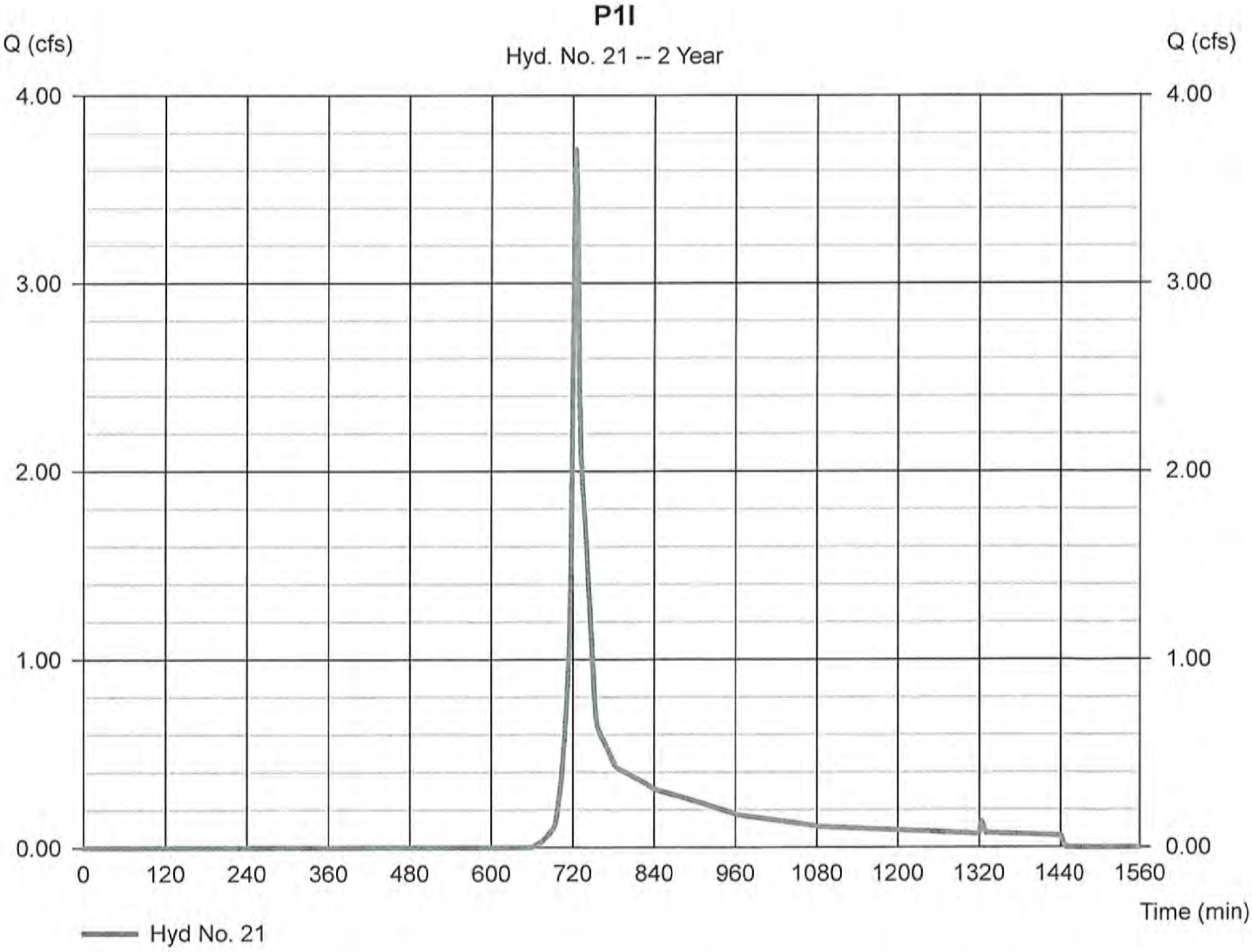
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 21

P1I

Hydrograph type	= SCS Runoff	Peak discharge	= 3.712 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 12,035 cuft
Drainage area	= 3.980 ac	Curve number	= 72.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



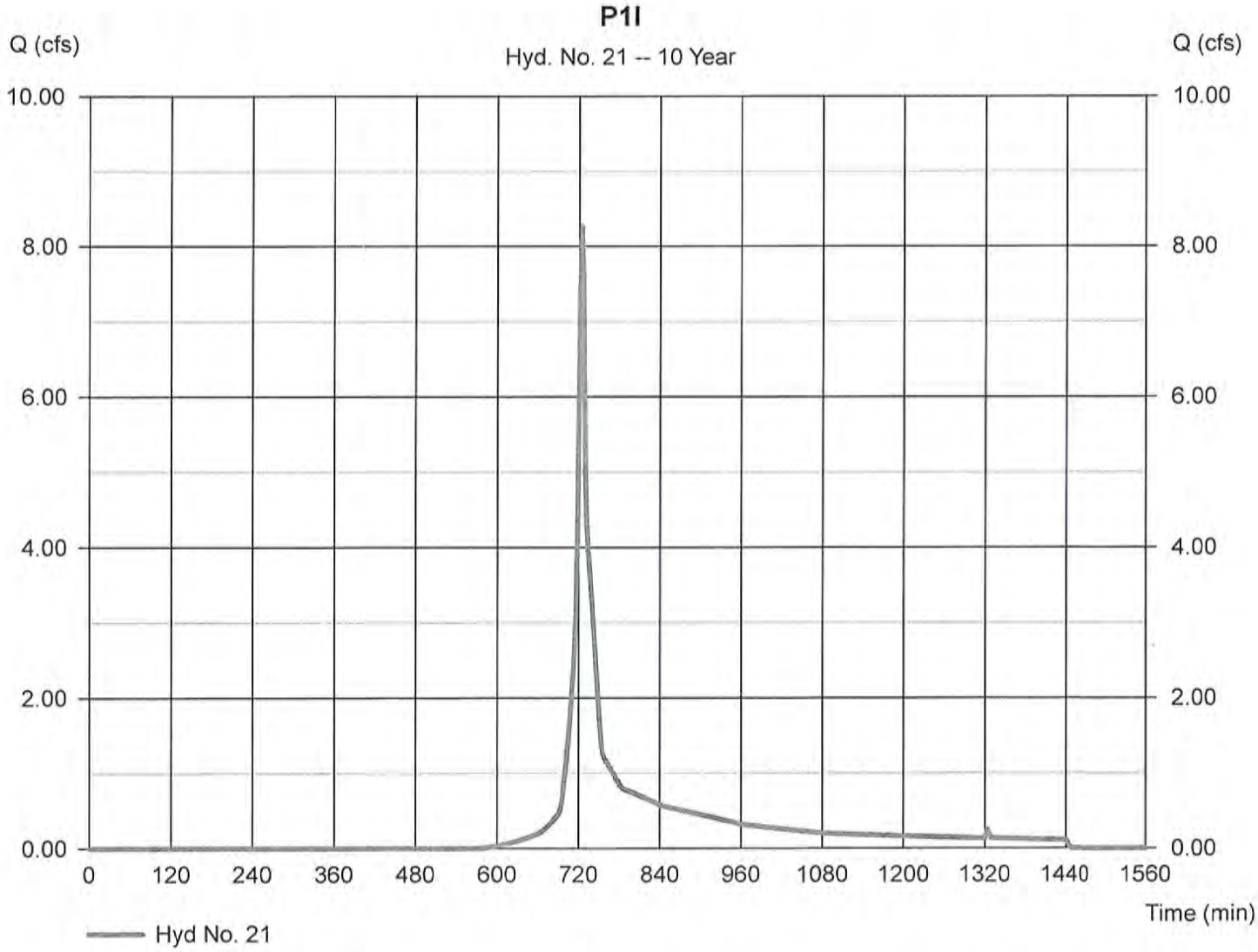
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 21

P1I

Hydrograph type	= SCS Runoff	Peak discharge	= 8.260 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 25,062 cuft
Drainage area	= 3.980 ac	Curve number	= 72.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



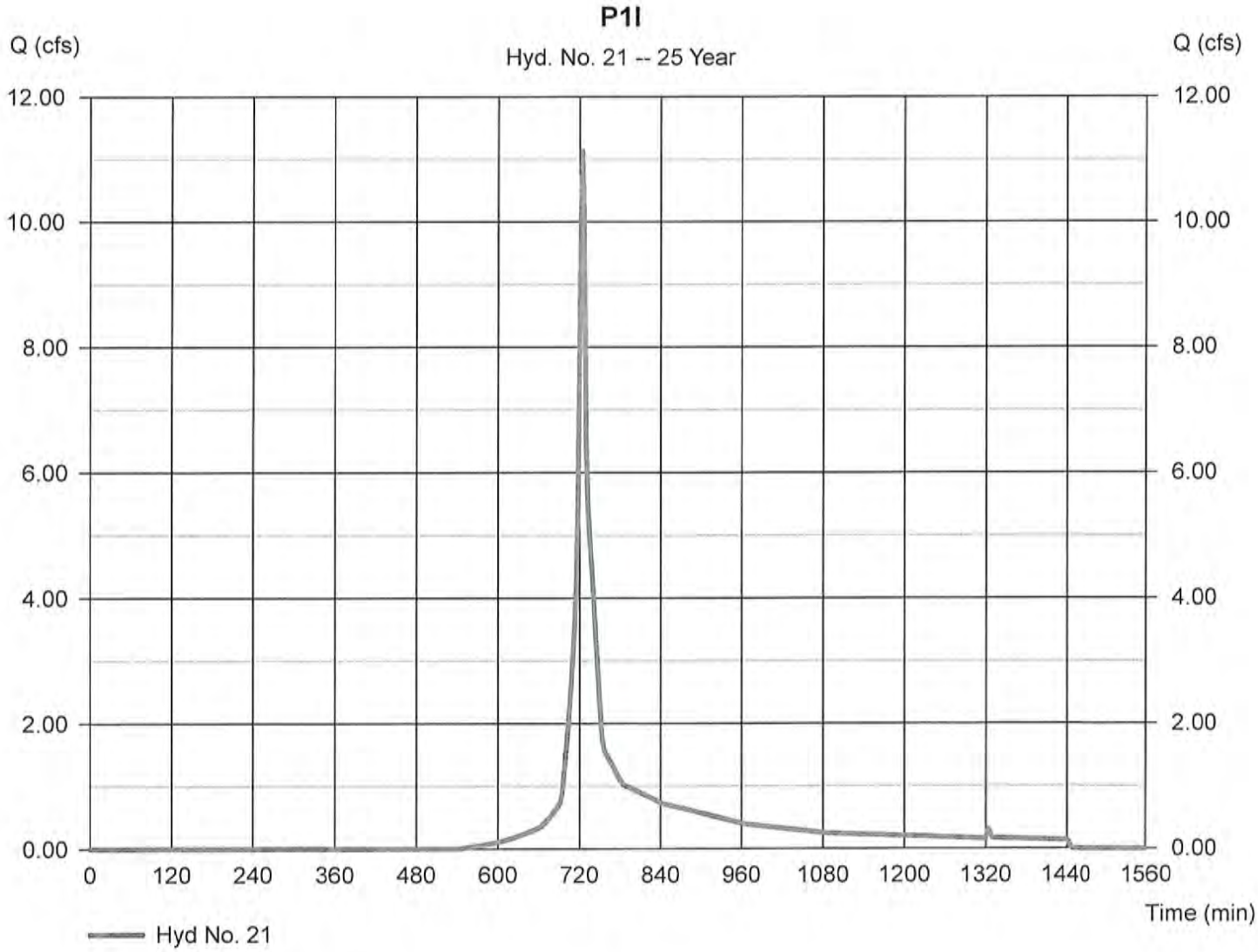
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 21

P1I

Hydrograph type	= SCS Runoff	Peak discharge	= 11.12 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 33,399 cuft
Drainage area	= 3.980 ac	Curve number	= 72.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



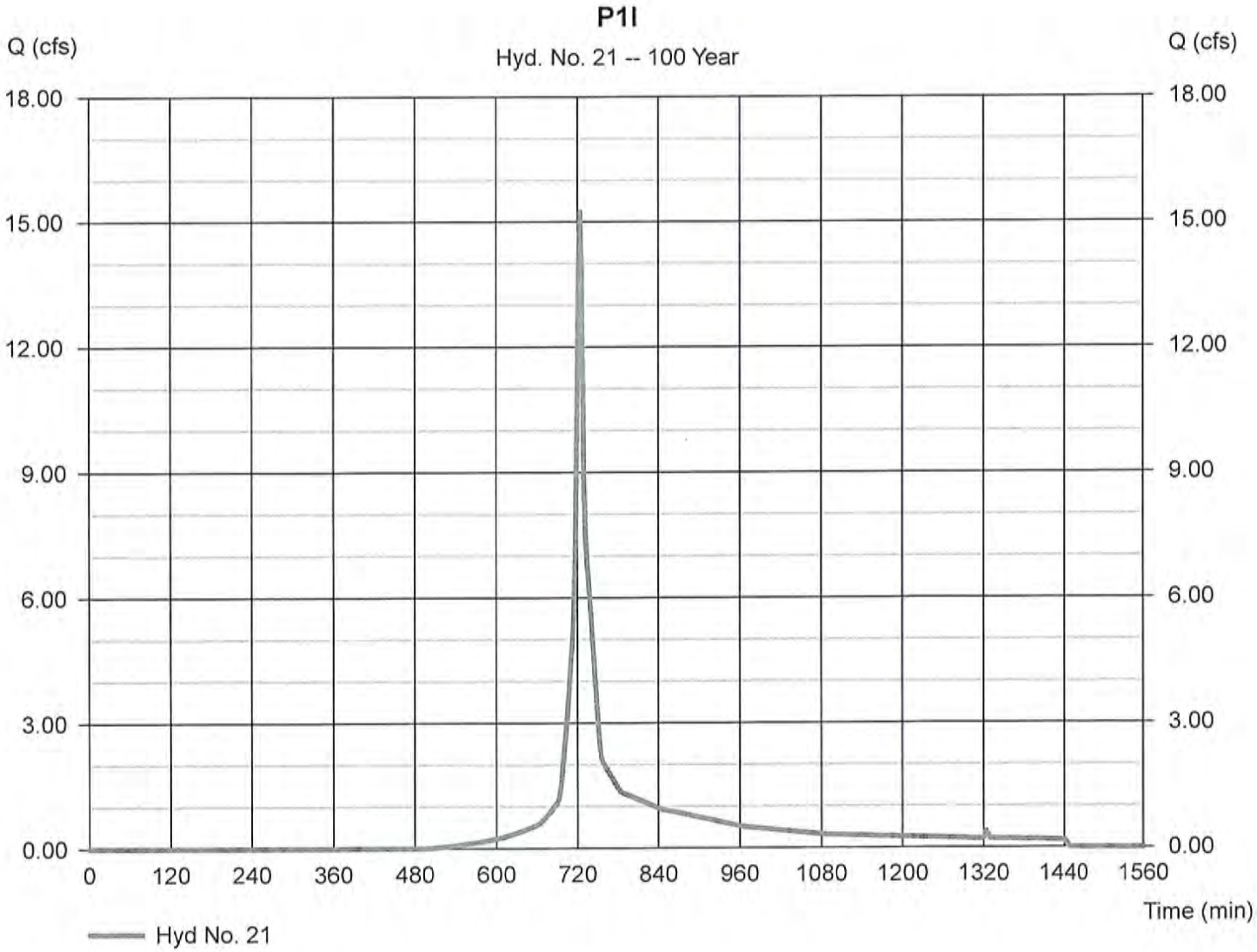
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 21

P1I

Hydrograph type	= SCS Runoff	Peak discharge	= 15.24 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 45,554 cuft
Drainage area	= 3.980 ac	Curve number	= 72.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1I

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			1.56	152.79
B	Woods- Good Condition	55			0.00	0.00
B	Open Space-Good Condition	61			1.86	113.54
A	Open Space-Good Condition	39			0.56	21.75
				Totals =	3.98	288.08

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{288.08}{3.98} = 72.42$; Use CN = 72.4

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.89	1.85	3.36
Runoff, Q.....	cf	12843	26737	48592

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

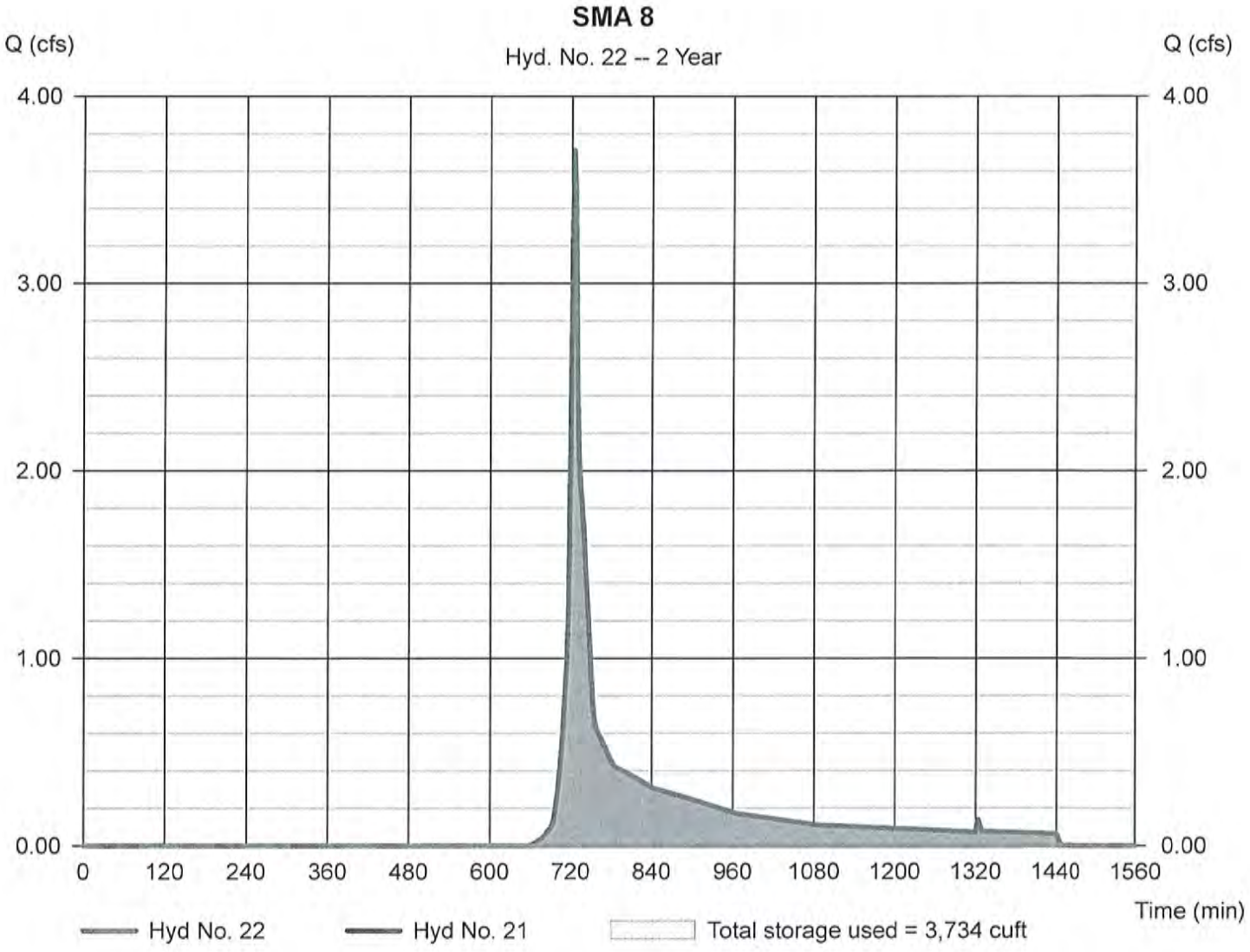
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 22

SMA 8

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 21 - P1I	Max. Elevation	= 312.66 ft
Reservoir name	= SMA 8	Max. Storage	= 3,734 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

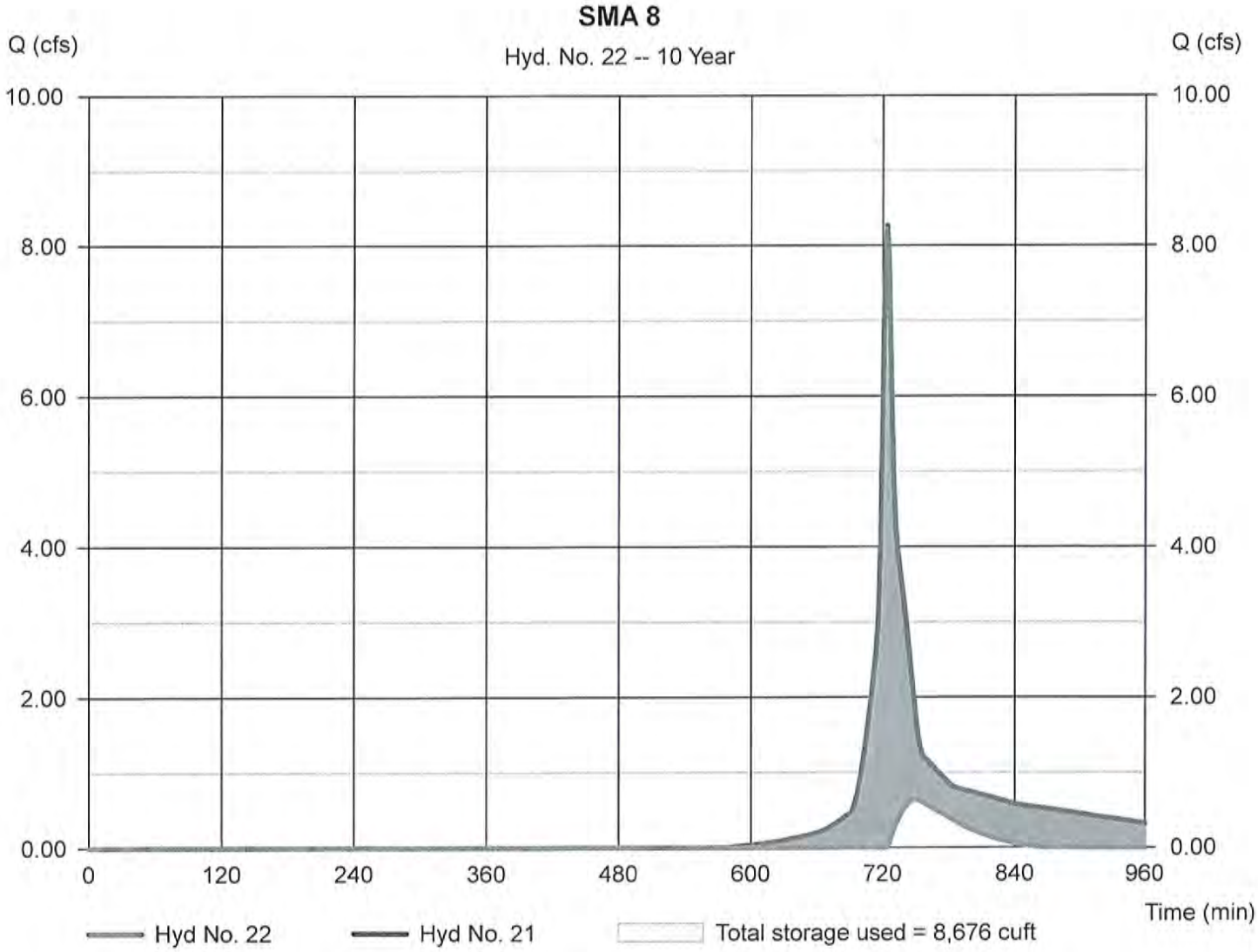
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 22

SMA 8

Hydrograph type	= Reservoir	Peak discharge	= 0.636 cfs
Storm frequency	= 10 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 2,317 cuft
Inflow hyd. No.	= 21 - P1I	Max. Elevation	= 313.63 ft
Reservoir name	= SMA 8	Max. Storage	= 8,676 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

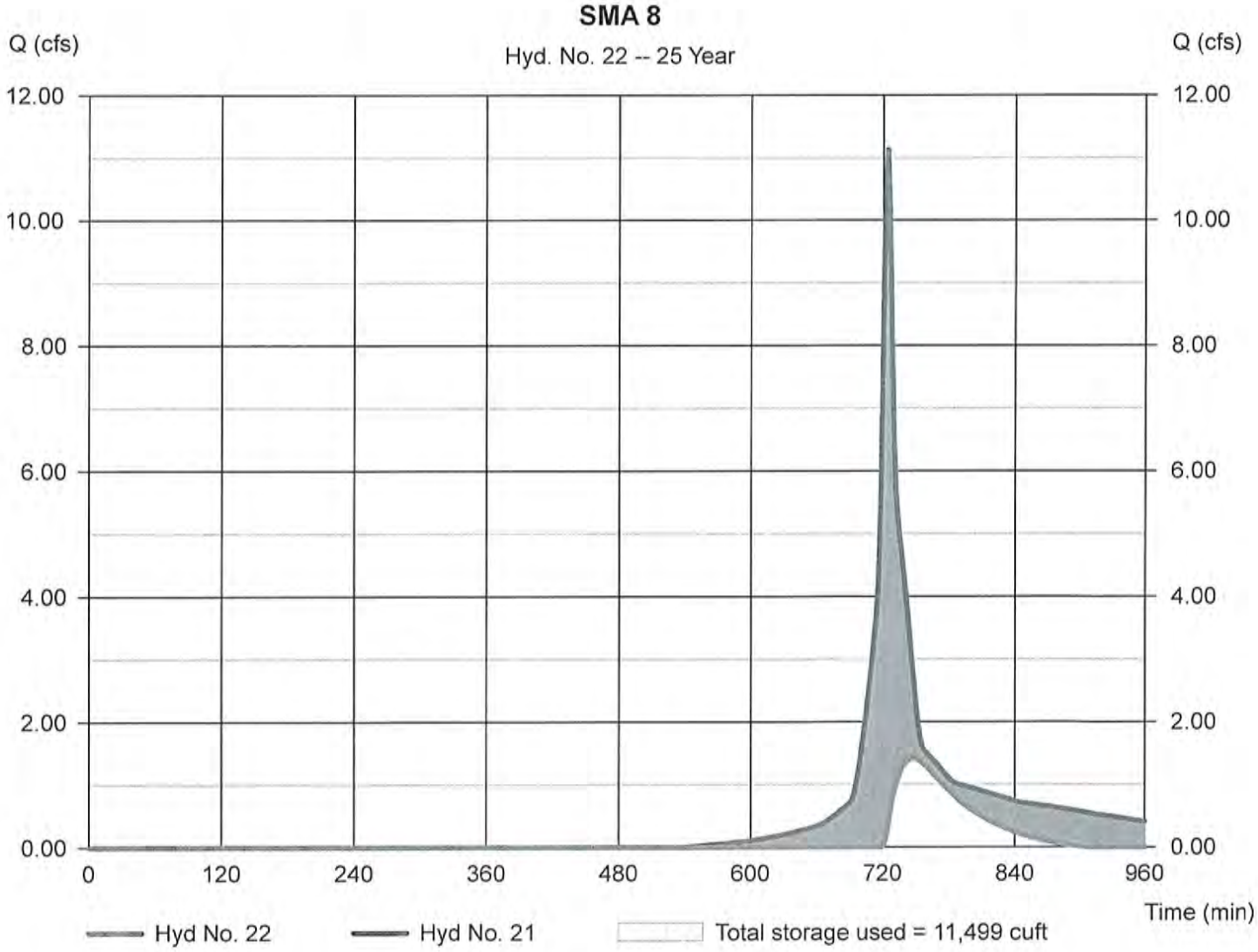
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 22

SMA 8

Hydrograph type	= Reservoir	Peak discharge	= 1.422 cfs
Storm frequency	= 25 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 6,080 cuft
Inflow hyd. No.	= 21 - P1I	Max. Elevation	= 314.08 ft
Reservoir name	= SMA 8	Max. Storage	= 11,499 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

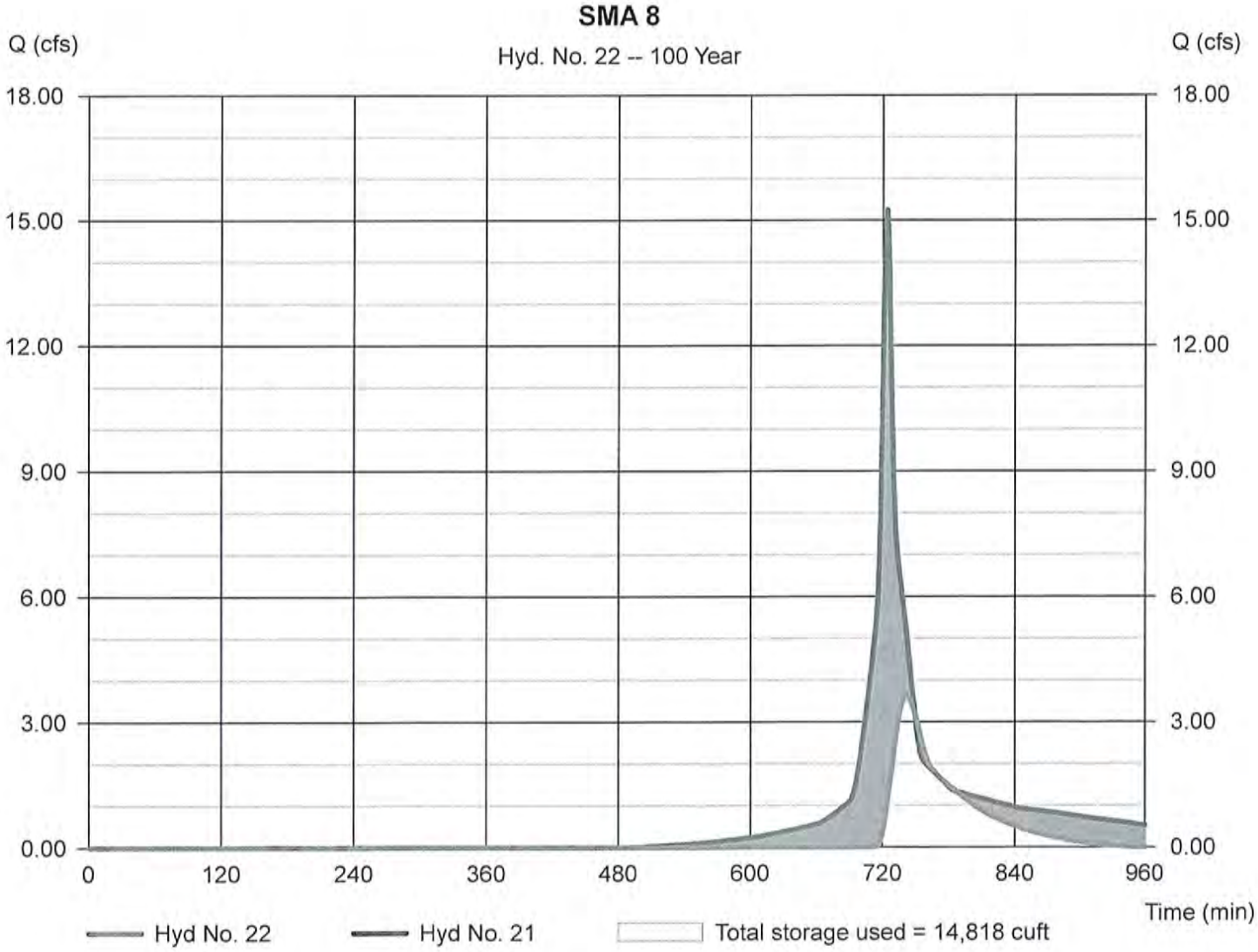
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 22

SMA 8

Hydrograph type	= Reservoir	Peak discharge	= 3.616 cfs
Storm frequency	= 100 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 12,805 cuft
Inflow hyd. No.	= 21 - P1I	Max. Elevation	= 314.51 ft
Reservoir name	= SMA 8	Max. Storage	= 14,818 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



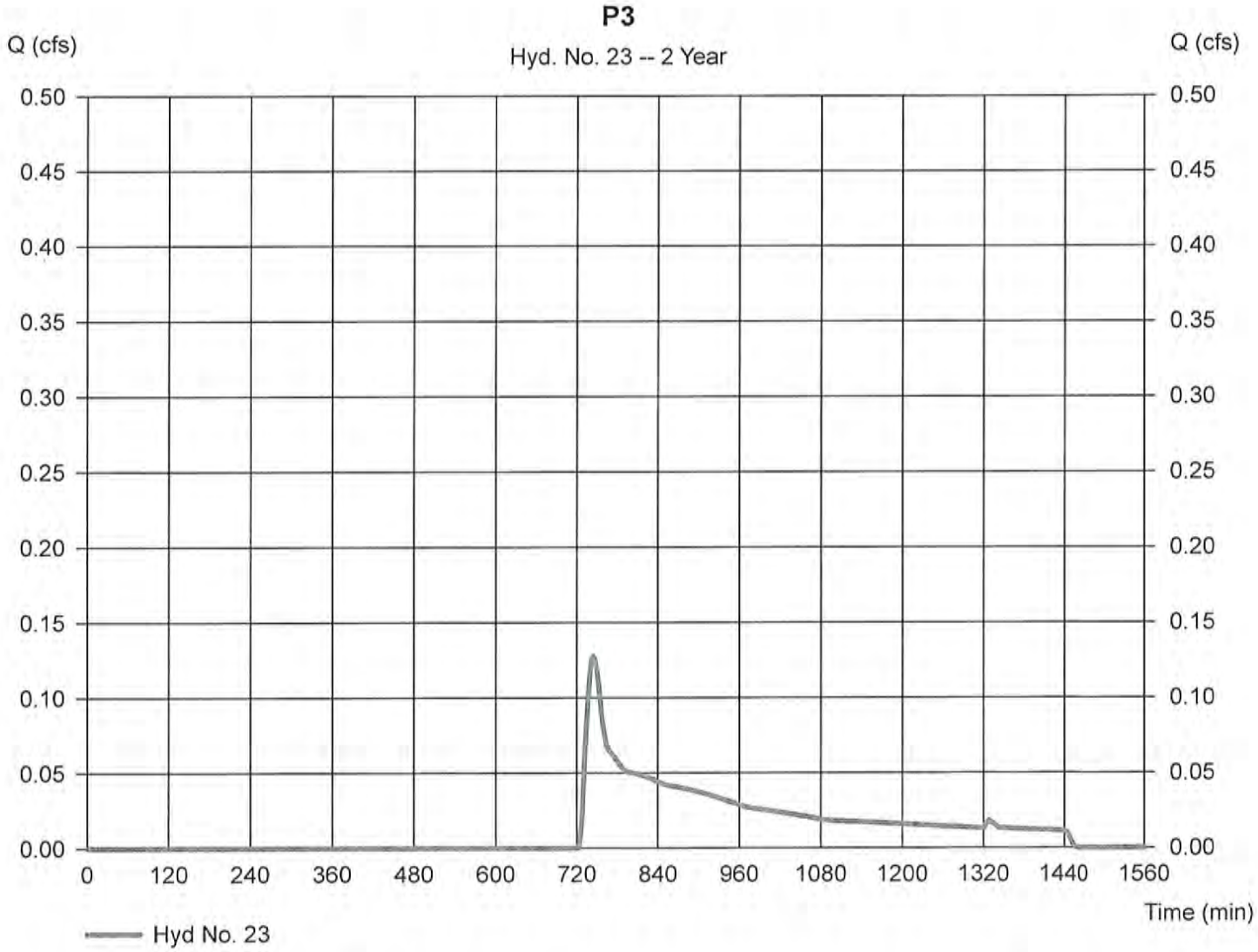
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 23

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.127 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 1,204 cuft
Drainage area	= 1.400 ac	Curve number	= 55.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.30 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



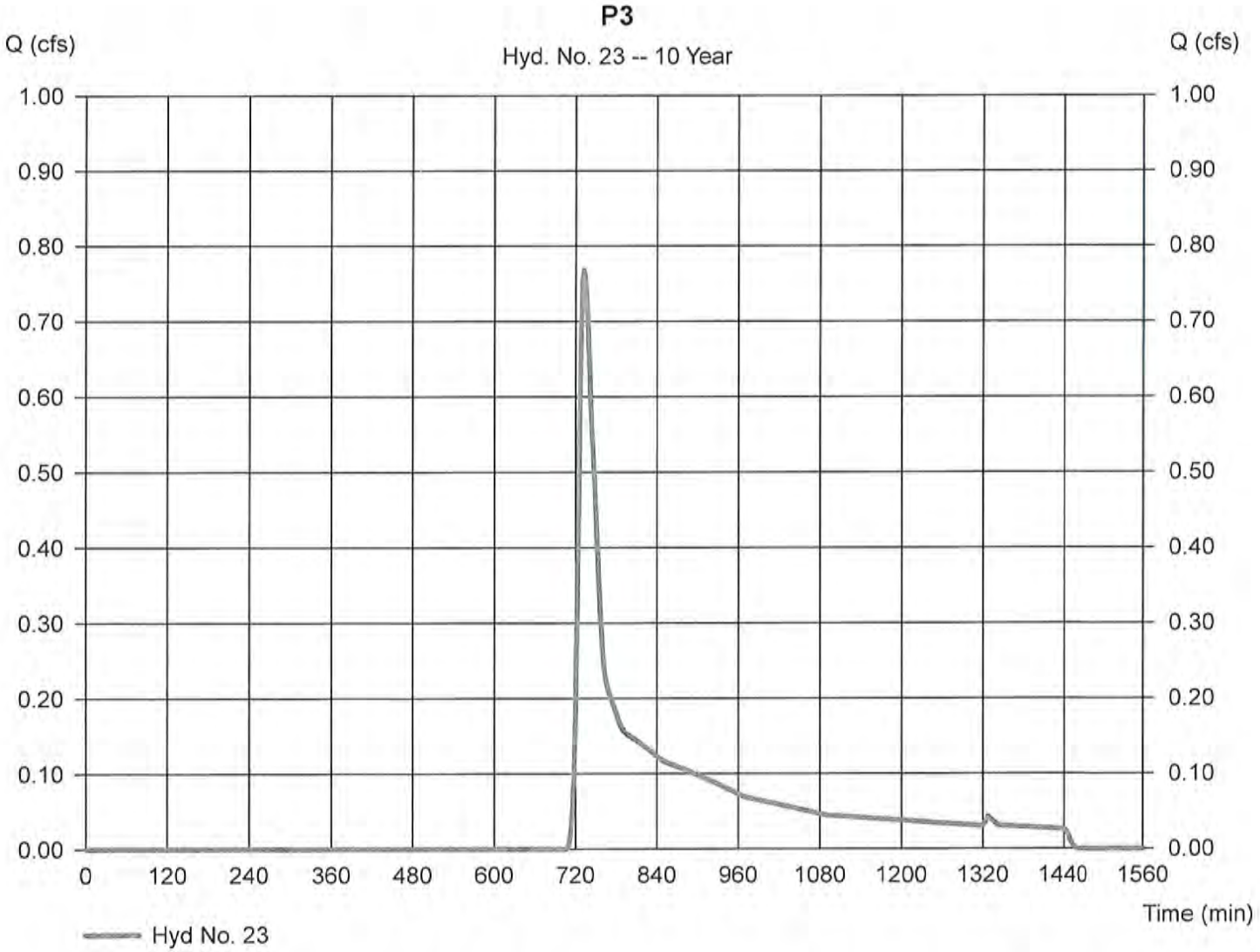
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 23

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.768 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 3,973 cuft
Drainage area	= 1.400 ac	Curve number	= 55.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.30 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



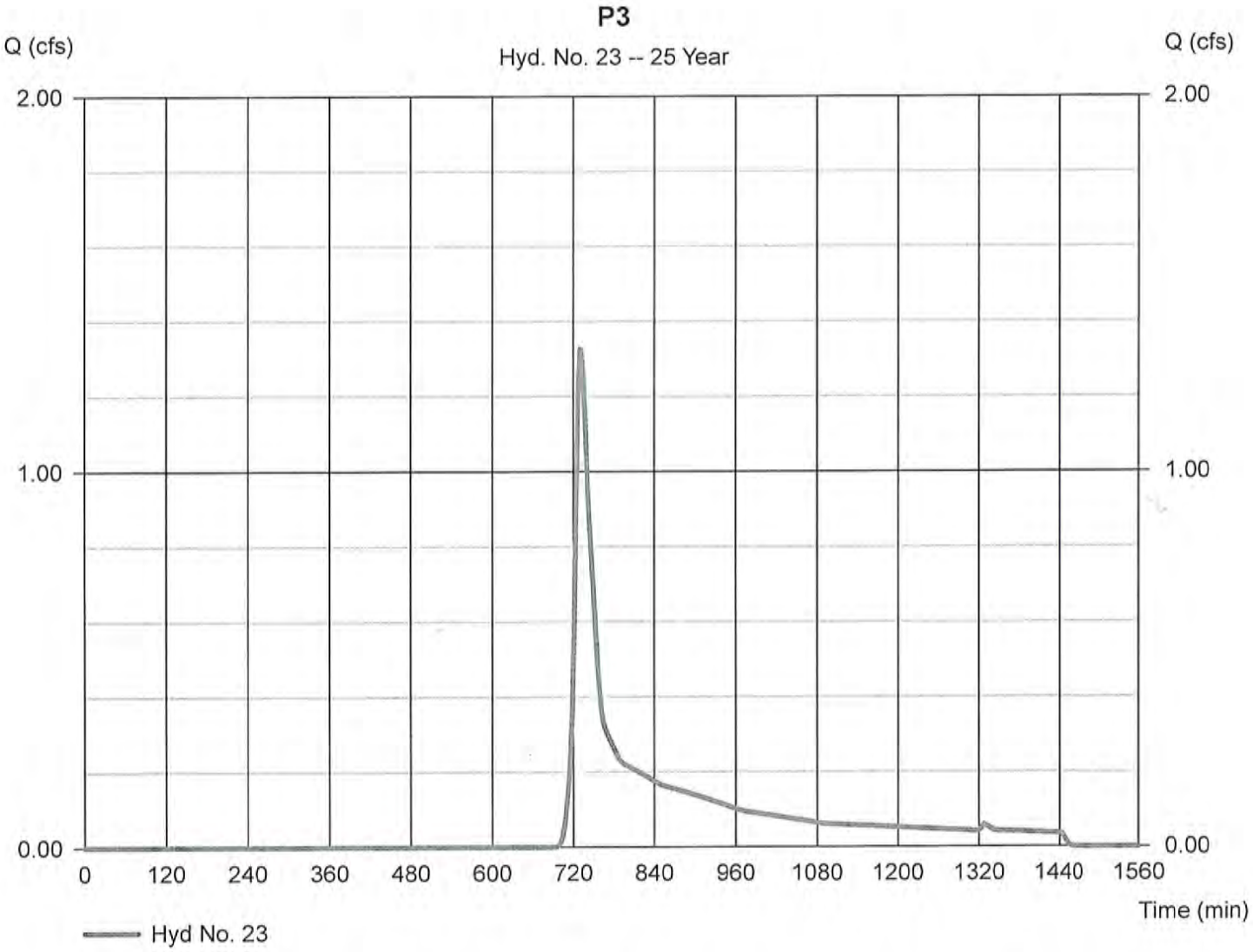
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 23

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.324 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 6,043 cuft
Drainage area	= 1.400 ac	Curve number	= 55.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.30 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



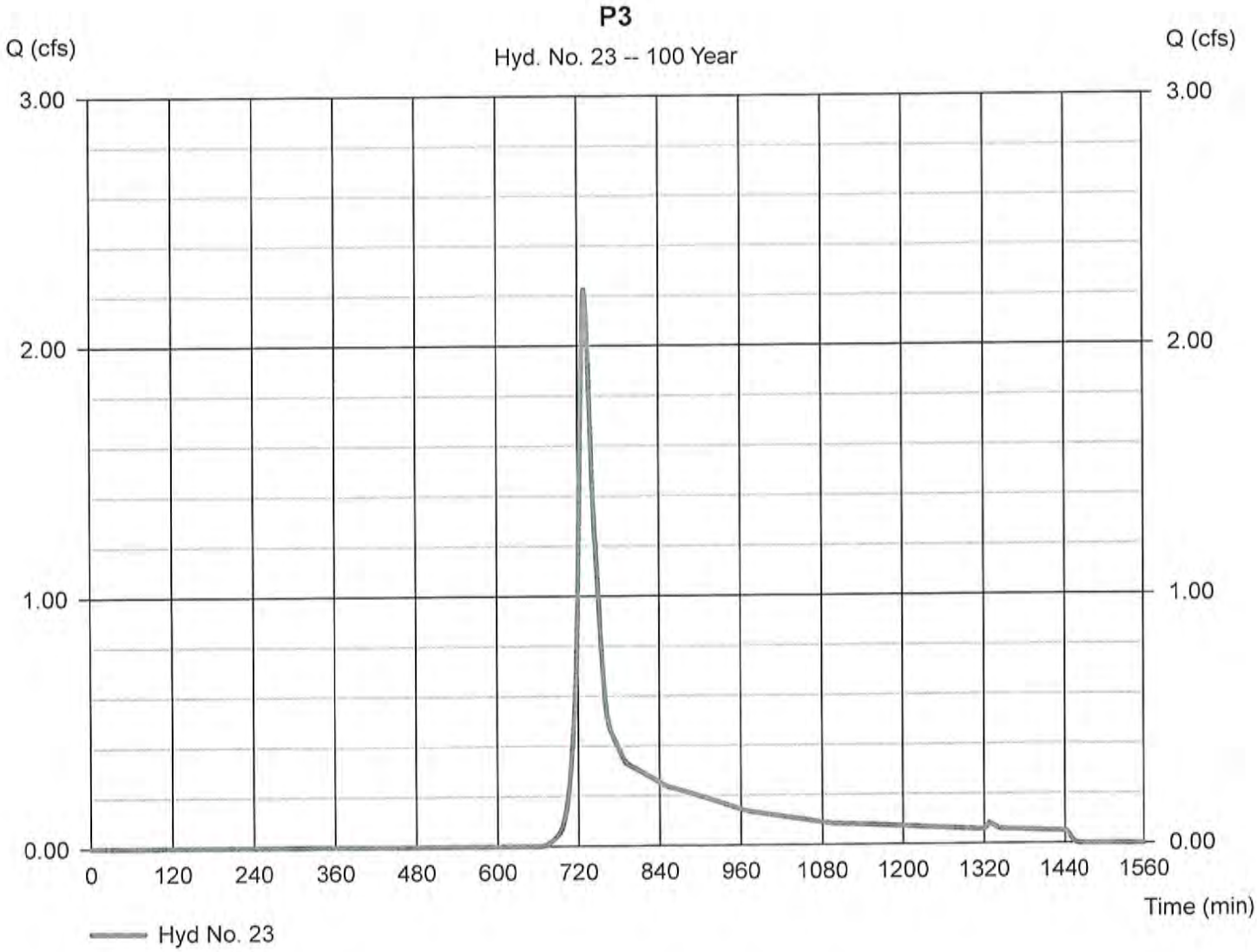
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Wednesday, Dec 21, 2016

Hyd. No. 23

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.223 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 9,320 cuft
Drainage area	= 1.400 ac	Curve number	= 55.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 13.30 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			0.73	40.05
B	Open- Good Condition	61			0.05	3.27
	Impervious	98			0.09	8.72
B	Brush-Good Condition	48			0.53	25.30
				Totals =	1.40	77.34

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{77.34}{1.40} =$ 55.33 ; Use CN = 55.3

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.23	0.76	1.78
Runoff, Q.....	cf	1171	3854	9035

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed

Circle one: Tc | Tt through subarea

SubcatchmentP P-3

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.046			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.21			0.21

Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	99	145		
9. Watercourse slope, s		ft/ft	0.098	0.055		
10. Average Velocity, V (figure 3-1)		ft/s	5.05	4.77		
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.01		0.01

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.22
min 13.3

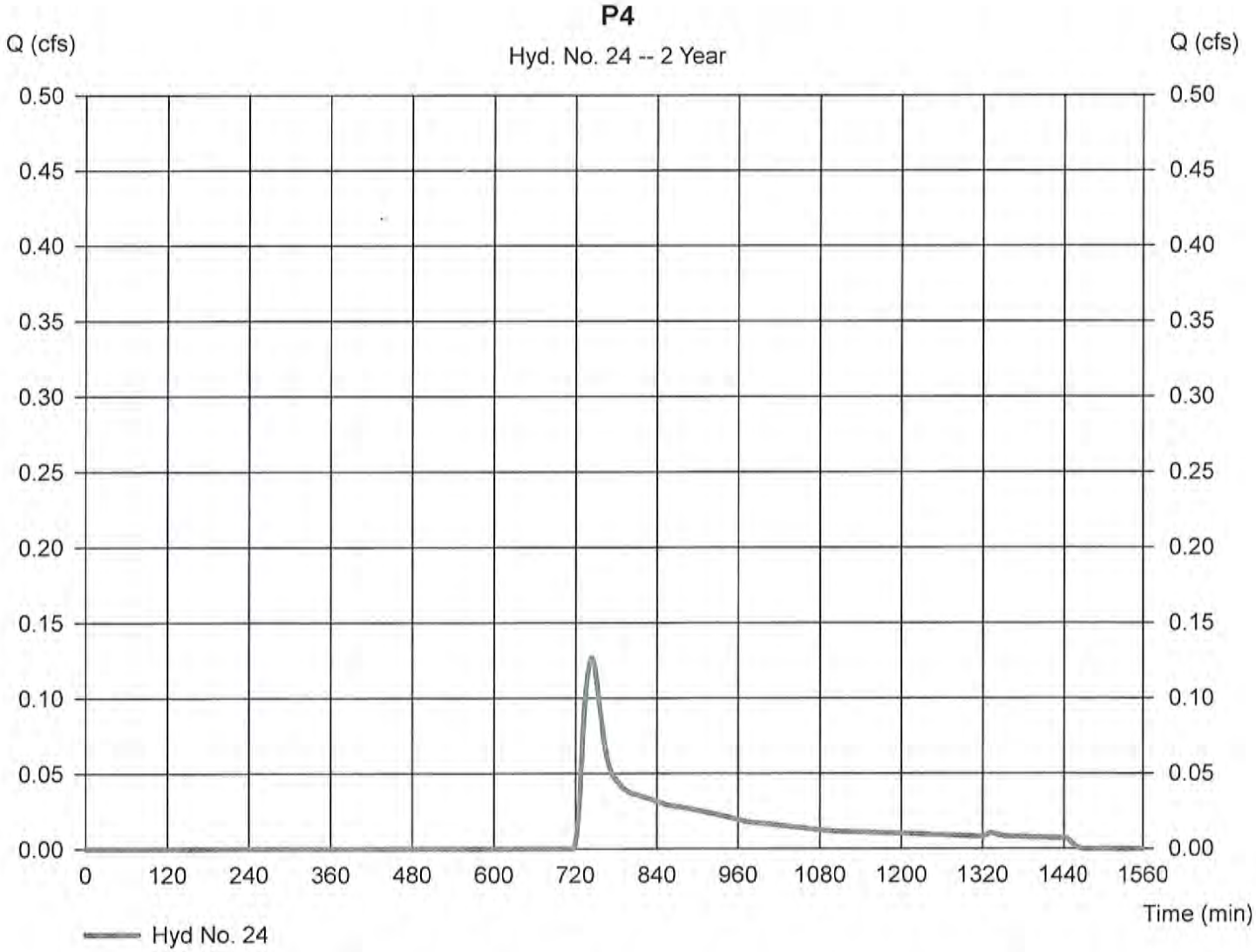
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 24

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.127 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 910 cuft
Drainage area	= 0.690 ac	Curve number	= 59.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.40 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



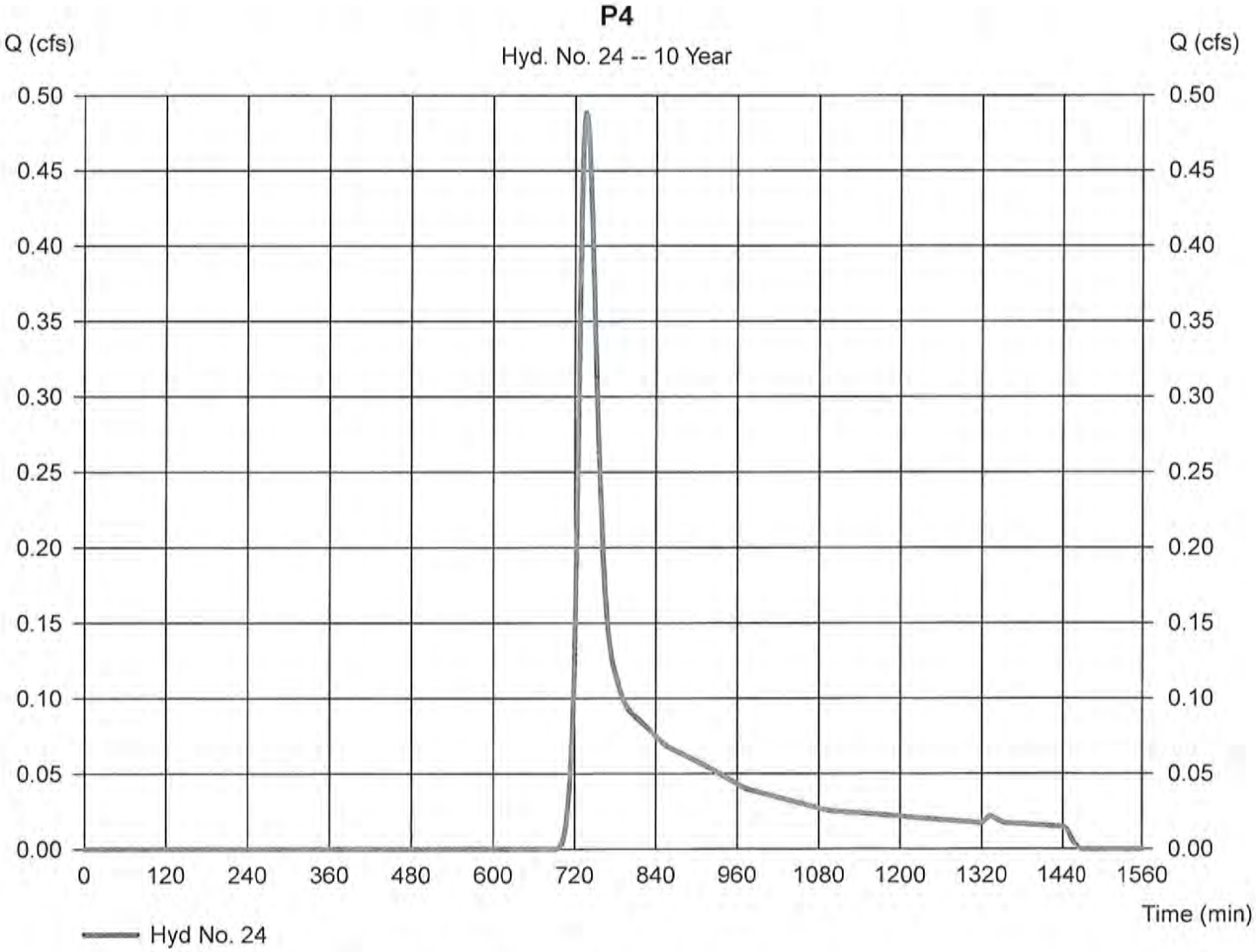
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 24

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.489 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 2,525 cuft
Drainage area	= 0.690 ac	Curve number	= 59.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.40 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



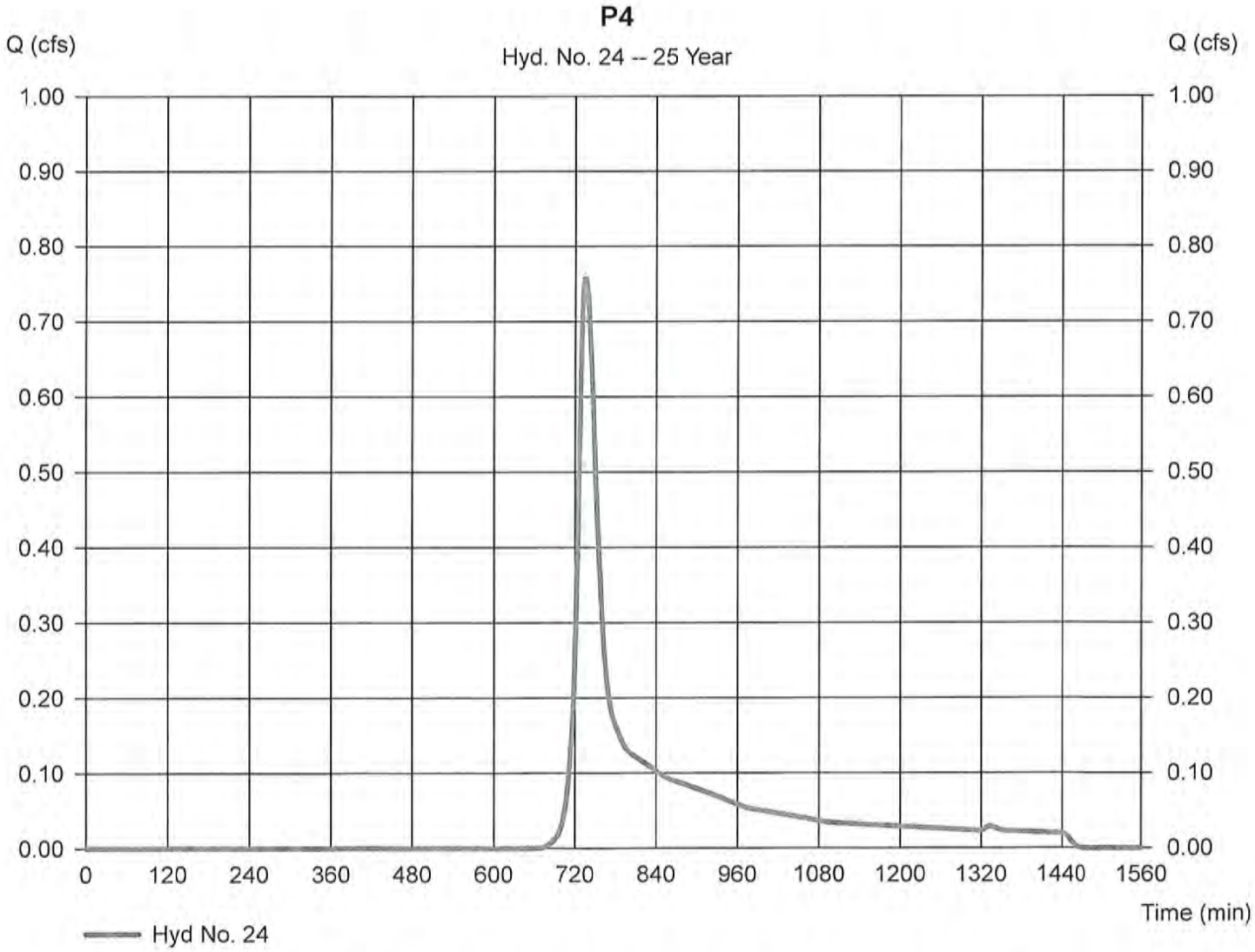
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 24

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.757 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 3,670 cuft
Drainage area	= 0.690 ac	Curve number	= 59.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.40 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



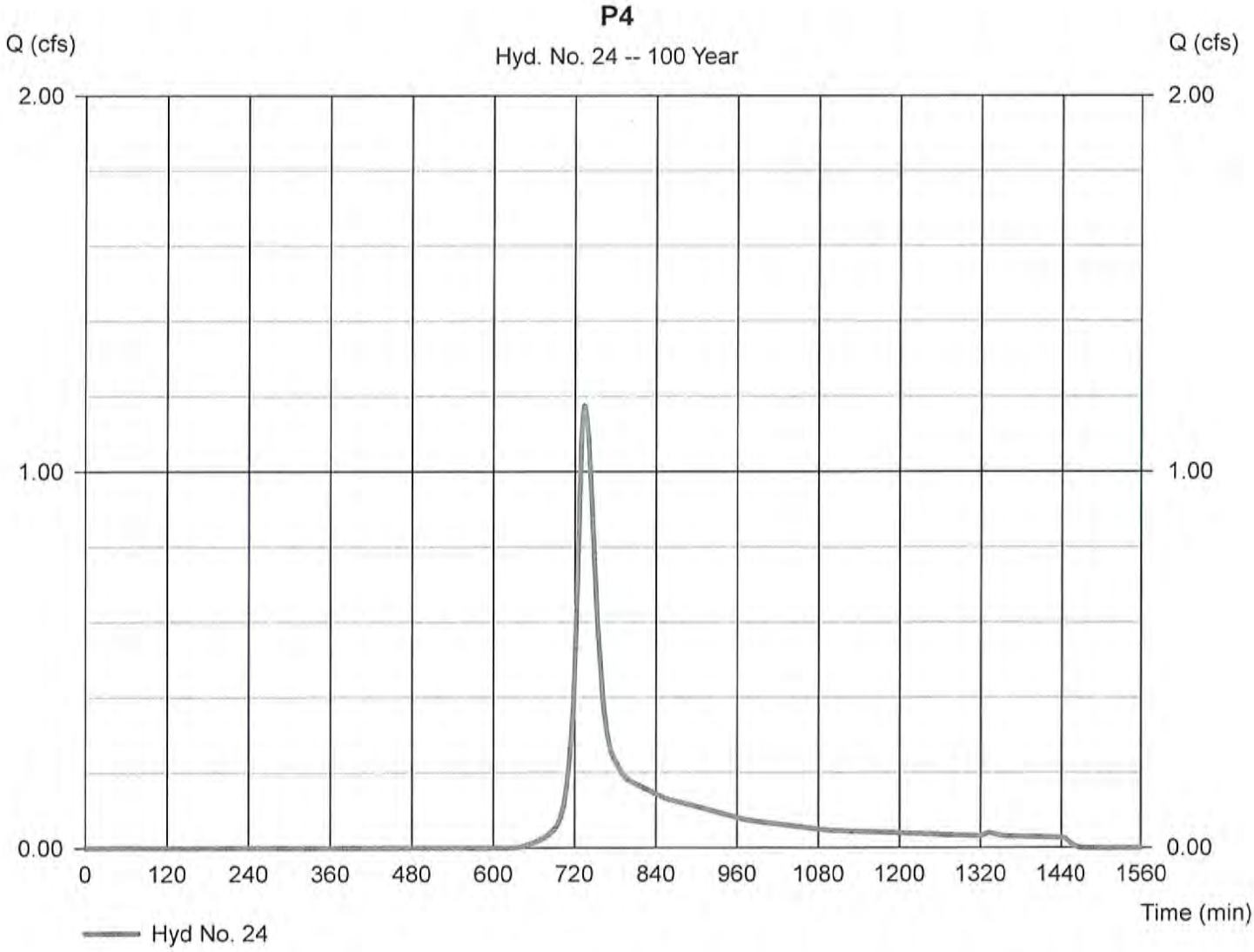
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 24

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.175 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 5,435 cuft
Drainage area	= 0.690 ac	Curve number	= 59.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 17.40 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2069**

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-4

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			0.14	7.59
B	Open- Good Condition	61			0.55	33.45
					Totals =	0.69	41.04

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{41.04}{0.69} =$ 59.79 ; Use CN = 59.8

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.36	1.01	2.17
Runoff, Q.....	cf	905	2510	5405

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2069

Project: 700-800 Mass Ave By JTM Date 11/18/2016

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present | Developed

Circle one: Tc | Tt through subarea SubcatchmentP P-4

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.02			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	26			
9. Watercourse slope, s		ft/ft	0.32			
10. Average Velocity, V (figure 3-1)		ft/s	9.13			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00

Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.29
min 17.4

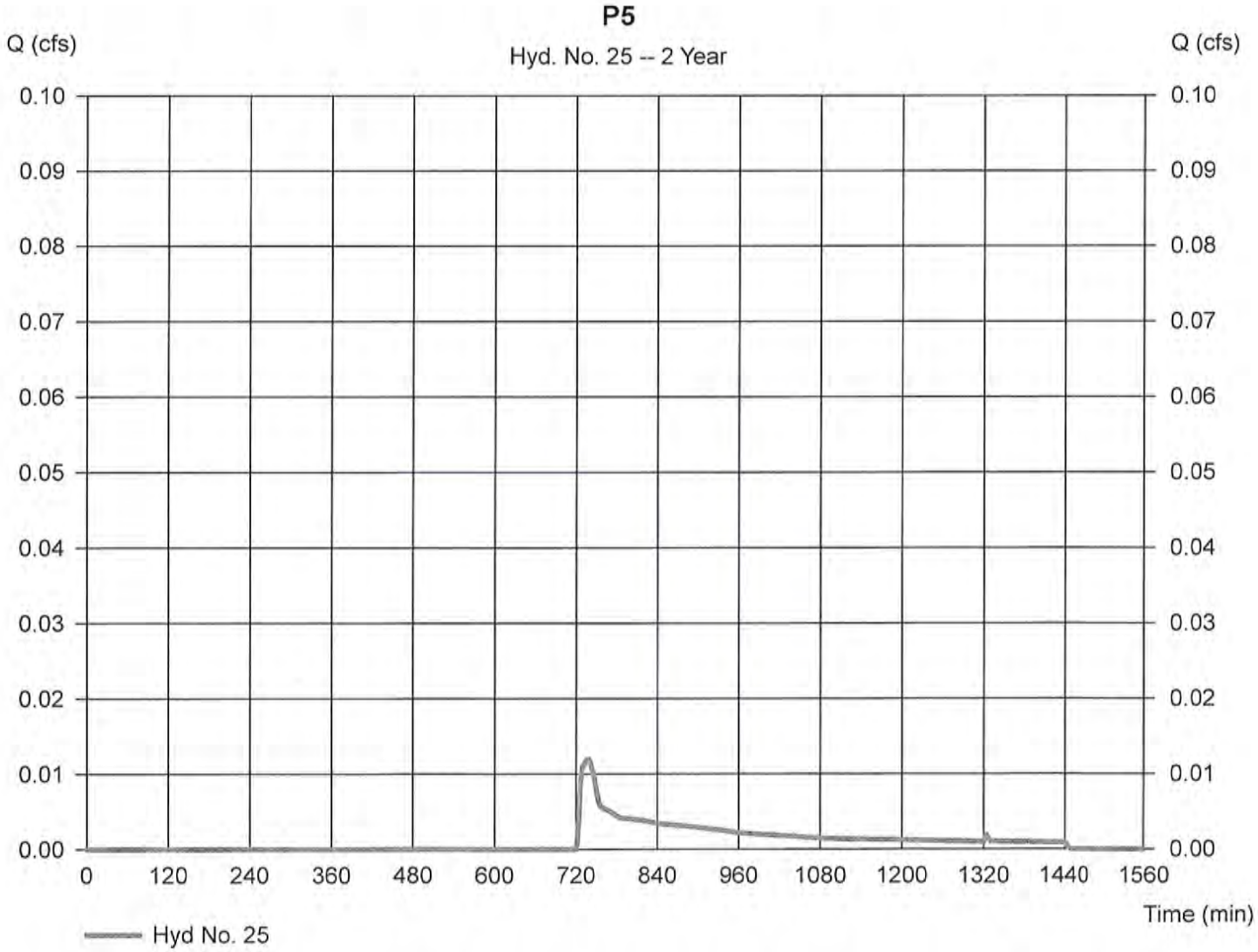
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 25

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.012 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 98 cuft
Drainage area	= 0.110 ac	Curve number	= 56.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



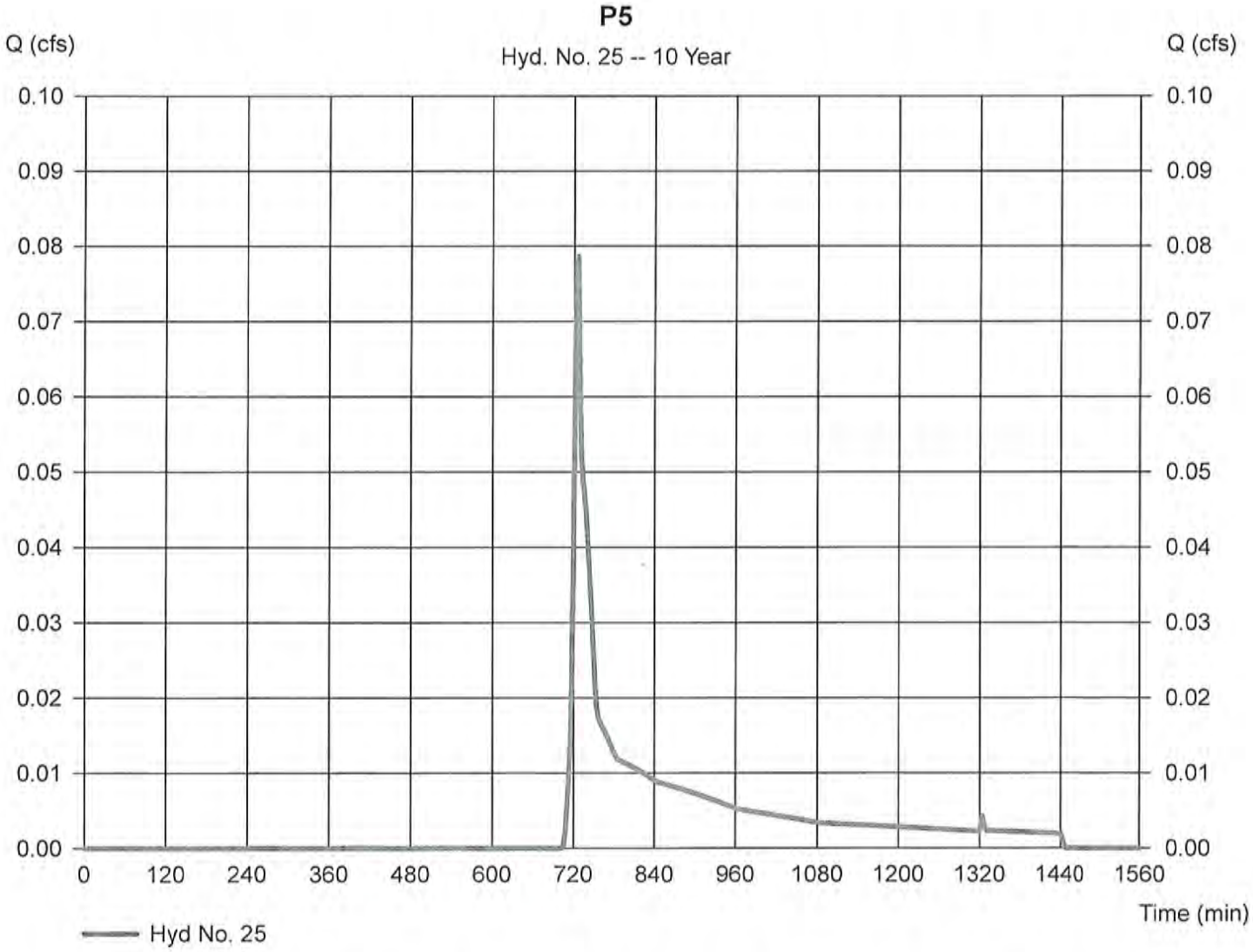
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 25

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.079 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 308 cuft
Drainage area	= 0.110 ac	Curve number	= 56.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



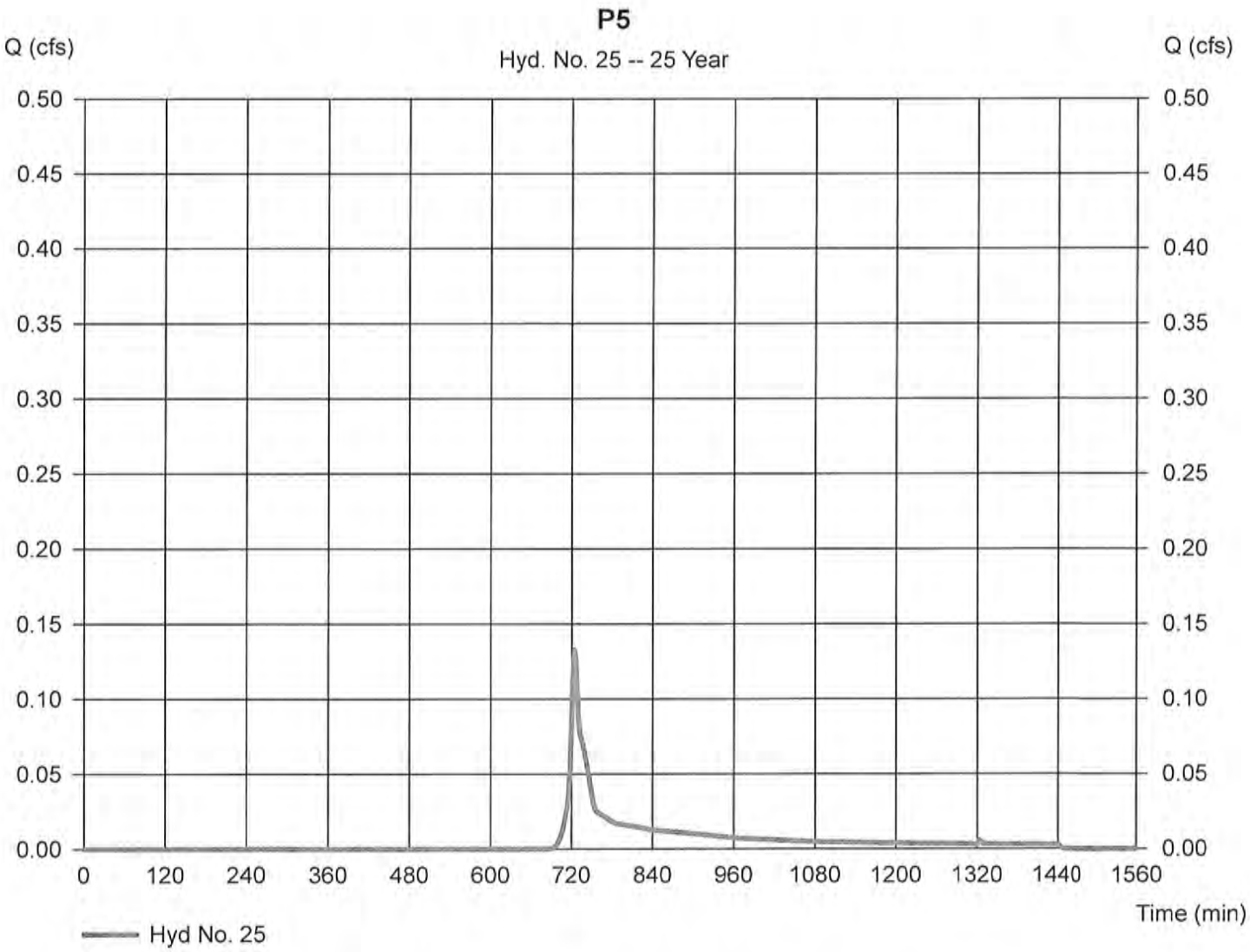
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 25

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.133 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 462 cuft
Drainage area	= 0.110 ac	Curve number	= 56.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



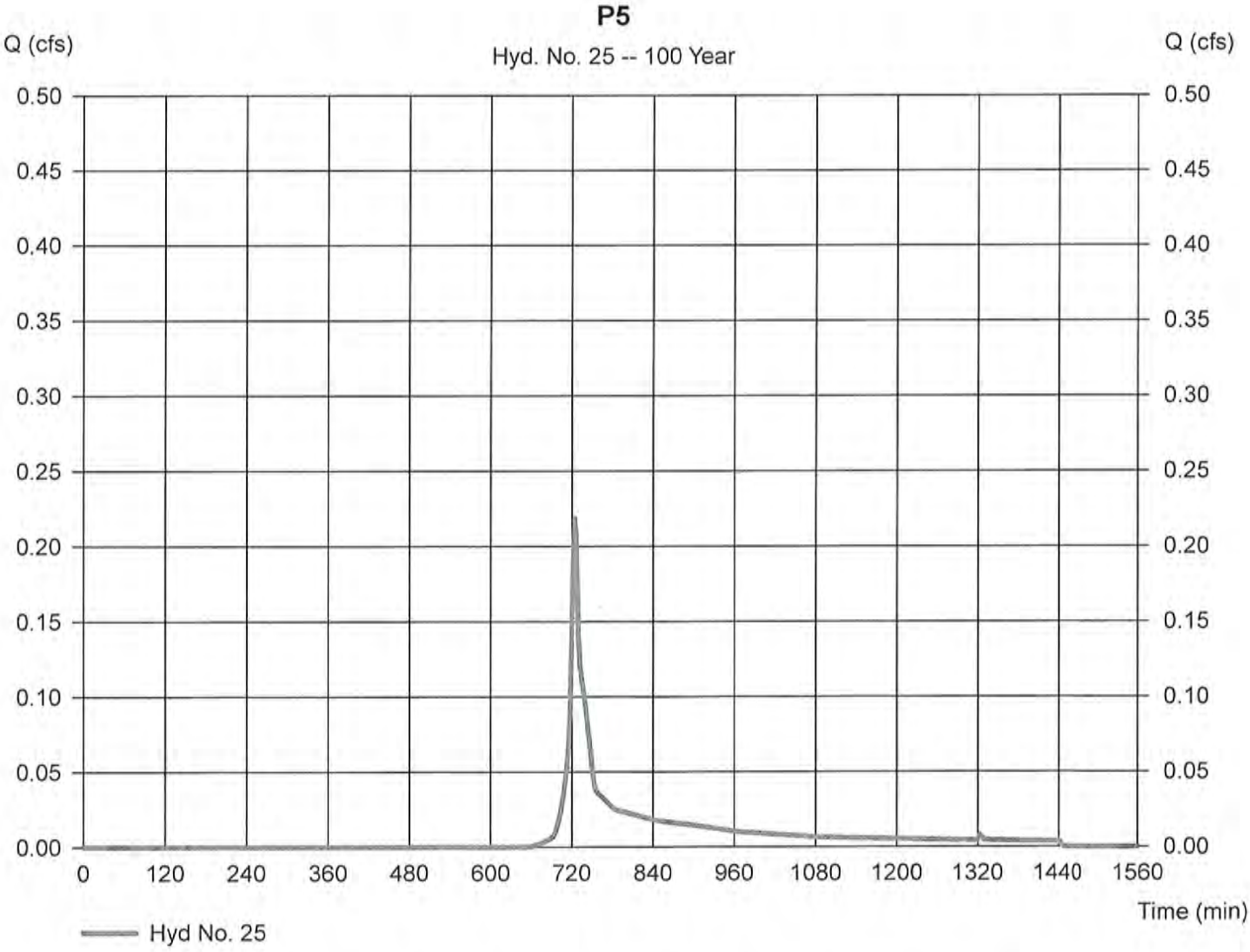
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 25

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.219 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 704 cuft
Drainage area	= 0.110 ac	Curve number	= 56.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2069**

Project: 700-800 Mass Ave By JTM Date 11/18/16

Location: Boxborough, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-5

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
B	Woods- Good Condition	55			0.08	4.56
B	Open- Good Condition	61			0.03	1.64
				Totals =	0.11	6.21

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{6.21}{0.11} =$ 56.47 ; Use CN = 56.5

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.26	0.82	1.88
Runoff, Q.....	cf	105	327	749

D-2 (210-VI-TR-55, Second Ed., June 1986)

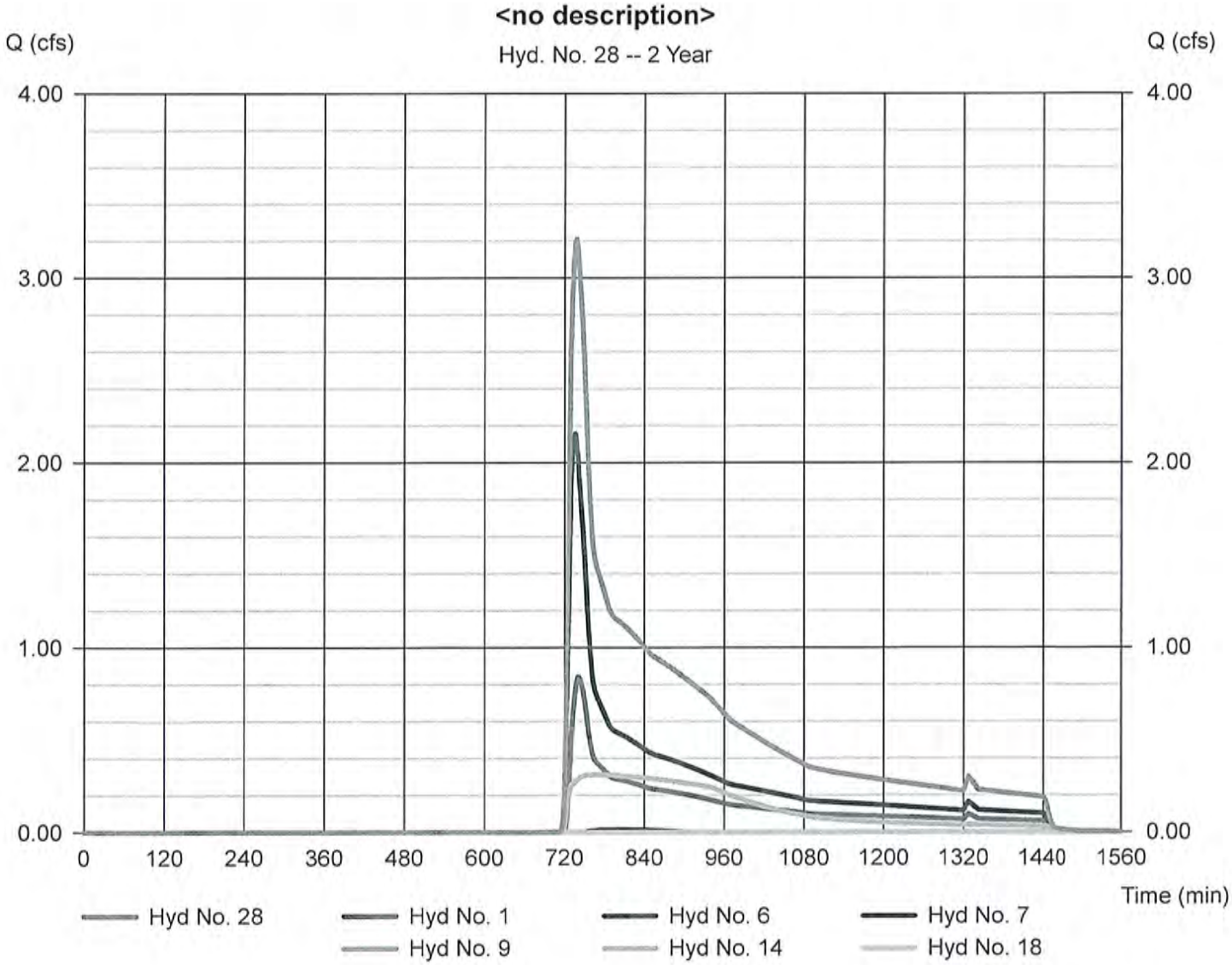
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Wednesday, Dec 21, 2016

Hyd. No. 28

<no description>

Hydrograph type	= Combine	Peak discharge	= 3.210 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 26,764 cuft
Inflow hyds.	= 1, 6, 7, 9, 14, 18	Contrib. drain. area	= 16.070 ac



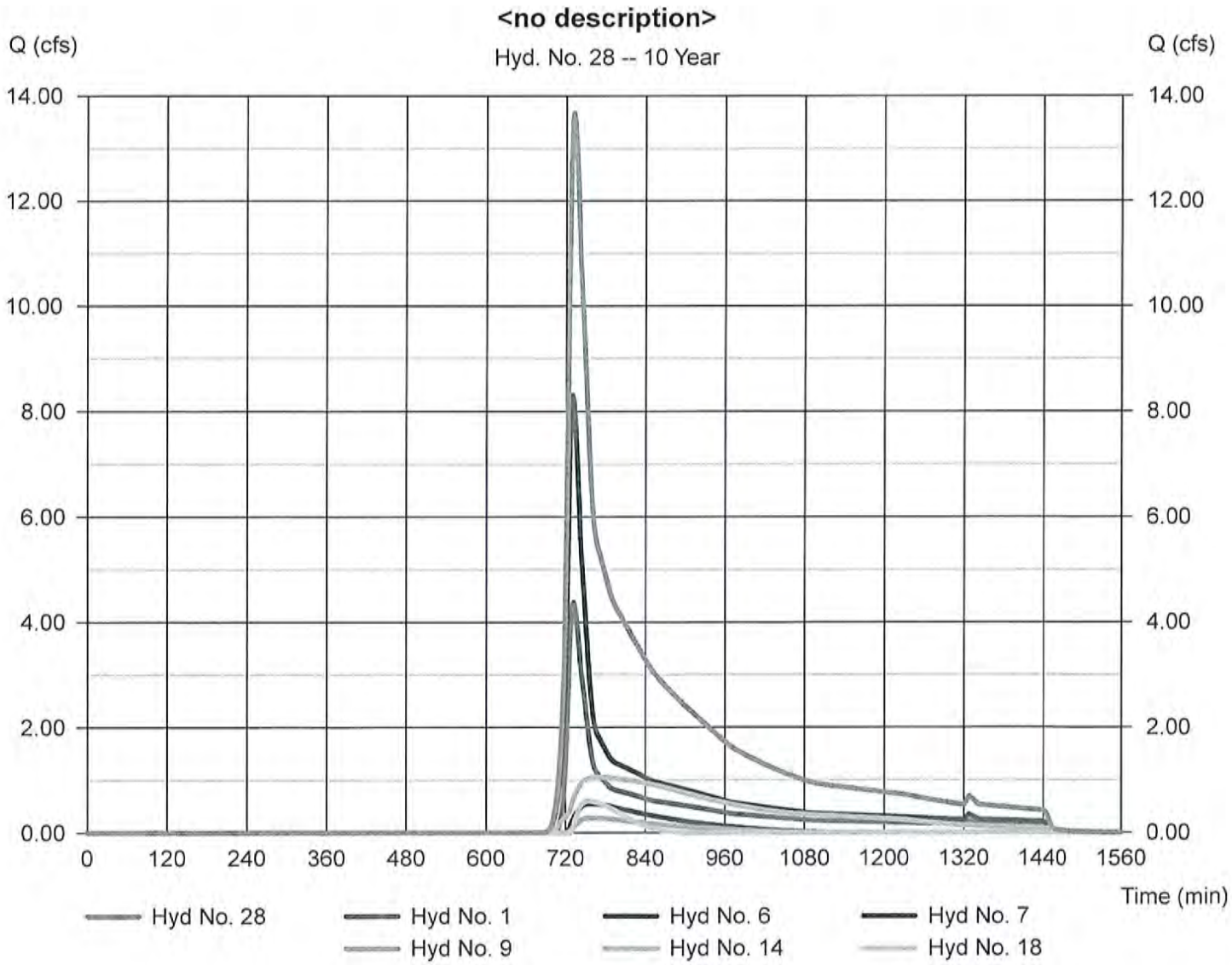
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Wednesday, Dec 21, 2016

Hyd. No. 28

<no description>

Hydrograph type	= Combine	Peak discharge	= 13.67 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 88,656 cuft
Inflow hyds.	= 1, 6, 7, 9, 14, 18	Contrib. drain. area	= 16.070 ac



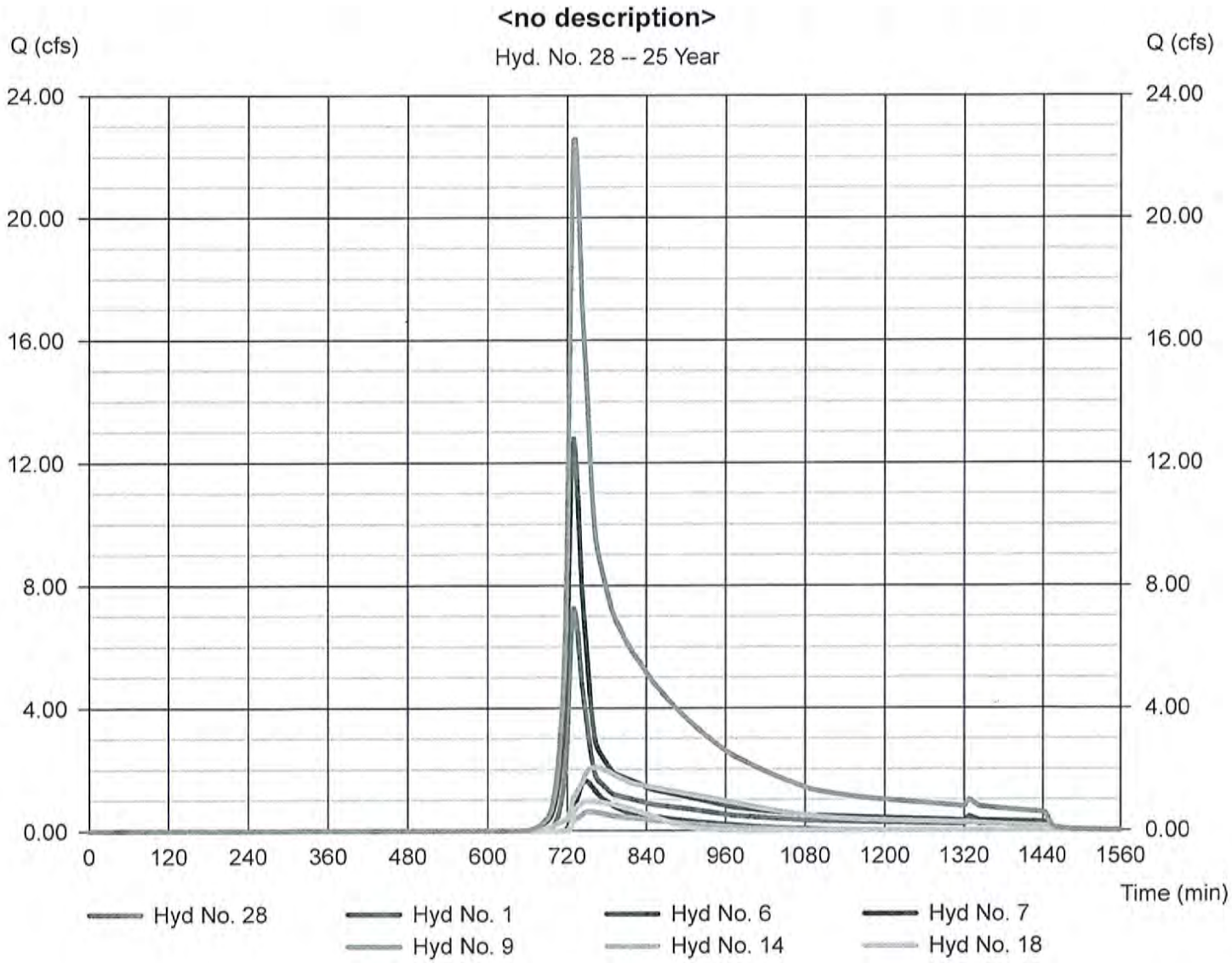
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 28

<no description>

Hydrograph type	= Combine	Peak discharge	= 22.56 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 139,386 cuft
Inflow hyds.	= 1, 6, 7, 9, 14, 18	Contrib. drain. area	= 16.070 ac



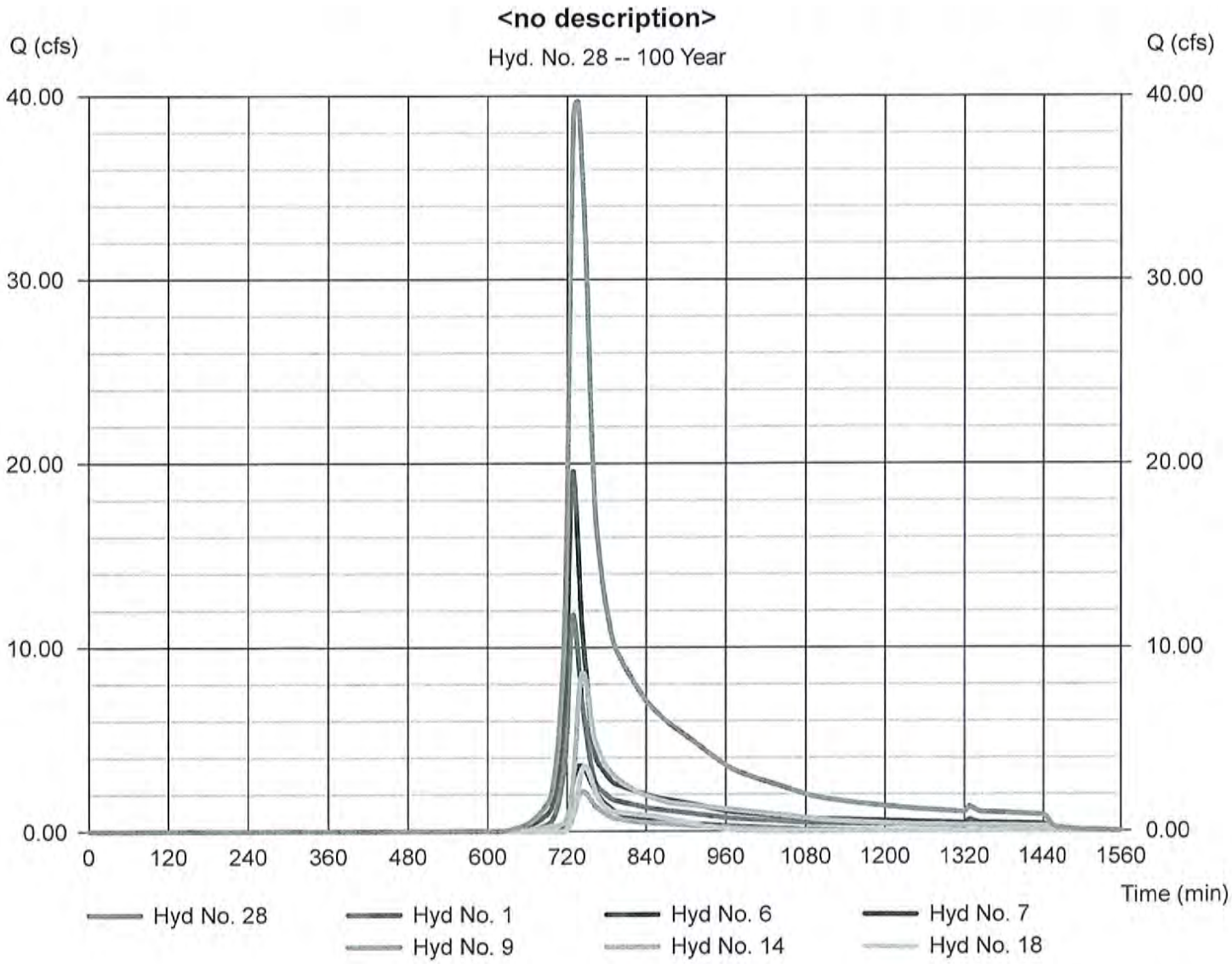
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 Wednesday, Dec 21, 2016

Hyd. No. 28

<no description>

Hydrograph type	= Combine	Peak discharge	= 39.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 223,458 cuft
Inflow hyds.	= 1, 6, 7, 9, 14, 18	Contrib. drain. area	= 16.070 ac



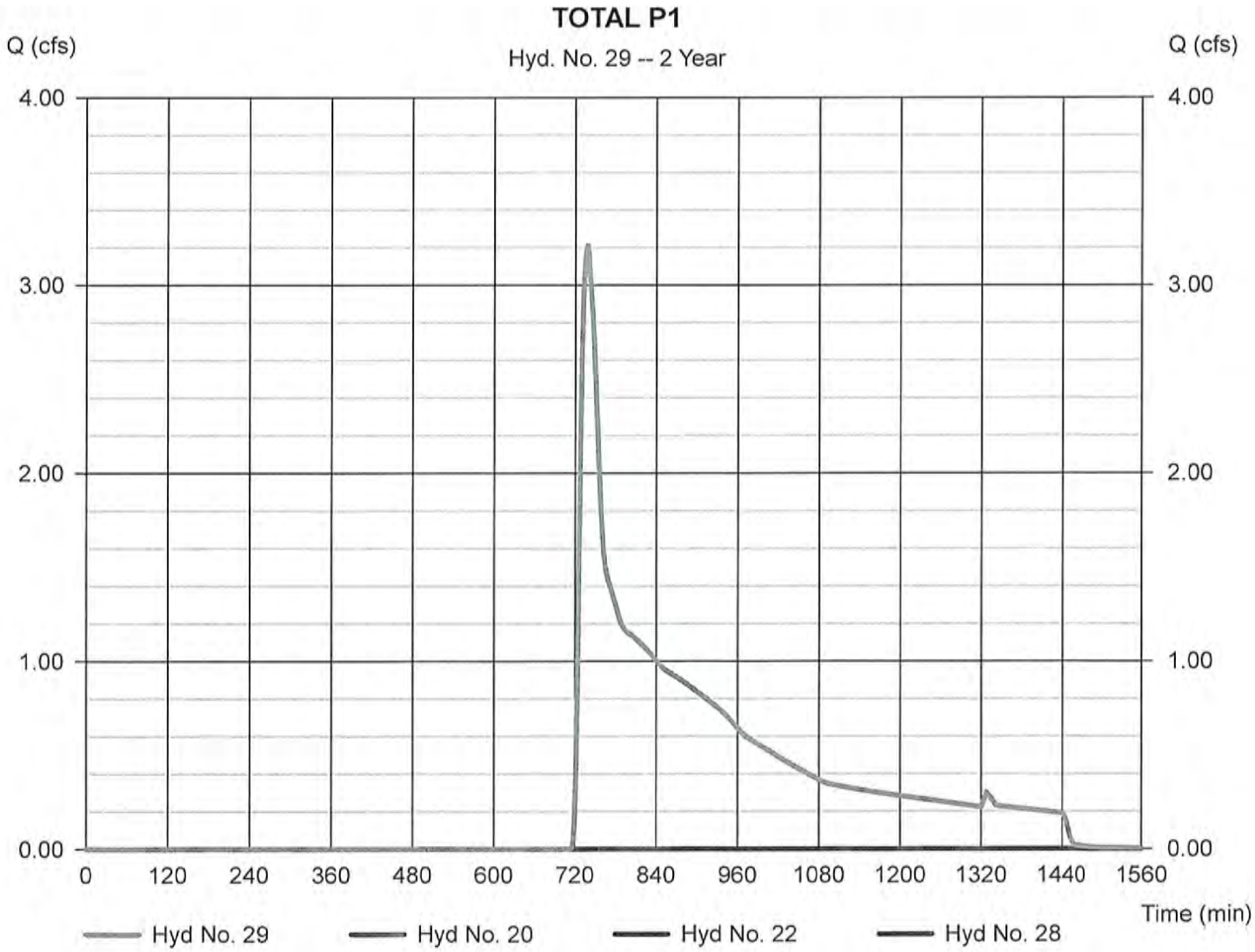
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 29

TOTAL P1

Hydrograph type	= Combine	Peak discharge	= 3.210 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 26,764 cuft
Inflow hyds.	= 20, 22, 28	Contrib. drain. area	= 0.000 ac



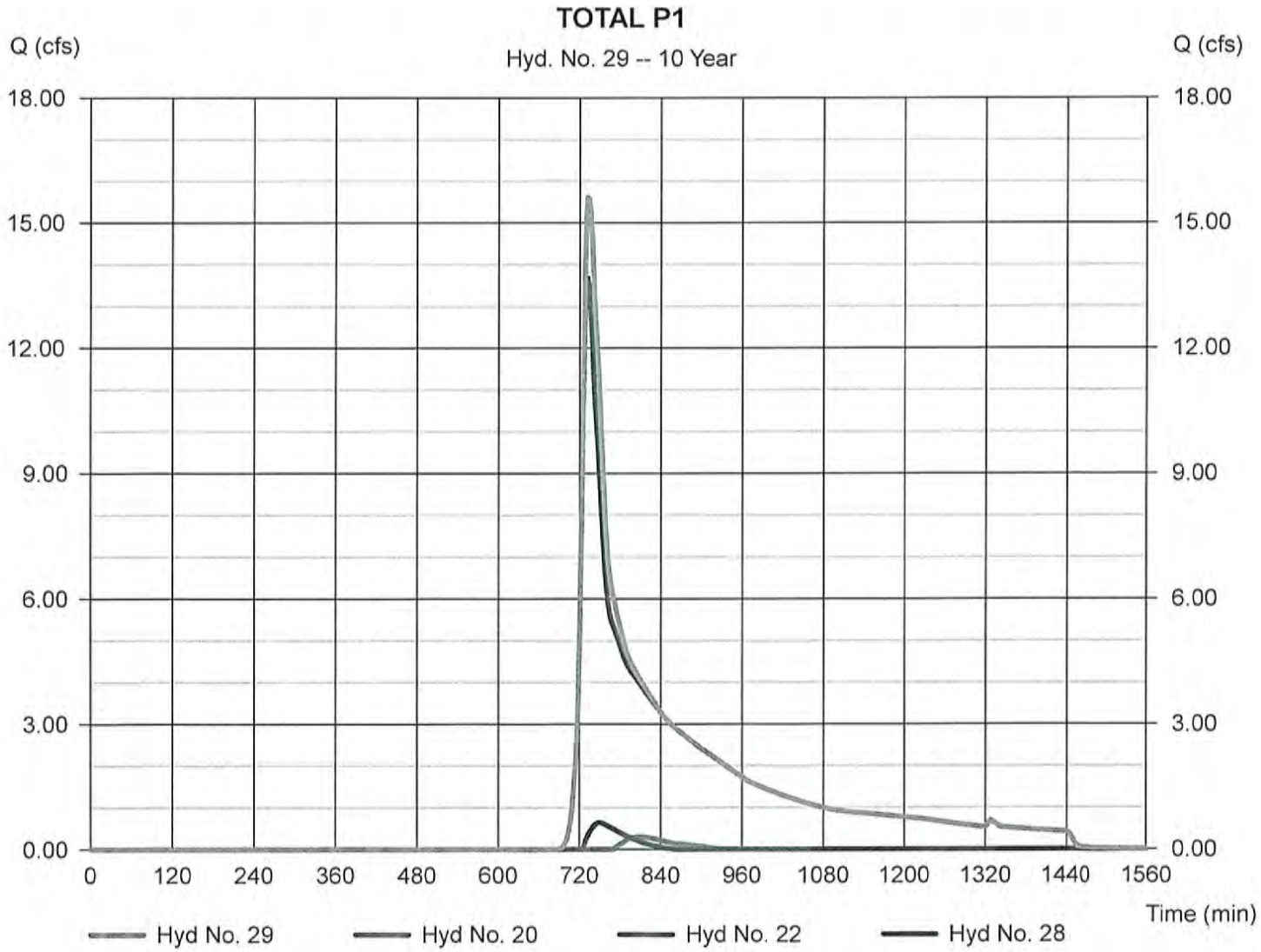
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 29

TOTAL P1

Hydrograph type	= Combine	Peak discharge	= 15.61 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 93,756 cuft
Inflow hyds.	= 20, 22, 28	Contrib. drain. area	= 0.000 ac



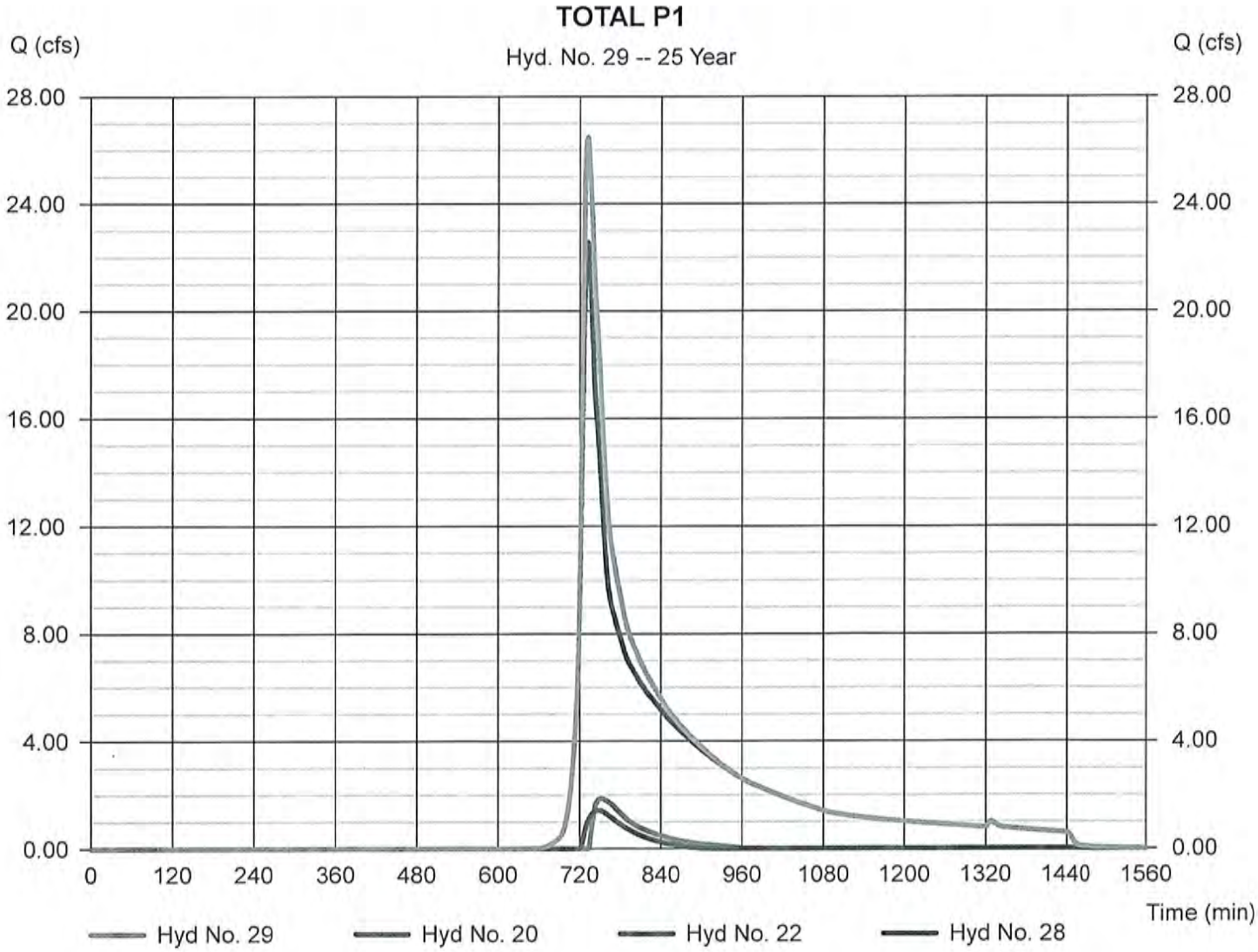
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 29

TOTAL P1

Hydrograph type	= Combine	Peak discharge	= 26.47 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 153,344 cuft
Inflow hyds.	= 20, 22, 28	Contrib. drain. area	= 0.000 ac



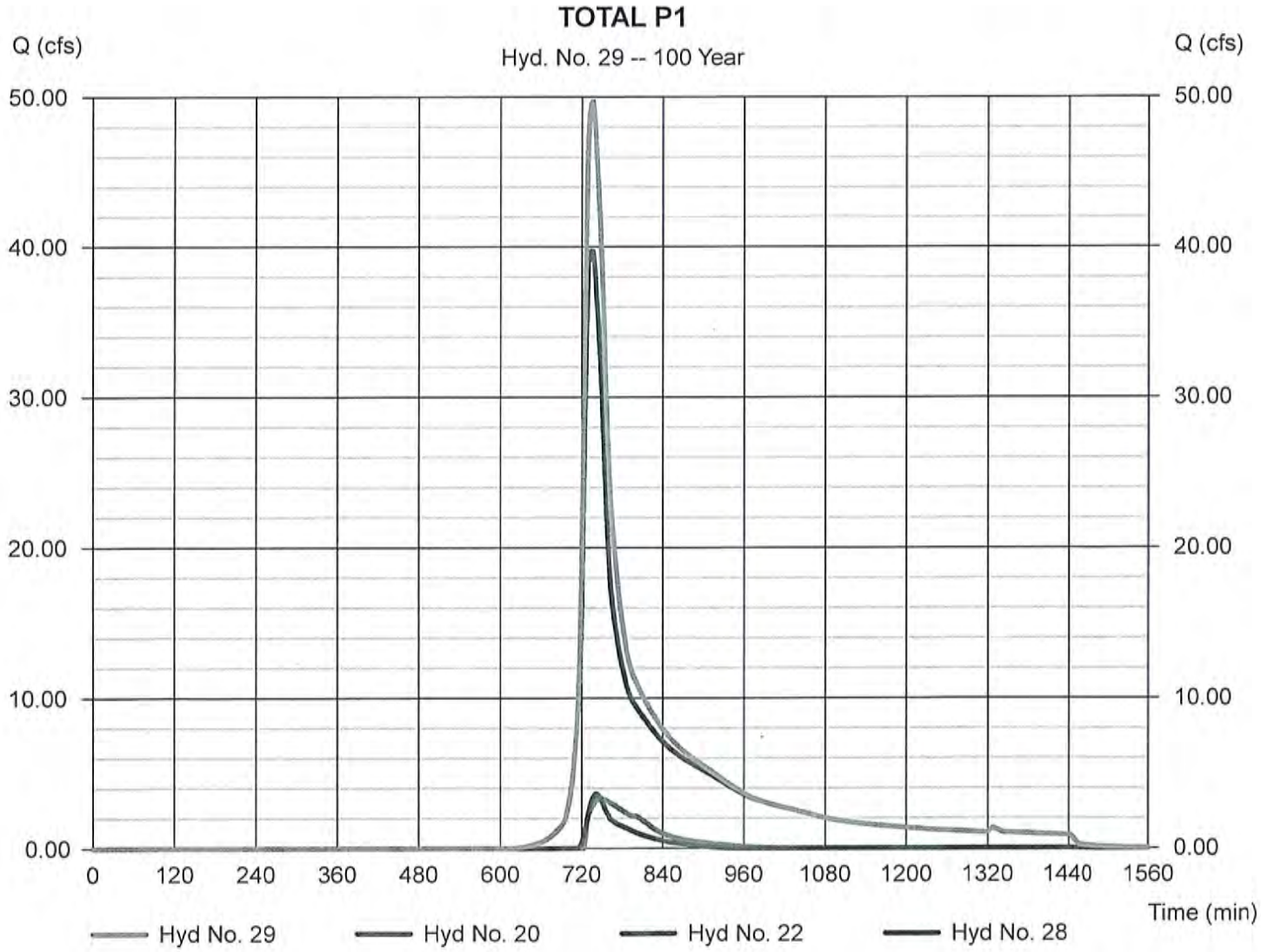
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 29

TOTAL P1

Hydrograph type	= Combine	Peak discharge	= 49.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 255,713 cuft
Inflow hyds.	= 20, 22, 28	Contrib. drain. area	= 0.000 ac



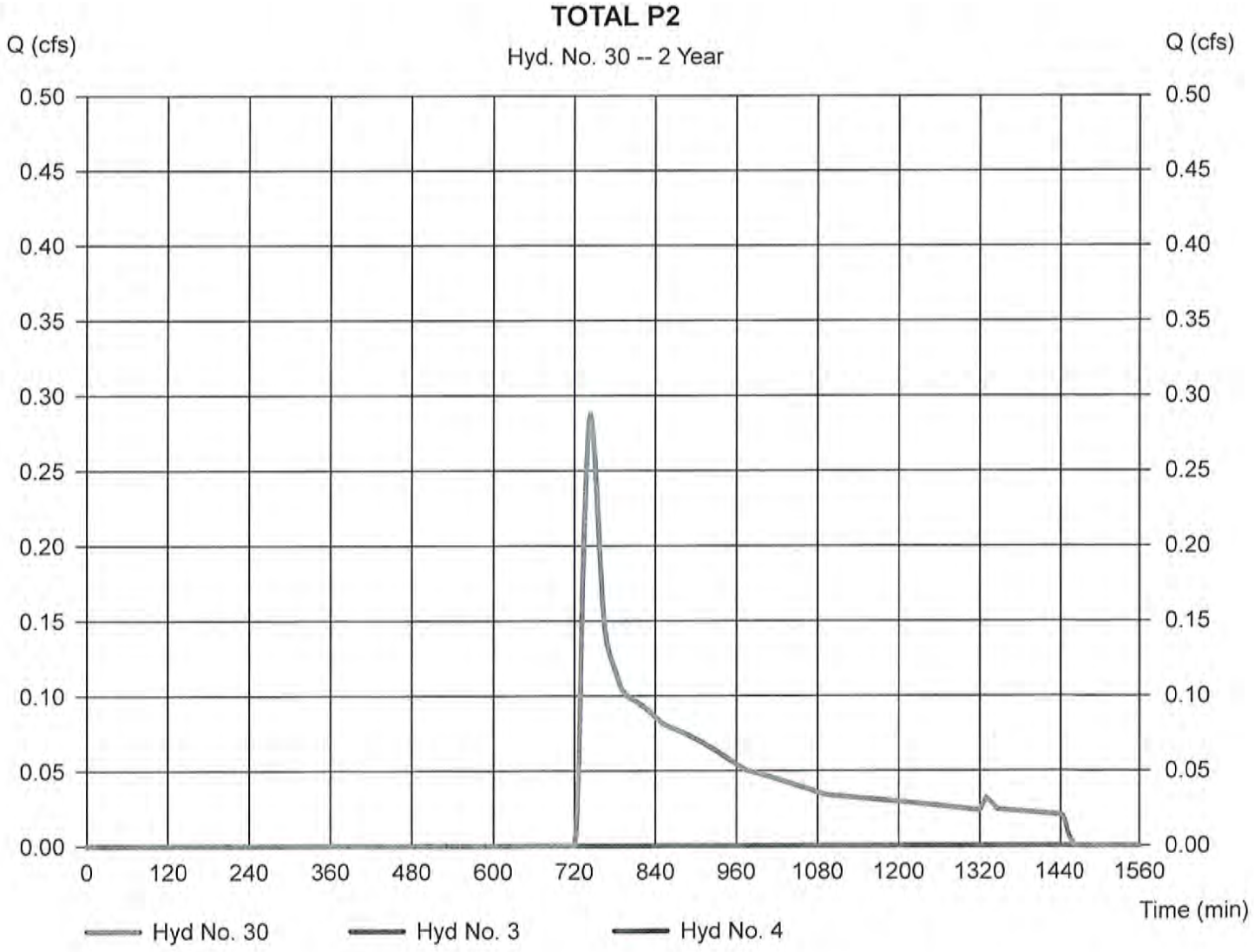
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 30

TOTAL P2

Hydrograph type	= Combine	Peak discharge	= 0.287 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 2,392 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.440 ac



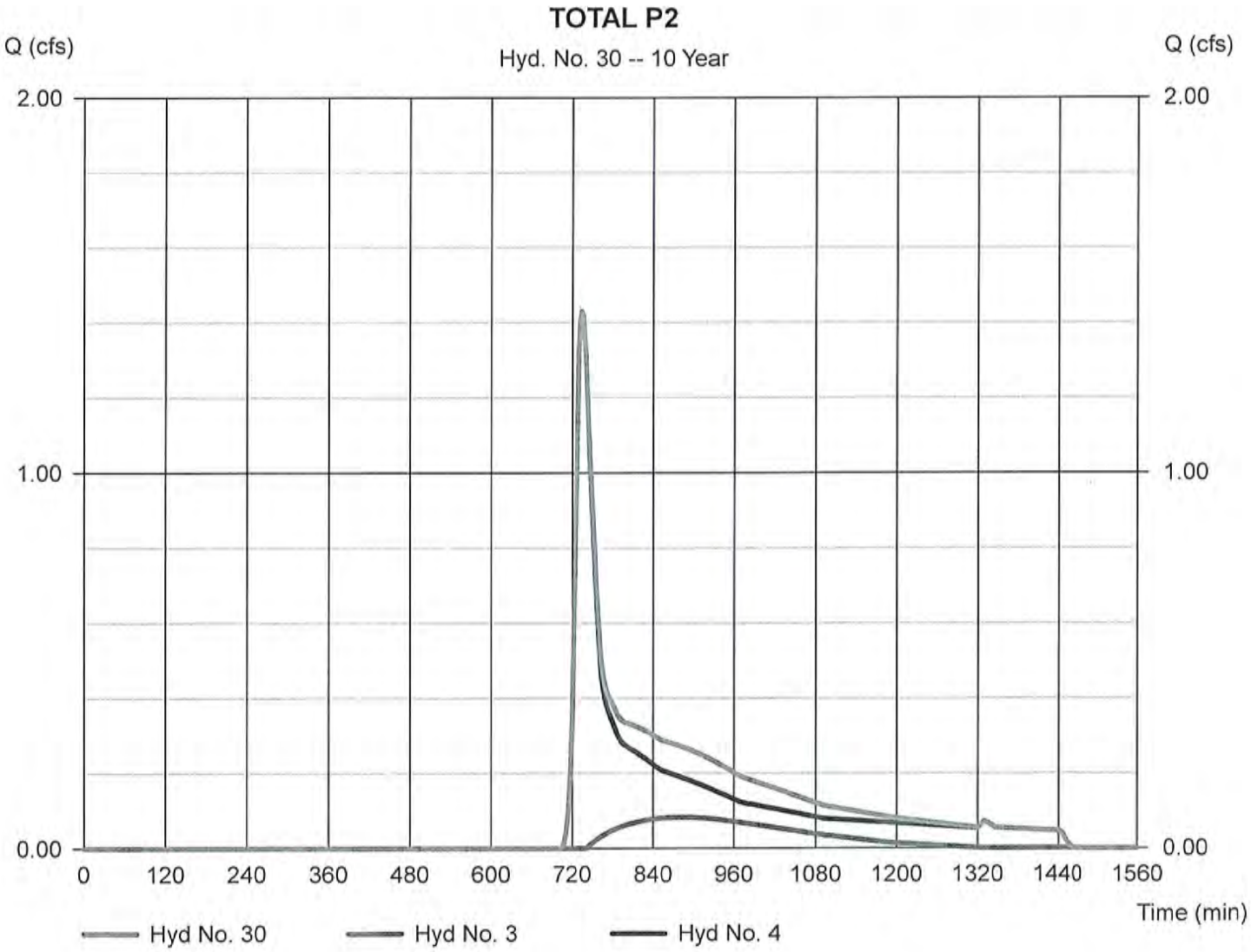
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 30

TOTAL P2

Hydrograph type	= Combine	Peak discharge	= 1.429 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 8,818 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.440 ac



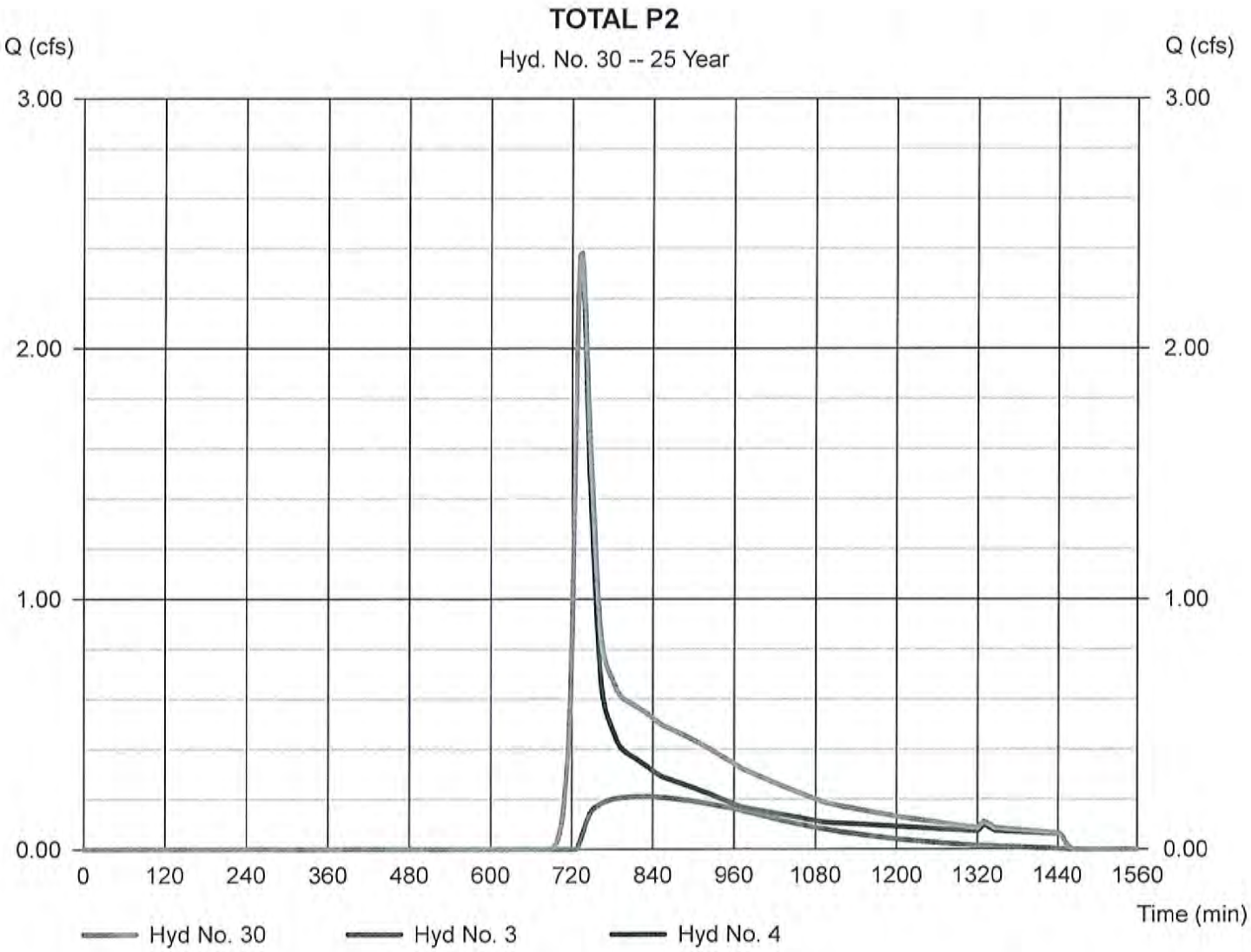
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 30

TOTAL P2

Hydrograph type	= Combine	Peak discharge	= 2.381 cfs
Storm frequency	= 25 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 15,052 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.440 ac



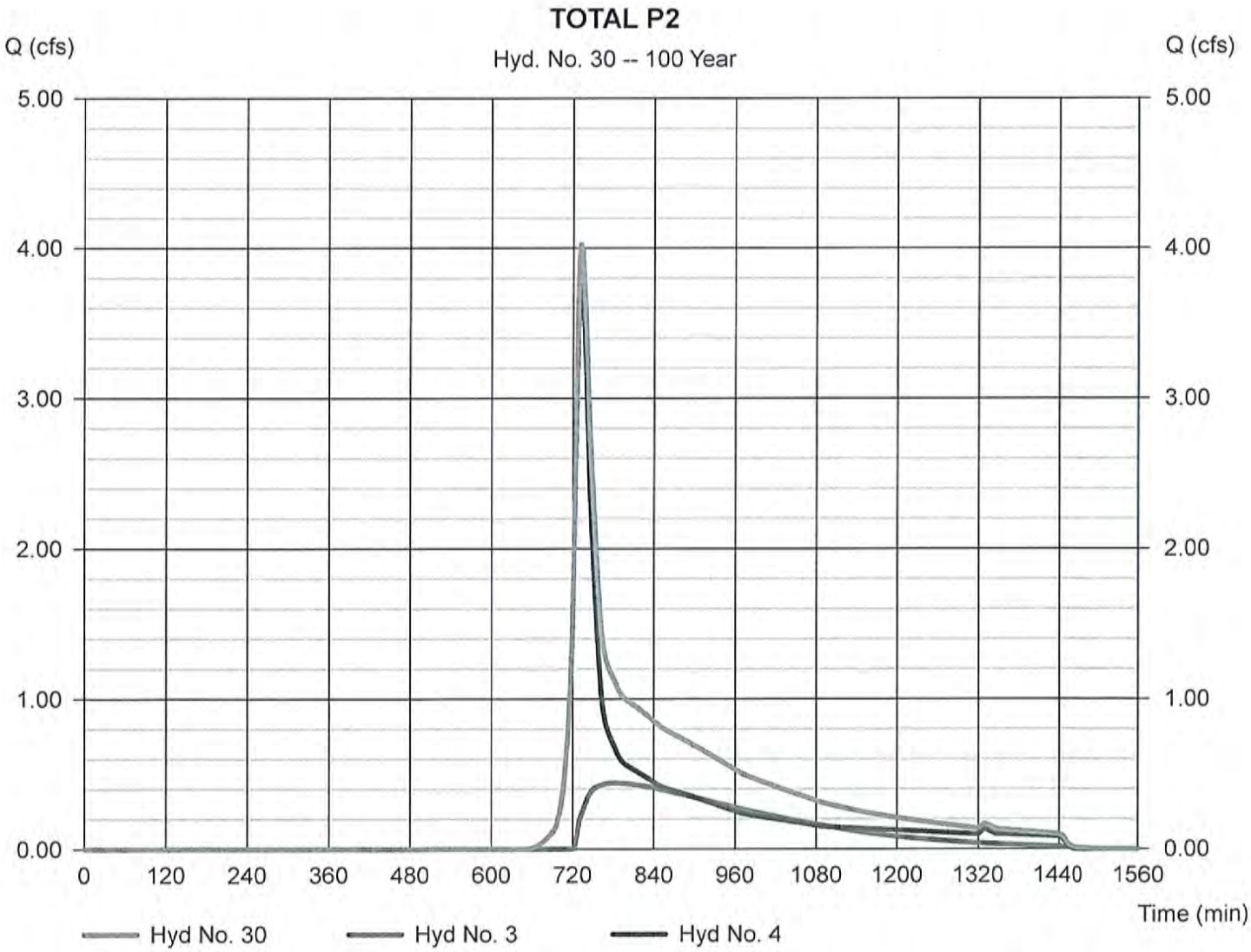
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 30

TOTAL P2

Hydrograph type	= Combine	Peak discharge	= 4.021 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 24,866 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 2.440 ac



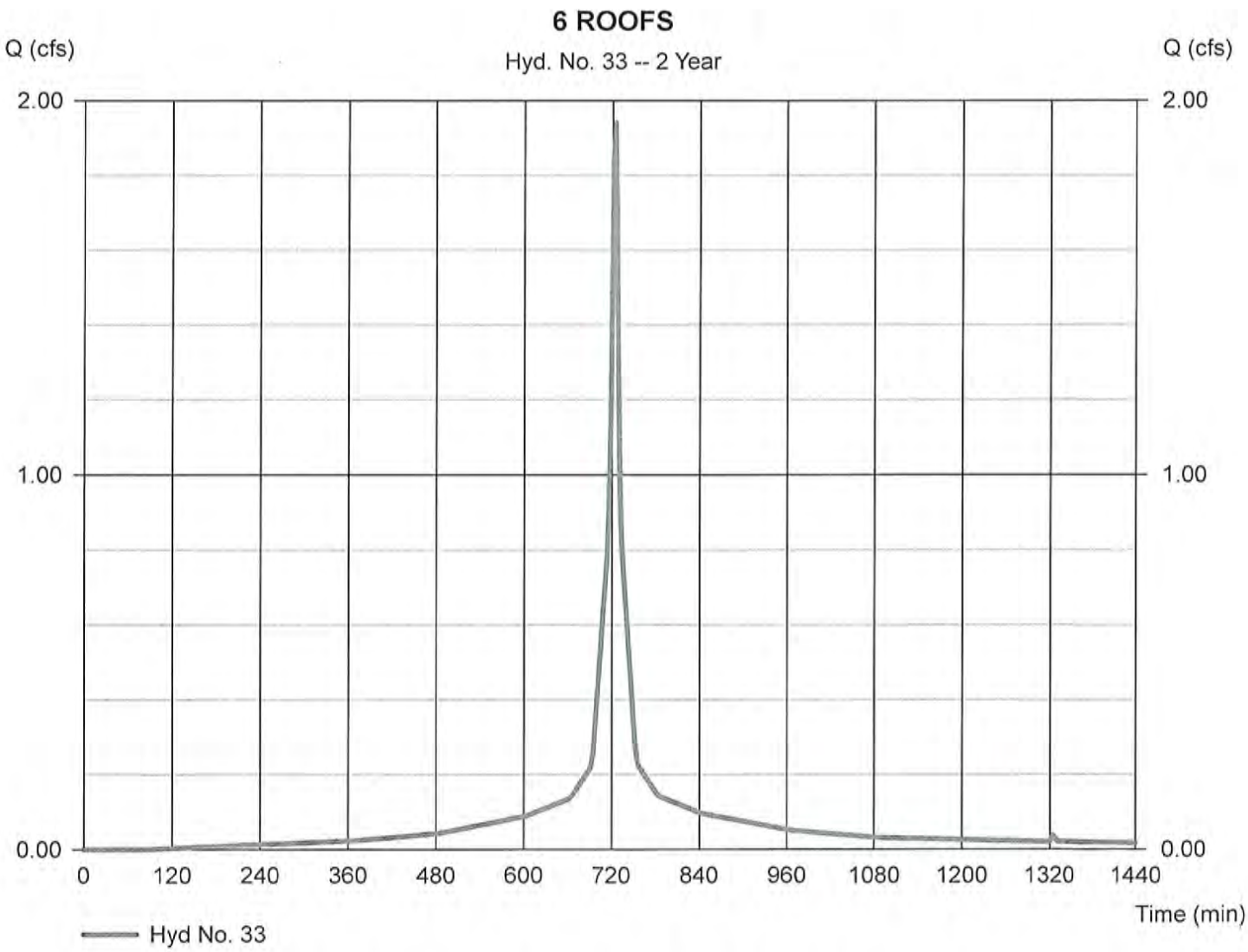
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 33

6 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 1.942 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,539 cuft
Drainage area	= 0.670 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



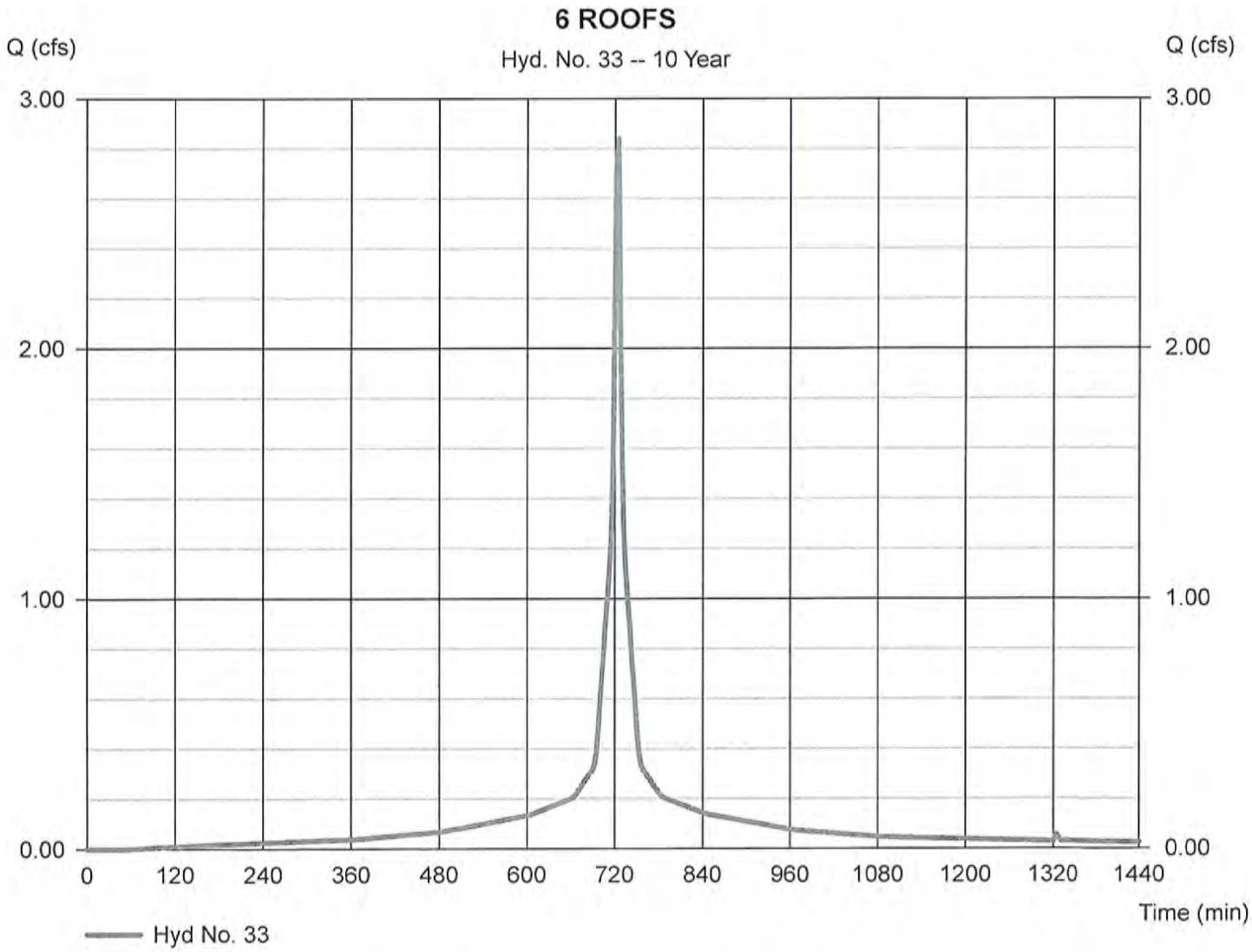
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 33

6 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 2.840 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 9,722 cuft
Drainage area	= 0.670 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



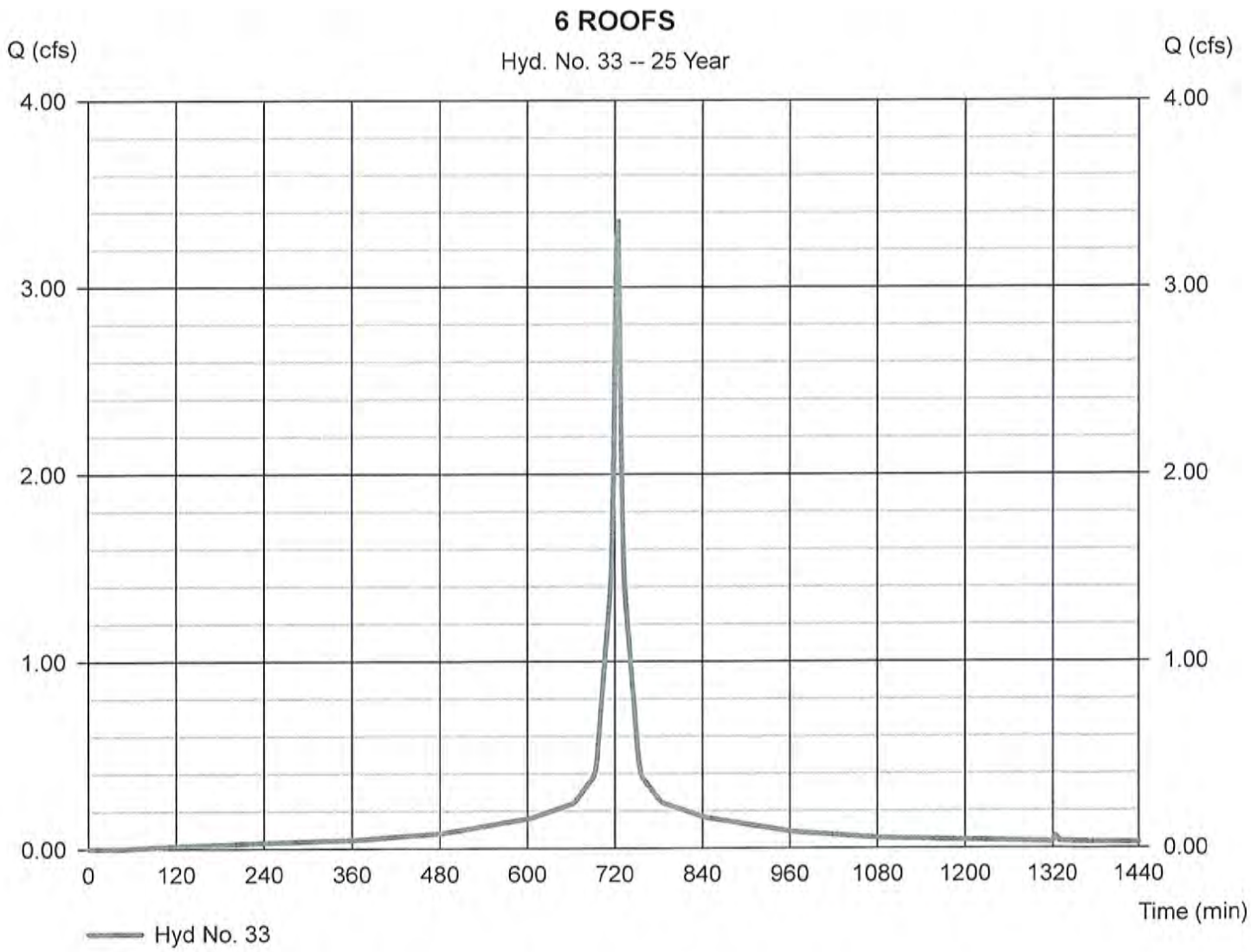
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 33

6 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 3.351 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,544 cuft
Drainage area	= 0.670 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



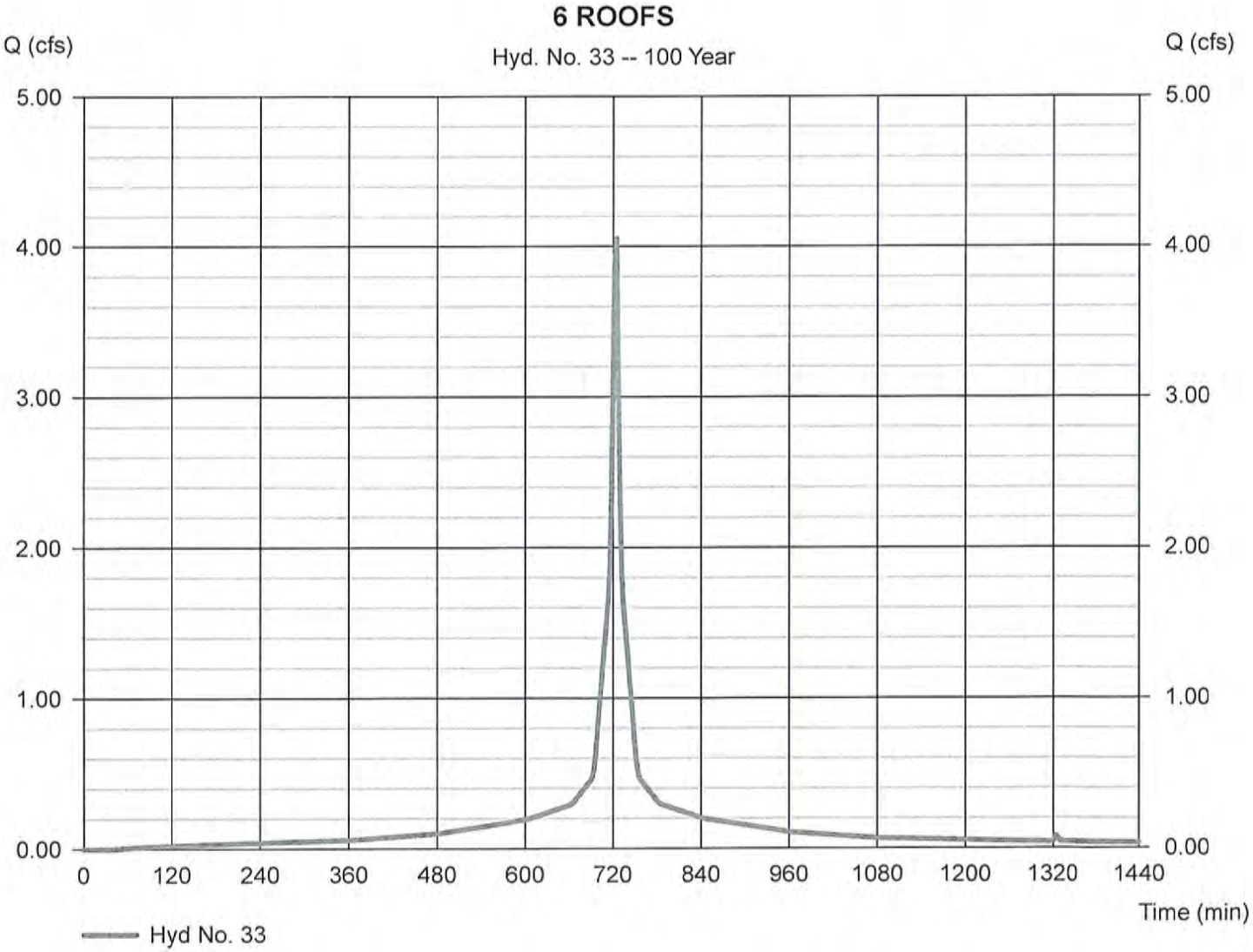
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 33

6 ROOFS

Hydrograph type	= SCS Runoff	Peak discharge	= 4.053 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 14,049 cuft
Drainage area	= 0.670 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

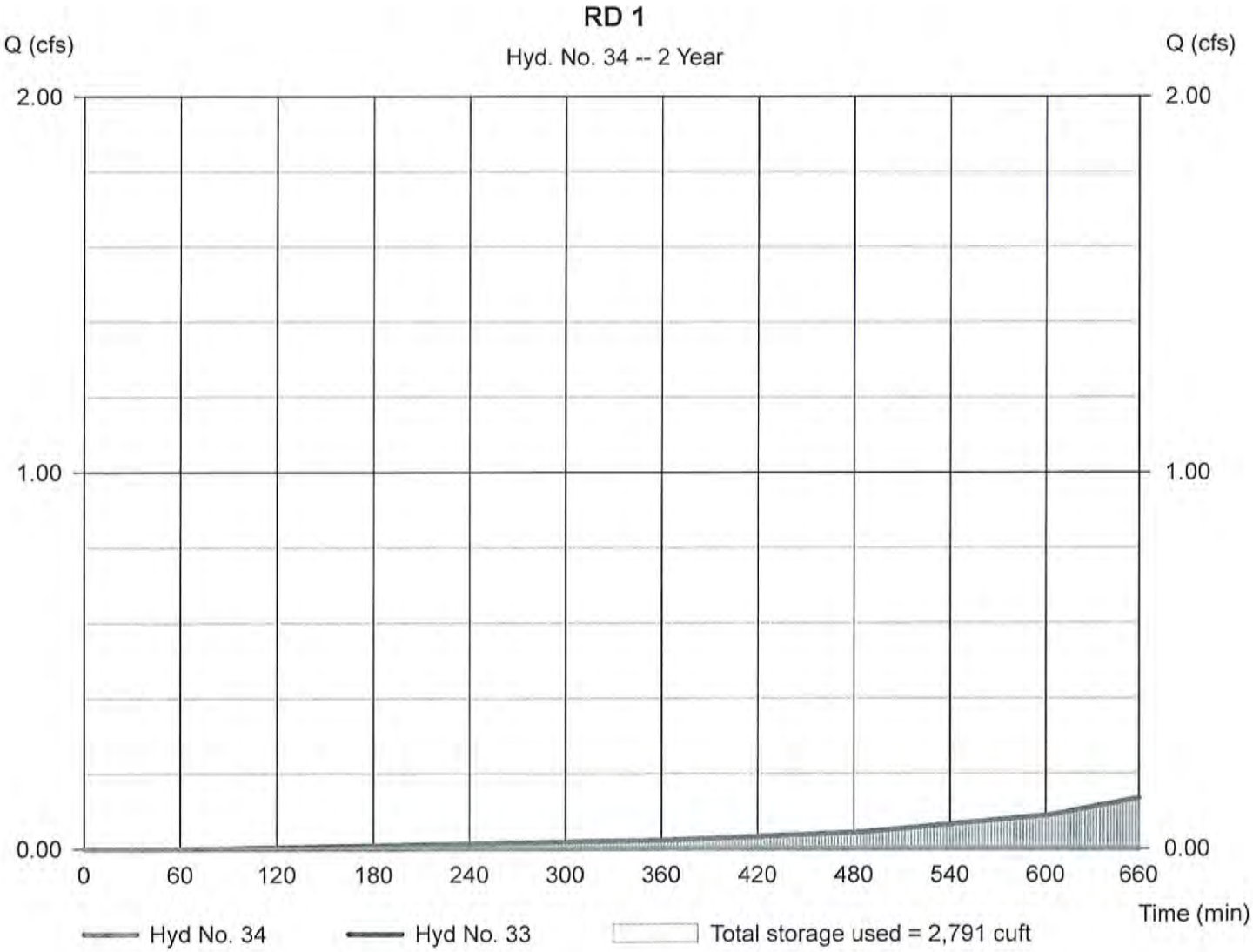
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 34

RD 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 604 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 33 - 6 ROOFS	Max. Elevation	= 316.51 ft
Reservoir name	= RD 1	Max. Storage	= 2,791 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

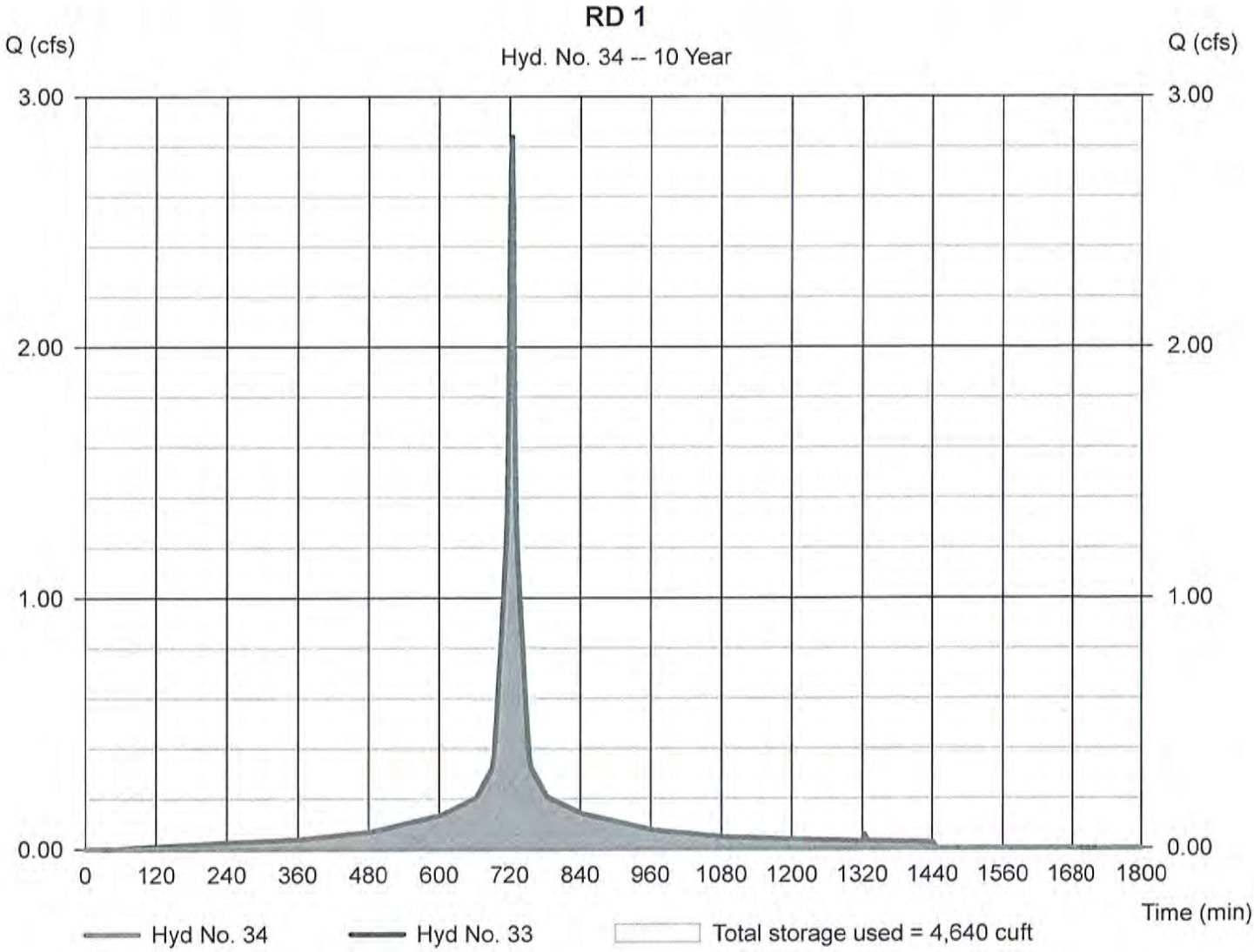
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 34

RD 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 524 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 33 - 6 ROOFS	Max. Elevation	= 317.86 ft
Reservoir name	= RD 1	Max. Storage	= 4,640 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

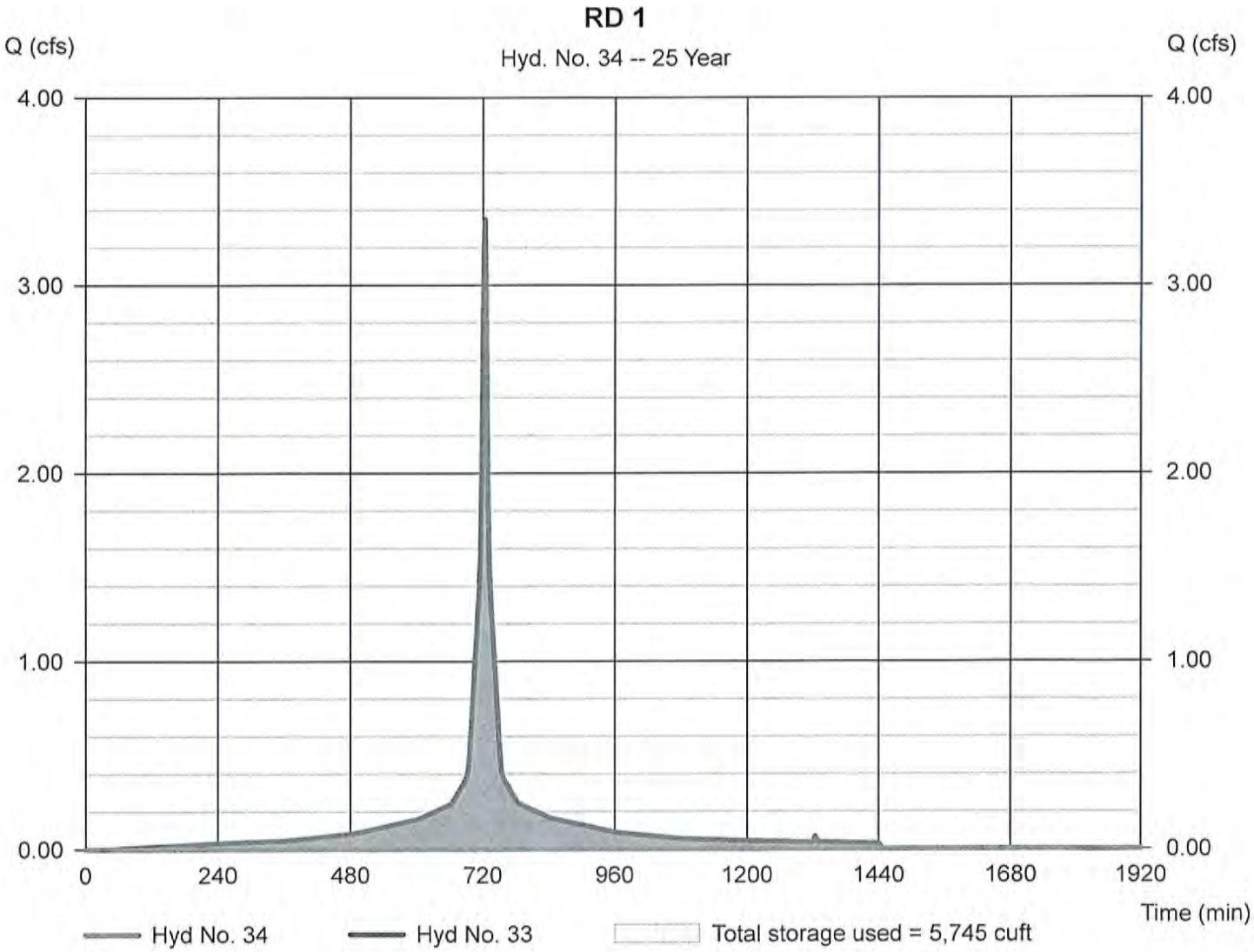
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 34

RD 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 496 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 33 - 6 ROOFS	Max. Elevation	= 318.75 ft
Reservoir name	= RD 1	Max. Storage	= 5,745 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

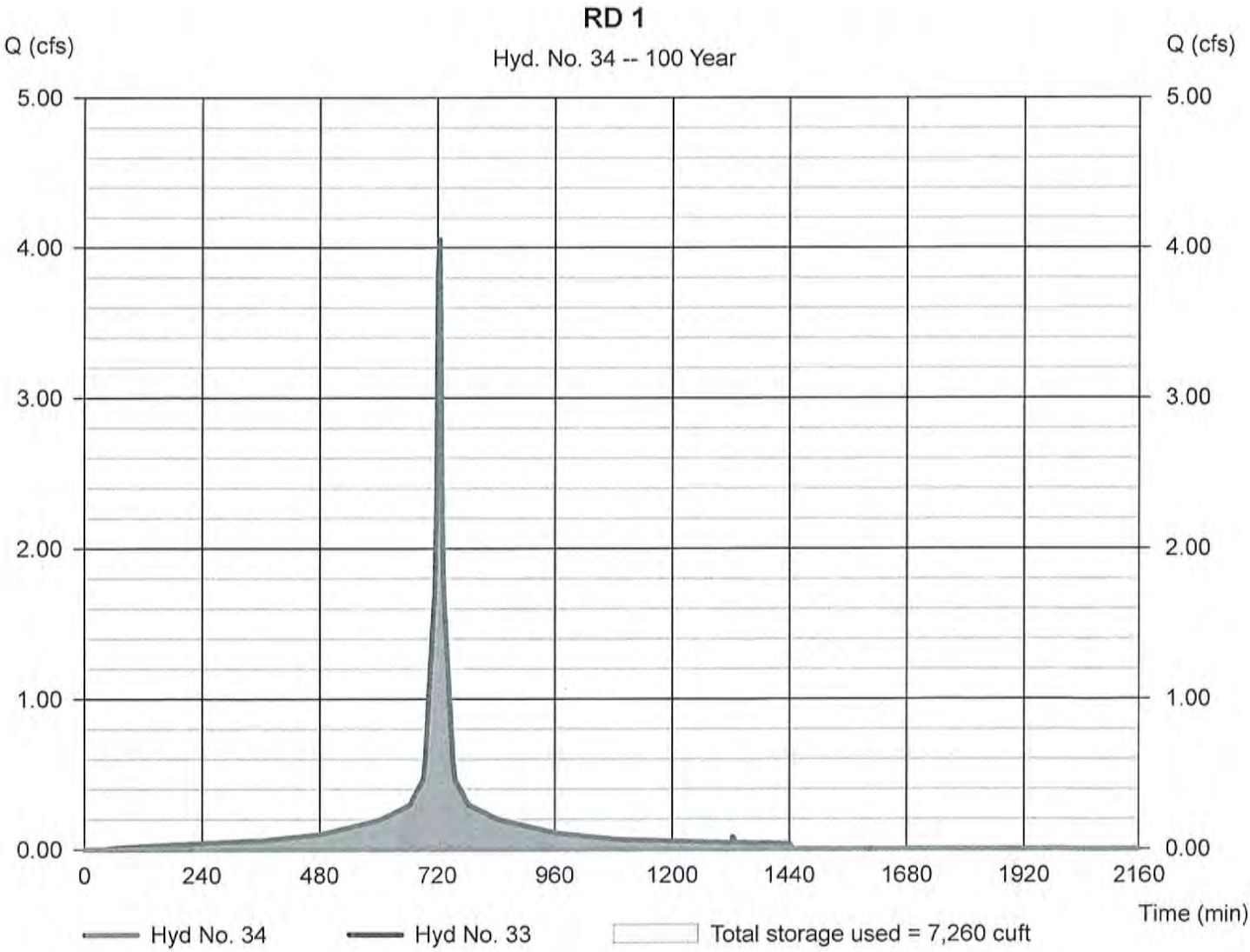
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 34

RD 1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 438 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 33 - 6 ROOFS	Max. Elevation	= 320.43 ft
Reservoir name	= RD 1	Max. Storage	= 7,260 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



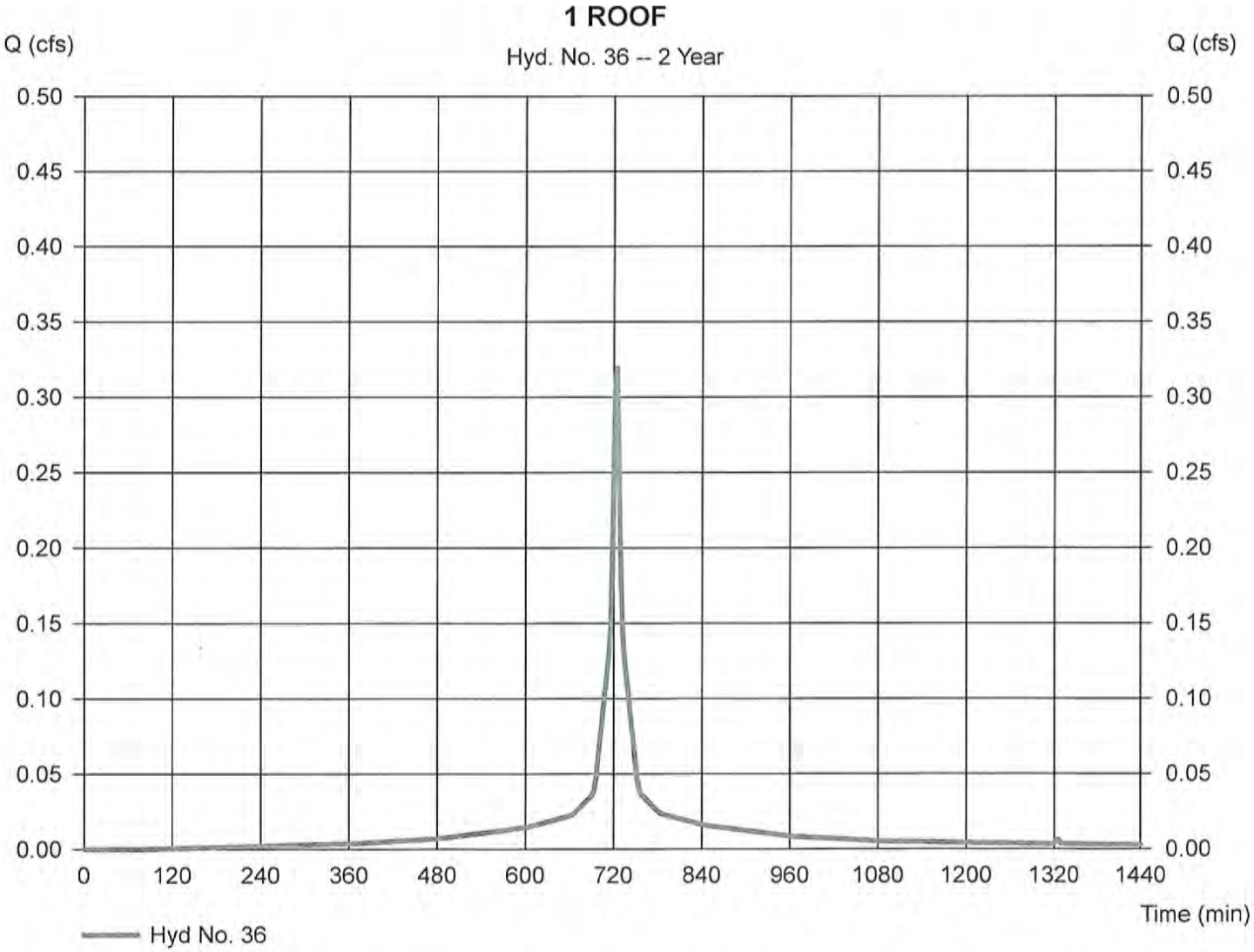
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 36

1 ROOF

Hydrograph type	= SCS Runoff	Peak discharge	= 0.319 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,074 cuft
Drainage area	= 0.110 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



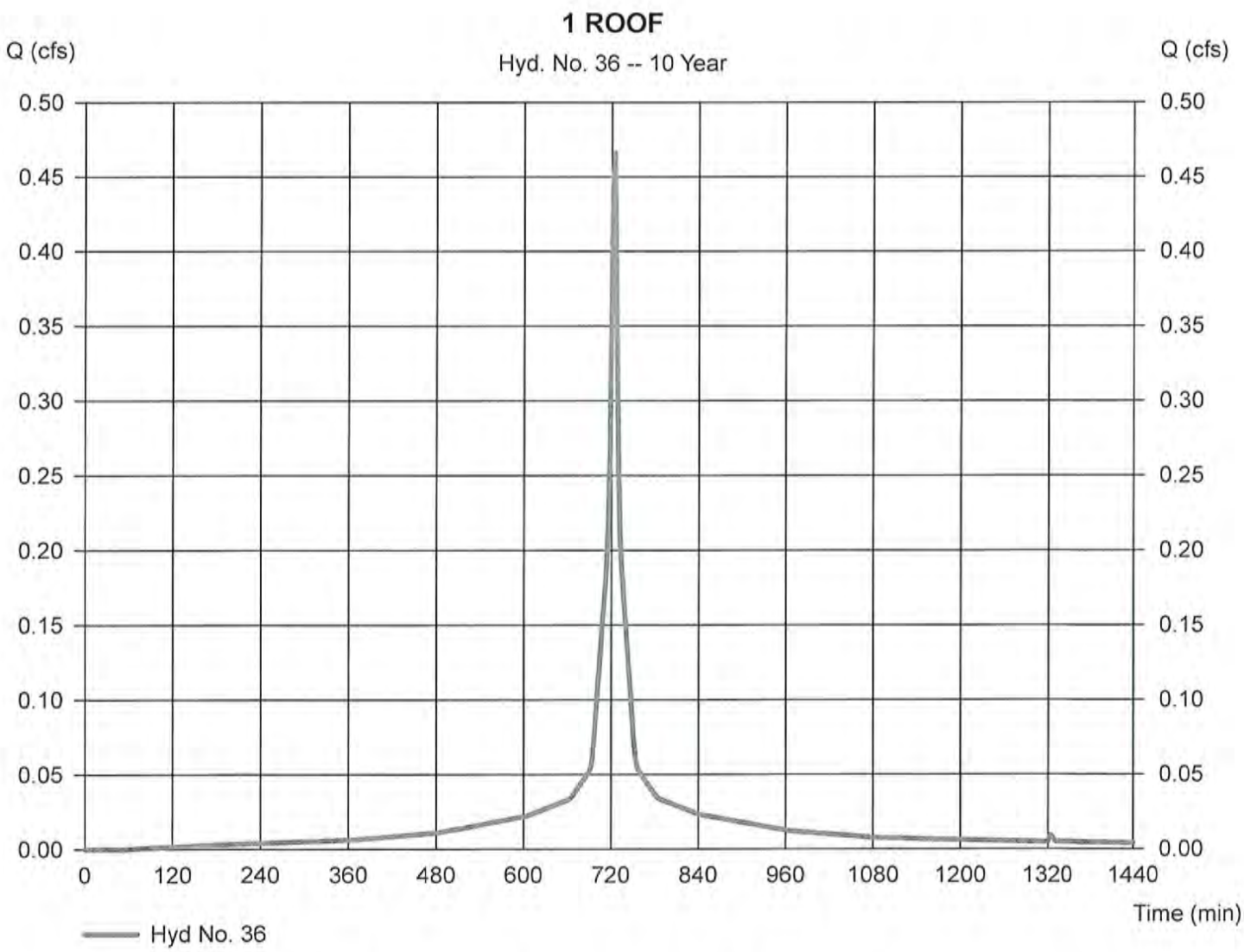
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 36

1 ROOF

Hydrograph type	= SCS Runoff	Peak discharge	= 0.466 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,596 cuft
Drainage area	= 0.110 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



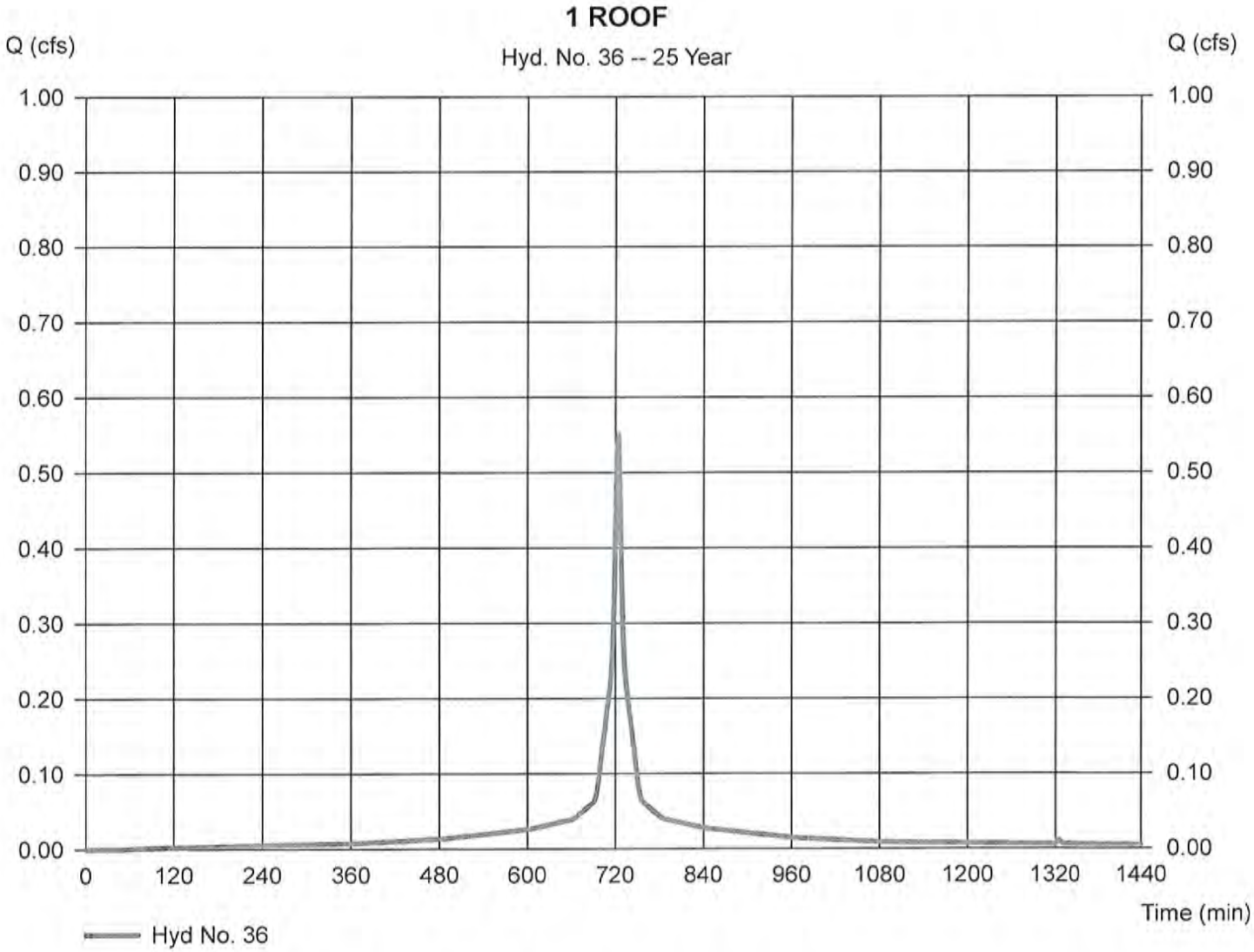
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 36

1 ROOF

Hydrograph type	= SCS Runoff	Peak discharge	= 0.550 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,895 cuft
Drainage area	= 0.110 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



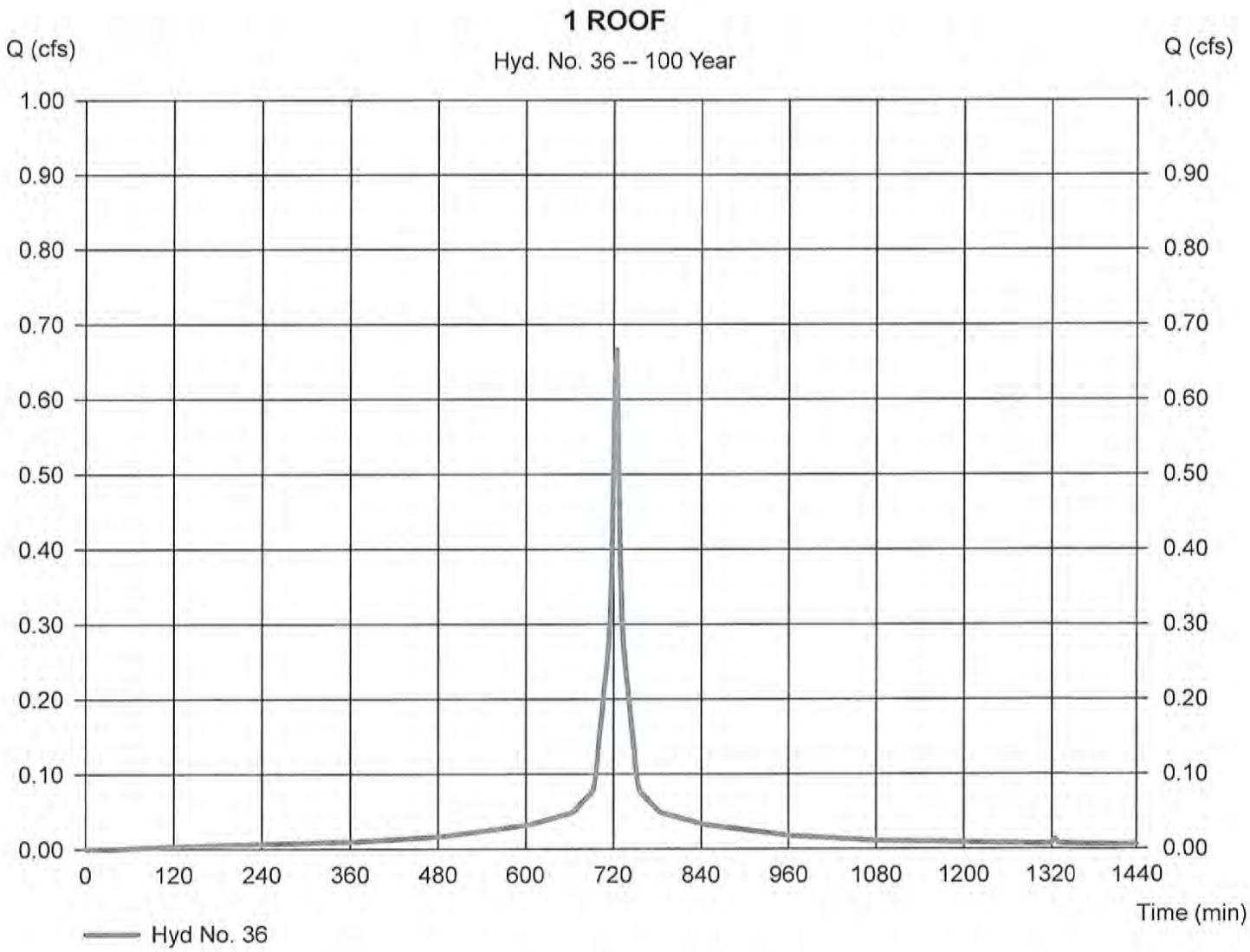
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 36

1 ROOF

Hydrograph type	= SCS Runoff	Peak discharge	= 0.665 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,307 cuft
Drainage area	= 0.110 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

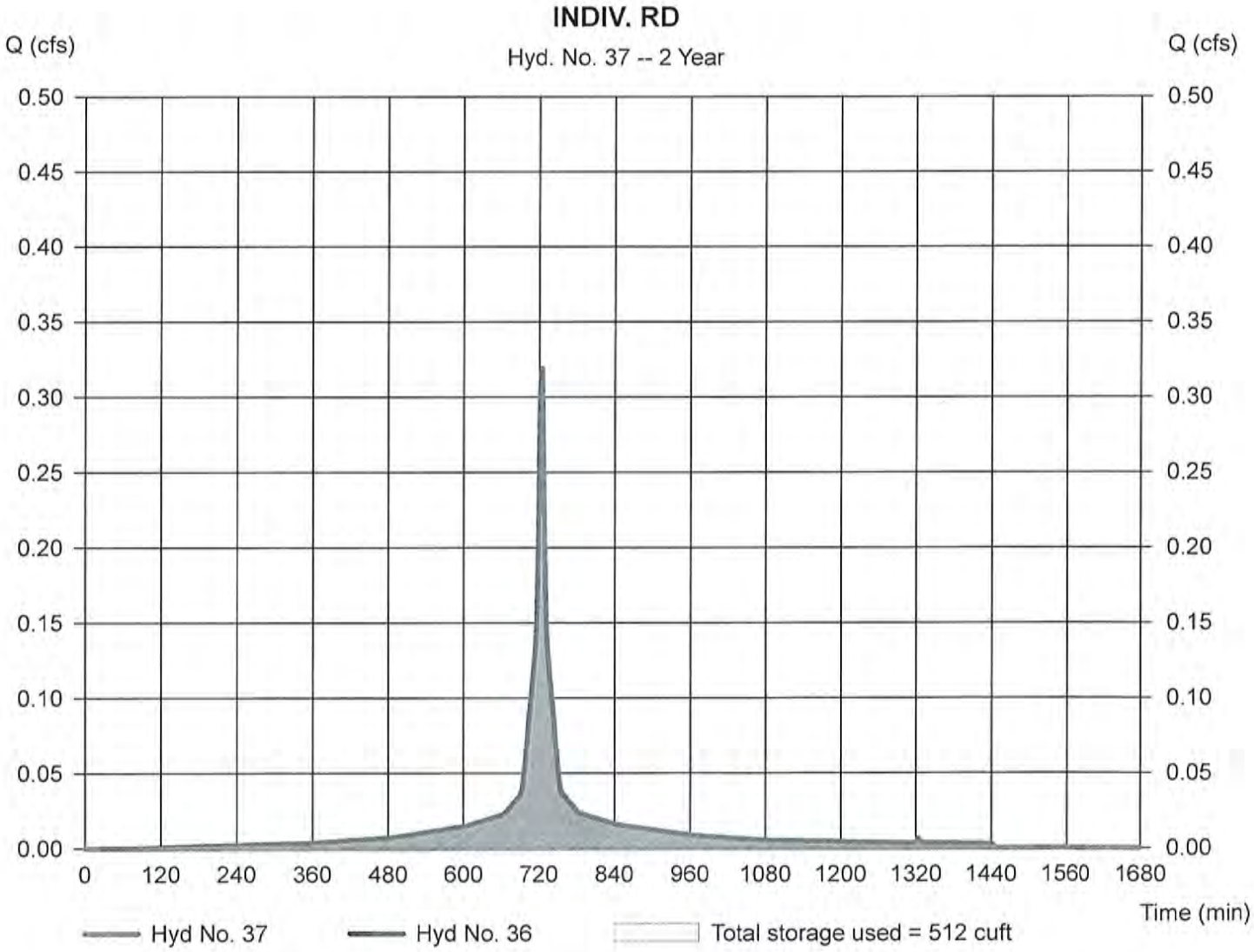
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 37

INDIV. RD

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1268 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 36 - 1 ROOF	Max. Elevation	= 2.43 ft
Reservoir name	= INDIV. RD	Max. Storage	= 512 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

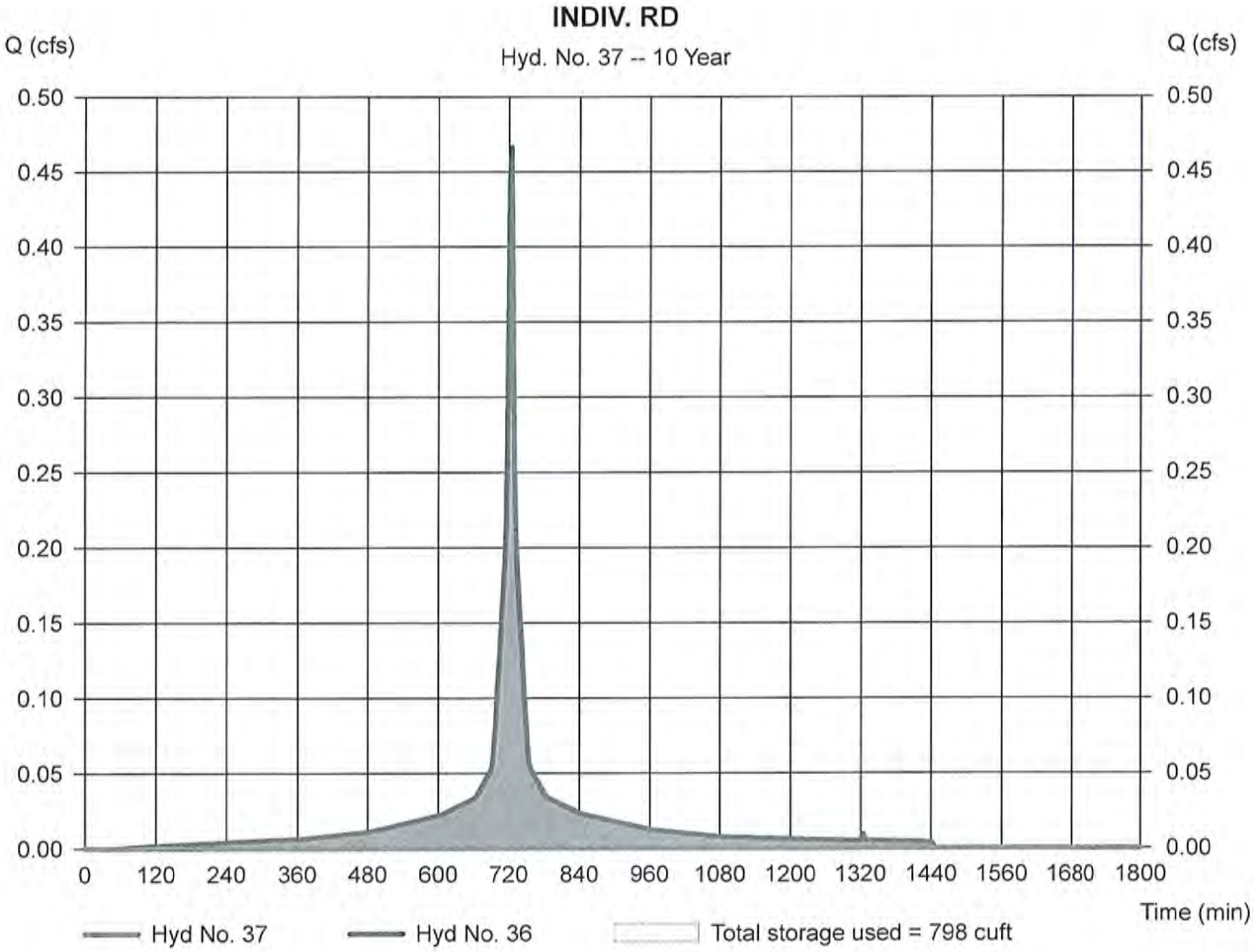
Hydraflow Hydrographs by Intelisolve v9.2 | Wednesday, Dec 21, 2016

Hyd. No. 37

INDIV. RD

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 496 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 36 - 1 ROOF	Max. Elevation	= 3.79 ft
Reservoir name	= INDIV. RD	Max. Storage	= 798 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

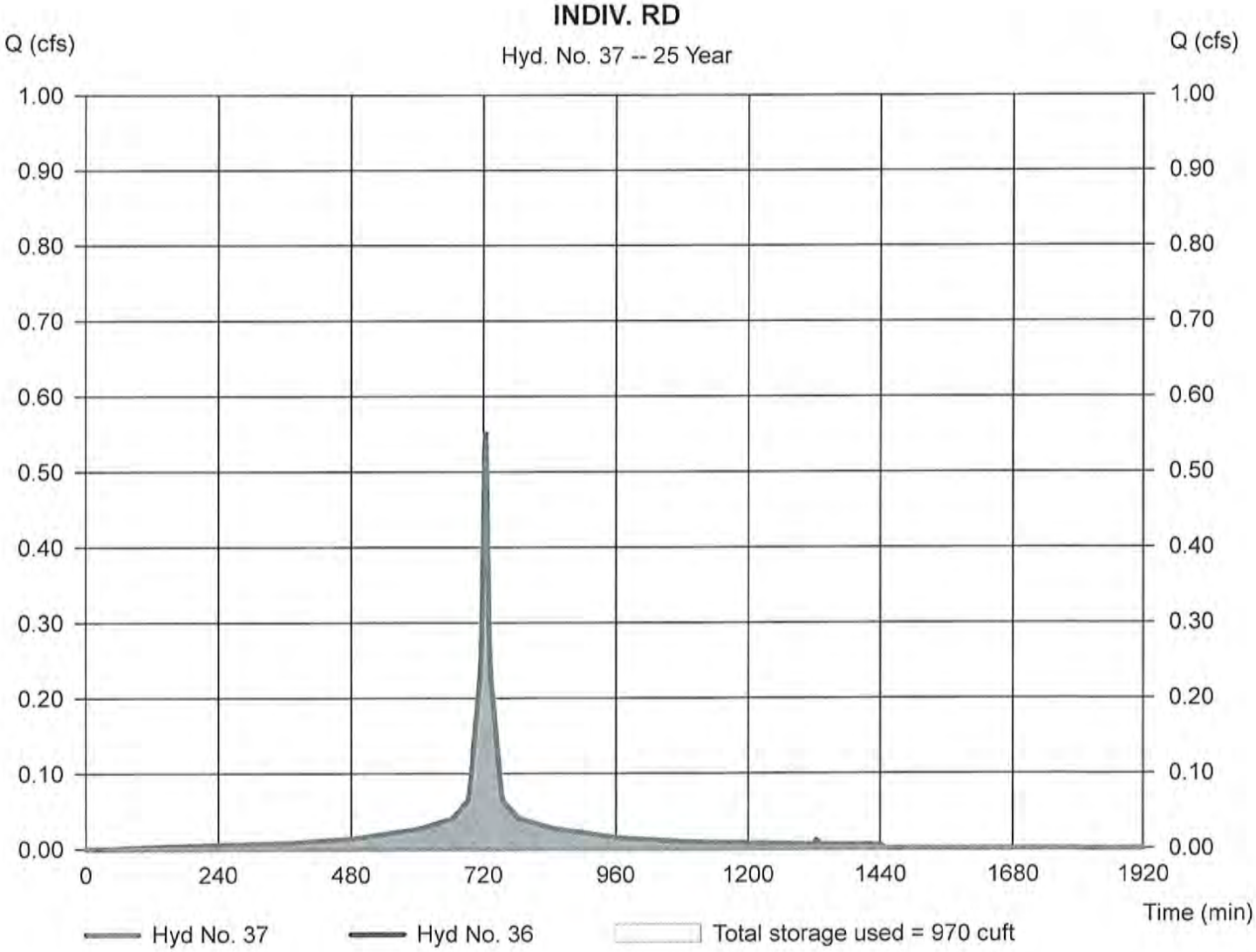
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 37

INDIV. RD

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 580 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 36 - 1 ROOF	Max. Elevation	= 4.61 ft
Reservoir name	= INDIV. RD	Max. Storage	= 970 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

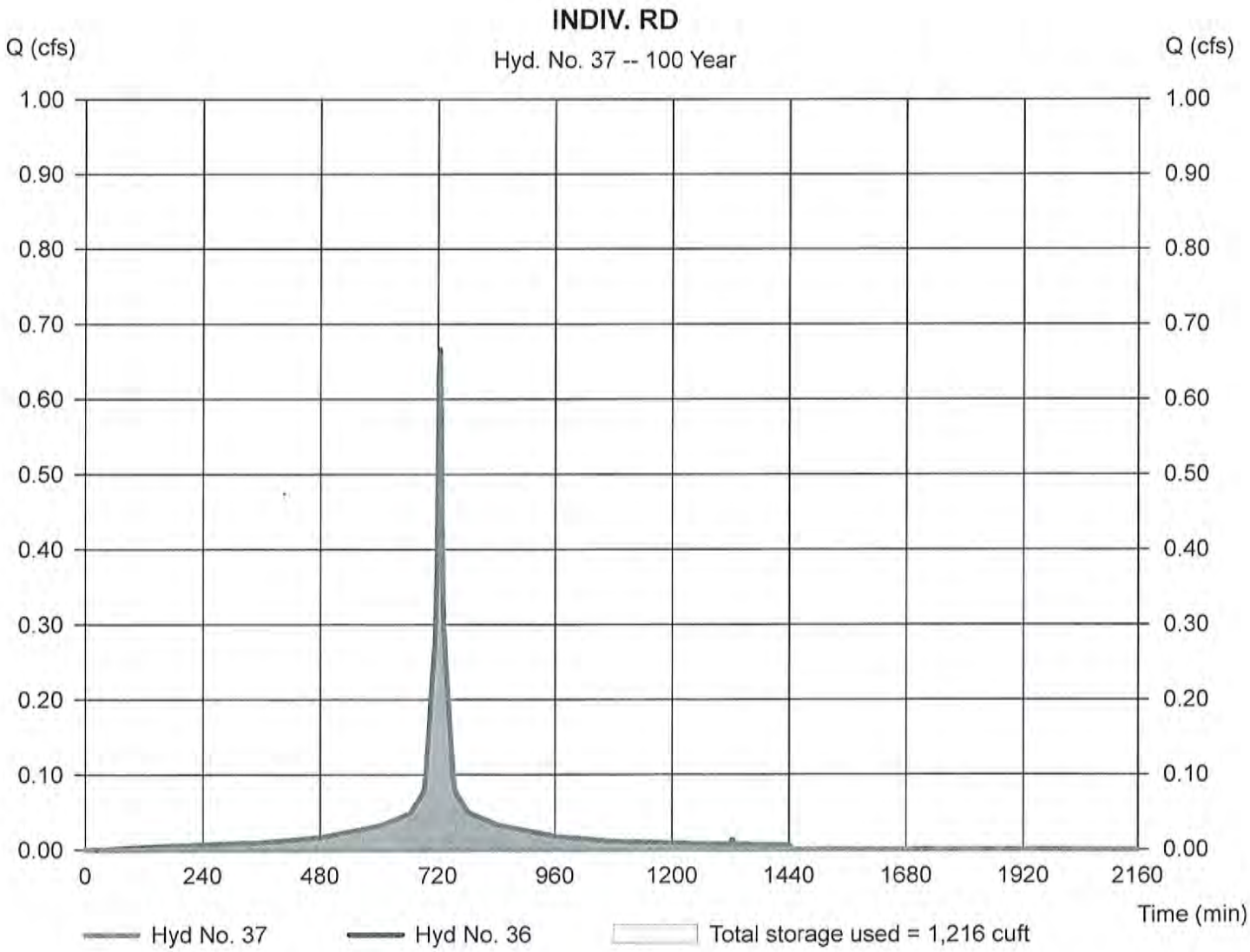
Hydraflow Hydrographs by Intelisolve v9.2 — Wednesday, Dec 21, 2016

Hyd. No. 37

INDIV. RD

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 1756 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 36 - 1 ROOF	Max. Elevation	= 5.78 ft
Reservoir name	= INDIV. RD	Max. Storage	= 1,216 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Water Quality Volume Calculations

Water Quality Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/2016

Subcatchment CB1 AND 2 (SMA 1)
Soils:
Hydrologic Group: B
Required Water Quality Volume
1 inches of runoff x impervious area

Impervious area: 0.23000459 acres
10,019 s.f.

Sediment Forebay P3 B

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
323	0	397		
324	1	653	525	
325	1	932	792.5	
			0	1,318

Required Water Quality Volume

V= 10,019 s.f. x $\frac{1}{12}$ = **835 c.f.**

Volume Provided 1,318 c.f.

1,318	c.f. >	835	c.f. O.K.

Subcatchment CB 3 (SMA 1)
Soils:
Hydrologic Group: B
Required Water Quality Volume
1 inches of runoff x impervious area

Impervious area: 0.16000918 acres
6,970 s.f.

Sediment Forebay P3 B

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
322	0	460		
323	1	632	546	
324	1	632	632	
			0	1,178

Required Water Quality Volume

V= 6,970 s.f. x $\frac{1}{12}$ = **581 c.f.**

Volume Provided 1,178 c.f.

1,178	c.f. >	581	c.f. O.K.

Subcatchment Road A 1900 to 2450 (SMA 2)
Soils:
Hydrologic Group: B
Required Water Quality Volume
1 inches of runoff x impervious area

Impervious area: 0.65 acres
28,314 s.f.

Sediment Forebay P3A

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
314	0	314		
315	1	686	500	
316	1	1186	936	
317	1	1815	1500.5	2,937

Required Water Quality Volume

V= 28,314 s.f. x $\frac{1}{12}$ = **2,360 c.f.**

Volume Provided 2,937 c.f.

2,937	c.f. >	2,360	c.f. O.K.

Subcatchment Road A 1450 to 1900 (SMA 2)

Soils:

Hydrologic Group: B

Required Water Quality Volume

1 inches of runoff x impervious area

Impervious area: 0.36000918 acres

15,682 s.f.

Sediment Forebay P3A

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
310	0	267		
311	1	1336	801.5	
312	1	2789	2062.5	
313	1	3857	3323	**6,187**

Required Water Quality Volume

$$V = 15{,}682 \text{ s.f.} \times \frac{1}{12} = \mathbf{1{,}307} \text{ c.f.}$$

Volume Provided 6,187 c.f.

6,187	c.f. >	1,307	c.f. O.K.

Subcatchment P1D (SMA 3)

Soils:

Hydrologic Group: B

Required Water Quality Volume

1 inches of runoff x impervious area

Impervious area: 0.54910468 acres

23,919 s.f.

Sediment Forebay P1C

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
312	0	1462		
313	1	2129	1795.5	
314	1	2862	2495.5	
			0	**4,291**

Required Water Quality Volume

$$V = 23{,}919 \text{ s.f.} \times \frac{1}{12} = \mathbf{1{,}993} \text{ c.f.}$$

Volume Provided 4,291 c.f.

4,291	c.f. >	1,993	c.f. O.K.

Subcatchment P1E (SMA 4)

Soils:

Hydrologic Group: B

Required Water Quality Volume

0.5 inches of runoff x impervious area

Impervious area: 1.48085399 acres

64,506 s.f.

Sediment Forebay P1D

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
318	0	2187		
319	1	2637	2412	
320	1	3114	2875.5	5287.5

Required Water Quality Volume

$$V = 64{,}506 \text{ s.f.} \times \frac{0.5}{12} = \mathbf{2{,}688} \text{ c.f.}$$

Volume Provided 0 c.f.

5,288	c.f. >	2,688	c.f. O.K.

Subcatchment P1H (SMA 7)

Soils:

Hydrologic Group: B

Required Water Quality Volume

0.5 inches of runoff x impervious area

Impervious area: 1.91581726 acres

83,453 s.f.

Sediment Forebay P1D

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
318	0	1600		
319	1	2111	1855.5	
320	1	2667	2389	4244.5
321	1	3293	2980	5369

Required Water Quality Volume

$$V = 83{,}453 \text{ s.f.} \times \frac{0.5}{12} = \mathbf{3{,}477} \text{ c.f.}$$

Volume Provided 5,369 c.f.

5,369	c.f. >	3,477	c.f. O.K.

Project: 700-800 Mass Ave
Location: Boxborough, MA
Prepared For: Stamski & McNary, Inc.

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A ($miles^2$)	t_c (min)	t_c (hr)	WQV (in)
DMH-25	0.50	0.0007813	6.0	0.100	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
DMH-25	774.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
DMH-25	0.60

Groundwater Recharge Calculations

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 1

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 0.65 acres
28,492 s.f.

Required Recharge Volume (Rv)

$$Rv = 28{,}492 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{831} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1	ft
K (saturated hydraulic conductivity):	1.02	inches/hour
	0.085	feet/hour
T (time):	2	hours
A=	3,841	s.f.
Volume of Chambers=	397	
Rv=	4,494	c.f. > 831 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 2.18 Hours
2.18 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 2

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 1.16 acres
50,495 s.f.

Required Recharge Volume (Rv)

$$Rv = 53{,}724 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{1{,}567 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1.2	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	4,746	s.f.
Volume of Chambers=	397	
Rv=	7,602	c.f.

> 1,567 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.03 Hours
1.03 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 3

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 0.55 acres
23,919 s.f.

Required Recharge Volume (Rv)

$$Rv = 23{,}919 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{698 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility): 0.5 ft
K (saturated hydraulic conductivity): 2.41 inches/hour
0.2008333 feet/hour
T (time): 2 hours
A= 4,580 s.f.
Rv= 4,130 c.f. > 698 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.84 Hours
0.84 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by:
Date:

SMA 4

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: A AND B
Required Recharge Volume
0.35 inches of runoff x impervious area
0.6 inches of runoff x impervious area

Impervious area:	1.27	acres	*B Soil*
	55,247	s.f.	
Impervious area:	0.21	acres	*A Soil*
	9,259	s.f.	

Required Recharge Volume (Rv)

$$Rv = 55{,}247 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{1{,}611 \text{ c.f.}}$$

$$Rv = 9{,}259 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{463 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft		
K (saturated hydraulic conductivity):	2.41	inches/hour		
	0.2008333	feet/hour		
T (time):	2	hours		
A=	5,305	s.f.		
Rv=	4,783	c.f.	>	2,074

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.68 Hours
1.68 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

ROOF BASIN

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 0.45 acres
19,404 s.f.

Required Recharge Volume (Rv)

$$Rv = 19{,}404 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{566 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	2	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	2,697	s.f.
Rv=	6,477	c.f. > 566 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.44 Hours
0.44 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 6

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 1.48 acres
64,417 s.f.

Required Recharge Volume (Rv)

$$Rv = 64{,}417 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{3{,}221 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	2	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	2,004	s.f.
Volume of Chambers=	18,531	
Rv=	23,344	c.f. > 3,221 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.87 Hours
0.87 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 7

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 2.14 acres
93,155 s.f.

Required Recharge Volume (Rv)

$$Rv = 93{,}155 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{2{,}717 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	7,036	s.f.
Voids=	0.40	
Volume of Chambers=	13,426	
Rv=	19,067	c.f. > 2,717 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.01 Hours
1.01 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

SMA 8

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 1.56 acres
67,914 s.f.

Required Recharge Volume (Rv)

$$Rv = 67{,}914 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{1{,}981 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility): 2 ft
K (saturated hydraulic conductivity): 2.41 inches/hour
0.2008333 feet/hour
T (time): 2 hours
A= 1,042 s.f.
Rv= 2,503 c.f. > 1,981 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 3.94 Hours
3.94 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

RD 1

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 0.67 acres
29,106 s.f.

Required Recharge Volume (Rv)

$$Rv = 29{,}106 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{849 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	1,651	s.f.
Voids=	0.40	
Volume of Chambers=	3,834	
Rv=	5,158	c.f. > 849 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.10 Hours
1.10 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2069

Calculated by: JTM
Date: 12/22/16

RD 2

Soils: Charlton Hollis Rock Outcrop
Hydrologic Group: B
Required Recharge Volume
0.35 inches of runoff x impervious area

Impervious area: 0.56 acres
24,255 s.f.

Required Recharge Volume (Rv)

$$Rv = 24{,}255 \text{ s.f.} \times \frac{0.35}{12} = \mathbf{707 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1	ft
K (saturated hydraulic conductivity):	2.41	inches/hour
	0.2008333	feet/hour
T (time):	2	hours
A=	1,569	s.f.
Voids=	0.40	
Volume of Chambers=	3,408	
Rv=	4,666	c.f. > 707 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 1.03 Hours
1.03 < 72 hours O.K.

Inlet Grate Capacity Calculations

Inlet Grate Capacity Calculations

Job: SM-2069 Calculated by: JTM
Project: 700-800 Mass Ave Date: 12/22/2016

LeBARON FOUNDRY, INC. LF246 inlet grate pass area A = 225 sq. in.
1.56 sq. ft.

Q = (C*A* SQRT(2*g*h))*f

C = orifice coefficient
C = 0.6 square edges
A = inlet area
A = 1.56 sq. ft.
g = gravitational constant
g = 32.2 ft/sec^2
h = head on inlet
h = 0.33 ft. (low points)
0.17 ft. (on slope)
f = clogging factor
f = 0.66

Single Grate
Q (MAX)= 2.85 cfs (LP) low points LF246
Q (MAX)= 2.04 cfs (OS) on slope LF246
Double Grate
Q (MAX)= 5.70 cfs (LP) low points LF246
Q (MAX)= 4.09 cfs (OS) on slope LF246

	TRIBUTARY AREA (AC)	TIME OF CONC.	100 YR INTENSITY	C	Q=CiA Q100	POSITION	Q (MAX)	single grate	double grate
CB1	0.10	10	7.6	0.9	0.68	LP	2.85	yes	
CB2	0.16	10	7.6	0.77	0.94	LP	2.85	yes	
CB3	0.23	10	7.6	0.69	1.21	LP	2.85	yes	
CB4	0.15	10	7.6	0.76	0.87	OS	2.04	yes	
CB4A	0.26	10	7.6	0.68	1.34	LP	2.85	yes	
CB5	0.11	10	7.6	0.77	0.64	OS	2.04	yes	
CB6	0.29	10	7.6	0.51	1.12	OS	2.04	yes	
CB7	0.16	10	7.6	0.77	0.94	OS	2.04	yes	
CB8	0.44	10	7.6	0.44	1.47	LP	2.85	yes	
CB9	0.25	10	7.6	0.79	1.50	LP	2.85	yes	
CB10	0.15	10	7.6	0.76	0.87	OS	2.04	yes	
CB11	0.12	10	7.6	0.78	0.71	OS	2.04	yes	
CB12	0.28	10	7.6	0.6	1.28	OS	2.04	yes	
CB13	0.28	10	7.6	0.68	1.45	OS	2.04	yes	

CB14	0.31	10	7.6	0.72	1.70	OS	4.09		yes
CB15	0.46	10	7.6	0.69	2.41	OS	4.09		yes
CB16	0.3	10	7.6	0.78	1.78	LP	2.85	yes	
CB17	0.43	10	7.6	0.72	2.35	LP	2.85	yes	
CB18	0.27	10	7.6	0.67	1.37	OS	2.04	yes	
CB19	0.2	10	7.6	0.76	1.16	OS	2.04	yes	
CB20	0.17	10	7.6	0.86	1.11	OS	2.04	yes	
CB21	0.12	10	7.6	0.73	0.67	OS	2.04	yes	
CB22	0.31	10	7.6	0.7	1.65	OS	2.04	yes	
CB23	0.13	10	7.6	0.79	0.78	OS	2.04	yes	
CB24	0.77	10	7.6	0.72	4.21	LP	5.7		yes
CB25	0.31	10	7.6	0.61	1.44	OS	2.04	yes	
CB26	0.22	10	7.6	0.61	1.02	OS	2.04	yes	
CB27	0.31	10	7.6	0.67	1.58	OS	2.04	yes	
CB28	0.14	10	7.6	0.75	0.80	OS	2.04	yes	

TSS Removal Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Pretreatment SMA-1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Sediment Forebay	25%	0.75	0.19	0.56

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Pretreatment SMA-2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Sediment Forebay	25%	0.75	0.19	0.56

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Pretreatment SMA-3

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Sediment Forebay	25%	0.75	0.19	0.56

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: SMA-1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Infiltration Basin W/ Sed. Forebay	80%	0.75	0.60	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: SMA-2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Infiltration Basin W/ Sed. Forebay	80%	0.75	0.60	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: SMA-3

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Infiltration Basin W/ Sed. Forebay	80%	0.75	0.60	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: SMA-4

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Infiltration Basin W/ Sed. Forebay	80%	0.75	0.60	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: SMA-7

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
Subsurface Basin W/ Sed. Forebay	80%	0.75	0.60	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 2069
Prepared By: JTM
Date: 11/14/16

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

VortSentry® HS Estimated Net Annual TSS Reduction

CONTECH ENGINEERED SOLUTIONS

700-800 MASS AVE
BOXBOROUGH, MA
Model VSHS48
System DMH-25

Design Ratio[1] = $\frac{\text{0.5 acres x 0.9}}{\text{63 ft3}}$ **= 0.007**

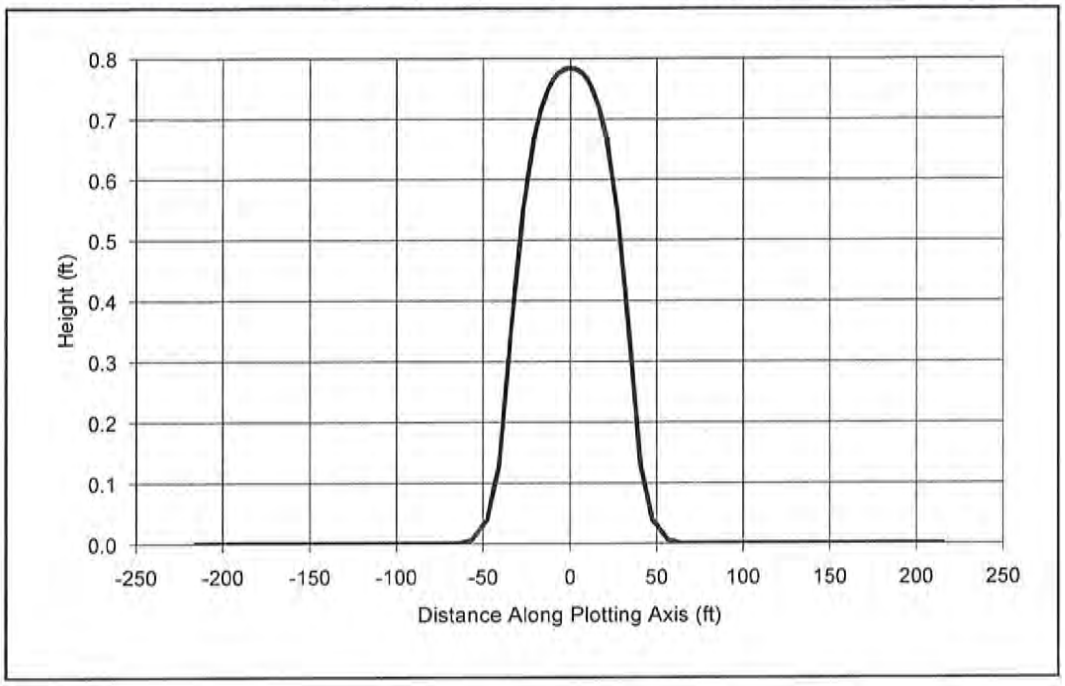
Rainfall Intensity "/hr	Flow Rate cfs	Operating Rate[2] cfs/ft^3	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.02	0.01	0.00014	10.2%	98.0%	10.0%
0.04	0.02	0.00029	9.6%	98.0%	9.5%
0.06	0.03	0.00043	9.4%	98.0%	9.3%
0.08	0.04	0.00057	7.7%	98.0%	7.6%
0.10	0.05	0.00072	8.6%	98.0%	8.4%
0.12	0.05	0.00086	6.3%	98.0%	6.2%
0.14	0.06	0.00100	4.7%	98.0%	4.6%
0.16	0.07	0.00115	4.6%	98.0%	4.5%
0.18	0.08	0.00129	3.5%	98.0%	3.5%
0.20	0.09	0.00143	4.3%	98.0%	4.3%
0.25	0.11	0.00179	8.0%	98.0%	7.8%
0.30	0.14	0.00215	5.6%	98.0%	5.5%
0.35	0.16	0.00251	4.4%	98.0%	4.3%
0.40	0.18	0.00286	2.5%	98.0%	2.5%
0.45	0.20	0.00322	2.5%	98.0%	2.5%
0.50	0.23	0.00358	1.4%	98.0%	1.4%
0.75	0.34	0.00537	5.0%	98.0%	4.9%
1.00	0.45	0.00716	1.0%	97.9%	1.0%
1.50	0.68	0.01074	0.0%	93.0%	0.0%
2.00	0.90	0.01432	0.0%	89.0%	0.0%
3.00	1.35	0.02149	0.5%	73.0%	0.4%
					97.9%
				% rain falling at >3"/hr =	0.0%
				Removal Efficiency Adjustment[4] =	6.5%
				Predicted Net Annual Load Removal Efficiency =	**91.4%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio
3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by: CJA	Date: 11/29/16	Checked by:	Date:

Groundwater Mounding Calculations

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 1

ANALYST: James Melvin

DATE: 12/1/2016 TIME: 7:15:42 PM

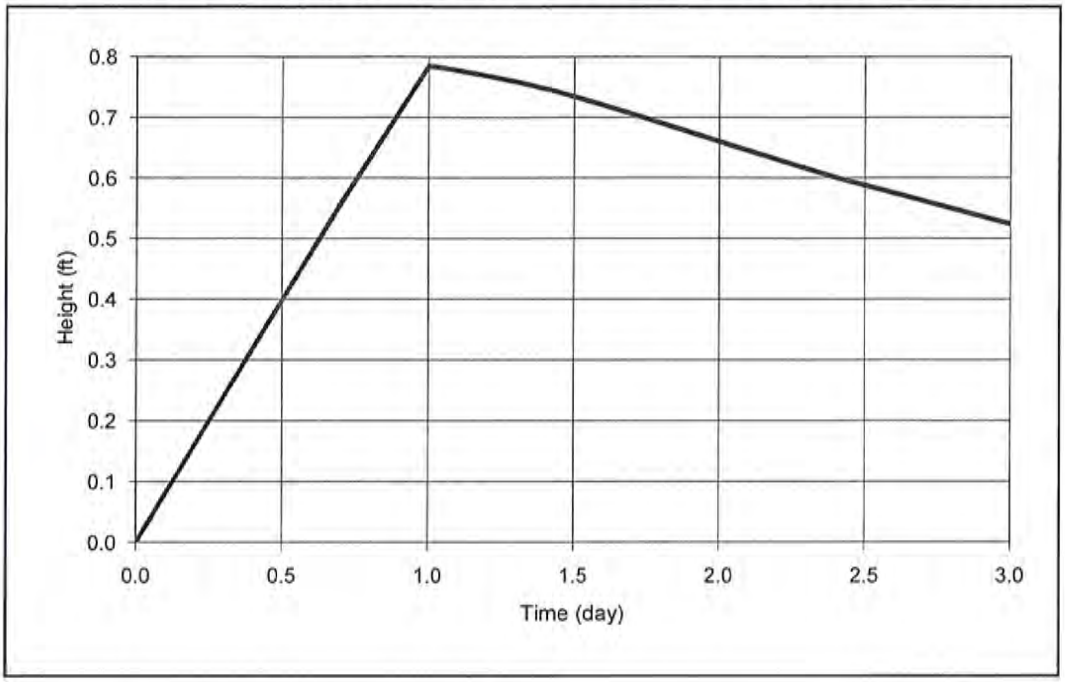
INPUT PARAMETERS

Application rate: 0.28 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 3 ft/day
Initial saturated thickness: 10 ft
Length of application area: 56.33 ft
Width of application area: 52 ft
Constant head boundary used at: 215 ft
Plotting axis from Y-Axis: 45 degrees
Edge of recharge area:
positive X: 26 ft
positive Y: 26 ft
Total volume applied: 820.1649 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-152	-152	-215	0
-127.9	-127.9	-181	0
-103.7	-103.7	-147	0
-79.5	-79.5	-112	0
-60.5	-60.5	-86	0
-45.8	-45.8	-65	0
-33.7	-33.7	-48	0.04
-23.5	-23.5	-33	0.37
-14.7	-14.7	-21	0.67
-8.8	-8.8	-12	0.75
-4.8	-4.8	-7	0.78
0	0	0	0.78
4.8	4.8	7	0.78
8.8	8.8	12	0.75
14.7	14.7	21	0.67
23.5	23.5	33	0.37
33.7	33.7	48	0.04
45.8	45.8	65	0
60.5	60.5	86	0
79.5	79.5	112	0
103.7	103.7	147	0
127.9	127.9	181	0
152	152	215	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 1

ANALYST: James Melvin

DATE: 12/1/2016 TIME: 7:15:47 PM

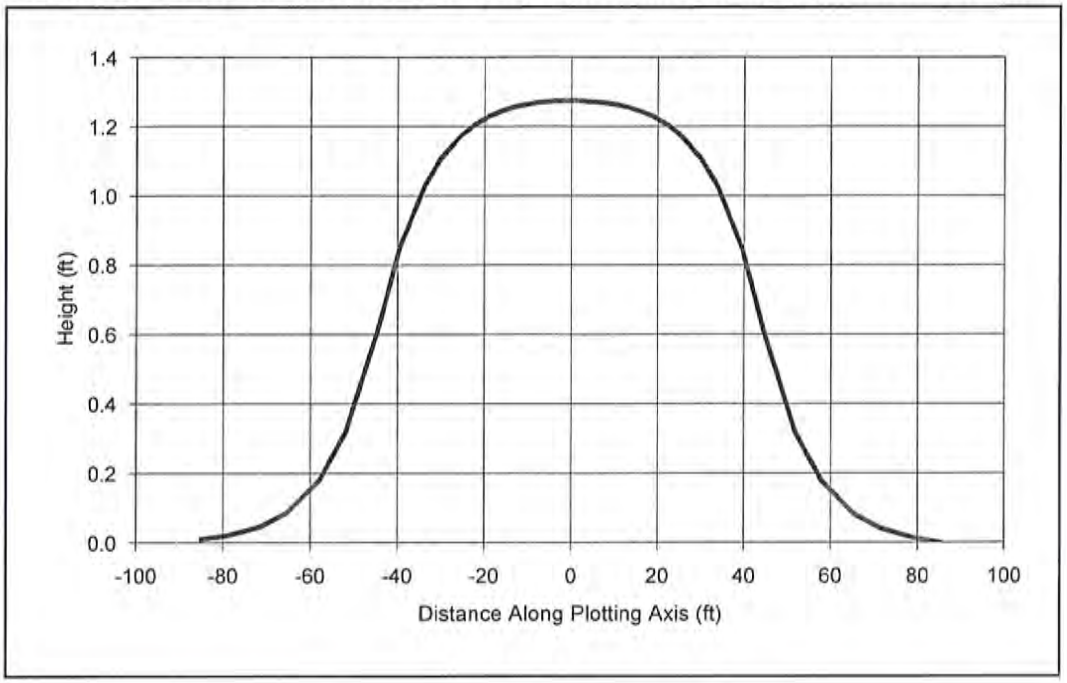
INPUT PARAMETERS

Application rate: 0.28 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 3 ft/day
Initial saturated thickness: 10 ft
Length of application area: 56.33 ft
Width of application area: 52 ft
Constant head boundary used at: 215 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 820.1648 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.01
0	0.04
0.1	0.08
0.2	0.12
0.2	0.18
0.3	0.24
0.4	0.32
0.5	0.42
0.7	0.56
1	0.78
1	0.78
1.1	0.78
1.2	0.77
1.3	0.76
1.4	0.74
1.6	0.72
1.8	0.69
2	0.65
2.4	0.6
3	0.52

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 2

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 7:57:27 PM

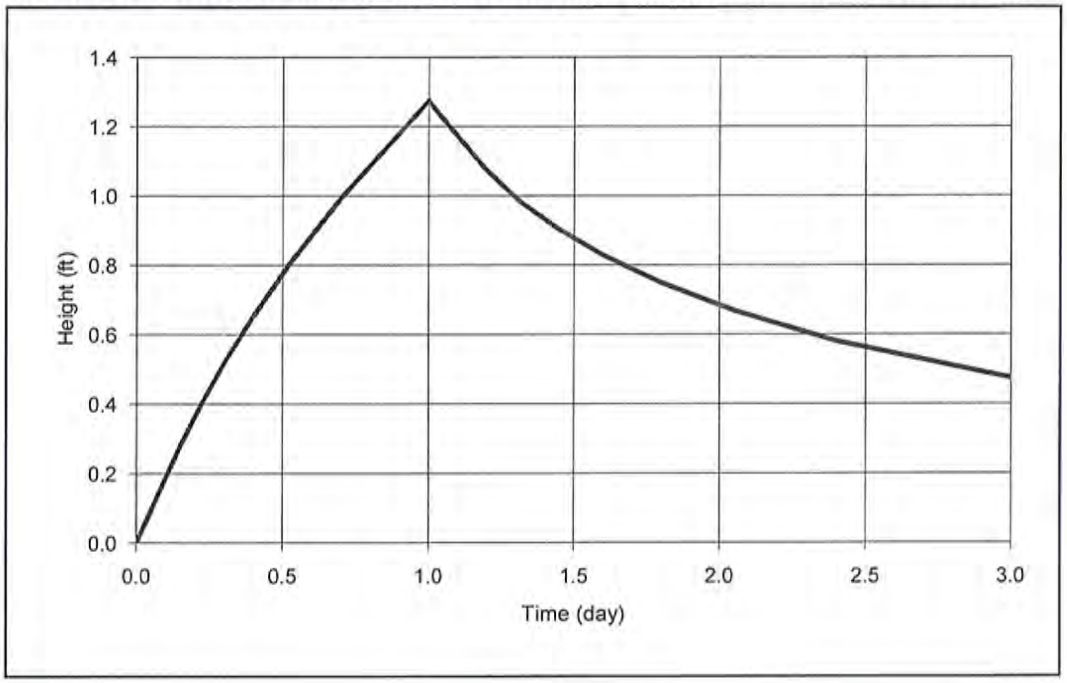
INPUT PARAMETERS

Application rate: 0.66 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 87.67 ft
Width of application area: 27 ft
Constant head boundary used at: 85 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 43.8 ft
Total volume applied: 1562.279 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-85	-85	0.01
0	-71.5	-71	0.05
0	-58	-58	0.18
0	-44.4	-44	0.61
0	-33.8	-34	1.03
0	-25.6	-26	1.17
0	-18.9	-19	1.23
0	-13.2	-13	1.26
0	-8.2	-8	1.27
0	-4.9	-5	1.27
0	-2.7	-3	1.27
0	0	0	1.27
0	2.7	3	1.27
0	4.9	5	1.27
0	8.2	8	1.27
0	13.2	13	1.25
0	18.9	19	1.23
0	25.6	26	1.17
0	33.8	34	1.03
0	44.4	44	0.61
0	58	58	0.18
0	71.5	71	0.04
0	85	85	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 2

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 7:57:35 PM

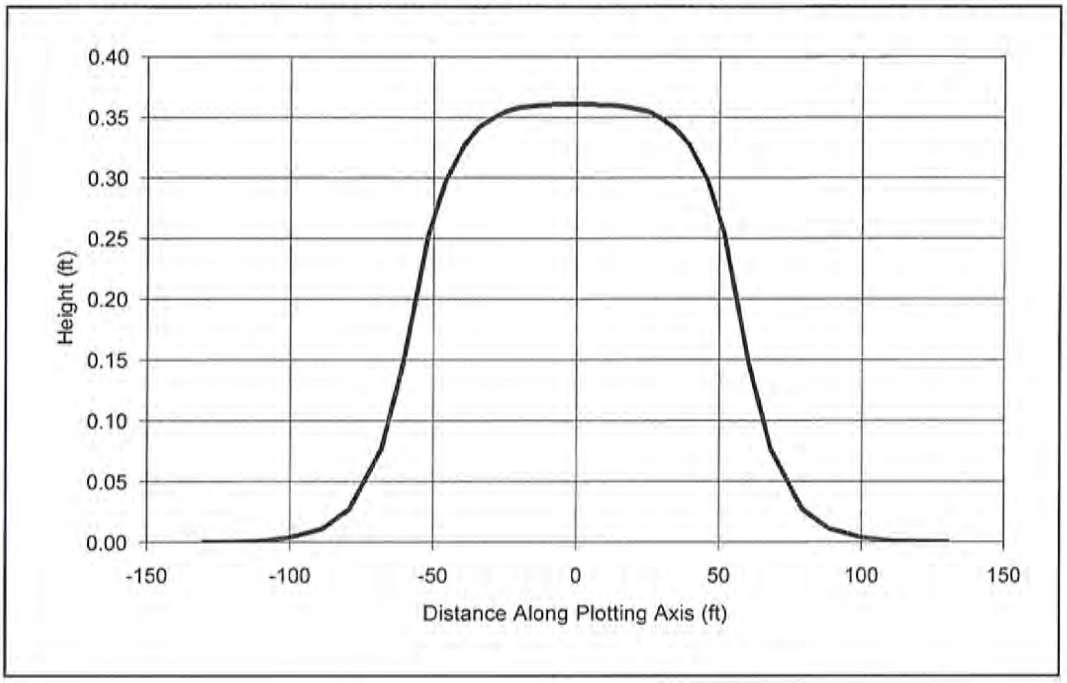
INPUT PARAMETERS

Application rate: 0.66 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 87.67 ft
Width of application area: 27 ft
Constant head boundary used at: 85 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 1562.279 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.08
0.1	0.18
0.2	0.29
0.2	0.4
0.3	0.52
0.4	0.65
0.5	0.8
0.7	0.99
1	1.27
1	1.25
1.1	1.18
1.2	1.08
1.3	0.99
1.4	0.9
1.6	0.83
1.8	0.75
2	0.67
2.4	0.58
3	0.47

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 3

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:03:01 PM

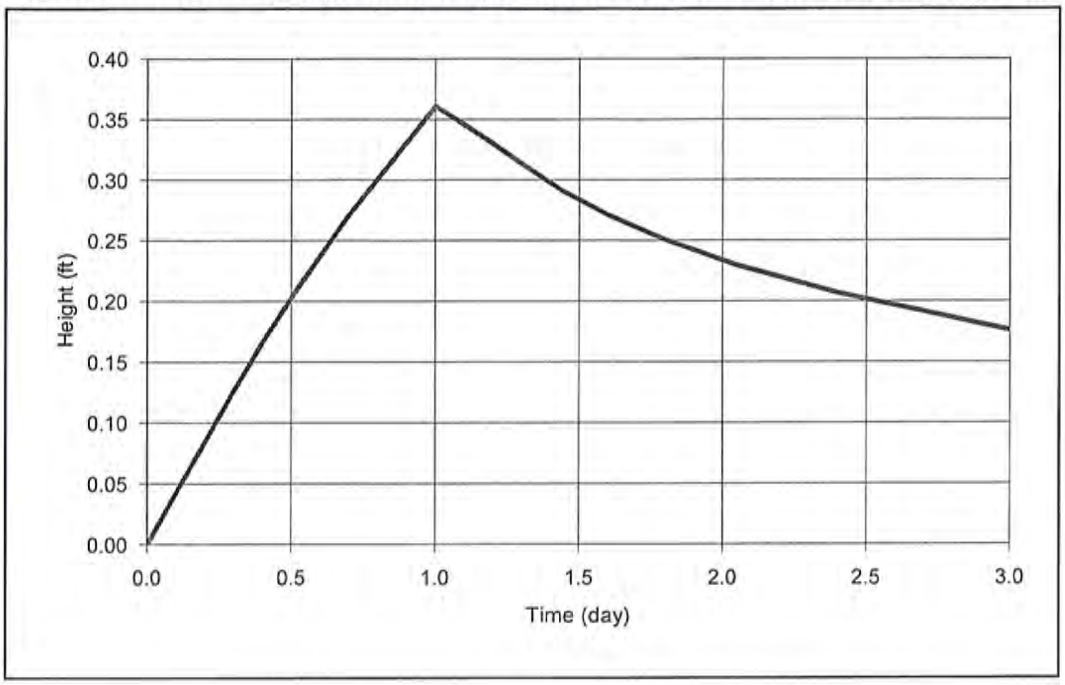
INPUT PARAMETERS

Application rate: 0.15 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 115.45 ft
Width of application area: 40.33 ft
Constant head boundary used at: 130 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 57.7 ft
Total volume applied: 698.4147 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-130	-130	0
0	-109.3	-109	0
0	-88.6	-89	0.01
0	-68	-68	0.08
0	-51.7	-52	0.25
0	-39.1	-39	0.33
0	-28.8	-29	0.35
0	-20.1	-20	0.36
0	-12.6	-13	0.36
0	-7.5	-8	0.36
0	-4.1	-4	0.36
0	0	0	0.36
0	4.1	4	0.36
0	7.5	8	0.36
0	12.6	13	0.36
0	20.1	20	0.36
0	28.8	29	0.35
0	39.1	39	0.33
0	51.7	52	0.25
0	68	68	0.08
0	88.6	89	0.01
0	109.3	109	0
0	130	130	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 3

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:03:07 PM

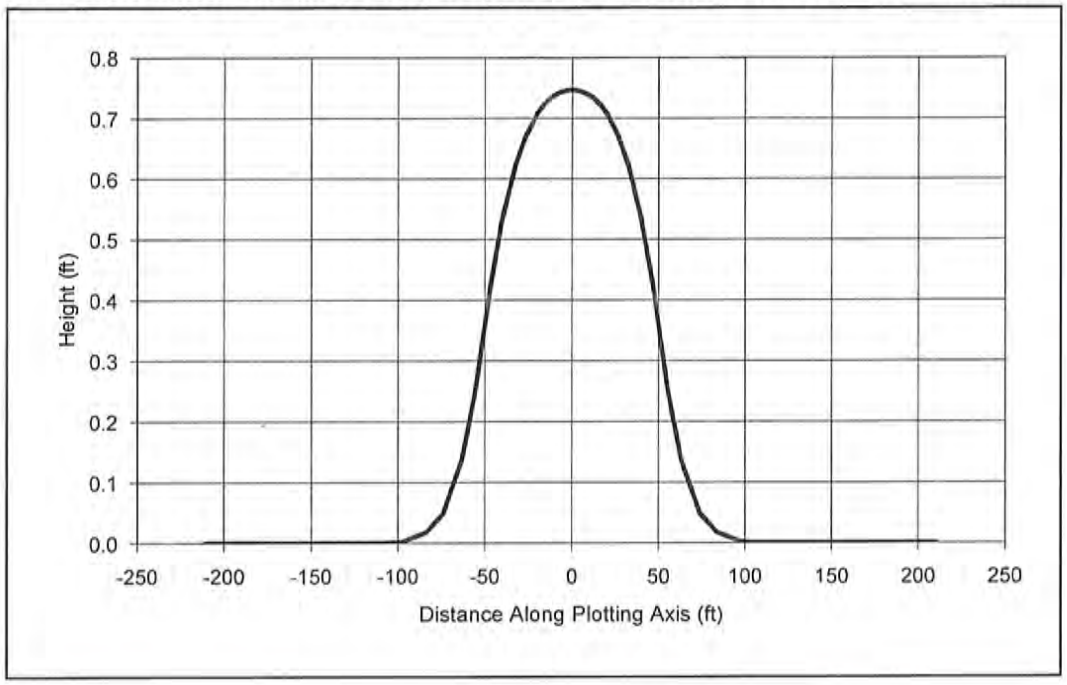
INPUT PARAMETERS

Application rate: 0.15 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 115.45 ft
Width of application area: 40.33 ft
Constant head boundary used at: 130 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 698.4148 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0
0	0.02
0.1	0.04
0.2	0.06
0.2	0.09
0.3	0.13
0.4	0.16
0.5	0.21
0.7	0.27
1	0.36
1	0.36
1.1	0.35
1.2	0.33
1.3	0.31
1.4	0.29
1.6	0.27
1.8	0.25
2	0.23
2.4	0.21
3	0.18

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 4

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:06:25 PM

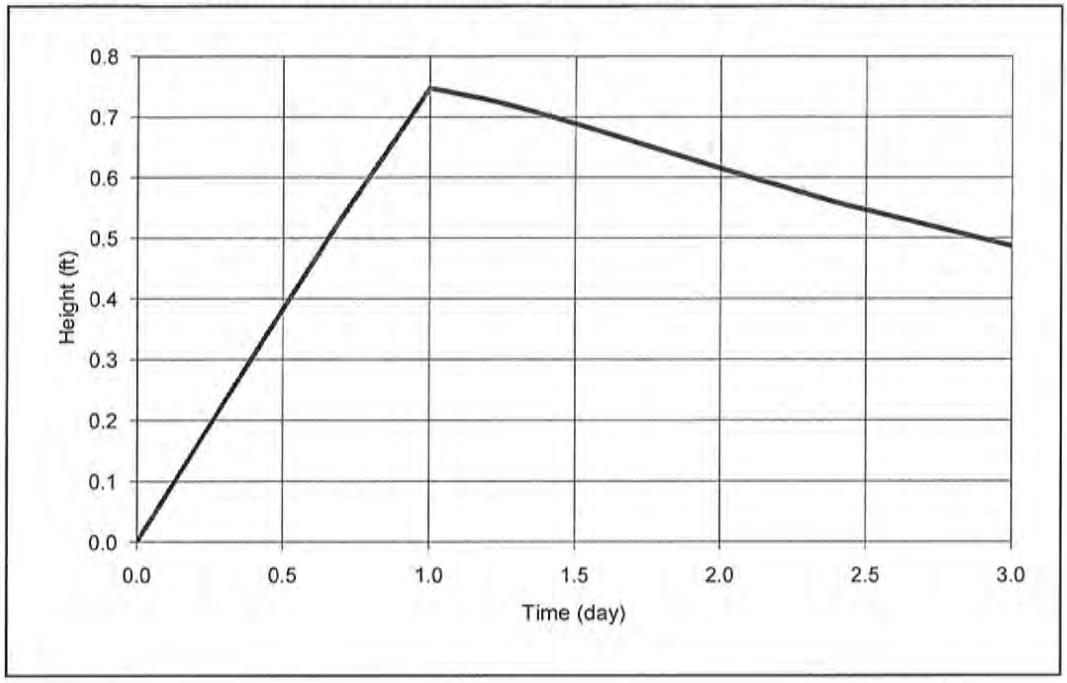
INPUT PARAMETERS

Application rate: 0.27 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 106 ft
Width of application area: 72 ft
Constant head boundary used at: 210 ft
Plotting axis from Y-Axis: 45 degrees
Edge of recharge area:
positive X: 36 ft
positive Y: 36 ft
Total volume applied: 2060.64 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-148.5	-148.5	-210	0
-124.9	-124.9	-177	0
-101.3	-101.3	-143	0
-77.6	-77.6	-110	0
-59.1	-59.1	-84	0.02
-44.7	-44.7	-63	0.14
-32.9	-32.9	-47	0.43
-23	-23	-33	0.62
-14.4	-14.4	-20	0.71
-8.6	-8.6	-12	0.73
-4.7	-4.7	-7	0.74
0	0	0	0.75
4.7	4.7	7	0.74
8.6	8.6	12	0.73
14.4	14.4	20	0.71
23	23	33	0.62
32.9	32.9	47	0.43
44.7	44.7	63	0.14
59.1	59.1	84	0.02
77.6	77.6	110	0
101.3	101.3	143	0
124.9	124.9	177	0
148.5	148.5	210	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 4

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:06:31 PM

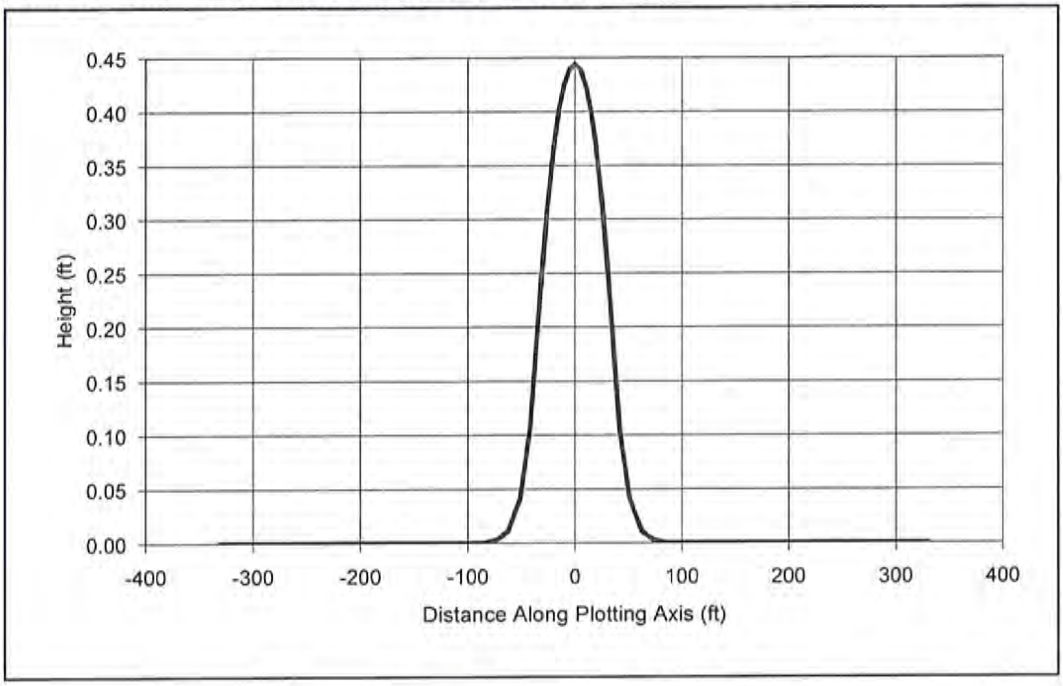
INPUT PARAMETERS

Application rate: 0.27 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 106 ft
Width of application area: 72 ft
Constant head boundary used at: 210 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 2060.64 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.01
0	0.04
0.1	0.07
0.2	0.12
0.2	0.17
0.3	0.23
0.4	0.31
0.5	0.4
0.7	0.53
1	0.75
1	0.74
1.1	0.74
1.2	0.73
1.3	0.72
1.4	0.7
1.6	0.67
1.8	0.64
2	0.61
2.4	0.56
3	0.49

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 5

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:09:18 PM

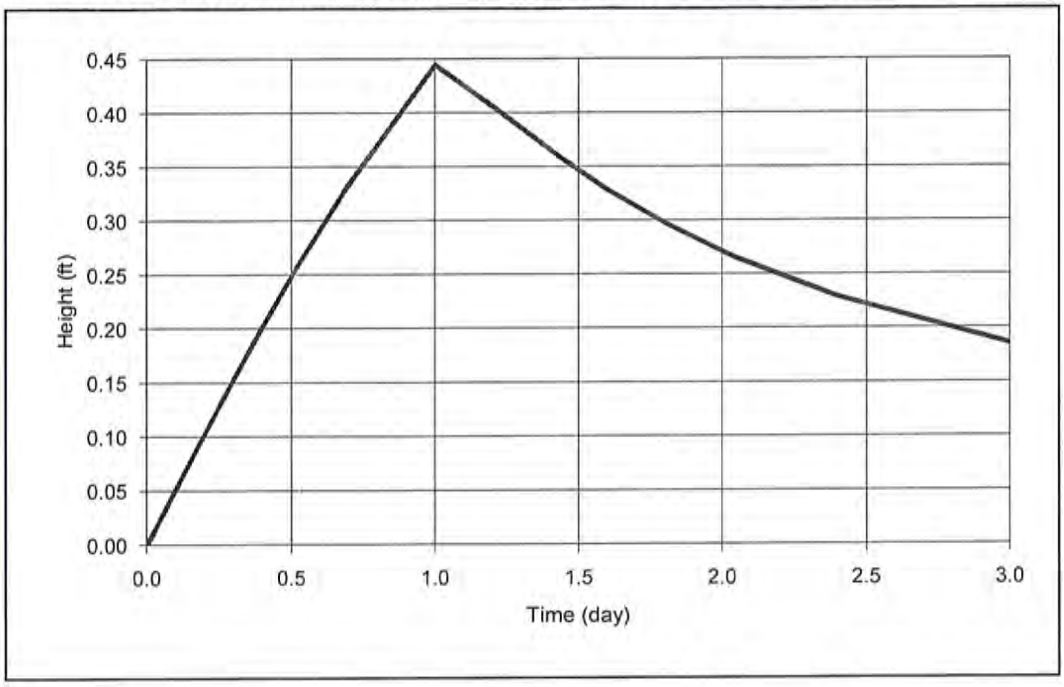
INPUT PARAMETERS

Application rate: 0.18 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 62 ft
Width of application area: 52 ft
Constant head boundary used at: 330 ft
Plotting axis from Y-Axis: 45 degrees
Edge of recharge area:
positive X: 26 ft
positive Y: 26 ft
Total volume applied: 580.32 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-233.3	-233.3	-330	0
-196.2	-196.2	-278	0
-159.1	-159.1	-225	0
-122	-122	-173	0
-92.8	-92.8	-131	0
-70.2	-70.2	-99	0
-51.8	-51.8	-73	0
-36.1	-36.1	-51	0.04
-22.6	-22.6	-32	0.24
-13.5	-13.5	-19	0.37
-7.4	-7.4	-10	0.42
0	0	0	0.44
7.4	7.4	10	0.42
13.5	13.5	19	0.37
22.6	22.6	32	0.24
36.1	36.1	51	0.04
51.8	51.8	73	0
70.2	70.2	99	0
92.8	92.8	131	0
122	122	173	0
159.1	159.1	225	0
196.2	196.2	278	0
233.3	233.3	330	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 5

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:09:23 PM

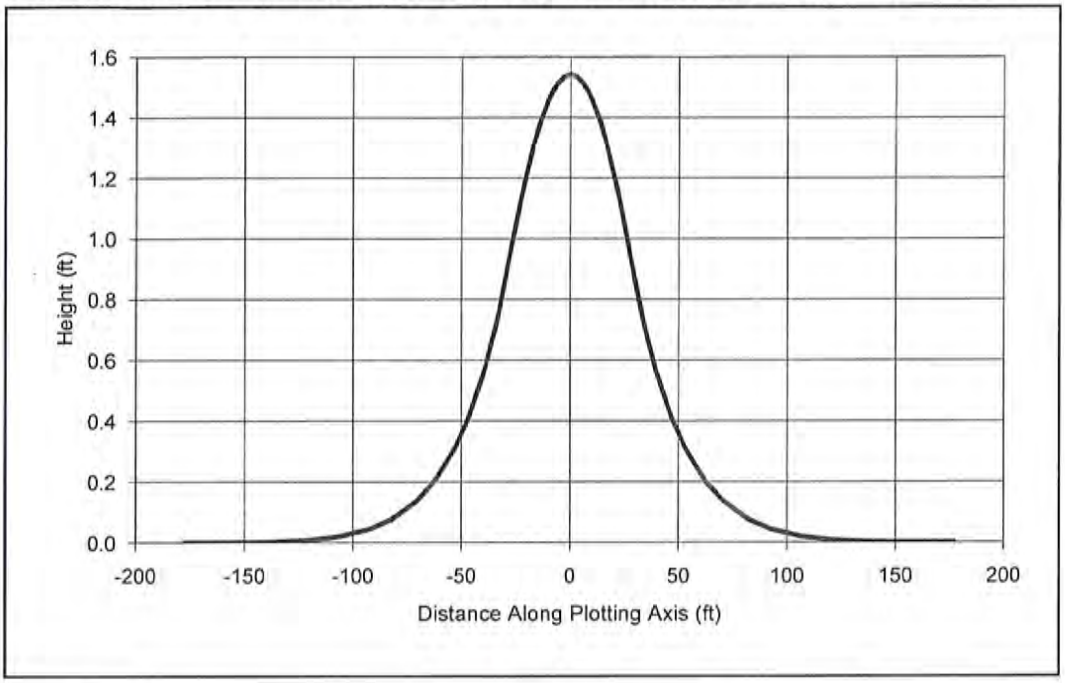
INPUT PARAMETERS

Application rate: 0.18 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 62 ft
Width of application area: 52 ft
Constant head boundary used at: 330 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 580.32 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.01
0	0.02
0.1	0.05
0.2	0.08
0.2	0.11
0.3	0.15
0.4	0.2
0.5	0.26
0.7	0.33
1	0.44
1	0.44
1.1	0.43
1.2	0.41
1.3	0.38
1.4	0.36
1.6	0.33
1.8	0.3
2	0.26
2.4	0.23
3	0.18

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 6

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:12:30 PM

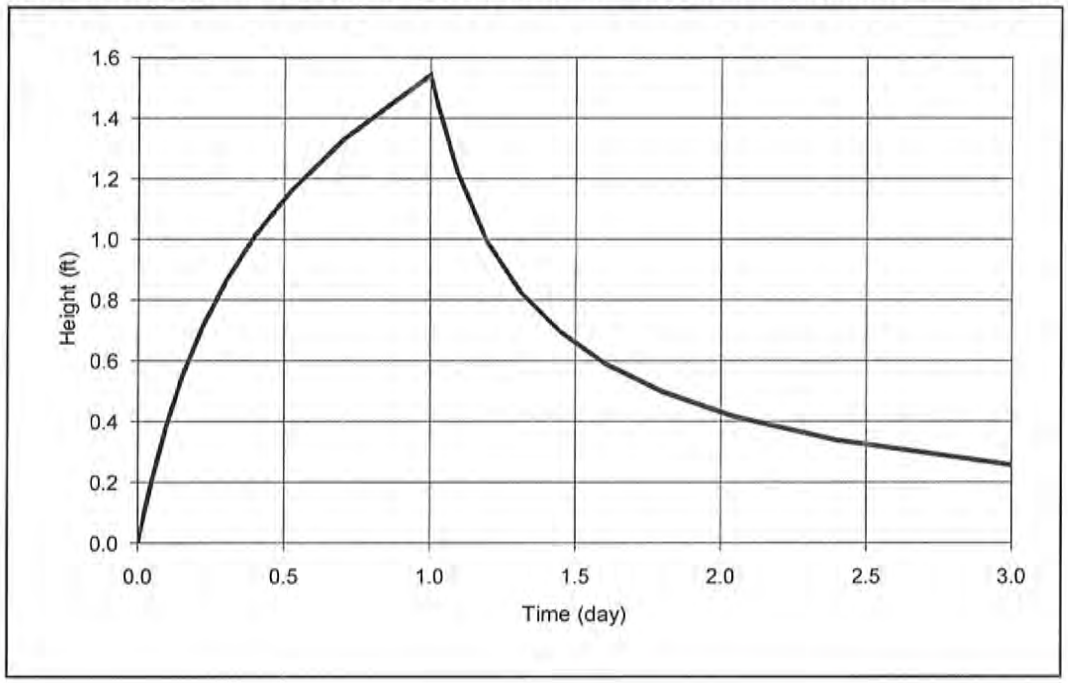
INPUT PARAMETERS

Application rate: 1.52 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 53 ft
Width of application area: 40 ft
Constant head boundary used at: 177 ft
Plotting axis from Y-Axis: 45 degrees
Edge of recharge area:
positive X: 20 ft
positive Y: 20 ft
Total volume applied: 3222.4 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-125.2	-125.2	-177	0
-105.3	-105.3	-149	0
-85.3	-85.3	-121	0.01
-65.4	-65.4	-93	0.04
-49.8	-49.8	-70	0.14
-37.7	-37.7	-53	0.31
-27.8	-27.8	-39	0.57
-19.4	-19.4	-27	0.96
-12.1	-12.1	-17	1.3
-7.3	-7.3	-10	1.45
-3.9	-3.9	-6	1.52
0	0	0	1.54
3.9	3.9	6	1.52
7.3	7.3	10	1.45
12.1	12.1	17	1.3
19.4	19.4	27	0.96
27.8	27.8	39	0.57
37.7	37.7	53	0.31
49.8	49.8	70	0.14
65.4	65.4	93	0.04
85.3	85.3	121	0.01
105.3	105.3	149	0
125.2	125.2	177	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 6

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:12:37 PM

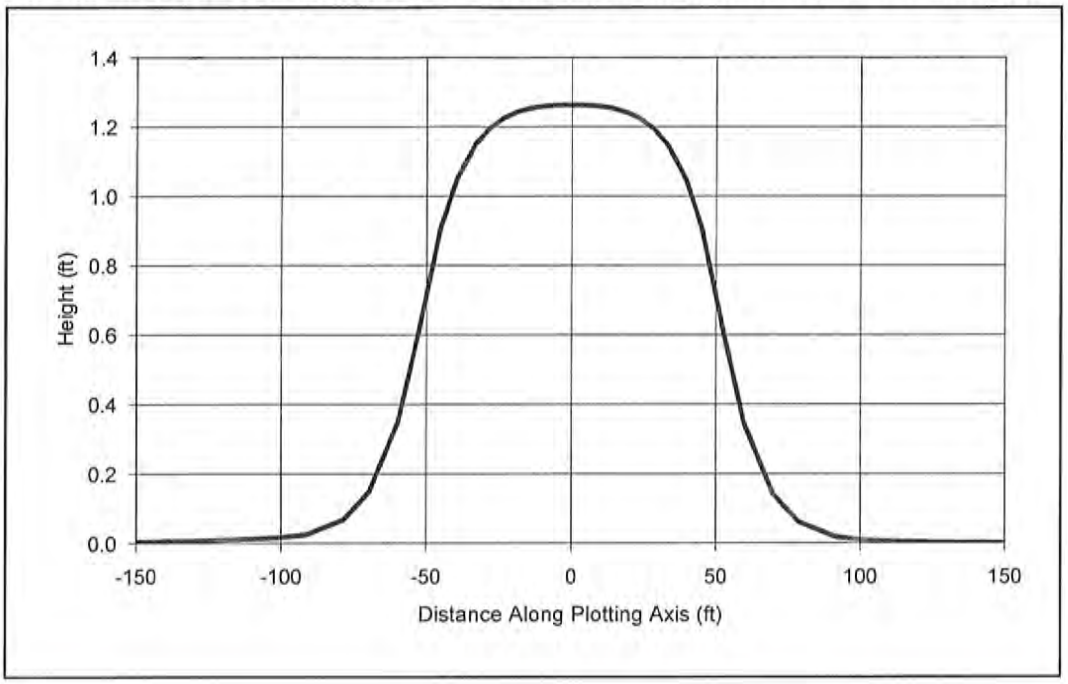
INPUT PARAMETERS

Application rate: 1.52 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 53 ft
Width of application area: 40 ft
Constant head boundary used at: 177 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 3222.4 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.06
0	0.2
0.1	0.39
0.2	0.56
0.2	0.72
0.3	0.86
0.4	1.01
0.5	1.16
0.7	1.33
1	1.54
1	1.44
1.1	1.23
1.2	1
1.3	0.83
1.4	0.7
1.6	0.59
1.8	0.5
2	0.42
2.4	0.34
3	0.26

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 7

ANALYST: James Melvin

DATE: 12/21/2016 TIME: 5:58:42 PM

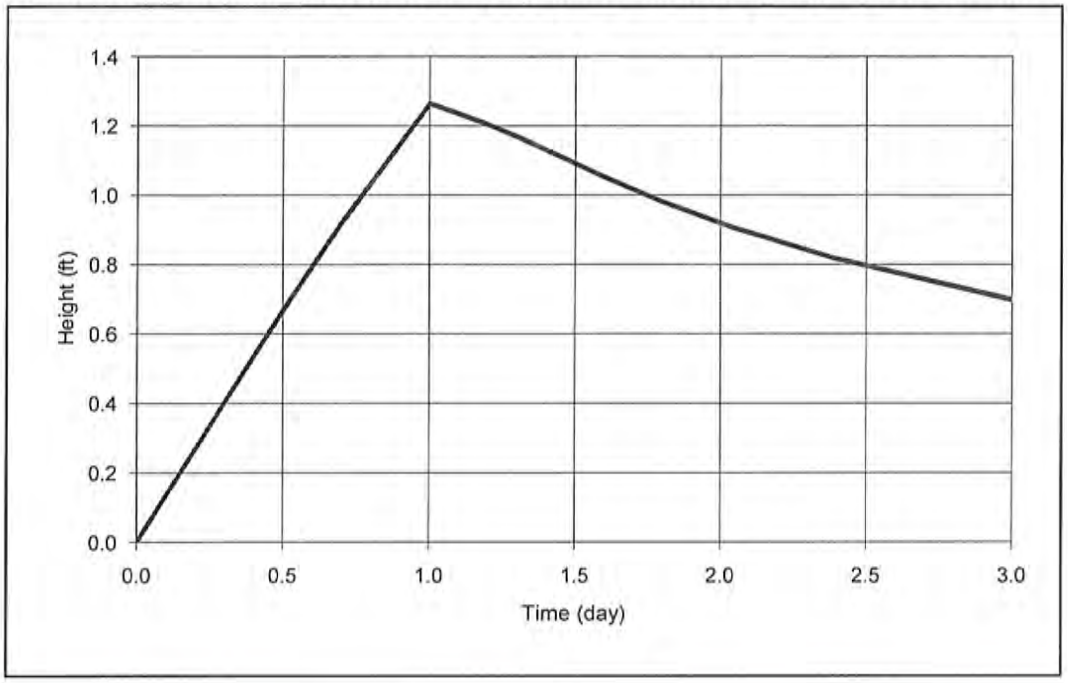
INPUT PARAMETERS

Application rate: 0.47 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 104 ft
Width of application area: 56 ft
Constant head boundary used at: 150 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 52 ft
Total volume applied: 2737.28 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-150	-150	0
0	-126.2	-126	0.01
0	-102.3	-102	0.02
0	-78.4	-78	0.07
0	-59.7	-60	0.35
0	-45.2	-45	0.91
0	-33.3	-33	1.15
0	-23.2	-23	1.23
0	-14.5	-15	1.25
0	-8.7	-9	1.26
0	-4.7	-5	1.26
0	0	0	1.26
0	4.7	5	1.26
0	8.7	9	1.26
0	14.5	15	1.25
0	23.2	23	1.23
0	33.3	33	1.15
0	45.2	45	0.9
0	59.7	60	0.35
0	78.4	78	0.06
0	102.3	102	0.01
0	126.2	126	0
0	150	150	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 7

ANALYST: James Melvin

DATE: 12/21/2016 TIME: 5:58:49 PM

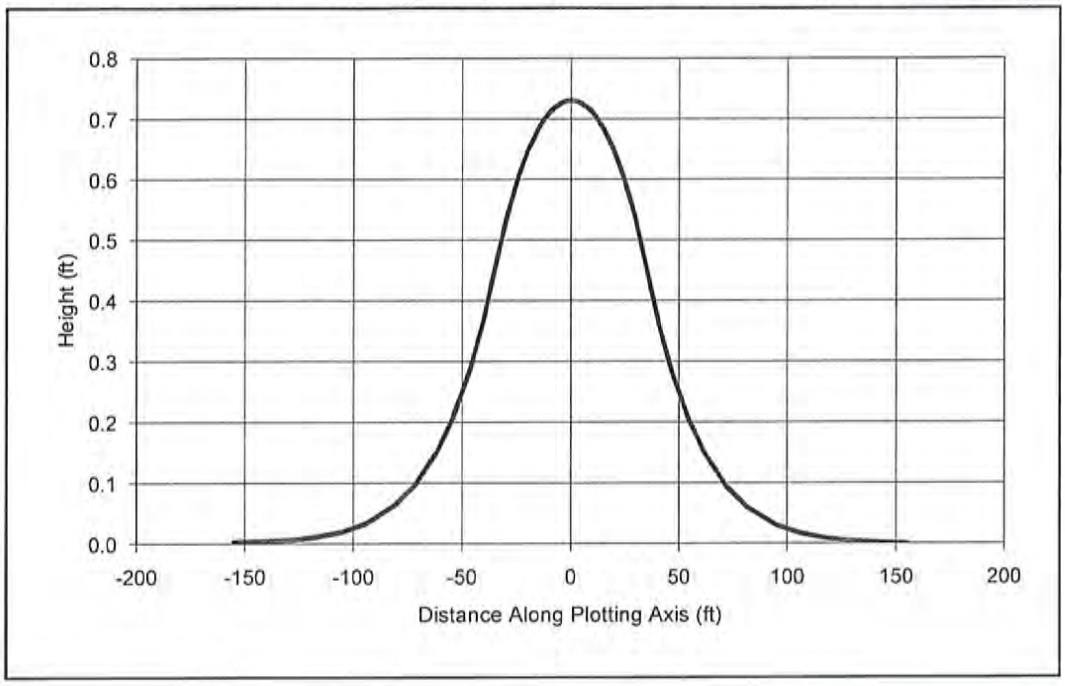
INPUT PARAMETERS

Application rate: 0.47 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 104 ft
Width of application area: 56 ft
Constant head boundary used at: 150 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 2737.28 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.13
0.2	0.21
0.2	0.3
0.3	0.4
0.4	0.53
0.5	0.7
0.7	0.92
1	1.26
1	1.26
1.1	1.24
1.2	1.21
1.3	1.16
1.4	1.11
1.6	1.05
1.8	0.98
2	0.9
2.4	0.82
3	0.7

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 8

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:18:32 PM

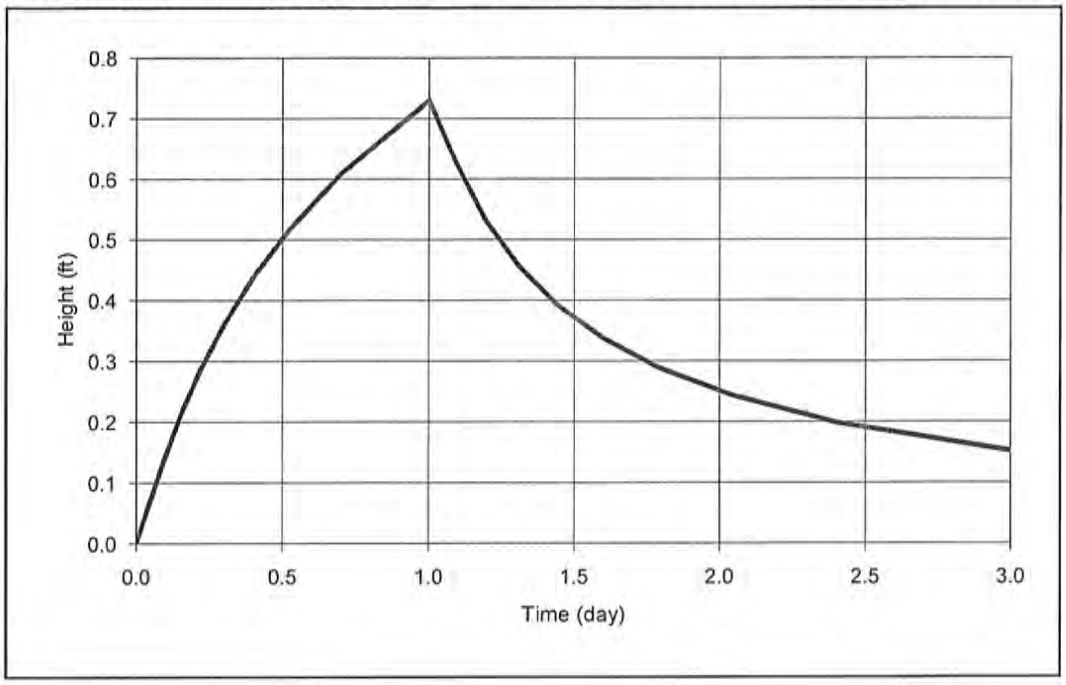
INPUT PARAMETERS

Application rate: 0.51 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 70 ft
Width of application area: 55 ft
Constant head boundary used at: 155 ft
Plotting axis from Y-Axis: 0 degrees
Edge of recharge area:
positive X: 0 ft
positive Y: 35 ft
Total volume applied: 1963.5 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
0	-155	-155	0
0	-130.4	-130	0.01
0	-105.7	-106	0.02
0	-81	-81	0.06
0	-61.7	-62	0.15
0	-46.7	-47	0.28
0	-34.4	-34	0.46
0	-24	-24	0.61
0	-15	-15	0.68
0	-9	-9	0.71
0	-4.9	-5	0.72
0	0	0	0.73
0	4.9	5	0.72
0	9	9	0.71
0	15	15	0.68
0	24	24	0.61
0	34.4	34	0.46
0	46.7	47	0.28
0	61.7	62	0.15
0	81	81	0.06
0	105.7	106	0.02
0	130.4	130	0
0	155	155	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: SMA 8

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:18:37 PM

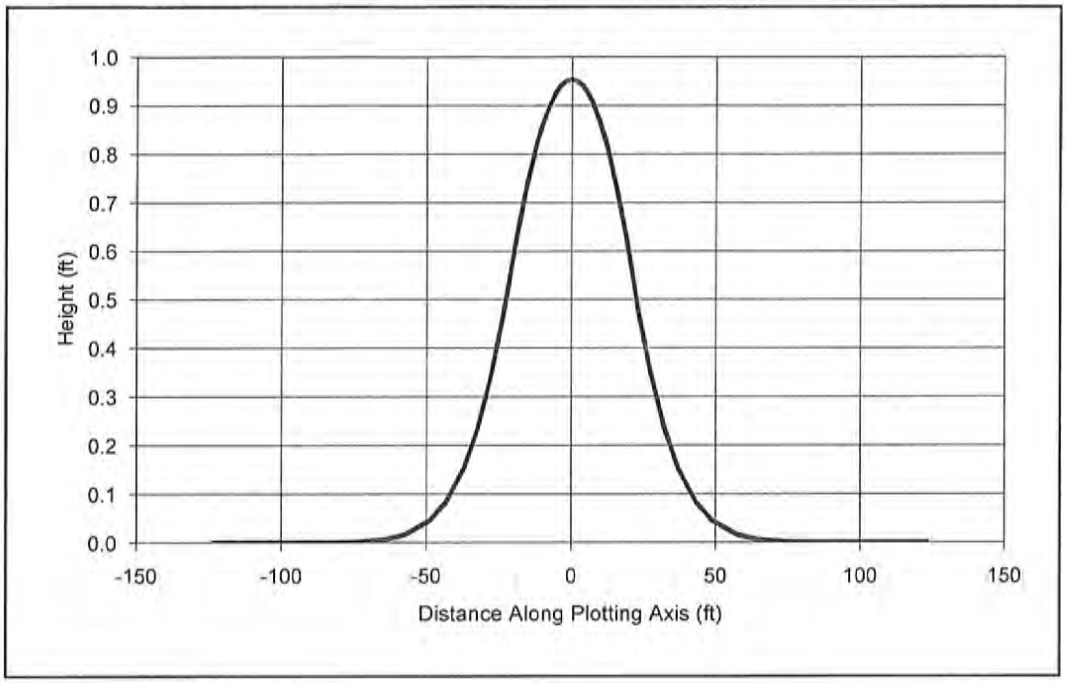
INPUT PARAMETERS

Application rate: 0.51 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 70 ft
Width of application area: 55 ft
Constant head boundary used at: 155 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 1963.5 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.07
0.1	0.14
0.2	0.21
0.2	0.29
0.3	0.36
0.4	0.44
0.5	0.52
0.7	0.61
1	0.73
1	0.7
1.1	0.63
1.2	0.53
1.3	0.46
1.4	0.39
1.6	0.34
1.8	0.29
2	0.24
2.4	0.2
3	0.15

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: RD 1

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:21:25 PM

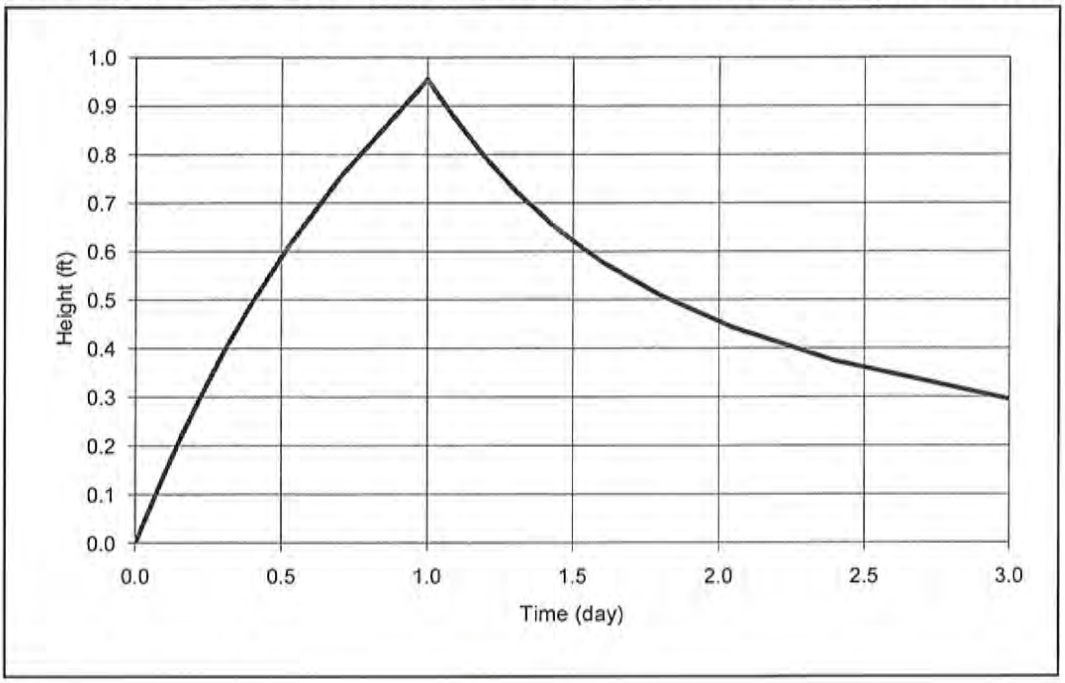
INPUT PARAMETERS

Application rate: 0.5 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 59 ft
Width of application area: 29 ft
Constant head boundary used at: 123 ft
Plotting axis from Y-Axis: 45 degrees
Edge of recharge area:
positive X: 14.5 ft
positive Y: 14.5 ft
Total volume applied: 855.5 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-87	-87	-123	0
-73.1	-73.1	-103	0
-59.3	-59.3	-84	0
-45.5	-45.5	-64	0.01
-34.6	-34.6	-49	0.04
-26.2	-26.2	-37	0.15
-19.3	-19.3	-27	0.35
-13.5	-13.5	-19	0.62
-8.4	-8.4	-12	0.82
-5	-5	-7	0.91
-2.7	-2.7	-4	0.94
0	0	0	0.95
2.7	2.7	4	0.94
5	5	7	0.91
8.4	8.4	12	0.82
13.5	13.5	19	0.62
19.3	19.3	27	0.35
26.2	26.2	37	0.15
34.6	34.6	49	0.04
45.5	45.5	64	0.01
59.3	59.3	84	0
73.1	73.1	103	0
87	87	123	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: RD 1

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:21:30 PM

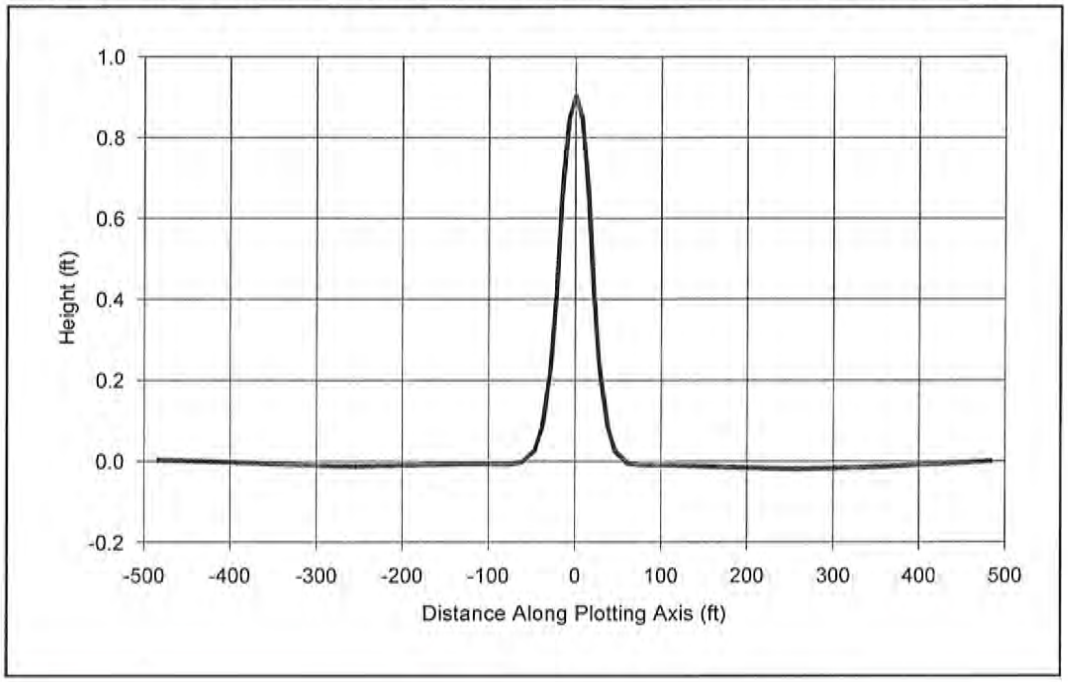
INPUT PARAMETERS

Application rate: 0.5 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 59 ft
Width of application area: 29 ft
Constant head boundary used at: 123 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 855.5 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.14
0.2	0.22
0.2	0.3
0.3	0.39
0.4	0.49
0.5	0.61
0.7	0.75
1	0.95
1	0.93
1.1	0.88
1.2	0.8
1.3	0.72
1.4	0.65
1.6	0.58
1.8	0.51
2	0.44
2.4	0.37
3	0.3

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: RD 2

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:23:58 PM

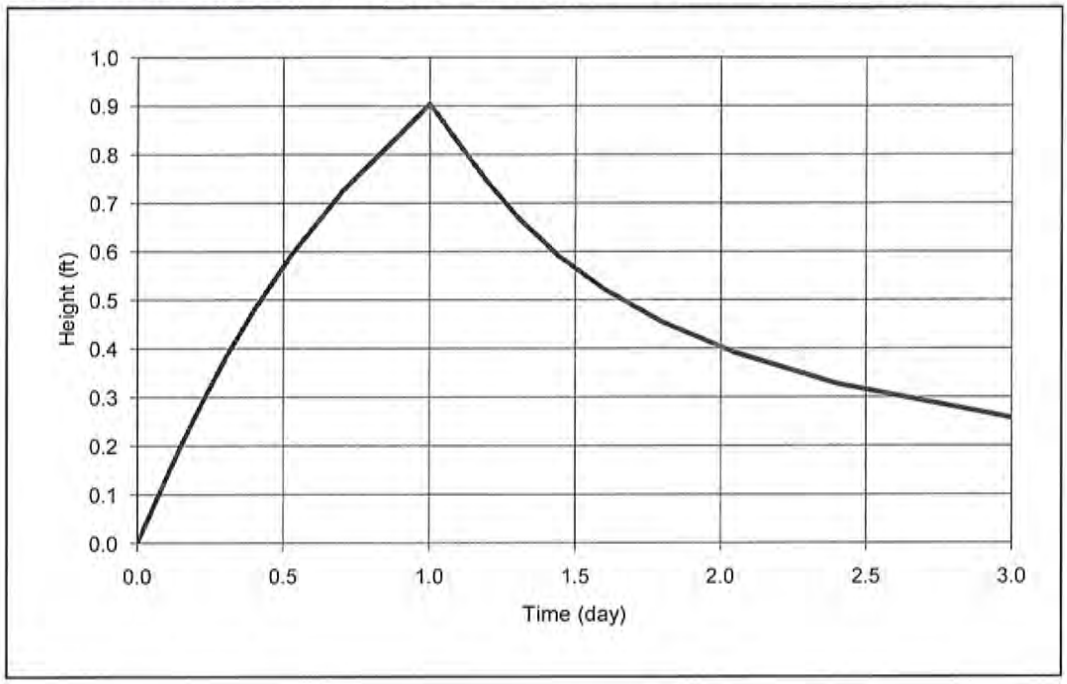
INPUT PARAMETERS

Application rate: 0.47 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 41 ft
Width of application area: 37 ft
Constant head boundary used at: 483 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 18.5 ft
positive Y: 0 ft
Total volume applied: 712.99 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-483	0	-483	0
-406.2	0	-406	0
-329.4	0	-329	-0.01
-252.6	0	-253	-0.01
-192.2	0	-192	-0.01
-145.4	0	-145	-0.01
-107.1	0	-107	-0.01
-74.8	0	-75	-0.01
-46.8	0	-47	0.03
-28	0	-28	0.24
-15.2	0	-15	0.66
0	0	0	0.9
15.2	0	15	0.66
28	0	28	0.23
46.8	0	47	0.02
74.8	0	75	-0.01
107.1	0	107	-0.01
145.4	0	145	-0.01
192.2	0	192	-0.02
252.6	0	253	-0.02
329.4	0	329	-0.02
406.2	0	406	-0.01
483	0	483	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: RD 2

ANALYST: James Melvin

DATE: 11/29/2016 TIME: 8:24:03 PM

INPUT PARAMETERS

Application rate: 0.47 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 3 day
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 10 ft
Length of application area: 41 ft
Width of application area: 37 ft
Constant head boundary used at: 483 ft
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 712.99 cft

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.02
0	0.06
0.1	0.13
0.2	0.21
0.2	0.29
0.3	0.38
0.4	0.48
0.5	0.59
0.7	0.72
1	0.9
1	0.88
1.1	0.83
1.2	0.75
1.3	0.67
1.4	0.59
1.6	0.52
1.8	0.46
2	0.39
2.4	0.33
3	0.26

STAMSKI AND McNARY, INC.
1000 MAIN STREET
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB 2069 700-800 MASS AVE
SHEET NO. _____ OF _____
CALCULATED BY JTM DATE 11/28/16
CHECKED BY _____ DATE _____
SCALE _____

GROUNDWATER MOUNDING

APPLICATION RATE

SMA 1

REQUIRED RECHARGE VOLUME = 831
BOTTOM AREA = 56.33 × 52 = 2929

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{831}{2929} = 0.28$$

SMA 2

REQUIRED RECHARGE VOLUME = 1567
BOTTOM AREA = 87.67 × 27 = 2367

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{1567}{2367} = 0.66$$

SMA 3

REQUIRED RECHARGE VOLUME = 698
BOTTOM AREA = 115.45 × 40.33 = 4656

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{698}{4656} = 0.15$$

SMA 4

REQUIRED RECHARGE VOLUME = 2077
BOTTOM AREA = 106 × 72 = 7632

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{2077}{7632} = 0.27$$

SMA 5

REQUIRED RECHARGE VOLUME = 566
BOTTOM AREA = 62 × 52 = 3224

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{566}{3224} = 0.18$$

STAMSKI AND McNARY, INC.
1000 MAIN STREET
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB 2069 700-800 MASS AVE
SHEET NO. _____ OF _____
CALCULATED BY JTM DATE 11/28/16
CHECKED BY _____ DATE _____
SCALE _____

GROUNDWATER MOUNDING

APPLICATION RATE

SMA 6

REQUIRED RECHARGE VOLUME = 3221
BOTTOM AREA = 53 × 40 = 2120

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{3221}{2120} = 1.52$$

SMA 7

REQUIRED RECHARGE VOLUME = 2717
BOTTOM AREA = 104 × 56 = 5824

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{2717}{5824} = 0.47$$

SMA 8

REQUIRED RECHARGE VOLUME = 1981
BOTTOM AREA = 70 × 55 = 3850

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{1981}{3850} = 0.51$$

RD 1

REQUIRED RECHARGE VOLUME = 849
BOTTOM AREA = 54 × 29 = 1711

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{849}{1711} = 0.5$$

RD 2

REQUIRED RECHARGE VOLUME = 707
BOTTOM AREA = 41 × 37 = 1517

$$\text{APPLICATION RATE} = \frac{\text{RRV}}{\text{BOT. AREA}} = \frac{707}{1517} = 0.47$$

SPECIFIC YIELD VALUES (%)

Coarse gravel	0.23
Medium gravel	0.24
Fine gravel	0.25
Coarse sand	0.27
Medium sand	0.28
Fine sand	0.23
Silt	0.08
Clay	0.03

HYDRAULIC CONDUCTIVITY VALUES (FT/DAY)

MATERIAL	AVERAGE	RANGE
Fine gravel	1476	1181 - 3280
Medium gravel	886	689 - 1181
Coarse gravel	492	328 – 689
Coarse sand	148	65 - 328
Medium sand	39	16 - 65
Fine sand	8	3 - 16
Silt	0.3	0.03 – 3
Clay	0.0007	<0.03
S & G mix	172	16 – 328
S & G glacial till		<100
Glacial till		<10

*Mass DEP Groundwater Mounding for Systems Larger than 2,000 GPD Presentation

Storm Sewer Design

DESIGN STORM: 25 YEAR (Pipe Velocity)
DATE: 12/22/2016
DONE BY: JTM
FILE: 2069 RATIONAL METHOD.wb3

STORM SEWER DESIGN

(ADS N-12)"n"= 0.010 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.013 42"-60"
(Cast Iron)"n"= 0.011
(RCP)"n"=0.013

PROJECT: SM-2069
LOCATION Boxborough, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA INCR. (ACRES)	TRIBUTARY AREA TOTAL (ACRES)	TIME OF FLOW TO UPPER END (MIN)	TIME OF FLOW TIME IN SECTION (MIN)	RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW VELOCITY (FPS)	DESIGN FLOW VELOCITY HEAD (FT)	DESIGN FLOW DEPTH OF FLOW (FT)	DESIGN FLOW TOTAL ENERGY HEAD (FT)	MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION UPPER END	DRAIN INV. ELEVATION LOWER END
CB-1	DMH-1	9		0.10	10	0.04	0.90	5.7	0.51	0.012	12	0.012	4.26	5.43	3.62	0.20	0.23	0.43		0.11	324.34	324.23
CB-2	DMH-1	19		0.16	10	0.10	0.77	5.7	0.70	0.006	12	0.012	2.93	3.73	3.05	0.14	0.33	0.47		0.11	324.34	324.23
DMH-1	Forebay	27		0.26	10	0.08	0.82	5.7	1.21	0.023	12	0.012	5.88	7.50	5.87	0.53	0.31	0.84		0.63	324.13	323.50
CB-3	Forebay +	12		0.23	10	0.04	0.69	5.7	0.90	0.017	12	0.012	4.97	6.34	4.78	0.35	0.29	0.64		0.20	323.20	323.00
CB-4	DMH-2	15		0.15	10	0.07	0.76	5.7	0.65	0.009	12	0.012	3.72	4.74	3.54	0.19	0.28	0.47		0.14	322.58	322.44
CB-4A	DMH-2	106		0.26	10	0.41	0.68	5.7	1.01	0.011	12	0.012	4.03	5.13	4.26	0.28	0.34	0.62		1.16	323.60	322.44
CB-5	DMH-2	13		0.11	10	0.06	0.77	5.7	0.48	0.011	12	0.012	4.00	5.09	3.44	0.18	0.24	0.42		0.14	322.58	322.44
DMH-2	DMH-3	182		0.52	10	0.49	0.73	5.7	2.15	0.017	12	0.012	5.04	6.41	6.15	0.59	0.46	1.04		3.11	320.21	317.10
DMH-3	Flared End	61		0.52	10	0.17	0.73	5.7	2.15	0.016	12	0.012	4.93	6.28	6.06	0.57	0.46	1.03		1.00	317.00	316.00
CB-6	DMH-4	10		0.29	10	0.04	0.51	5.7	0.85	0.013	12	0.012	4.39	5.60	4.30	0.29	0.30	0.58		0.13	316.58	316.45
CB-7	DMH-4	18		0.16	10	0.09	0.77	5.7	0.70	0.007	12	0.012	3.27	4.17	3.29	0.17	0.31	0.48		0.13	316.58	316.45
DMH-4	Flared End	51		0.45	10	0.12	0.60	5.7	1.55	0.036	12	0.012	7.28	9.27	7.32	0.83	0.31	1.14		1.82	316.35	314.53
CB-8	DMH-5	10		0.44	10	0.04	0.44	5.7	1.10	0.010	12	0.012	3.85	4.91	4.23	0.28	0.37	0.64		0.10	312.85	312.75
CB-9	DMH-5	20		0.25	10	0.10	0.79	5.7	1.12	0.005	12	0.012	2.72	3.47	3.29	0.17	0.45	0.61		0.10	312.85	312.75
DMH-5	Flared End	63		0.69	10	0.20	0.57	5.7	2.22	0.010	12	0.012	3.91	4.98	5.14	0.41	0.54	0.95		0.65	312.65	312.00
CB-10	DMH-6	13		0.15	10	0.07	0.76	5.7	0.65	0.008	12	0.012	3.38	4.30	3.31	0.17	0.30	0.47		0.10	317.59	317.49
CB-11	DMH-6	19		0.12	10	0.12	0.78	5.7	0.54	0.005	12	0.012	2.79	3.56	2.74	0.12	0.30	0.41		0.10	317.59	317.49
DMH-6	DMH-7	41		0.27	10	0.20	0.77	5.7	1.19	0.005	12	0.012	2.76	3.51	3.37	0.18	0.46	0.63		0.21	313.31	313.10
CB-12	DMH-9	13		0.28	10	0.05	0.60	5.7	0.96	0.012	12	0.012	4.27	5.44	4.38	0.30	0.32	0.62		0.16	322.38	322.22
CB-13	DMH-9	19		0.28	10	0.08	0.68	5.7	1.08	0.008	12	0.012	3.54	4.50	3.93	0.24	0.38	0.61		0.16	322.38	322.22
DMH-9	DMH-8	54		0.56	10	0.24	0.64	5.7	2.03	0.005	15	0.012	4.94	4.03	3.82	0.23	0.56	0.78		0.27	321.34	321.07
DMH-8	DMH-7	101		0.56	10	0.44	0.64	5.7	2.03	0.005	15	0.012	4.97	4.05	3.84	0.23	0.56	0.79		0.51	313.61	313.10
DMH-7	Forebay	41		0.83	10	0.11	0.68	5.7	3.22	0.012	15	0.012	7.72	6.29	6.00	0.56	0.56	1.12		0.50	313.00	312.50
DMH-7	INF	65		0.83	10	0.14	0.68	5.7	3.22	0.023	15	0.012	10.62	8.66	7.56	0.89	0.47	1.36		1.50	312.00	310.50
CB-14	DMH-10	23		0.31	10	0.09	0.72	5.7	1.27	0.010	12	0.012	3.77	4.80	4.33	0.29	0.40	0.69		0.22	323.47	323.25
CB-15	DMH-10	12		0.46	10	0.03	0.69	5.7	1.80	0.018	12	0.012	5.22	6.64	6.03	0.57	0.41	0.97		0.22	323.47	323.25
CB-16	DMH-11	19		0.30	10	0.09	0.78	5.7	1.34	0.005	12	0.012	2.79	3.56	3.51	0.19	0.49	0.68		0.10	321.58	321.48
CB-17	DMH-11	5		0.43	10	0.01	0.72	5.7	1.77	0.020	12	0.012	5.45	6.94	6.18	0.59	0.39	0.98		0.10	321.58	321.48
DMH-11	DMH-10	135		1.20	10	0.36	0.73	5.7	5.00	0.010	15	0.012	6.99	5.70	6.19	0.60	0.78	1.38		1.35	320.60	319.25
DMH-10	Flared End	63		1.97	10	0.15	0.72	5.7	8.07	0.010	18	0.012	11.10	6.28	6.84	0.73	0.95	1.67		0.60	319.00	318.40
DI 1	DMH-9A	12		0.82	10	0.05	0.20	5.7	0.93	0.008	12	0.012	3.52	4.48	3.78	0.22	0.35	0.57		0.10	324.80	324.70
DMH-9A	DMH 9B	55		0.82	10	0.29	0.20	5.7	0.93	0.005	12	0.012	2.75	3.50	3.16	0.15	0.40	0.55		0.28	324.60	324.32
DMH 9B	Forebay	48		0.82	10	0.17	0.20	5.7	0.93	0.015	12	0.012	4.65	5.93	4.60	0.33	0.30	0.63		0.70	320.70	320.00
DI 2	Flared End	78		5.79	10	0.27	0.16	5.7	5.33	0.005	18	0.012	8.14	4.61	4.90	0.37	0.88	1.25		0.40	317.45	317.05
CB-18	DMH-13	14		0.27	10	0.04	0.67	5.7	1.03	0.024	12	0.012	6.00	7.65	5.66	0.50	0.28	0.77		0.34	330.58	330.24
CB-19	DMH-13	20		0.20	10	0.07	0.76	5.7	0.87	0.017	12	0.012	5.02	6.40	4.78	0.35	0.28	0.63		0.34	330.58	330.24
DMH-13	DMH-12	113		0.47	10	0.39	0.71	5.7	1.89	0.010	12	0.012	3.85	4.91	4.86	0.37	0.49	0.86		1.13	323.91	322.78
DMH-12	DMH-11	183		1.2	10	0.49	0.73	5.7	5.00	0.010	15	0.012	6.99	5.70	6.19	0.60	0.78	1.38		1.83	322.53	320.70
DI 3	Flared End	83		1.57	10	0.36	0.21	5.7	1.84	0.005	15	0.012	5.15	4.20	3.83	0.23	0.51	0.74		0.45	337.45	337.00
DI 4	Flared End	92		0.25	10	0.67	0.20	5.7	0.29	0.005	12	0.012	2.78	3.54	2.28	0.08	0.22	0.30		0.48	336.48	336.00
CB-20	DMH-14	21		0.17	10	0.09	0.86	5.7	0.83	0.010	12	0.012	3.85	4.91	3.91	0.24	0.32	0.55		0.21	344.76	344.55
CB-21	DMH-14	10		0.12	10	0.04	0.73	5.7	0.50	0.021	12	0.012	5.58	7.11	4.37	0.30	0.20	0.50		0.21	344.76	344.55
DMH-14	DMH-15	71		0.29	10	0.19	0.80	5.7	1.33	0.025	12	0.012	6.10	7.77	6.19	0.60	0.32	0.91		1.78	341.88	340.10
DMH-15	DMH-16	79		0.29	10	0.22	0.80	5.7	1.33	0.022	12	0.012	5.70	7.26	5.89	0.54	0.33	0.86		1.73	340.00	338.27
DMH-16	DMH-17	137		0.29	10	0.31	0.80	5.7	1.33	0.040	12	0.012	7.71	9.82	7.34	0.84	0.28	1.12		5.49	337.25	331.76
CB-22	DMH-17	13		0.31	10	0.04	0.70	5.7	1.23	0.017	12	0.012	5.01	6.38	5.26	0.43	0.34	0.76		0.22	331.98	331.76
CB-23	DMH-17	9		0.13	10	0.03	0.79	5.7	0.59	0.024	12	0.012	6.02	7.67	4.86	0.37	0.21	0.58		0.22	331.98	331.76
DMH-17	DMH-17A	190		0.73	10	0.34	0.76	5.7	3.15	0.039	12	0.012	7.65	9.75	9.25	1.33	0.45	1.77		7.50	330.00	322.50
DMH-17A	DMH-18	80		0.73	10	0.16	0.76	5.7	3.15	0.029	15	0.012	11.98	9.77	8.18	1.04	0.43	1.47		2.35	322.25	319.90
CB-27	DMH-22	23		0.31	10	0.06	0.67	5.7	1.19	0.031	12	0.012	6.82	8.68	6.49	0.65	0.28	0.93		0.72	339.52	338.80
CB-28	DMH-22	14		0.14	10	0.04	0.75	5.7	0.60	0.051	12	0.012	8.74	11.13	6.32	0.62	0.18	0.80		0.72	339.52	338.80
DMH-22	DMH-21	154		0.45	10	0.32	0.70	5.7	1.79	0.041	12	0.012	7.83	9.98	8.09	1.02	0.33	1.34		6.37	338.00	331.63
DMH-21	DMH-20	86		0.45	10	0.18	0.70	5.7	1.79	0.040	12	0.012	7.66	9.76	7.91	0.97	0.33	1.30		3.40	331.00	327.60
CB-25	DMH-20	20		0.31	10	0.05	0.61	5.7	1.07	0.033	12	0.012	7.05	8.98	6.44	0.64	0.26	0.90		0.67	328.27	327.60
CB-26	DMH-20	17		0.22	10	0.05	0.61	5.7	0.77	0.039	12	0.012	7.65	9.74	6.17	0.59	0.21	0.80		0.67	328.27	327.60
DMH-20	DMH-19A	62		0.98	10	0.11	0.65	5.7	3.63	0.038	12	0.012	7.53	9.59	9.47	1.39	0.49	1.88		2.37	327.00	324.63
DI 8	DMH-19A	149		1.06	10	0.49	0.20	5.7	1.21	0.016	12	0.012	4.82	6.14	5.09	0.40	0.34	0.74		2.33	323.75	321.42
DMH-19A	DMH-19	43		2.04	10	0.08	0.42	5.7	4.84	0.031	15	0.012	12.25	9.98	9.38	1.36	0.54	1.91		1.32	321.32	320.00
DMH-19	DMH-18	130		2.04	10	0.23	0.42	5.7	4.84	0.030	15	0.012	12.03	9.81	9.26	1.33	0.55	1.88		3.85	323.75	319.90
CB-24	DMH-18	27		0.77	10	0.10	0.72	5.7	3.15	0.006	15	0.012	5.21	4.25	4.44	0.31	0.70	1.01		0.15	319.96	319.81
DMH-18	DMH-18A	44		3.54	10	0.07	0.55	5.7	11.14	0.020	18	0.012	16.27	9.21	9.90	1.52	0.91	2.43		0.90	319.65	318.75
DMH-18A	INF	20		3.54	10	0.03	0.55	5.7	11.14	0.020	18	0.012	16.08	9.11	9.82	1.50	0.92	2.41		0.40	318.65	318.25
DI 5	DMH-23	221		0.86	10	0.59	0.20	5.7	0.98	0.033	12	0.012	6.98	8.89	6.23	0.60	0.25	0.85		7.25	329.00	321.75
DI 6	DMH-23	8		1.21	10	0.02	0.20	5.7	1.38	0.031	12	0.012	6.81	8.68	6.79	0.72	0.31	1.02		0.25	321.25	321.00
DMH-23	DMH 24	113		2.07	10	0.32	0.20	5.7	2.36	0.015	15	0.012	8.57	6.99	5.93	0.55	0.44	0.99		1.70	315.40	313.70
DMH 24	Flared End	40		2.07	10	0.11	0.20	5.7	2.36	0.015	15	0.012	8.56	6.98	5.93	0.55	0.44	0.99		0.60	313.60	313.00
DI 7	Flared End	84		0.66	10	0.38	0.20	5.7	0.75	0.010	15	0.012	7.03	5.73	3.73	0.22	0.28	0.49		0.85	309.00	308.15

CB - CATCH BASIN
DI - DROP INLET
DMH- DRAIN MANHOLE
INF - INFILTRATION AREA

DESIGN STORM: 100 YEAR
DATE: 12/22/2016
DONE BY: JTM
FILE: 2069 RATIONAL METHOD.wb3

STORM SEWER DESIGN

(ADS N-12)"n"= 0.010 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.013 42"-60"
(Cast Iron)"n"= 0.011
(RCP)"n"=0.013

PROJECT: SM-2069
LOCATION Boxborough, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA INCR. (ACRES)	TRIBUTARY AREA TOTAL (ACRES)	TIME OF FLOW TO UPPER END (MIN)	TIME OF FLOW TIME IN SECTION (MIN)	RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW VELOCITY (FPS)	DESIGN FLOW VELOCITY HEAD (FT)	DESIGN FLOW DEPTH OF FLOW (FT)	DESIGN FLOW TOTAL ENERGY HEAD (FT)	MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION UPPER END	DRAIN INV. ELEVATION LOWER END
CB-1	DMH-1	9		0.10	10	0.04	0.90	7.6	0.68	0.012	12	0.012	4.26	5.43	3.97	0.24	0.27	0.51		0.11	324.34	324.23
CB-2	DMH-1	19		0.16	10	0.10	0.77	7.6	0.93	0.006	12	0.012	2.93	3.73	3.30	0.17	0.39	0.55		0.11	324.34	324.23
DMH-1	Forebay	27		0.26	10	0.07	0.82	7.6	1.62	0.023	12	0.012	5.88	7.50	6.36	0.63	0.36	0.98		0.63	324.13	323.50
CB-3	Forebay +	12		0.23	10	0.04	0.69	7.6	1.20	0.017	12	0.012	4.97	6.34	5.18	0.42	0.33	0.75		0.20	323.20	323.00
CB-4	DMH-2	15		0.15	10	0.07	0.76	7.6	0.87	0.009	12	0.012	3.72	4.74	3.84	0.23	0.33	0.55		0.14	322.58	322.44
CB-4A	DMH-2	106		0.26	10	0.38	0.68	7.6	1.35	0.011	12	0.012	4.03	5.13	4.60	0.33	0.40	0.72		1.16	323.60	322.44
CB-5	DMH-2	13		0.11	10	0.06	0.77	7.6	0.65	0.011	12	0.012	4.00	5.09	3.73	0.22	0.27	0.49		0.14	322.58	322.44
DMH-2	DMH-3	182		0.52	10	0.46	0.73	7.6	2.87	0.017	12	0.012	5.04	6.41	6.62	0.68	0.54	1.22		3.11	320.21	317.10
DMH-3	Flared End	61		0.52	10	0.16	0.73	7.6	2.87	0.016	12	0.012	4.93	6.28	6.51	0.66	0.55	1.20		1.00	317.00	316.00
CB-6	DMH-4	10		0.29	10	0.04	0.51	7.6	1.13	0.013	12	0.012	4.39	5.60	4.68	0.34	0.35	0.69		0.13	316.58	316.45
CB-7	DMH-4	18		0.16	10	0.08	0.77	7.6	0.93	0.007	12	0.012	3.27	4.17	3.59	0.20	0.37	0.57		0.13	316.58	316.45
DMH-4	Flared End	51		0.45	10	0.11	0.60	7.6	2.07	0.036	12	0.012	7.28	9.27	7.99	0.99	0.37	1.36		1.82	316.35	314.53
CB-8	DMH-5	10		0.44	10	0.04	0.44	7.6	1.47	0.010	12	0.012	3.85	4.91	4.56	0.32	0.43	0.75		0.10	312.85	312.75
CB-9	DMH-5	20		0.25	10	0.09	0.79	7.6	1.50	0.005	12	0.012	2.72	3.47	3.54	0.19	0.53	0.72		0.10	312.85	312.75
DMH-5	Flared End	63		0.69	10	0.19	0.57	7.6	2.96	0.010	12	0.012	3.91	4.98	5.48	0.47	0.65	1.12		0.65	312.65	312.00
CB-10	DMH-6	13		0.15	10	0.06	0.76	7.6	0.87	0.008	12	0.012	3.38	4.30	3.60	0.20	0.35	0.55		0.10	317.59	317.49
CB-11	DMH-6	19		0.12	10	0.11	0.78	7.6	0.71	0.005	12	0.012	2.79	3.56	2.95	0.14	0.34	0.48		0.10	317.59	317.49
DMH-6	DMH-7	41		0.27	10	0.19	0.77	7.6	1.58	0.005	12	0.012	2.76	3.51	3.62	0.20	0.54	0.74		0.21	313.31	313.10
CB-12	DMH-9	13		0.28	10	0.05	0.60	7.6	1.28	0.012	12	0.012	4.27	5.44	4.73	0.35	0.37	0.72		0.16	322.38	322.22
CB-13	DMH-9	19		0.28	10	0.07	0.68	7.6	1.44	0.008	12	0.012	3.54	4.50	4.25	0.28	0.44	0.72		0.16	322.38	322.22
DMH-9	DMH-8	54		0.56	10	0.22	0.64	7.6	2.71	0.005	15	0.012	4.94	4.03	4.11	0.26	0.66	0.92		0.27	321.34	321.07
DMH-8	DMH-7	101		0.56	10	0.41	0.64	7.6	2.71	0.005	15	0.012	4.97	4.05	4.13	0.26	0.66	0.92		0.51	313.61	313.10
DMH-7	Forebay	41		0.83	10	0.11	0.68	7.6	4.29	0.012	15	0.012	7.72	6.29	6.44	0.64	0.66	1.31		0.50	313.00	312.50
DMH-7	INF	65		0.83	10	0.13	0.68	7.6	4.29	0.023	15	0.012	10.62	8.66	8.17	1.04	0.55	1.59		1.50	312.00	310.50
CB-14	DMH-10	23		0.31	10	0.08	0.72	7.6	1.69	0.010	12	0.012	3.77	4.80	4.65	0.34	0.47	0.80		0.22	323.47	323.25
CB-15	DMH-10	12		0.46	10	0.03	0.69	7.6	2.40	0.018	12	0.012	5.22	6.64	6.50	0.66	0.48	1.13		0.22	323.47	323.25
CB-16	DMH-11	19		0.30	10	0.08	0.78	7.6	1.79	0.005	12	0.012	2.79	3.56	3.77	0.22	0.58	0.80		0.10	321.58	321.48
CB-17	DMH-11	5		0.43	10	0.01	0.72	7.6	2.36	0.020	12	0.012	5.45	6.94	6.66	0.69	0.46	1.14		0.10	321.58	321.48
DMH-11	DMH-10	135		1.20	10	0.35	0.73	7.6	6.67	0.010	15	0.012	6.99	5.70	6.49	0.65	0.98	1.63		1.35	320.60	319.25
DMH-10	Flared End	63		1.97	10	0.15	0.72	7.6	10.76	0.010	18	0.012	11.10	6.28	7.16	0.80	1.19	1.98		0.60	319.00	318.40
DI 1	DMH-9A	12		0.82	10	0.05	0.20	7.6	1.25	0.008	12	0.012	3.52	4.48	4.09	0.26	0.41	0.67		0.10	324.80	324.70
DMH-9A	DMH 9B	55		0.82	10	0.27	0.20	7.6	1.25	0.005	12	0.012	2.75	3.50	3.41	0.18	0.47	0.65		0.28	324.60	324.32
DMH 9B	Forebay	48		0.82	10	0.16	0.20	7.6	1.25	0.015	12	0.012	4.65	5.93	5.00	0.39	0.35	0.74		0.70	320.70	320.00
DI 2	Flared End	78		5.79	10	0.25	0.16	7.6	7.11	0.005	18	0.012	8.14	4.61	5.19	0.42	1.08	1.50		0.40	317.45	317.05
CB-18	DMH-13	14		0.27	10	0.04	0.67	7.6	1.37	0.024	12	0.012	6.00	7.65	6.15	0.59	0.32	0.91		0.34	330.58	330.24
CB-19	DMH-13	20		0.20	10	0.06	0.76	7.6	1.16	0.017	12	0.012	5.02	6.40	5.19	0.42	0.33	0.74		0.34	330.58	330.24
DMH-13	DMH-12	113		0.47	10	0.36	0.71	7.6	2.52	0.010	12	0.012	3.85	4.91	5.22	0.42	0.59	1.01		1.13	323.91	322.78
DMH-12	DMH-11	183		1.2	10	0.47	0.73	7.6	6.67	0.010	15	0.012	6.99	5.70	6.49	0.65	0.98	1.63		1.83	322.53	320.70
DI 3	Flared End	83		1.57	10	0.33	0.21	7.6	2.45	0.005	15	0.012	5.15	4.20	4.14	0.27	0.61	0.87		0.45	337.45	337.00
DI 4	Flared End	92		0.25	10	0.62	0.20	7.6	0.38	0.005	12	0.012	2.78	3.54	2.46	0.09	0.25	0.34		0.48	336.48	336.00
CB-20	DMH-14	21		0.17	10	0.08	0.86	7.6	1.11	0.010	12	0.012	3.85	4.91	4.23	0.28	0.37	0.64		0.21	344.76	344.55
CB-21	DMH-14	10		0.12	10	0.04	0.73	7.6	0.66	0.021	12	0.012	5.58	7.11	4.75	0.35	0.23	0.58		0.21	344.76	344.55
DMH-14	DMH-15	71		0.29	10	0.18	0.80	7.6	1.77	0.025	12	0.012	6.10	7.77	6.70	0.70	0.37	1.06		1.78	341.88	340.10
DMH-15	DMH-16	79		0.29	10	0.21	0.80	7.6	1.77	0.022	12	0.012	5.70	7.26	6.38	0.63	0.38	1.01		1.73	340.00	338.27
DMH-16	DMH-17	137		0.29	10	0.29	0.80	7.6	1.77	0.040	12	0.012	7.71	9.82	7.97	0.99	0.33	1.31		5.49	337.25	331.76
CB-22	DMH-17	13		0.31	10	0.04	0.70	7.6	1.64	0.017	12	0.012	5.01	6.38	5.69	0.50	0.39	0.89		0.22	331.98	331.76
CB-23	DMH-17	9		0.13	10	0.03	0.79	7.6	0.78	0.024	12	0.012	6.02	7.67	5.25	0.43	0.24	0.67		0.22	331.98	331.76
DMH-17	DMH-17A	190		0.73	10	0.32	0.76	7.6	4.20	0.039	12	0.012	7.65	9.75	9.94	1.54	0.53	2.06		7.50	330.00	322.50
DMH-17A	DMH-18	80		0.73	10	0.15	0.76	7.6	4.20	0.029	15	0.012	11.98	9.77	8.87	1.22	0.51	1.73		2.35	322.25	319.90
CB-27	DMH-22	23		0.31	10	0.05	0.67	7.6	1.59	0.031	12	0.012	6.82	8.68	7.04	0.77	0.33	1.09		0.72	339.52	338.80
CB-28	DMH-22	14		0.14	10	0.03	0.75	7.6	0.80	0.051	12	0.012	8.74	11.13	6.84	0.73	0.20	0.93		0.72	339.52	338.80
DMH-22	DMH-21	154		0.45	10	0.29	0.70	7.6	2.39	0.041	12	0.012	7.83	9.98	8.71	1.18	0.38	1.55		6.37	338.00	331.63
DMH-21	DMH-20	86		0.45	10	0.17	0.70	7.6	2.39	0.040	12	0.012	7.66	9.76	8.58	1.14	0.38	1.52		3.40	331.00	327.60
CB-25	DMH-20	20		0.31	10	0.05	0.61	7.6	1.43	0.033	12	0.012	7.05	8.98	7.03	0.77	0.31	1.07		0.67	328.27	327.60
CB-26	DMH-20	17		0.22	10	0.04	0.61	7.6	1.03	0.039	12	0.012	7.65	9.74	6.75	0.71	0.25	0.95		0.67	328.27	327.60
DMH-20	DMH-19A	62		0.98	10	0.10	0.65	7.6	4.84	0.038	12	0.012	7.53	9.59	10.17	1.61	0.58	2.19		2.37	327.00	324.63
DI 8	DMH-19A	149		1.06	10	0.45	0.20	7.6	1.61	0.016	12	0.012	4.82	6.14	5.50	0.47	0.40	0.87		2.33	323.75	321.42
DMH-19A	DMH-19	43		2.04	10	0.07	0.42	7.6	6.45	0.031	15	0.012	12.25	9.98	10.10	1.59	0.64	2.23		1.32	321.32	320.00
DMH-19	DMH-18	130		2.04	10	0.22	0.42	7.6	6.45	0.030	15	0.012	12.03	9.81	9.96	1.54	0.65	2.19		3.85	323.75	319.90
CB-24	DMH-18	27		0.77	10	0.10	0.72	7.6	4.20	0.006	15	0.012	5.21	4.25	4.72	0.35	0.85	1.20		0.15	319.96	319.81
DMH-18	DMH-18A	44		3.54	10	0.07	0.55	7.6	14.85	0.020	18	0.012	16.27	9.21	10.43	1.69	1.13	2.82		0.90	319.65	318.75
DMH-18A	INF	20		3.54	10	0.03	0.55	7.6	14.85	0.020	18	0.012	16.08	9.11	10.33	1.66	1.13	2.79		0.40	318.65	318.25
DI 5	DMH-23	221		0.86	10	0.54	0.20	7.6	1.31	0.033	12	0.012	6.98	8.89	6.77	0.71	0.29	1.00		7.25	329.00	321.75
DI 6	DMH-23	8		1.21	10	0.02	0.20	7.6	1.84	0.031	12	0.012	6.81	8.68	7.37	0.84	0.36	1.20		0.25	321.25	321.00
DMH-23	DMH 24	113		2.07	10	0.29	0.20	7.6	3.15	0.015	15	0.012	8.57	6.99	6.42	0.64	0.52	1.16		1.70	315.40	313.70
DMH 24	Flared End	40		2.07	10	0.10	0.20	7.6	3.15	0.015	15	0.012	8.56	6.98	6.41	0.64	0.52	1.16		0.60	313.60	313.00
DI 7	Flared End	84		0.66	10	0.34	0.20	7.6	1.00	0.010	15	0.012	7.03	5.73	4.06	0.26	0.32	0.58		0.85	309.00	308.15

CB - CATCH BASIN
DI - DROP INLET
DMH- DRAIN MANHOLE
INF - INFILTRATION AREA

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.10	0.9	0.09
lands/grass	0.00	0.2	0
woods	0	0.15	0
sum =	0.10	sum =	0.09

C = **0.90** = total product / total area

CB-2

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.117
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.16	sum =	0.123

C = **0.77** = total product / total area

DMH-1

Surface Cover	A (ac)	C	Product A x C
CB 1	0.10	0.90	0.09
CB-2	0.16	0.77	0.123
sum =	0.26	sum =	0.213

C = **0.82** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-3

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.144
lands/grass	0.07	0.2	0.014
woods	0	0.15	0
sum =	0.23	sum =	0.158

C = **0.69** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

I = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-4

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.108
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.15	sum =	0.114

C = **0.76** = total product / total area

CB-4A

Surface Cover	A (ac)	C	Product A x C
impervious	0.18	0.9	0.162
lands/grass	0.08	0.2	0.016
woods	0	0.15	0
sum =	0.26	sum =	0.178

C = **0.68** = total product / total area

CB-5

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.081
lands/grass	0.02	0.2	0.004
woods	0	0.15	0
sum =	0.11	sum =	0.085

C = **0.77** = total product / total area

DMH-2

Surface Cover	A (ac)	C	Product A x C
CB-4	0.15	0.76	0.114
CB-4A	0.26	0.68	0.178
CB-5	0.11	0.77	0.085
sum =	0.52	sum =	0.377

C = **0.73** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-6

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.117
lands/grass	0.16	0.2	0.032
woods	0	0.15	0
sum =	0.29	sum =	0.149

C = **0.51** = total product / total area

CB-7

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.117
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.16	sum =	0.123

C = **0.77** = total product / total area

DMH-4

Surface Cover	A (ac)	C	Product A x C
CB-6	0.29	0.51	0.149
CB-7	0.16	0.77	0.123
sum =	0.45	sum =	0.272

C = **0.60** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-8

Surface Cover	A (ac)	C	Product A x C
impervious	0.15	0.9	0.135
lands/grass	0.29	0.2	0.058
woods	0	0.15	0
sum =	0.44	sum =	0.193

C = **0.44** = total product / total area

CB-9

Surface Cover	A (ac)	C	Product A x C
impervious	0.21	0.9	0.189
lands/grass	0.04	0.2	0.008
woods	0	0.15	0
sum =	0.25	sum =	0.197

C = **0.79** = total product / total area

DMH-5

Surface Cover	A (ac)	C	Product A x C
CB-8	0.44	0.44	0.193
CB-9	0.25	0.79	0.197
sum =	0.69	sum =	0.39

C = **0.57** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-10

Surface Cover	A (ac)	C	Product A x C
impervious	0.12	0.9	0.108
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.15	sum =	0.114

C = **0.76** = total product / total area

CB-11

Surface Cover	A (ac)	C	Product A x C
impervious	0.10	0.9	0.09
lands/grass	0.02	0.2	0.004
woods	0	0.15	0
sum =	0.12	sum =	0.094

C = **0.78** = total product / total area

DMH-6

Surface Cover	A (ac)	C	Product A x C
CB-10	0.15	0.76	0.114
CB-11	0.12	0.78	0.094
sum =	0.27	sum =	0.208

C = **0.77** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-12

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.144
lands/grass	0.12	0.2	0.024
woods	0	0.15	0
sum =	0.28	sum =	0.168

C = **0.60** = total product / total area

CB-13

Surface Cover	A (ac)	C	Product A x C
impervious	0.19	0.9	0.171
lands/grass	0.09	0.2	0.018
woods	0	0.15	0
sum =	0.28	sum =	0.189

C = **0.68** = total product / total area

DMH-9

Surface Cover	A (ac)	C	Product A x C
CB-12	0.28	0.60	0.168
CB-13	0.28	0.68	0.189
sum =	0.56	sum =	0.357

C = **0.64** = total product / total area

DMH-7

Surface Cover	A (ac)	C	Product A x C
DMH-6	0.27	0.77	0.208
DMH-8	0.56	0.64	0.357
sum =	0.83	sum =	0.565

C = **0.68** = total product / total area

Closed Drainage System

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 4

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	0.25	0.2	0.05
woods	0	0.15	0
sum =	0.25	sum =	0.05

C = **0.20** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 3

Surface Cover	A (ac)	C	Product A x C
impervious	0.03	0.9	0.027
lands/grass	1.30	0.2	0.26
woods	0.24	0.15	0.036
sum =	1.57	sum =	0.323

C = **0.21** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked Date

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 2

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	1.33	0.2	0.266
woods	4.46	0.15	0.669
sum =	5.79	sum =	0.935

C = **0.16** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

CB-16

Surface Cover	A (ac)	C	Product A x C
impervious	0.25	0.9	0.225
lands/grass	0.05	0.2	0.01
woods	0	0.15	0
sum =	0.30	sum =	0.235

C = **0.78** = total product / total area

CB-17

Surface Cover	A (ac)	C	Product A x C
impervious	0.32	0.9	0.288
lands/grass	0.11	0.2	0.022
woods	0	0.15	0
sum =	0.43	sum =	0.31

C = **0.72** = total product / total area

DMH-11

Surface Cover	A (ac)	C	Product A x C
CB-16	0.30	0.78	0.235
DMH-12	0.47	0.71	0.332
CB-17	0.43	0.72	0.310
sum =	1.2	sum =	0.877

C = **0.73** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-18

Surface Cover	A (ac)	C	Product A x C
impervious	0.18	0.9	0.162
lands/grass	0.09	0.2	0.018
woods	0	0.15	0
sum =	0.27	sum =	0.18

C = **0.67** = total product / total area

CB-19

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.144
lands/grass	0.04	0.2	0.008
woods	0	0.15	0
sum =	0.20	sum =	0.152

C = **0.76** = total product / total area

DMH-13

Surface Cover	A (ac)	C	Product A x C
CB-18	0.27	0.67	0.18
CB-19	0.20	0.76	0.152
sum =	0.47	sum =	0.332

C = **0.71** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 1

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	0.82	0.2	0.164
woods	0	0.15	0
sum =	0.82	sum =	0.164

C = **0.20** = total product / total area

DMH-9A

Surface Cover	A (ac)	C	Product A x C
DI 1	0.82	0.20	0.164
sum =	0.82	sum =	0.164

C = **0.20** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-14

Surface Cover	A (ac)	C	Product A x C
impervious	0.23	0.9	0.207
lands/grass	0.08	0.2	0.016
woods	0	0.15	0
sum =	0.31	sum =	0.223

C = **0.72** = total product / total area

CB-15

Surface Cover	A (ac)	C	Product A x C
impervious	0.32	0.9	0.288
lands/grass	0.14	0.2	0.028
woods	0	0.15	0
sum =	0.46	sum =	0.316

C = **0.69** = total product / total area

DMH-10

Surface Cover	A (ac)	C	Product A x C
DMH-11	1.2	0.73	0.877
CB-14	0.31	0.72	0.223
CB-15	0.46	0.69	0.316
sum =	1.97	sum =	1.416

C = **0.72** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-20

Surface Cover	A (ac)	C	Product A x C
impervious	0.16	0.9	0.144
lands/grass	0.01	0.2	0.002
woods	0	0.15	0
sum =	0.17	sum =	0.146

C = **0.86** = total product / total area

CB-21

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.081
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.12	sum =	0.087

C = **0.73** = total product / total area

DMH-14

Surface Cover	A (ac)	C	Product A x C
CB-20	0.17	0.86	0.146
CB-21	0.12	0.73	0.087
sum =	0.29	sum =	0.233

C = **0.80** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-22

Surface Cover	A (ac)	C	Product A x C
impervious	0.22	0.9	0.198
lands/grass	0.09	0.2	0.018
woods	0	0.15	0
sum =	0.31	sum =	0.216

C = **0.70** = total product / total area

CB-23

Surface Cover	A (ac)	C	Product A x C
impervious	0.11	0.9	0.099
lands/grass	0.02	0.2	0.004
woods	0	0.15	0
sum =	0.13	sum =	0.103

C = **0.79** = total product / total area

DMH-17

Surface Cover	A (ac)	C	Product A x C
CB-22	0.31	0.70	0.216
DMH-16	0.29	0.80	0.233
CB-23	0.13	0.79	0.103
sum =	0.73	sum =	0.552

C = **0.76** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-24

Surface Cover	A (ac)	C	Product A x C
impervious	0.57	0.9	0.513
lands/grass	0.20	0.2	0.04
woods	0	0.15	0
sum =	0.77	sum =	0.553

C = **0.72** = total product / total area

DMH-18

Surface Cover	A (ac)	C	Product A x C
CB-24	0.77	0.72	0.553
DMH-19	2.04	0.42	0.849
DMH-17	0.73	0.76	0.552
sum =	3.54	sum =	1.954

C = **0.55** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-27

Surface Cover	A (ac)	C	Product A x C
impervious	0.21	0.9	0.189
lands/grass	0.10	0.2	0.02
woods	0	0.15	0
sum =	0.31	sum =	0.209

C = **0.67** = total product / total area

CB-28

Surface Cover	A (ac)	C	Product A x C
impervious	0.11	0.9	0.099
lands/grass	0.03	0.2	0.006
woods	0	0.15	0
sum =	0.14	sum =	0.105

C = **0.75** = total product / total area

DMH-22

Surface Cover	A (ac)	C	Product A x C
CB-27	0.31	0.67	0.209
CB-28	0.14	0.75	0.105
sum =	0.45	sum =	0.314

C = **0.70** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 8

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	1.06	0.2	0.212
woods	0	0.15	0
sum =	1.06	sum =	0.212

C = **0.20** = total product / total area

DMH-19A

Surface Cover	A (ac)	C	Product A x C
DI 8	1.06	0.20	0.212
DMH-20	0.98	0.65	0.637
sum =	2.04	sum =	0.849

C = **0.42** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-25

Surface Cover	A (ac)	C	Product A x C
impervious	0.18	0.9	0.162
lands/grass	0.13	0.2	0.026
woods	0	0.15	0
sum =	0.31	sum =	0.188

C = **0.61** = total product / total area

CB-26

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.117
lands/grass	0.09	0.2	0.018
woods	0	0.15	0
sum =	0.22	sum =	0.135

C = **0.61** = total product / total area

DMH-20

Surface Cover	A (ac)	C	Product A x C
CB-25	0.31	0.61	0.188
DMH-21	0.45	0.70	0.314
CB-26	0.22	0.61	0.135
sum =	0.98	sum =	0.637

C = **0.65** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked Date

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 5

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	0.86	0.2	0.172
woods	0	0.15	0
sum =	0.86	sum =	0.172

C = **0.20** = total product / total area

DI 6

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	1.21	0.2	0.242
woods	0	0.15	0
sum =	1.21	sum =	0.242

C = **0.20** = total product / total area

DMH-23

Surface Cover	A (ac)	C	Product A x C
DI 5	0.86	0.20	0.172
DI 6	1.21	0.20	0.242
sum =	2.07	sum =	0.414

C = **0.20** = total product / total area

Project: 700-800 Mass Ave By JTM Date 10/17/2016

Location: Boxborough, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DI 7

Surface Cover	A (ac)	C	Product A x C
impervious	0.00	0.9	0
lands/grass	0.66	0.2	0.132
woods	0	0.15	0
sum =	0.66	sum =	0.132

C = **0.20** = total product / total area

Soil Evaluation

No. SM - 2069

Date: 4-28-97

Commonwealth of Massachusetts
BOXBOROUGH, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed By: RICHARD J. HARRINGTON - STAMSKI & McNARY, INC. Date: 4-28-97
Witnessed By: JUDITH GIORGIO - NASHOBA B.O.H.

Location Address or Lot: ASSESSOR'S MAP 6 PARCEL 130, 127.1 MAP 10 PARCEL STOW ROAD, MASS AVE New Construction ☒ Repair ☐	Owner's Name, Address, and Telephone #: AUTHENTIC HOMES 98 CHARTER ROAD ACTON, MA 01720 263-8628

Office Review

Published Soil Survey Available: No ☐ Yes ☒

Year Published ..... Publication Scale ..... Soil Map Unit

Drainage Class A Soil Limitations RAPID PERMEABILITY

Surficial Geologic Report Available: No ☒ Yes ☐

Year Published Publication Scale

Geologic Material (Map Unit)

Landform

Flood Insurance Rate Map:

Above 500 year flood boundary No ☐ Yes ☒

Within 500 year flood boundary No ☒ Yes ☐

Within 100 year flood boundary No ☒ Yes ☐

Wetland Area:

National Wetland Inventory Map (map unit) WETLANDS FLAGGED ON SITE

Wetlands Conservancy Program Map (map unit)

Current Water Resource Conditions (USGS): Month

Range: Above Normal ☐ Normal ☒ Below Normal ☐

Other References Reviewed: _____

Location Address or Lot No. PARCEL 127.1 STRW RD
BOXBORO

On-site Review

Deep Hole Number SM-6 Date: 4-28-97 Time: 10:35 Weather RAIN 40°
Location (identify on site plan)
Land Use WOODS Slope (%) Surface Stones —
Vegetation TREES
Landform TERRACE
Position on landscape (sketch on the back)
Distances from:

Open Water Body	— feet	Drainage way	— feet
Possible Wet Area	120+ feet	Property Line	— feet
Drinking Water Well	7200 feet	Other	—

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-6"	A	SANDY LOAM	10YR 3/3	—	MASSIVE FRIABLE
0'-6" - 1'-6"	B	LOAMY SAND	2.5Y 5/6	—	MASSIVE FRIABLE
1'-6" - 4'-0"	C_1	COARSE SAND	2.5Y 6/4	—	GRANULAR FRIABLE 5% BOULDERS
4'-0" - 6'-6"	C_2	LOAMY SAND	2.5Y 6/3	—	MASSIVE FRIABLE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ICE CONTACT OUTWASH Depth to Bedrock: 6'-6" OR REFUSAL POSSIBLE BOULDERS
Depth to Groundwater: Standing Water in the Hole: — Weeping from Pit Face: —
Estimated Seasonal High Ground Water: 6'-6"

Location Address or Lot No. PARCEL 127.1 STAW RD
BARSBORO

On-site Review

Deep Hole Number SM-7 Date: 4-28-97 Time: 10:55 Weather RAIN 40°

Location (identify on site plan)

Land Use WOODS Slope (%) 5 Surface Stones –

Vegetation PINE

Landform

Position on landscape (sketch on the back)

Distances from:

Open Water Body – feet Drainage way – feet

Possible Wet Area 150+ feet Property Line 100+ feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-6"	A	SANDY LOAM	10YR 3/3	–	MASSIVE FRIABLE
0'-6" - 1'-6"	B	LOAMY SAND	2.5Y 5/6	–	MASSIVE FRIABLE
1'-6" - 8'-0"	C_1	MEDIUM SAND	2.5Y 6/3	–	MASSIVE VERY FRIABLE
8'-0" - 10'-0"	C_2	FINE SAND	2.5Y 6/2	>5% 8'-0" GREYS	MASSIVE FRIABLE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: –

Depth to Groundwater: Standing Water in the Hole: – Weeping from Pit Face: –

Estimated Seasonal High Ground Water: 8'-0"

Location Address or Lot No. PARCEL 127.1 STOW RD
BOXBORO

On-site Review

Deep Hole Number SM-8 Date: 4-28-97 Time: 11:00 Weather RAIN 40°
Location (identify on site plan)
Land Use WOODS Slope (%) Surface Stones —
Vegetation PINE
Landform
Position on landscape (sketch on the back)
Distances from:

Open Water Body	— feet	Drainage way	— feet
Possible Wet Area	>150' feet	Property Line	100' feet
Drinking Water Well	— feet	Other	—

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-8"	A	SANDY LOAM	10YR 3/3	—	MASSIVE FRIABLE
0'-8" - 1'-6"	B	LOAMY SAND	2.5Y 5/6	—	MASSIVE FRIABLE
1'-6" - 6'-0"	C_1	COARSE SAND	2.5Y 6/4	—	GRANULAR FRIABLE
6'-0" - 10'-0"	C_2	LOAMY SAND	2.5Y 6/2	8'-0" 75% GRAYS	MASSIVE FRIABLE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ICE CONTACT OUTWASH Depth to Bedrock: —
Depth to Groundwater: Standing Water in the Hole: — Weeping from Pit Face: —
Estimated Seasonal High Ground Water: 8'-0"

Location Address or Lot No. PARCEL 127.1 STOW RD
BOXBORO

On-site Review

Deep Hole Number SM-9 Date: 4-28-97 Time: 11:15 Weather RAIN 40°
Location (identify on site plan)
Land Use WOODS Slope (%) 5 Surface Stones —
Vegetation PINE
Landform
Position on landscape (sketch on the back)
Distances from:
Open Water Body — feet Drainage way feet
Possible Wet Area 7150 feet Property Line 50± feet
Drinking Water Well — feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-6"	A	SANDY LOAM	10YR 3/3	—	MASSIVE FRIABLE
0'-6" - 1'-6"	B	LOAMY SAND	2.5Y 5/6	—	MASSIVE FRIABLE
1'-6" - 7'-0"	C_1	LOAMY SAND	2.5Y 6/4	—	MEDIUM MASSIVE FRIABLE 5% BOULDERS
7'-0" - 9'-0"	C_2	FINE LOAMY SAND	2.5Y 6/2	75% 7'-0" GREYS	FINE MASSIVE FIRM

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ICE CONTACT OUTWASH Depth to Bedrock: BOULDERS 9'-0"
Depth to Groundwater: Standing Water in the Hole: — Weeping from Pit Face: —
Estimated Seasonal High Ground Water: 7'-0"

Location Address or Lot No. PARCEL 127.1 STOW RD
BOXBORO

On-site Review

Deep Hole Number SM-10 Date: 4-28-97 Time: 11:30 Weather RAIN 40°

Location (identify on site plan)

Land Use WOODS Slope (%) 2 Surface Stones —

Vegetation PINE

Landform OUTWASH PLAIN

Position on landscape (sketch on the back)

Distances from:

Open Water Body — feet Drainage Way — feet

Possible Wet Area 7150 feet Property Line — feet

Drinking Water Well — feet Other —

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-6"	A	SANDY LOAM	10YR 3/3	—	MASSIVE FRIABLE
0'-6" - 1'-0"	B	LOAMY SAND	10YR 5/6	—	MASSIVE FRIABLE
1'-0" - 10'-0"	C	COARSE SAND	2.5Y 6/4	—	GRANULAR LOOSE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: — Weeping from Pit Face: —

Estimated Seasonal High Ground Water: 10'-0"

Location Address or Lot No. PARCEL 127.1 STAN RD
BOXBORO

On-site Review

Deep Hole Number SM-11 Date: 4-28-97 Time: 11:40 Weather RAIN 40°
Location (identify on site plan)
Land Use WOODS Slope (%) 2 Surface Stones —
Vegetation PINE
Landform OUTWASH PLAIN
Position on landscape (sketch on the back)
Distances from:
Open Water Body — feet Drainage way — feet
Possible Wet Area >150' feet Property Line feet
Drinking Water Well — feet Other

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0'-0" - 0'-6"	A	SANDY LOAM	10YR 3/3	—	MASSIVE FRIABLE
0'-6" - 1'-0"	B	LOAMY SAND	10YR 5/6	—	MASSIVE FRIABLE
1'-0" - 11'-0"	C	COARSE SAND	2.5Y 6/4	—	GRANULAR LOOSE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: —
Depth to Groundwater: Standing Water in the Hole: — Weeping from Pit Face: —
Estimated Seasonal High Ground Water: 11'-0"

MAP 6 PARCELS 130, 127.1

Location Address or Lot No. MAP 10 · PARCEL
BOXBORO

Determination for Seasonal High Water Table

Method Used:

- [x] Depth observed standing in observation hole ..... inches
- [ ] Depth weeping from side of observation hole ..... inches
- [x] Depth to soil mottles ..... inches
- [ ] Ground water adjustment ..... feet

Index Well Number ..... Reading Date ..... Index well level .....

Adjustment factor ..... Adjusted ground water level .....

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? yes

If not, what is the depth of naturally occurring pervious material? _____

Certification

I certify that on 10-25-94 (date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature _____ Date 4-28-97

4/28/97
SOIL TESTING
SKETCH
FOR: AUTHENTIC HOMES
— STAMSEL & MCNARY, INC
SM-2069
TOWN CENTER
AGRICULTURAL
RESIDENTIAL
BUSINESS DISTRICT # 12
RESIDENTIAL
BUSINESS AGRICULTURAL
RESIDENTIAL
DISTRICT # 13
ULTURAL
USINESS
G R O U P

FORM II - SOIL EVALUATOR FORM
Page 1 of 3

No. SM 2069 Date: 8/13/98

Commonwealth of Massachusetts
Boxborough, Massachusetts
Soil Suitability Assessment for On-site Sewage Disposal

Performed By: George Dimakarakus / STANSKI & McNARY INC Date: 8/13/98
Witnessed By: MATT MORAN N.A.B.H. BERNIE SULLIVAN NABH
MARGO WEBBER D.E.P.

Location Address of Lot: PARCEL 127-1 PARCEL 130 STOW ROAD	Owner's Name, Address, Tel Telephone: AUTHENTIC HOMES INC 28 CHARTER ROAD ACTON, MA 01720 263-9628
New construction ☐ Repair ☐	

Office Review

Published Soil Survey Available: No ☐ Yes ☒
Year Published ..... Publication Scale ..... Soil Map Unit .....
Drainage Class ..... Soil Limitations .....
Surficial Geologic Report Available: No ☒ Yes ☐
Year Published ..... Publication Scale .....
Geologic Material (Map Unit) .....
Landform .....
Flood Insurance Rate Map:
Above 500 year flood boundary: No ☐ Yes ☒
Within 500 year flood boundary: No ☒ Yes ☐
Within 100 year flood boundary: No ☒ Yes ☐
Wetland Areas:
National Wetland Inventory Map (map unit) Upland
Wetlands Conservancy Program Map (map unit) .....

Current Water Resource Conditions (USGS): Month April, 1998
Range: Above Normal ☐ Normal ☒ Below Normal ☐
Other References Reviewed: _____

Location Address or Lot No. PARCEL 127.1, STOW ROAD

On-site Review

Deep Hole Number 16 Date: 4/29/98 Time: 8:30 Weather SUNY 50°F

Location (identify on site plan)

Land Use WOODS Slope (%) 2 Surface Stones

Vegetation WOODS

Landform TERRACE

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 6"	A	SANDY LOAM	10YR3/3	–	MASSIVE, FRIABLE
6" - 18"	B	LOAMY SAND	10YR5/6	–	MASSIVE, VERY FRIABLE
18" - 144"	C	FINE SAND	2.5Y5/4	RUST BAND @66"	SINGLE GRAIN VERY FRIABLE FINE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: –

Depth to Groundwater: Standing Water in the Hole: 144" Weeping from Pit Face: 132"

Estimated Seasonal High Ground Water: 7.37' (SEE ATTACHED CALCS)

Location Address or Lot No. PARCEL 127.1 STOW RD

On-site Review

Deep Hole Number 17 Date: 4/29/98 Time: 8:45 Weather SUNNY 50's
Location (identify on site plan)
Land Use WOODS Slope (%) 2 Surface Stones
Vegetation WOODS
Landform TERRACE
Position on landscape (sketch on the back) BOTTOM SLOPE
Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 20"	A_1	SANDY LOAM	10YR3/2	–	MASSIVE, FRIABLE
20" - 27"	A_2	SANDY LOAM	7.5YR3/4	–	MASSIVE, FRIABLE
27" - 36"	B	SANDY LOAM	10YR4/4	–	MASSIVE, FRIABLE
36" - 132"	C_1	FINE SAND	2.5Y5/4		VERY FRIABLE SINGLE GRAIN
132" - 180"	C_2	LOAMY SAND	2.5Y4/3	RUST BAND @66"	MASSIVE, FRIABLE GRAVELLY 10% STONES GLEYED BELOW 132"

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: –
Depth to Groundwater: Standing Water in the Hole: BOTTOM Weeping from Pit Face: 132"
Estimated Seasonal High Ground Water: 7.37' (SEE ATTACHED CALC.)

Location Address or Lot No. PARCEL 127.1, STOW ROAD

On-site Review

Deep Hole Number 18 Date: 4/29/98 Time: 9:15 Weather SUNNY 50's

Location (identify on site plan)

Land Use WOODS Slope (%) 3-5 Surface Stones

Vegetation WOODS

Landform TERRACE

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 8"	A	SANDY LOAM	10YR3/3	-	MASSIVE; FRIABLE
8" - 18"	B	LOAMY SAND	10YR5/6	- HIGH+ LOW CHROMA BANDS @ 8"	MASSIVE, VERY FRIABLE
18" - 216"	C	MEDIUM SAND	2.5Y5/4		SINGLE GRAIN VERY FRIABLE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) PROGLACIAL OUTWASH Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: BOTTOM Weeping from Pit Face: 168"

Estimated Seasonal High Ground Water: 10.37' (SEE ATTACHED CALC'S)

Location Address or Lot No. PARCEL 127.1 STONY ROAD

On-site Review

Deep Hole Number 19 Date: 7/29/98 Time: 9:30 Weather SUNNY 60

Location (identify on site plan)

Land Use WOODS Slope (%) 5 Surface Stones —

Vegetation WOODS

Landform TERRACE

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 6"	A	SANDY LOAM	10YR3/3	—	MASSIVE, FRIABLE
6" - 18"	B	LOAMY SAND	10YR 5/6	—	MASSIVE, VERY FRIABLE
18" - 216"	C	MEDIUM COARSE SAND	10YR4/6	FAINT MOTTLES @ 132"	LOOSE, SINGLE GRAIN GRAVELLY COBBLY

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ICE CONTACT OUTWASH Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 198 Weeping from Pit Face: 198"

Estimated Seasonal High Ground Water: 128.7' (SEE ATTACHED CALC'S)

Location Address or Lot No. PARCEL 127-1, STOW ROAD

On-site Review

Deep Hole Number 20 Date: 4/29/98 Time: 9:45 Weather SUNNY 60S

Location (identify on site plan)

Land Use WOODS Slope (%) 3-5 Surface Stones

Vegetation WOODS

Landform TERRACE

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 6"	A	SANDY LOAM	10YR2/3	-	MASSIVE, FRIABLE
6" - 18"	B	LOAMY SAND	10YR5/6	-	MASSIVE, VERY FRIABLE
18" - 192"	C	FINE - MEDIUM SAND	2.5Y5/4	HIGH - LOW CHROMA @ 72"	VERY FRIABLE SINGLE GRAIN 15% GRAVEL (SANDY LOAM LENSE @ ≈ 3'-4', APPROX 10' LONG)

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ICE CONTACT OUTWASH Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: BOTTOM Weeping from Pit Face: 180"

Estimated Seasonal High Ground Water: 11.37' (SEE ATTACHED CALC'S)

Location Address or Lot No. PARCEL 130 , STOW RD

On-site Review

Deep Hole Number 21 Date: 4/29/98 Time: 11:00 Weather 60°F SUNNY

Location (identify on site plan)

Land Use YARD Slope (%) 3-5 Surface Stones

Vegetation GRASS/BRUSH

Landform

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8"	A	SANDY LOAM	10YR3/3	—	MASSIVE, FRIABLE
8"-18"	B	LOAMY SAND	10YR5/6	—	MASSIVE, VERY FRIABLE
18"-174"	C	LOAMY SAND	2.5Y5/3	COMMON 7.5YR5/8 2.5Y6/2 @ 36"	MASSIVE, FRIABLE 15% GRAVEL 5% COBBLES

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION TILL Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 138" Weeping from Pit Face: 120"

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. PARCEL 130, STOW RD

On-site Review

Deep Hole Number 22 Date: 4/22/98 Time: 11:20 Weather SUNY 60's

Location (identify on site plan)

Land Use YARD Slope (%) 3-5 Surface Stones

Vegetation BRUSH

Landform

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 8"	A	SANDY LOAM	10YR3/3		MASSIVE, FRIABLE
8" - 24"	B	LOAMY SAND	10YR5/6		MASSIVE, FRIABLE
24" - 182"	C	LOAMY SAND	2.5Y5/4	COMMON 7.5YR5/8 + 2.5YR4/2 @ 48"	MASSIVE, FRIABLE MOIST 15% GRAVEL 10% STONES

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 13' Weeping from Pit Face: 12'6" 48"

Estimated Seasonal High Ground Water:

Location Address or Lot No. PARCEL 130, STOW RD

On-site Review

Deep Hole Number 23 Date: 4/29/98 Time: 11:50 Weather 60's SUNNY
Location (identify on site plan)
Land Use YARD Slope (%) 5-8 Surface Stones
Vegetation BRUSH
Landform
Position on landscape (sketch on the back) ON SLOPE
Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8"	A	SANDY LOAM	10YR 3/3		MASSIVE, FRIABLE
8"-24"	B	LOAMY SAND	10YR 5/6	COMMON 7.5YR 5/8	MASSIVE, FRIABLE
24"-144"	C	LOAMY SAND	2.5Y 5/4	2.5Y 6/2 @ 66"	MASSIVE, FRIABLE 10% BOULDERS 15% GRAVEL 10% STONES

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION TILL Depth to Bedrock:
Depth to Groundwater: Standing Water in the Hole: BOTTOM Weeping from Pit Face: 132"
Estimated Seasonal High Ground Water: 66"

Location Address or Lot No. PARCEL 130, SNOW ROAD

On-site Review

Deep Hole Number 24 Date: 4/29/98 Time: 12:15 Weather SUNNY 60°F

Location (identify on site plan)

Land Use YARD Slope (%) 3-5 Surface Stones

Vegetation BRUSH

Landform

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-18"	FILL				
18"-36"	C1	FINE SAND	2.5Y5/6		VERY FRIABLE SINGLE GRAIN
36"-150"	C2	LOAMY SAND	2.5Y4/3	COMMON 7.5YR5/8 + 2.5Y6/2 @ 36"	FIRM IN PLACE 10% GRAVEL

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION TILL Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 138" Weeping from Pit Face: 126"

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. PARCEL 130 , STOW ROAD

On-site Review

Deep Hole Number 25 Date: 4/29/98 Time: 12:25 Weather SUNNY 60's

Location (identify on site plan)

Land Use YARD Slope (%) 3-5 Surface Stones

Vegetation BRUSH

Landform

Position on landscape (sketch on the back) ON SLOPE

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-12"	A	SANDY LOAM	10YR3/3	–	MASSIVE, FRIABLE
12"-24"	B	LOAMY SAND	10YR5/6	–	MASSIVE, VERY FRIABLE
24"-144"	C	LOAMY SAND	2.5Y5/4	COMMON 7.5YR5/8 2.5Y6/2 @ 36"	MASSIVE, FRIABLE 10% GRAVEL 10% STONES

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION TILL Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 102" Weeping from Pit Face: 102"

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. PARCEL 130 STOW ROAD

On-site Review

Deep Hole Number 25 Date: 4/29/98 Time: 12:35 Weather SUNNY 60's

Location (identify on site plan)

Land Use YARD Slope (%) 3-5 Surface Stones

Vegetation BRUSH.

Landform ON SLOPE

Position on landscape (sketch on the back)

Distances from:

Open Water Body	feet	Drainage way	feet
Possible Wet Area	feet	Property Line	feet
Drinking Water Well	feet	Other	

DEEP OBSERVATION HOLE LOG*

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-12"	A	SANDY LOAM	10YR3/3	-	MASSIVE, FRIABLE.
12"-24"	B	LOAMY SAND	10YR5/6	-	MASSIVE, FRIABLE
24"-144"	C	LOAMY SAND	2.5Y5/3	COMMON 7.5YR5/8 2.5Y6/2 @ 36"	MASSIVE, FRIABLE 10% GRAVEL COARSE

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) ABLATION TILL Depth to Bedrock: —

Depth to Groundwater: Standing Water in the Hole: 132" Weeping from Pit Face: 84"

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. PARCEL 127.1, STOW ROAD

COMMONWEALTH OF MASSACHUSETTS

BOXBORO, Massachusetts

Percolation Test*

Date: 8/13/98	Time: 9:48	
Observation Hole #	16	17
Depth of Perc	50"	47"
Start Pre-soak	9:48	9:54
End Pre-soak	10:03	10:09
Time at 12"	10:03	
Time at 9"	10:05	
Time at 6"	10:08	
Time (9"-6")	3	UNABLE TO SATURATE
Rate Min./inch	2	<2

* Minimum of 1 percolation test must be performed in both the primary area AND reserve area.

Site Passed ☒ Site Failed ☐

Performed By: George Dimakarakos / STAMSKI & McNARY, INC

Witnessed By: MATT MORAN - NABH

Comments: MARGO WEBBER - DEP

Location Address or Lot No. PARCEL 127.1, STOW ROAD

COMMONWEALTH OF MASSACHUSETTS

BOXBORO, Massachusetts

Percolation Test*

Date:	8/13/98	Time: 10:12
Observation Hole #	18	19
Depth of Perc	45	40"
Start Pre-soak	10:12	10:18
End Pre-soak	10:27	
Time at 12"	10:27	
Time at 9"	10:34	
Time at 6"	10:41	
Time (9"-6")	7	UNABLE TO SAT.
Rate Min./Inch	3	<2

* Minimum of 1 percolation test must be performed in both the primary area AND reserve area.

Site Passed [X] Site Failed [ ]

Performed By: George Dimakarakos / STANSKI & MAVARY, INC

Witnessed By: MATT MORAN - NAEH.

Comments: MARGO WEBBER - DEP

Location Address or Lot No. PARCEL 130

COMMONWEALTH OF MASSACHUSETTS

BOXBORO , Massachusetts

Percolation Test*

Date: 8/13/98	Time: 11:10	
Observation Hole #	22	23
Depth of Perc	53"	48"
Start Pre-soak	11:10	11:38
End Pre-soak	11:25	11:53
Time at 12"	11:25	11:53
Time at 9"	11:45	12:05
Time at 6"	12:22	12:25
Time (9"-6")	27	20
Rate Min./Inch	13	7

* Minimum of 1 percolation test must be performed in both the primary area AND reserve area.

Site Passed ☒ Site Failed ☐

Performed By: George Dimakarakos / STAMSKI + McNARY INC

Witnessed By: MATT MORAN - NARA

Comments:

DEP APPROVED FORM - 12/01/95

Location Address or Lot No. Parcel 127.1, PARCEL 130
STOW ROAD

Determination for Seasonal High Water Table

Method Used:

- [ ] Depth observed standing in observation hole ..... inches
- [ ] Depth weeping from side of observation hole ..... inches
- [x] Depth to soil mottles inches
- TP's 16-20 [x] Ground water adjustment 3.63 feet

Index Well Number ..... Reading Date ..... Index well level ..

Adjustment factor ..... Adjusted ground water level .....

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? YES

If not, what is the depth of naturally occurring pervious material? _____

Certification

I certify that on 7/26/95 (date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature George Dimitrovsky Date 8/13/98

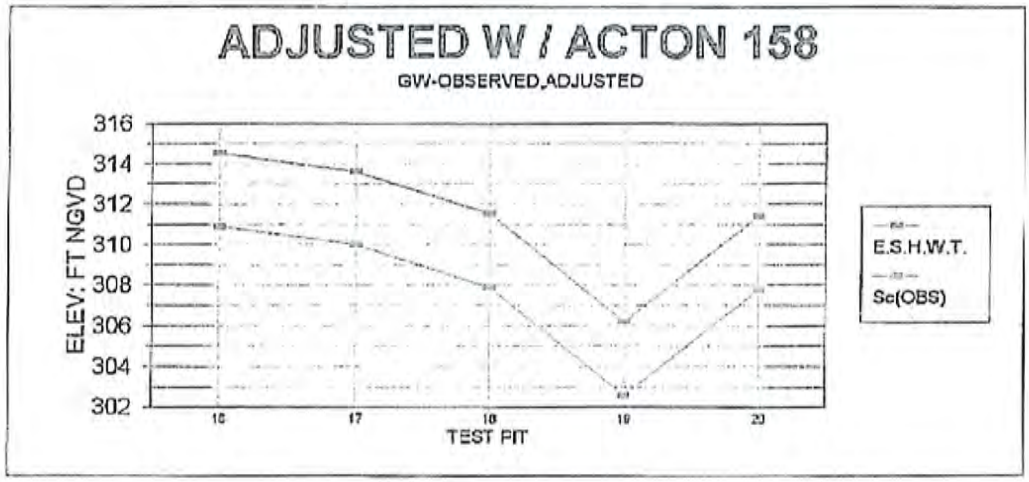
STAMSKI & McNARY INC.

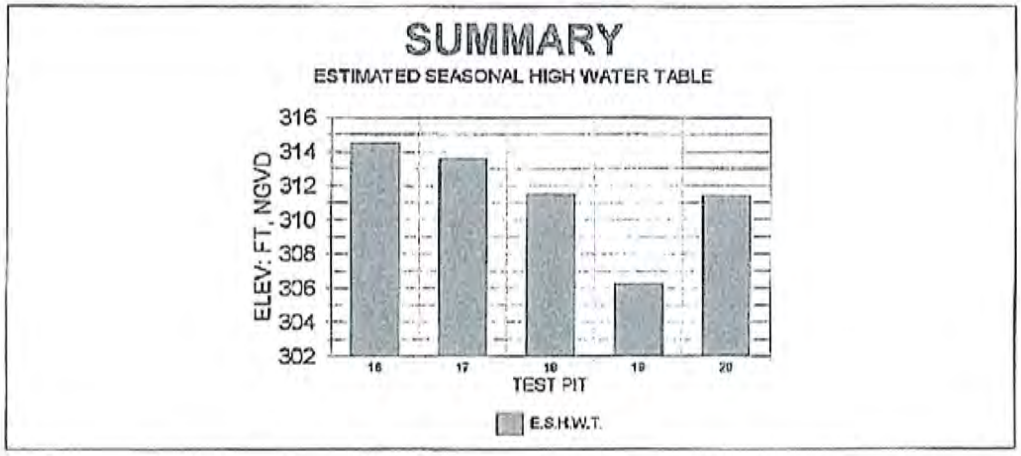
CALCULATED BY: GD

PROJECT: SM-2069

REFERENCE WELL: ACTON 158
FRIMPTER CALCULATIONS:
Sc=MEASURED DEPTH TO GW @ SITE
14.98 =OwMAX=MAX GW ELEV IN WELL
17.34 =Owc=MEASURED GW IN WELL
8.3 =Sr=RANGE OF WATER LEVEL
5.4 =Owr=RECORDED UPPER LIMIT OF WELL
Sh=SEASONAL HIGH AT SITE
Sc-Sr/Owr(Owc-OwMAX)=Sh

TEST PIT #	GROUND ELEV.	Sc FT	Sc(OBS) ELEV	Sh FT	FRIMPTER ADJUSTED ELEV.	E.S.H.W.T. N.G.V.D.
16	321.90	11.00	310.90	7.37	314.53	314.53
17	321.00	11.00	310.00	7.37	313.63	313.63
18	321.90	14.00	307.90	10.37	311.53	311.53
19	319.10	16.50	302.60	12.87	306.23	306.23
20	322.80	15.00	307.80	11.37	311.43	311.43



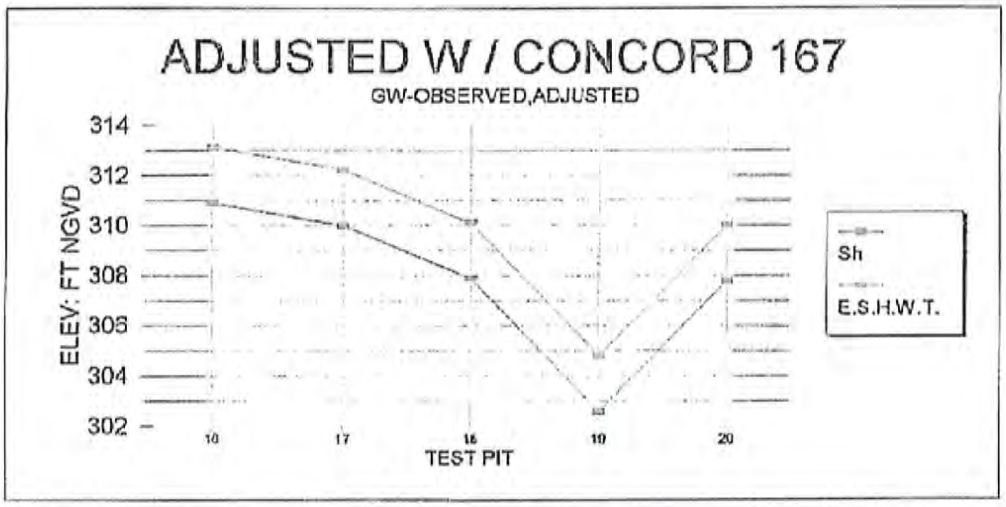


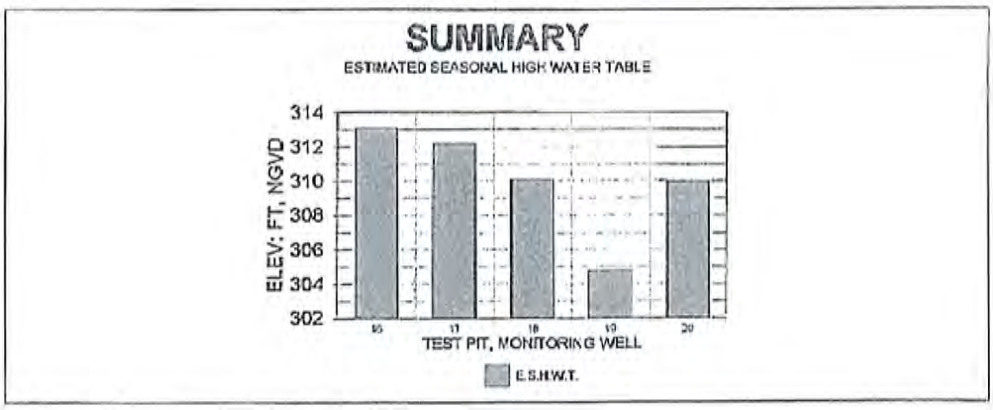
CALCULATED BY: GD

PROJECT: SM-2069

REFERENCE WELL:CONCORD 167
FRIMPTER CALCULATIONS:
Sc=MEASURED DEPTH TO GW @ SITE
4.47 =OwMAX=MAX GW ELEV IN WELL
5.73 =Owc=MEASURED GW IN WELL
8.3 =Sr=RANGE OF WATER LEVEL
4.72 =Owr=RECORDED UPPER LIMIT OF WELL
Sh=SEASONAL HIGH AT SITE
Sc-Sr/Owr(Owc-OwMAX)=Sh

TEST PIT #	GROUND ELEV.	Sc FT	Sc(OBS) ELEV	Sh FT	FRIMPTER ADJUSTED ELEV.	E.S.H.W.T. N.G.V.D.
16	321.90	11.00	310.90	8.78	313.12	**313.12**
17	321.00	11.00	310.00	8.78	312.22	**312.22**
18	321.90	14.00	307.90	11.78	310.12	**310.12**
19	319.10	16.50	302.60	14.28	304.82	**304.82**
20	322.80	15.00	307.80	12.78	310.02	**310.02**





USE ACTON 158

SUMMARY OF GROUND-WATER LEVELS APRIL 1998 PROVISIONAL

WELL	TOPO	LITHO	START YEAR OF RECORD	NET CHANGE IN MONTH (FEET)	NET CHANGE IN ONE YEAR (FEET)	DEPARTURE FROM MONTHLY MEDIAN (FEET)	WATER LEVEL BELOW LAND-SURFACE DATUM (FEET)	DAY
MASSACHUSETTS								
ACTON 158	TS		1965	+ 0.16	- 1.57	+ 0.47	17.34	22
ANDOVER 462	VS		1968	- 0.35	- 0.90	- 0.69	14.77	22
ATTLEBORO 83	VS		1964	- 0.26	- 0.03	+ 0.19	3.27	28
BARNSTABLE 230	FS		1957	+ 0.03	+ 0.01	+ 1.93	20.74 >	28
BARNSTABLE 247	FS		1962	+ 0.47	- 0.31	+ 2.78	20.83 >	28
BECKET 12	TS		1986	+ 0.15	+ 0.09	+ 0.35	3.12	21
BILLERICA 363	HS		1962	- 1.66	- 0.35	- 4.25	8.50 <	22
BLANDFORD 9	VS		1986	- 1.15	- 0.62	- 0.92	3.18 <	21
BOURNE 198	FS		1962	- 0.05	+ 0.85	+ 2.40	29.78 >	28
BOYLSTON 87	VT		1995	- 2.12	- 1.37	-----	5.92	29
BREWSTER 21	FS		1962	+ 0.45	+ 0.38	+ 1.71	7.80	22
BREWSTER 22	FS		1962	+ 0.62	+ 0.47	+ 2.22	28.15 >	22
CHATHAM 138	FS		1962	+ 0.58	+ 0.34	+ 2.17	21.10	28
CHELMSFORD 384	TS		1987	- 0.47	- 0.57	+ 0.46	14.81	22
CHESHIRE 2	HT		1951	- 0.02	+ 0.26	+ 0.08	1.85	21
CHICOPEE 95	TS		1984	+ 0.53	+ 0.04	+ 0.76	20.37	20
COLRAIN 8	VS		1965	- 0.86	- 0.92	- 0.34	16.93	21
CONCORD 165	TS		1965	+ 0.66	- 1.07	+ 1.80	39.74.	22
CONCORD 167	TS		1965	- 0.86	- 0.55	+ 0.35	5.73	22
CUMMINGTON 13	VS		1986	- 0.17	- 0.31	- 0.48	3.86	20
DEDHAM 231	ST		1965	- 0.28	+ 2.09	+ 0.99	3.83	27
DEERFIELD 44	VS		1965	- 0.06	- 0.10	+ 0.21	2.40	21
DOVER 10	TS		1965	- 0.35	+ 0.59	+ 0.10	31.52	27
DUXBURY 79	VS		1965	- 0.35	+ 0.31	+ 0.55	7.40	27
DUXBURY 80	VR		1965	- 0.36	+ 0.21	+ 0.61	20.92	27
EAST BRIDGEWATER 30	HT		1958	- 0.39	+ 1.76	+ 1.57	3.46	27
EDGARTOWN 52	VS		1976	+ 0.79	- 0.33	+ 4.37	13.68 >	28
FOXBOROUGH 3	TS		1965	- 0.44	- 0.19	+ 0.61	17.26	28
FREETOWN 23	TS		1964	+ 0.19	- 0.45	+ 1.03	11.84	27
GEORGETOWN 168	VS		1965	- 1.10	- 0.95	- 0.29	4.23	22
GRANBY 68	VS		1954	- 0.33	- 0.03	+ 0.18	6.15	20
GRANVILLE 5	TS		1965	+ 0.61	- 0.81	+ 0.65	31.57	21
GRANVILLE 6	SS		1965	+ 0.15	- 0.11	+ 0.07	3.30	21
GREAT BARRINGTON 2	VT		1951	- 0.46	+ 0.05	- 1.12	8.88	20
HALIFAX 97	VR		1977	-----	-----	-----	-----	
HANSON 76	VS		1964	- 0.15	+ 0.67	+ 0.15	4.13	27
HARDWICK 1	TS		1965	- 2.40	- 1.94	- 0.22	12.55	24
HARDWICK 31	TS		1984	- 3.17	- 0.06	+ 0.19	10.64	20
HAVERHILL 23	TS		1960	- 0.91	- 0.80	+ 0.59	9.36	22
HAWLEY 8	ST		1986	+ 0.13	- 0.18	+ 0.59	2.79	20
HOLDEN 169	FT		1995	- 0.46	- 0.39	-----	1.05	29
LAKEVILLE 14	TS		1964	- 0.57	- 0.29	+ 3.11	10.07	23
LEXINGTON 104	VS		1965	- 0.37	- 0.08	+ 0.57	1.73	22
MASHPEE 29	FS		1976	+ 0.03	+ 0.17	+ 1.75	6.26	28
MIDDLEBOROUGH 82	VT		1965	- 1.42	- 0.59	+ 1.17	4.17	23
MONTGOMERY 19	SS		1986	+ 0.03	+ 0.08	+ 0.20	0.50	21
NANTUCKET 228	FS		1976	+ 0.82	+ 0.72	+ 3.08	21.21 >	24
NEW BEDFORD 116	VS		1964	- 0.09	+ 0.19	+ 0.27	3.59	27
NEWBURY 27	VT		1965	- 1.05	- 1.38	+ 0.93	4.37	22

SUMMARY OF GROUND-WATER LEVELS APRIL 1998 PROVISIONAL

The following well characteristics are provided for each of 142 wells in the MA-RI

Table 1.--General well information and water-level statistics for wells in the Massachusetts-Rhode Island Observation-Well Network.

[Water levels are in feet below land-surface elevation; * indicates insufficient length of record for use in estimating water levels]

MASSACHUSETTS WELLS

ACTON (ACW) 158
Start year of record - 1965
Land-surface elevation 153 ft, well depth 33.8 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 14.98 LOW 21.86 (OWr) 5.40

ANDOVER (AJW) 462
Start year of record - 1968
Land-surface elevation 110 ft, well depth 32.5 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - Water level affected by nearby construction starting about January 1993
Period of record - HIGH (OWmax) 11.72 LOW 22.56 (OWr) 8.57

ATTLEBORO (ATW) 83
Start year of record - 1964
Land-surface elevation 145 ft, well depth 21.0 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - none
Period of record - HIGH (OWmax) 1.98 LOW 5.23 (OWr) 2.72

BARNSTABLE (A1W) 230
Start year of record - 1957
Land-surface elevation 43.23 ft, well depth 35.8 ft
Lithology - SAND
Topographic setting - FLAT
Remarks - none
Period of record - HIGH (OWmax) 20.51 LOW 26.59 (OWr) 4.84

BARNSTABLE (A1W) 247
Start year of record - 1962
Land-surface elevation 44.52 ft, well depth 52.0 ft
Lithology - SAND
Topographic setting - FLAT
Remarks - none
Period of record - HIGH (OWmax) 20.52 LOW 28.64 (OWr) 4.80

BECKET (A3W) 12
Start year of record - 1986
Land-surface elevation 1285 ft, well depth 35.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 2.36 LOW 4.62 (OWr) 2.06

BILLERICA (BCW) 363
Start year of record - 1962
Land-surface elevation 166 ft, well depth 15.0 ft
Lithology - SAND
Topographic setting - HILLTOP
Remarks - none
Period of record - HIGH (OWmax) 0.73 LOW 15.00 (dry) (OWr) 10.88

CHELMSFORD (CHW) 384
Start year of record - 1987
Land-surface elevation 125 ft, well depth 42.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 14.24 LOW 17.31 (OWr) 2.62

CHESHIRE (CJW) 2
Start year of record - 1951
Land-surface elevation 1210 ft, well depth 22.0 ft
Lithology - TILL
Topographic setting - HILLTOP
Remarks - Water level may be affected by nearby pumping during summer period
Period of record - HIGH (OWmax) 0.09 LOW 19.83 (OWr) 17.14

CHICOPEE (CMW) 95
Start year of record - 1984
Land-surface elevation 200 ft, well depth 34.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 19.40 LOW 23.62 (OWr) 3.31

COLRAIN (CSW) 8
Start year of record - 1965
Land-surface elevation 460 ft, well depth 32.0 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - Water level affected by North River
Period of record - HIGH (OWmax) 14.62 LOW 23.48 (OWr) 7.74

CONCORD (CTW) 165
Start year of record - 1965
Land-surface elevation 201.12 ft, well depth 67.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 35.50 LOW 47.10 (OWr) 4.67

CONCORD (CTW) 167
Start year of record - 1965
Land-surface elevation 135 ft, well depth 24.0 ft
Lithology - SAND
Topographic setting - TERRACE
Remarks - none
Period of record - HIGH (OWmax) 4.47 LOW 10.59 (OWr) 4.72

CUMMINGTON (CYW) 13
Start year of record - 1986
Land-surface elevation 988 ft, well depth 39.0 ft
Lithology - SAND
Topographic setting - VALLEY
Remarks - none
Period of record - HIGH (OWmax) 2.10 LOW 6.52 (OWr) 4.42

DEDHAM (DDW) 231
Start year of record - 1965
Land-surface elevation 65 ft, well depth 22.0 ft
Lithology - TILL
Topographic setting - HILLSIDE
Remarks - none
Period of record - HIGH (OWmax) 2.45 LOW 14.96 (OWr) 10.87

LETTER OF TRANSMITTAL

GOLDSMITH, PREST & RINGWALL, INC.

Civil & Structural Engineering * Land Surveying * Land Planning

257 Ayer Road, Harvard, MA 01451
978.772.1590
FAX 978.772.1591

civil@gpr-inc.com
www.gpr-inc.com

To: John Lyons
571 Burroughs Road
Boxborough, MA 01719

Date: December 8, 2004
Job No: Boxborough Library
Subject: Soil Test Results

We Are Sending You: X Attached / Under separate cover

Via: hand / mail / FEDEX / AM / PM

The Following Items:

COPIES	DATE	NO.	DESCRIPTION	SCALE
1			Soil test results	
1			Sketch plan	

Disposition:

- For approval
- X For your use
- For review and comment
- Please contact me if questions
- I will contact you
- For bids due
- Approved as noted
- Returned after loan to us
- Returned as requested
- As requested

Remarks:

John,

Call if you need anything further.

Rgards,
Cal

No. 00.229

Date: 11/28/00

Commonwealth of Massachusetts
BOXBOROUGH, Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed By: Barry Berzinis, GPR, INC. Date: 11/27/00
Witnessed By: unwitnessed

Location Address or Lot No. 800 Mass Ave. Boxborough, MA New Construction ☒ Repair ☐	Owner's Name: John - Lyons Address: Telephone No.:

Office Review

Published Soil Survey Available: No ☐ Yes ☒
Year Published 1989 Publication Scale 1:25,000 Soil Map Unit 7B/Charlton-Hollis-Rock Outcrop Complex
Drainage Class Excessively drained Soil Limitations Slope and depth to bedrock
Surficial Geologic Report Available: No ☐ Yes ☒
Year Published 1948 Publication Scale 1:31,680
Geologic Material (Map Unit) Qgm
Landform Ground moraine
Flood Insurance Rate Map: 250184 003C
Above 500 year flood boundary No ☐ Yes ☒
Within 500 year flood boundary No ☒ Yes ☐
Within 100 year flood boundary No ☒ Yes ☐
Wetland Area:
National Wetland Inventory Map (map unit) NO
Wetlands Conservancy Program Map (map unit) NO

Current Water Resource Conditions (USGS): Month October
Range :Above Normal ☐ Normal ☒ Below Normal ☐
Other References Reviewed: National Heritage Atlas 2000-01 Edition

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-01 Date: 11-27-00 Time: 7:30 AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 5 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Top of Knoll

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >200 feet Property Line >100 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

1100-01

Depth from Surface (inches)	Soil Horizon	Soil Texture (LSDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-5	A	fsl	10YR3/4	--	m, mfvr, cl
5-16	Bw1	fsl	10YR 4/6	--	m, mfvr, dw
16-26	Bw2	fsl	10YR 5/6	--	m ,mvfr, gw
26-68	C1	ls	2.5Y 5/3-5/4	@35" 5-10%fm 10YR 6/8f&m 2.5Y 6/1-6/2	lsbk-ipl, mfr, gw
68-104	C2	ls-s pockets s&fs	2.5Y 5/3-6/3	15%fm&c 2.5Y 6/8 5%f&m 10YR 6/8 10% f&m 2.5Y 6/1-6/2	m-1sbk, mvfr

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >104"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 35"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-02 Date: 11-27-00 Time: 8:00 AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 4 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Top of Knoll

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >150 feet Property Line >100 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	A	fsl	10YR 3/4	--	m,mvfr, ci
4-16	Bw1	fsl	10YR 4/6	--	m, mvfr, dw
16-32	Bw2	fsl	10Y 5/6	--	m,mvfr,gw
32 - 60	C1	ls	2.5Y5/3-5/4	@36" 5 - 10 f&m 10YR 6/8 10% f&m 2.5 Y 6/2	lsbk mfr, gw
60 - 106	C2	ls-s	2.5Y 5/3-4/3	10% fmc 2.5Y 6/8 5% f&m 10YR 6/8 10% f&m 2.5Y 6/2	m-lsbk, mvfr

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >106"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-03 Date: 11-27-00 Time: 8:30Am Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 7 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Mild Slope

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >150 feet Property Line >150 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-4	A	fsl	10YR 3/4	--	m,mvfr,ci
40-30	Bw1	fsl	10YR 4/6	--	m,mvfr,dw
30-36	Bw2	fsl	10YR 5/6	--	m,mvfr,gw
				@36"	
36-84	C	ls	2.5Y 5/3-5/4		lsbk, mfr, Ang/Subang C & S

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >84"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 36"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-04 Date: 11-27-00 Time: 9:00AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 4 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Mild Slope

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >200 feet Property Line >200 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 4	A	fsl	10YR 3/4	--	m,mvfr
40 - 30	Bw	fsl	10YR4/6-5/6	--	m,mvfr
30 - 53	C	ls	2.5YR 5/3-5/4	ND	lsbk, mfr, Ang C & S

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: possible @ 53", nested boulders

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: Not determined

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-05 Date: 11-27-00 Time: 9:30AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 4 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Mild Slope

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >200 feet Property Line >200 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 3	A	fsl	10YR 3/4	--	m,mvfr
3 - 34	Bw	fsl	10YR4/6-5/6	--	m,mvfr
				@34"	
34 - 86	C	ls w/pockets s& fs	25Y 5/3 - 5/4		m-lsbk, mfr, mvfr, mostly angular c & s

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >86"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 34"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-06 Date: 11-27-00 Time: 10AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 6 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Top of Knoll

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >200 feet Property Line >200 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 4	A	fsl	10YR 3/4	--	
4 - 30	Bw	fsl	10YR4/5-5/6	--	
				@30"	
30 - 69	C	ls-s	2.5YR 5/3-6/3		
					mostly angular c & s

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >69"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 34"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-07 Date: 11-27-00 Time: 10:30AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 4 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Top of Knoll

Distances from:

Open Water Body >200 feet Drainage way >150 feet

Possible Wet Area >200 feet Property Line >150 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 3	A	fsl	10YR3/4	--	m,mvfr
3 - 26	Bw	fsl	10YR5/6	--	m,mvfr
				/@34"	
26-86	C	ls w/pockets s	2.5YR 5/3-5/4		m-lsbk, mfr

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) Ablation Till Depth to Bedrock: >86

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: 34"

Location Address or Lot No. 800 Mass Ave. Boxborough, MA

On-site Review

Deep Hole Number: 1100-08 Date: 11-27-00 Time: 11:00AM Weather: 40's, Cloudy

Location (identify on site plan) See sketch

Land Use Residential Wooded Slope(%) 5 Surface Stones Many

Vegetation Oak, Maple & White pine

Landform Ground moraine

Position on landscape (sketch on the back) Top of Knoll

Distances from:

Open Water Body >200 feet Drainage way >200 feet

Possible Wet Area >200 feet Property Line >200 feet

Drinking Water Well >200 feet Other

DEEP OBSERVATION HOLE LOG

Depth from Surface (inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0 - 3	A	fsl	10YR 3/4	--	m, mvfr
3 - 30	Bw	fsl	10YR5/6	--	m, mvf
30 - 78	C	ls	2.5YR 5/3	N/D	>60% coarse angular fragment

* MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

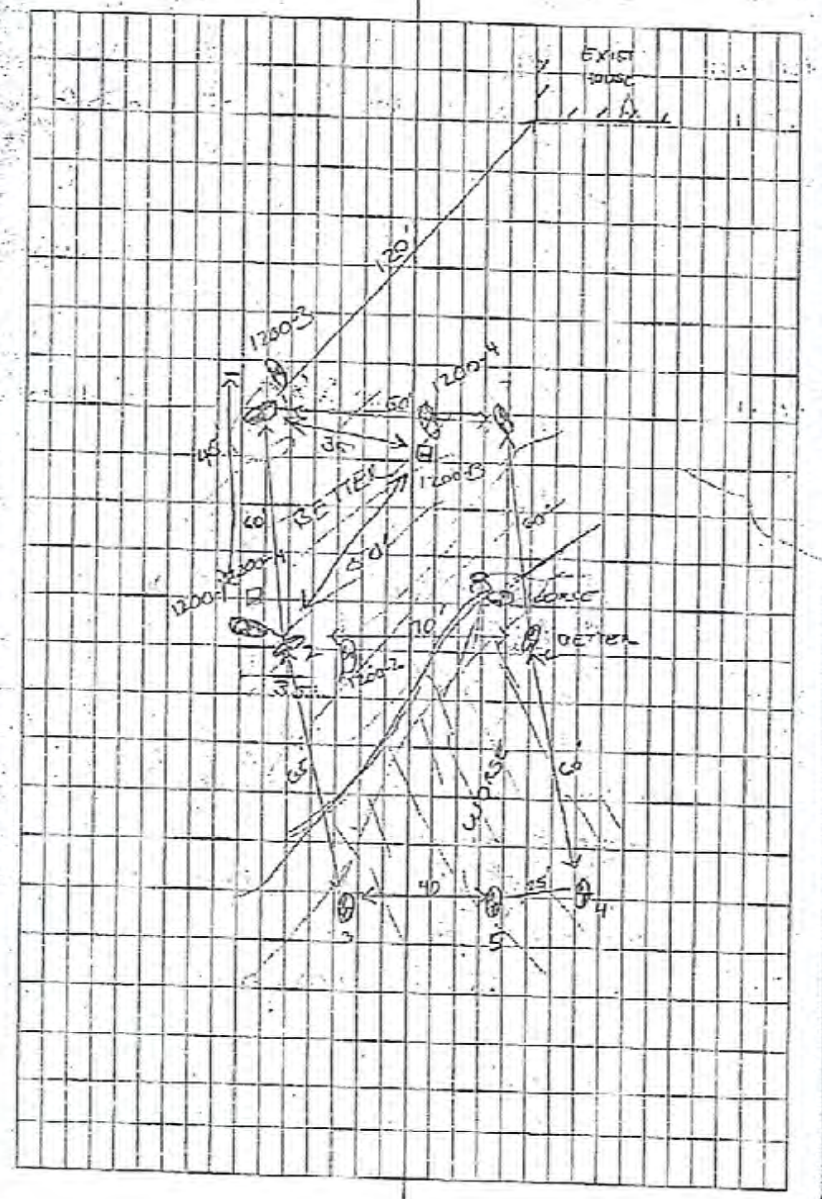
Parent Material (geologic) Ablation Till Depth to Bedrock: >78"

Depth to Groundwater: Standing Water in the Hole: None Weeping from Pit Face: None

Estimated Seasonal High Ground Water: Not Determined

U1100-07					
0-3	A	fsl	10YR 3/4	-	m, mvfr
3-26	Bw	fsl	10YR 3/6	-	m, mvfr
				@ 34"	
26-86	C	ls w/parkers	2.5Y 5/3-5/4		m, lsbk, mfr
	NO SWO	NO REF			
U1100-8					
0-3	A	fsl	10YR 3/4	-	m, mvfr
3-30	Bw	fsl	10YR 5/6	-	m, mvf
30-78	C	ls	2.5Y 5/3	N/A	
					>60% coarse angular fragments
	MANY	NESTED	ANGULAR	BOULDERS	

E10/69



12-12-00 CLOUDY 50's-30's | BOXBOROUGH LIBRARY MASS AVE BOXBOROUGH, MA | JOB # 00-229 | EXCAV: TOWN BOXBOROUGH (SCOTT) NASH: BRIDGETTE BRADLEY GPR: BB, BDL

E10/73

TH/DEPTH	HORIZON	TEXTURE	COLOR	RMF	OTHER
1200-1					
0-4	A	fsl	10YR 3/4	-	m, mvfr, ci
4-18	Bw1	fsl	10YR 4/6	-	m, mvfr, dw
18-32	Bw2	fsL	10YR 5/6	-	m, mvfr gw
32-65	C1	LS	2.5Y 5/3 5/4	@ 36" 5-10% f&m 10YR 5/8 10% f&m 2.5Y 6/2	1 sbk, mfr gw
65-110	C2	LS-S	2.5Y 5/3-4/3	10% fmc 2.5Y 6/8 5% f&m 10YR 6/8 10% f&m 2.5Y 6/2	m-1sbk, mvfr

NO GWO ESHGW @ 36" NO REF

TH/DEPTH	HORIZON	TEXTURE	COLOR	RMF	OTHER
1200-2					
0-5	A	fsl	10YR 3/4	-	m, mvfr, ci
5-20	Bw1	fsL	10YR 4/6	-	m, mvfr dw
20-33	Bw2	fsL	10YR 5/6	-	m, mvfr gw
33-89	C1	LS	2.5Y 5/3 5/4	@ 35" 5-10% f&m 10YR 5/8 5-10% f&m 2.5Y 6/2	1sbk, mfr gw MANY C, S & B
89-114	C2	LS-S	2.5Y 5/3 4/3	10% fmc 2.5Y 6/8 5% f&m 10YR 6/8 10% f&m 2.5Y 6/2	m-1sbk, mvfr

NO GWO ESHGW @ 35" NO REF

1200-A
54"
SOAKE 1:28
12" @ 1:43
9" @ 2:09
6" @ 2:46
(37 MIN)
13 MIN/IN

1200-B
59"
SOAKE 1:47
12" @ 2:02
9" @ 2:20
6" @ 2:45
(25 MIN)
9 MIN/IN

E10/77

NOTES: SEE E10/69 FOR SKETCH
MANY SURFACE STONES
VEG: WHITE PINE, RED OAK
BLACK BIRCH, LB BLUEBERRY
AM CHESTNUT

U1200-1 FILL @ 60"

U1200-2
0-36 FILL
36-46 A
46-66 B
66-122 C LS-LS
NO REF

TH/DEPTH	HORIZON	TEXT	COLOR	RMF	OTHER
1200-3					
0-4	A	fSL	10YR 3/4	–	m, mvfr, ci
4-12	Bw1	fSL	10YR 4/6	–	m, mvfr, dw
12-28	Bw2	fSL	10YR 5/6	–	m, mvfr, gw
28-70	C1	LS	2.5Y 5/3 5/4	@ 32" 10% f&m 10YR 5/8 5-10% 2.5Y 6/2	1sbk, mfr, gw 10% g&c
70-94	C2	LS-S	2.5Y 5/3 6/3	10% fmc 2.5Y 6/8 5% f&m 10YR 5/8 10% f&m 2.5Y 6/2	m-mvfr

NO REF ESHGW @ 32" NO GWO

1200-4					
0-4	A	fSL	10YR 3/4	–	m, mvfr, ci
4-30	Bw	fSL	10YR 5/6	–	m, mvfr, gw
30-100	C	LS w/ rocks S	2.5Y 5/3 4/3	@ 33" 10% f&m 10YR 5/8 10% f&m 2.5Y 6/2 5% f 10YR 5/8	1sbk, mfr-mvfr many c, s & b

NO REF NO GWO ESHGW @ 33"

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: [illegible] (Date) [illegible] (Time) [illegible] (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: [illegible] (e.g. woodland, agricultural field, vacant lot, etc.) [illegible] Surface Stones _____ Slope (%) _____

Light Trees Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: Till Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 3' (inches) _____ elevation _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8"	A	10YR 3/4	—	—	—	Sandy Loam	—		[illegible]	[illegible]	
8"-24"	B	10YR 4/6	—	—		Sandy Loam	5%	—	[illegible]	[illegible]	
24"-46"	C1	10YR 5/6	—		—	Sandy Loam	10%	[illegible]	[illegible]	[illegible]	
46"-70"	C2	2.5Y 4/4	8"	High Low	5%	Sandy Loam	10%	5%	[illegible]		

Additional Notes MANY STONES

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: [illegible] (Date) [illegible] (Time) [illegible] (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOOD LAND (e.g. woodland, agricultural field, vacant lot, etc.) [illegible] (Surface Stones) 0-5% (Slope (%))

TREES (Vegetation) _____ (Landform) ON-SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 68" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

800 MASS AVE
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 3/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
6"-20"	B	10YR 4/6	—	—	—	SANDY LOAM	5%	—	MASSIVE	FRIABLE	
20"-68"	C1	10YR 4/4	—	—	—	SANDY LOAM	10%	35%	MASSIVE	LOOSE	
68"-96"	C2	2.5Y 4/2	68"	HELL LOW	5%	FINE SANDY LOAM	—	35%	MASSIVE	FRIABLE	

Additional Notes _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11/26/13 (Date) 9:00 (Time) CLOUDY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD / WOODS (e.g. woodland, agricultural field, vacant lot, etc.) MANY (Surface Stones) 0-5% (Slope (%))

LIGHT TREES (Vegetation) _____ (Landform) ON-SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes ☒ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 42" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

800 AVE AVE
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 3/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
6"-22"	B	2.5Y 5/6	—	—	—	LOAMY SAND	2%	10%	MASSIVE	[illegible]	
22"-54"	C	2.5Y 7/6	42"	[illegible]	5%	LOAMY SAND	2%	10%	MASSIVE	[illegible]	

Additional Notes REFUSAL @ 54"

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11/26 (Date) 9:00 (Time) CLOUDY (Weather)

1. Deep Observation Hole Logs

   Deep Hole Number _____ Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) MANY (Surface Stones) _____ (Slope (%))

   TREES (Vegetation) _____ (Landform) ON-SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 48" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

[illegible]
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6'	A	10YR 2/2	—	—	—	SANDY LOAM	—	—	MASSIVE	FRIABLE	
6-24'	B	10YR 5/6	—	—	—	SANDY LOAM	5%	15%	MASSIVE	FRIABLE	
24'-7'	C	2.5Y 5/4	48"	HIGH LOW	5%	SANDY LOAM	5%	20%	MASSIVE	FRIABLE	

Additional Notes LARGE BOULDER @ 7'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole A: 11/26/12 (Date) 9:45 (Time) Cloudy (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: Woodland (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones [illegible] Slope (%) 0-5%

Vegetation TREES Landform _____ Position on landscape (attach sheet) [illegible]

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet, Drinking Water Well _____ feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes ☒ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☒

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole —

Estimated Depth to High Groundwater: _____ inches _____ elevation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

900 MAIN AVE
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 3/1	–	–	–	SANDY LOAM	–	–	MASSIVE	FRIABLE	
6-24"	B	10YR 3/6	–	–	–	SANDY LOAM	5%	15%	MASSIVE	FRIABLE	
24-72"	C	7.5YR 4/1	44"	PALE BROWN	5%	SANDY LOAM	5%	30%	MASSIVE	VF & LOOSE	

Additional Notes LARGE BOULDER @ 72"

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole A: 11/26/12 (Date) 10:20 (Time) Cloudy (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones: MANY Slope (%): 0-5%

Vegetation: TREES Landform: _____ Position on landscape (attach sheet): CONSLOPE

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: TILL Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: 46" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

800 MAIN AVE

Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
0-6"	A	10YR 3/2	–	–	–	SANDY LOAM	–	–	MASSIVE	FRIABLE	
6"-24"	B	10YR 5/6	–	–	–	SANDY LOAM	5%	10%	MASSIVE	FRIABLE	
24"-90"	C	2.5Y 5/4	46"	10YR LOW	5%	SANDY LOAM	10%	20%	MASSIVE	FRIABLE	

Additional Notes _____

Commonwealth of Massachusetts
City/Town of

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

DEP has provided this form for use by on-site professionals and local Boards of Health. Other forms may be used, but the information must be substantially the same as provided here. Before using this form, check with your local Board of Health to determine the form they use.

A. Facility Information

1. Facility Information BOXBOROUGH TOWN CENTER, LLC
Owner Name
Street Address ACTON Map/Lot
City/Town MA State Zip Code

* STORMWATER EVALUATIONS ONLY *
9/20/2016 16-1 ⇒ 16-15
9/21/2016 16-16 ⇒ 16-34
9/30/2016 16-35 ⇒ 16-56

B. Site Information

1. (Check one) New Construction ☒ Upgrade ☐ Repair ☐
2. Published Soil Survey available? Yes ☐ No ☐ If yes: Year Published Publication Scale Soil Map Unit
Soil Name Soil limitations
3. Surficial Geological Report available? Yes ☐ No ☐ If yes: Year Published Publication Scale Map Unit
Geologic Material Landform
4. Flood Rate Insurance Map:
Above the 500 year flood boundary? Yes ☒ No ☐ Within the 100 year flood boundary? Yes ☐ No ☒
Within the 500 year flood boundary? Yes ☐ No ☒ Within a Velocity Zone? Yes ☐ No ☐
5. Wetland Area: National Wetland Inventory Map UPLAND - WETLANDS CONFIRMED ON-SITE
Map Unit Name
Wetlands Conservancy Program Map
Map Unit Name

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-1 Date 9/20/2016 Time _____ Weather OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) WITHIN SWALE

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation PINE, HARDWOOD Landform _____ Position on landscape (plan/c sheet) _____

3. Distances from: Open Water Body — feet Drainage Way — feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well 60' feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit: — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 60"

Deep Observation Hole Number: 16-1

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	20% BOULDERS
20	B	10YR 5/6	—	—	—	SL			M	F	
66	C1	2.5Y 7/4	60	5YR 5/8	75	LS		2C	M	F	20
120	C2	2.5Y 6/3				SL		5S	M	F	BOULDERS

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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700 & 800 MASSACHUSETTS AVE

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-2 Date 9/20/2016 Time _____ Weather OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation MAPLE, PINE Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other: _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 30"

Deep Observation Hole Number: 16-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
26	A FILL	FILL	—	—	—	SL	—	10S	M	F	BOULDERS PERVASIVE
30	B	10YR 5/6	—	—	—	SL	—	—	M	F	
48	C_1	2.5Y 6/4	30	5YR 5/8	>5	SL	—	5S	M	F	20 BLOCKS
120	C_2	2.5Y 6/3				SL	—	—	M	F	

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON, P.E., MA SE 1012

City/Town of

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-3 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

Vegetation: PINE, HARDWOOD Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 60"

Deep Observation Hole Number: 16-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	LARGE BOULDERS
22	B	10YR 5/6	—	—	—	SL	—	—	M	F	
60	C1	2.5Y 6/4	60	5YR 5/8	>5	SL		5S	M	F	
96	C2	2.5Y 6/3				SL			M	F	
	BOULDERS										

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-4 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation HARDWOOD Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet 120+L

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 55

Deep Observation Hole Number: 16-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	5S	M	F	LARGE BOULDERS
20	B	10YR 5/6	—	—	—	SL	—		M	F	
120	C	2.5Y 6/3	55	5YR 5/8	>5	LS	2G	5C	M	F	BOULDERS

Additional Notes STORM WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-5 9/20/2016 (Date) _____ (Time) OVERCAST 70° (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 48

Deep Observation Hole Number: 16-5

Depth (in:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BOULDER
22	B	10YR 5/6	—	—	—	SL	—	—	M	F	LARGE
36	C_1	2.5Y 7/6	—	—	—	LS	—	5C	M	F	
120	C_2	2.5Y 6/3	48	5YR 5/8	>5	SL	3G 2C	10S	M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-6 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 50"

Deep Observation Hole Number: 16-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5	A	10YR 3/2	—	—	—	SL		—	M	F	LARGE BOULDERS
21	B	10YR 5/6	—	—	—	SL		—	M	F	
44	C_1	2.5Y 7/4	—	—	—	LS		5S 2C	M	F	
130	C_2	2.5Y 6/3	50	5YR 5/8	>5	SL	3G		M	F	LARGE BOULDERS

Additional Notes STORM WATER SOIL OBSERVATIONS
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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-7 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit: — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 50"

Deep Observation Hole Number: 16-7

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	LARGE
18	B	10YR 5/6	—	—	—	SL	—	—	M	F	BOULDERS
102	C	2.5Y 6/3	50	5YR 5/8	>5	LS	56	2C 55	M	F	GRAVELLY
102	R									BOULDERS	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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BOXBOROUGH TOWN COUNCIL, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-B 9/20/2014 (Date) _____ (Time) OVERCAST 70° (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 54

Deep Observation Hole Number: 16-B

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
4	A	10YR 3/2	—	—	—	SL			M	F	
18	B	10YR 5/6	—	—	—	SL			M	F	
108	C	2.5Y	54	5YR 5/8	>5	LS	5G	2C 2S	M	VERY FRIABLE	
108	R					POCKETS MEDIUM SAND					

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-9 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 44

Deep Observation Hole Number: 16-9

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	
23	B	10YR 5/6	—	—	—	SL	—	—	M	F	LARGE BOULDERS
108	C	2.5Y 4/3	44			LS	5G	5S 2C	M	F	

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-10 9/20/2016 (Date) _____ (Time) OVERCAST 70° (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit – Depth Standing Water in Hole –

   Estimated Depth to High Groundwater: 53

Deep Observation Hole Number: 16-10

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	–	–	–	SL			M	F	Large
19	B	10YR 5/6	–	–	–	SL			M	F	Boulders
94	C	2.5Y 6/3	53	5YR 5/8	>5	LS	5G	2C 5S	M	F	
94	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012
JOHN DEERE 892 EXCAVATOR

City/Town of

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Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-11 Date: 9/20/2014 Time: _____ Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 60

Deep Observation Hole Number: 16-11

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
4	A	10YR 3/2	—	—	—	SL	—		M	F	LARGE
16	B	10YR 5/6	—	—	—	SL	—		M	F	BOULDERS
100	C	2.5Y 6/3	60	5YR 5/8	>5	LS	5G	5C 25	M	VERY FRIABLE	
100	R										

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-12 9/20/2016 (Date) _____ (Time) OVERCAST 70° (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 44

Deep Observation Hole Number: 16-12

Depth (in:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—	—	—	SL	—	—	M	F	
15	B	10YR 5/6	—	—	—	SL	—	—	M	F	
72	C	2.5Y 6/3	44	5YR 5/8	>5	LS	5g	2C 2S	M	VERY FRIABLE	
72	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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700 & 800 MASSACHUSETTS AVE

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-13 9/20/2016 (Date) _____ (Time) OVERCAST 70° (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 40

Deep Observation Hole Number: 16-13

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—	—	—	SL	—	—	M	F	LARGE
16	B	10YR 5/6	—	—	—	SL	—	—	M	F	BOULDER
74	C	2.5Y 6/3	40	5YR 5/8	>5	LS	—	20 25	M	F	
74	R										

Additional Notes STORM-WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-14 | Date: 9/20/2016 | Time: | Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones | Slope (%)

   Vegetation | Landform | Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: GLACIAL TILL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: _____

Deep Observation Hole Number: 16-14

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume: Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
5	A	10YR 3/2	—	—	—	SL	—	—	M	F	LARGE BOULDERS
14	B	10YR 5/6	—	—	—	SL	—	—	M	F	
106	C	2.5Y 6/3	42	5YR 5/8	>5	LS	—	3C 2S	M	F	BLDRS
106	R										

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-15 Date: 9/20/2016 Time: _____ Weather: OVERCAST 70°

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 42

Deep Observation Hole Number: 16-15

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	Large
15	B	10YR 5/6	—	—	—	SL	—	—	M	F	Boulders
109	C	2.5Y 6/3	42	5YR 5/8	>5	LS	—	25 20	M	F	
109	R	L									

Additional Notes: STORM WATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

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City/Town of

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-16 | 9/21/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 40

Deep Observation Hole Number: 16-16

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLDR
20	B	10YR 5/6	—	—	—	SL	—	—	M	F	
108	C	2.5Y 6/4	40	5YR 5/8	>5	LS	—	5C	M	F	
	BOULDERS										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-17-9 | 21 | 2016 (Date) _____ (Time) Sm 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16-17

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	
15	B	10YR 5/6	—	—	—	SL	—	—	M	F	
50	C_1	2.5Y 6/4	24	5YR 5/8	>10	LS	—	—	M	F	
100	C_2	2.5Y 6/3				SL	—	—	M	F	
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

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City/Town of

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-18 | Date: 9/21/2016 | Time: _____ | Weather: SUN 90

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones _____ | Slope (%) _____

   Vegetation _____ | Landform _____ | Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: GLACIAL TILL | Unsuitable Materials Present: Yes ☐ No ☑

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☑

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: _____ _____

Deep Observation Hole Number: 16-18

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5	A	10YR 3/1	—	—	—	SL	—	—	M	F	10 BLOR
16	B	10YR 7/2	—	—	—	SL	—	—	M	F	
55	C_1	2.5Y 6/3	18"	High CHROMA	>20	LS	POCKETS SAND	—	M	F	
96	C_2	2.5Y 6/4				SL		2C 5S			
	NO REFUSAL										

Additional Notes: STORMWATER SOIL OBSERVATIONS
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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-19 9/21/2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16 - 19

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/1	–	–	–	SL	—	–	M	F	10 STONES
14	B	10YR 5/6	–	—	–	SL	—	–	M	F	
30	C1	2.5Y 7/4	24	5YR 5/6	>20	LS	—	–	M	F	
100	C2	2.5Y 7/2				LS	POCKETS FINE TO MEDIUM SAND		M	F	
	NO	REFUSAL									

Additional Notes STORMWATER SOIL OBSERVATIONS
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700 & 800 MASSACHUSETTS AVE

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole Number: 16-20 9/21/2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 76

Deep Observation Hole Number: 16 - 20

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
5	A	10YR 3/2	—	—	—	SL	—		M	F	20 BLDRS
16	B	10YR 5/6	—	—	—	SL			M	F	
60	C_1	2.5Y 6/4	—	—	—	LS	2G	5S 2C	M	F	
76	C_2	2.5Y 5/4	—	—	—	COARSE SAND	15G	2C	M	VERY FRIABLE	
120	C_3	2.5Y 6/2	76	5YR 5/8	>5	SL					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

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City/Town of
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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-21 | 9/21/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 20

Deep Observation Hole Number: 16-21

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
4	A	10YR 3/2	—	—	—	SL			M	F	10 ROOTS
16	B	10YR 5/6				SL			M	F	
76	C	2.5Y 6/4	20	5YR 5/6	>5	LS		20C 10S	M		
	NO	REFUSAL									

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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700 & 800 MASSACHUSETTS AVE

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-209 | 21 | 2016 (Date) _____ (Time) Sm 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (Attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16-22

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	—	—	—	SL	—	—	M	F	BLOCKS
18	B	10YR 5/6	—	—	—	SL	—	—	M	F	
120	C	2.5Y 6/4	24	5YR 5/8	>5	LS	20	10C 2S	M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON P.E., MA SE 1012

City/Town of

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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-239 | 21 | 2016 (Date) _____ (Time) SM 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16-23

Depth (in:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
6	A	10YR 3/2	—	—	—	SL		—	M	F	20 BLDR
16	B	10YR 5/6		—	—	SL			M	F	
84	C	2.5Y 7/2	24	5YR 5/8	>10	LS FINE		5C	M	F	BLDRS
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
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City/Town of
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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-24 9/21/2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 18

Deep Observation Hole Number: 16-24

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
3	A	10YR 3/1	—	—	—	SL			M	F	LARGE BLDRS
12	B	10YR 4/2	—	—	—	SL			M	F	
60	C_1	2.5Y 6/2	18	High Low	>10	LS	POCKETS GRAVEL	5C 5S	M	F	BLDR
132	C_2			CHROMA		SL					
132											

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-25 | Date: 9/21/2016 | Time: _____ | Weather: Sun 90

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones _____ | Slope (%) _____

   Vegetation _____ | Landform _____ | Position on landscape (sketch sheet) _____

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: GLACIAL TILL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 26

Deep Observation Hole Number: 16-25

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
16	A	10YR 3/2	—	—	—	SL	—	—	M	F	LARGE BOULDERS
24	B	10YR 6/4	—	—	—	SL	—	—	M	F	
84	C	2.5Y 6/3	26	Low Chroma	>5	LS	—	55	M	F	BLDR

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON P.E., MA SE 1012

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-26 9/21/2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 40

Deep Observation Hole Number: 16-26

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—	—	—	SL	—	—	M	F	
15	B	10YR 5/6	—	—	—	SL	—	—	M	F	
100	C	2.5Y 6/4	40	5YR 5/8	>5	LS	—	10S	M	F	
100	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-27 9 | 21 | 2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 40

Deep Observation Hole Number: 16-27

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLDR
14	B	10YR 5/6	—	—	—	SL	—	—	M	F	
63	C	2.5Y 6/4	40	5YR 5/6	>5	LS	—		M	F	
63	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-289 | 21 | 2016 (Date) _____ (Time) Sm 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 40

Deep Observation Hole Number: 16-28

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLDR
12	B	10YR 5/6	—	—	—	SL	—	—	M	F	
40	C_1	2.5Y 6/4	—	—	—	LS	—	—	M	F	
84	C_2	2.5Y 6/2	40	5YR 5/8	>5	FINE SAND	POCKETS GRAVEL		M	VERY FRIABLE	
108	C_3					LS			M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-29 | Date: 9/21/2016 | Time: _____ | Weather: Sun 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones _____ | Slope (%) _____

   Vegetation _____ | Landform _____ | Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: GLACIAL TILL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 30

Deep Observation Hole Number: 16-29

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
4	A	10YR 3/2	—	—	—	SL			M	F	20 BLDR
14	B	10YR 5/6	—	—	—	SL			M	F	
60	C1	2.5Y 6/2	30	5YR 5/8	>5	FINE SAND			M	F	—
120	C2	2.5Y 6/3				LS	GRAVELLY	10 S			

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

BUXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

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(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-30 Date 9/21/2016 Time _____ Weather SUN 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 38

Deep Observation Hole Number: 16-30

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BOULDERS
14	B	10YR 5/4	—	—	—	SL	—	—	M	F	
76	C1	2.5Y 6/3	38"	5YR 5/8	>5	LS	—	—	M	F	20 BLDR
130	C2	2.5Y 6/2				LS	5G	10S	M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAWKINSON P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-31 | Date: 9/21/2016 | Time: _____ | Weather: SM 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones _____ | Slope (%) _____

   Vegetation _____ | Landform _____ | Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: GLACIAL TILL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 30"

Deep Observation Hole Number: 16-31

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	SURFACE BOULDERS
16	B	10YR 5/6	—	—	—	SL	—	—	M	F	
70	C1	2.5Y 6/2	30"	5YR 5/6	>5	LS			M	F	
120	C2	2.5Y 6/3				LS			M	F	

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-32 | 9/21/2016 (Date) _____ (Time) Sun 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: _____ _____

Deep Observation Hole Number: 16-32

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
5	A	10YR 3/2				SL			M	F	
15	B	10YR 5/6				SL			M	F	
59	C	2.5Y 5/3	31		75	LS			M	F	
59	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON, P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-339 | 21 | 2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☑

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 130 OR BELOW

Deep Observation Hole Number: 16-33

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
6	A	10YR 3/2	—	—	—	SL			M	F	
18	B	10YR 5/6	—	—	—	SL			M	F	
130	C	2.5Y 6/3	—	5YR GYC INFO		MEDIUM SAND		25	SG	LOOSE	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1012

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-34 | 9 | 21 | 2016 (Date) _____ (Time) Sun 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Possible Wet Area >100 feet

   Property Line ____ feet Drinking Water Well ____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☑

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☑

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 72

Deep Observation Hole Number: 16-34

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLOR
	B	10YR 5/6	—	—	—	SL	—	10C	M	F	
72	C	2.5Y 6/4	—	—	—	LS					
	BOULDERS										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON P.E., MA SE 1017

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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ACTON, MA 01720
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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-35 | 9/30/2016 (Date) _____ (Time) SUN 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 14"

Deep Observation Hole Number: 16-35

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10	A	10YR 2/2	—	—	—	SL			M	F	LO STONES
19	B	10YR 5/6	14	LOW CHROMA	>5	SL			M	F	
41	C1	2.5Y 4/2			>20	SL	5%		M	F	
120	C2	2.5Y 6/4				COARSE TO MEDIUM					
						WASHED LOAMY SAND					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON P.E., MA SE 1012

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-369 | 30 | 2014 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 14

Deep Observation Hole Number: 16-36

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10	A	10YR 2/2	—	—	—	SL	—	—	M	F	5 BOULDERS
17	B	10YR 5/6	14	LOW CHROMA	>5	SL	—	—	M	F	
36	C_1	2.5Y 4/2		5YR 5/8	>20	SL			M	F	
84	C_2	2.5Y 6/4				SAND VARIGATED	3G	5S 5C	M	VERY FRIABLE	
120	C_3	2.5Y 4/2				MEDIUM TO COARSE			M	F	20 BLDR
						C_3 SL					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole Number: 16-379 | 30 | 2016 (Date) _____ (Time) SM 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 44

Deep Observation Hole Number: 16-37

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	
12	B	10YR 5/6	—	—	—	SL	—	—	M	F	
38	C1	2.5Y 6/4	—	—	—	COARSE SAND	10G	5C	M	VERY FRIABLE	
72	C2	2.5Y 6/3	44	5YR 5/8	>5	VERY SAND			M	F	
112	C3	2.5Y 6/2				SANDY LOAM			M	F	
	BOULDER										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-38 9/30/2016 (Date) _____ (Time) Sm 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 112

Deep Observation Hole Number: 16-38

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	
12	B	10YR 5/6	—	—	—	SL	—	—	M	F	
48	C_1	2.5Y 6/6	—	—	—	LS	—	—	M	F	
72	C_2	2.5Y 6/4	—	—	—	COARSE SAND	15G	2C	M	VERY LOOSE	
112	C_3	2.5Y 6/6				MEDIUM SAND	VARIGATED COLORS		M	VERY LOOSE	
120	C_4	2.5Y 6/2				SL					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BURLINGTON TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area;

Deep Observation Hole Number: 16-39 | 9/30/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 96

Deep Observation Hole Number: 16-39

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—	—	M	F	
12	B	10YR 5/6	—	—	—	LS	—	—	M	F	
60	C1	2.5Y 6/4	—	—	—	COARSE SAND	15G	2C	M	VERY LOOSE	
96	C2	2.5Y 6/6	—	—	—	MEDIUM SAND	—		M	VERY FRIABLE	
120	C3	2.5Y 6/2	96		>5	SL	—	5S	M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-40 | 9/30/2016 (Date) _____ (Time) Sm 90 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 140+

Deep Observation Hole Number: 16-40

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—		—	—	M		
10	B	10YR 5/6	—	—	—		—	—	M		
70	C_1	2.5Y 6/3	—	—	—	COARSE SAND	15G	3C	M	VERY LOOSE	
140	C_2	2.5Y 6/6	—	—	—	MEDIUM SAND	—	—	M	VERY LOOSE	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of:

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STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BURLINGTON TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-41 | Date: 9/30/2016 | Time: _____ | Weather: SUN 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones _____ | Slope (%) _____

   Vegetation _____ | Landform _____ | Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Possible Wet Area >100 feet

   Property Line _____ feet | Drinking Water Well _____ feet | Other _____

4. Parent Material: PROGLACIAL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 104

Deep Observation Hole Number: 16-41

Depth (In:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M		
9	B	10YR 5/6	—	—	—	LS	—	—	M		
94	C	2.5Y 6/4	—	—	—	MEDIUM COARSE SAND	100		M	VERY FRIABLE	
132	C2	2.5 6/3	104	5YR 5/8	>5	FINE LOAMY SAND			M		

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMERSTROM, P.E., MA SE 1012

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-42 | 30 | 2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: 22

Deep Observation Hole Number: 16-42

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	Ap	10YR 3/2	—	—	—	SL	—	—	M	F	
10	B	10YR 5/6	—	—	—	LS	—	—	M	F	
36	C1	2.5Y 6/6	22	5YR 5/8	>5	FINE LS	—	—	M	F	
72	C2	2.5Y 6/4				MEDIUM SAND			M	VERY FRIABLE	
105	C3	2.5Y 6/2				SL			M	F	
	BOULDER										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 10012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-43 | 9/30/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 54

Deep Observation Hole Number: 16-43

Depth (in:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	Ap	10YR 3/2	-	-	-	SL			M	F	
12	Bw	10YR 5/6	-	-	-	SL			M	F	
12-24	Bc	2.5Y 6/6	-	-	-	FINE LS			M	F	
114	C1	2.5Y 6/4	54	5YR 5/8	>5	MEDIUM FINE SAND	5G	2S		VERY FRIABLE	
124	C2	2.5Y 6/2				SL					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-44 | 9 | 30 | 2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: PROGLACIAL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 42

Deep Observation Hole Number: 16-44

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
7	A	10YR 3/2	—	—	—	SL	—	—	M	F	10 BLDR
18	B	10YR 5/6	—	—	—	SL	—	—	M	F	
72	C1	2.5Y 6/4	42	LOW CHROM	>5	MEDIUM SAND	—	—	M	very FRIABLE	
100	C2	2.5Y 6/2				SL			M	F	
	NO REFUSAL										

Additional Notes: STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-459 | 30 | 2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16-45

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	Ap	10YR 3/2	—	—	—	SL	—	—	M	F	
24	Bw	10YR 5/6	—	—	—	SL	—	—	M	F	
72	C	2.5Y 6/2	24		>10	SL	—	—	M	Firm	
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-46 | 9/30/2016 (Date) _____ (Time) SM 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 24

Deep Observation Hole Number: 16-46

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
9	Ap	10YR 3/2	—	—	—	SL	—	—	M	F	
15	Bw	10YR 5/6	—	—	—	SL	—	—	M	F	
98	C	2.5Y 5/3	24		>10	SL	—	—	M	FRM	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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1000 Main Street
ACTON, MA 01720
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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-47 | 9/30/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 32

Deep Observation Hole Number: 16-47

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10	Ap	10YR 3/2	—	—	—	SL	—	—	M	F	10 STONES
24	Bw	10YR 5/6	—	—	—	SL	—	—	M	F	
100	C	2.5Y 6/3	32	LOW CHROMA	>10	SL	5%	—	M	Firm	
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 10112

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-48 9/30/2016 (Date) _____ (Time) SM 60 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 36

Deep Observation Hole Number: 16-48

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
7	Ap	10YR 3/2	–	–	–	SL			M	F	20 BLDRS
14	B	10YR 5/6	–	–	–	SL			M	F	
36	C1	2.5Y 6/4	36	5YR 5/8	>5	LS			M	Firm	
100+	C2	2.5Y 6/3				SL					
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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ACTON, MA 01720
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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-49 | 30 | 2016 (Date) _____ (Time) Sun 60 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 30

Deep Observation Hole Number: 16-49

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLOCK
14	B	10YR 5/6	—	—	—	SL	—	—	M	F	
48	C1	2.5Y 6/6	30	LOW CHROMA	>5	LS	—	—	M	FIRM	
58	C2	2.5Y 6/3				SL	—	—	M	FIRM	
110	C3	2.5Y 6/2				SL	5g	—	M	FRIABLE	
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 10:2

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

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BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-50 Date 9/30/2016 Time _____ Weather ~~Sun~~ 60 OVERCAST

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 30

Deep Observation Hole Number: 16-50

Depth (in:)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BLDM
24	B	10YR 5/6	—	—	—	SL	—	—	M	F	
80	C	2.5Y 6/3	30	5YR 5/8	>5	SL	—	—	M	FIRM	
	NO REFUSAL										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

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ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review *(minimum of two holes required at every proposed disposal area)*

Deep Observation Hole Number: 16-51 Date 9/30/2016 Time _____ Weather Sm 90

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☐

   If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: _____ _____

51

Deep Observation Hole Number: 16-51

Depth (in)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10	A	10YR 3/2	—	—	—	SL			M	F	
20	B	10YR 5/6	—	—	—	SL			M	F	
50	C	2.5Y 6/3	24		>20	SL			M	FIRM	
50	R					SL					

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAMMINGTON, P.E., MA SE 1012

City/Town of

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ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-52 | 9/30/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface-Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: 30

Deep Observation Hole Number: 16-52

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
8	A	10YR 3/2	—	—	—	SL	—	—	M	F	20 BWK
22	B	10YR 5/6	—	—	—	SL	—	—	M	F	
60	C	2.5Y 6/3	30	—	>15	SL	—	—	M	F	
60	R		30								

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-53 Date 9/30/2016 Time _____ Weather SUN 90

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

   Estimated Depth to High Groundwater: 30

Deep Observation Hole Number: 16-53

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
10	A	10YR 3/2	–	–	–	SL	–	–	M	F	20 BLOCK
20	B	10YR 5/6	–	–	–	SL	–	–	M	F	
100	C	2.5Y 6/3	30			SL			M	F	
100	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

City/Town of:

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BURBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review (minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-54 9/30/2016 (Date) _____ (Time) Sun 80 (Weather)

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) _____ Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☐

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: _____ _____

Deep Observation Hole Number: 16-54

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL			M	F	
11	B	10YR 5/6	—	—	—	SL			M	F	
80	C	2.5Y 6/3	28		>5	LS	59	55	M	FRIABLE	
80	R										

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-559 | Date: 30 | 2016 | Time: | Weather: Sm 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) | Surface Stones | Slope (%)

   Vegetation | Landform | Position on landscape (attach sheet)

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Possible Wet Area >100 feet

   Property Line ____ feet | Drinking Water Well ____ feet | Other ____

4. Parent Material: PROGLACIAL | Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — | Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 114

Deep Observation Hole Number: 16-55

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
7	A	10YR 3/2	—	—	—		—	—			
20	B	10YR 5/6	—	—	—		—	—			
114	C	2.5Y 6/4	—	—	—	FINE SAND	—	—	M	VERY FRIABLE	
120	C2	2.5Y 6/2	114			LS	—	—			

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HAVERINGTON, P.E., MA SE 1012

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

BOXBOROUGH TOWN CENTER, LLC
700 & 800 MASSACHUSETTS AVE

C. On-Site Review

(minimum of two holes required at every proposed disposal area)

Deep Observation Hole Number: 16-S6 Date: 9/30/2016 Time: _____ Weather: Sm 80

1. Location

   Ground Elevation at Surface of Hole _____

   Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) Surface Stones _____ Slope (%) _____

   Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

   Property Line _____ feet Drinking Water Well _____ feet Other _____

4. Parent Material: GLACIAL TILL Unsuitable Materials Present: Yes ☐ No ☒

   If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

   If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

   Estimated Depth to High Groundwater: 132 or BELOW

Deep Observation Hole Number: 16-S6

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL	—		M	F	10 BLOR
19	B	10YR 5/6	—	—	—	SL			M	F	
132	C	2.5Y 6/3	—			LS	29	55	M	F	

Additional Notes STORMWATER SOIL OBSERVATIONS
RICHARD J. HARRINGTON, P.E., MA SE 1012

STAMSKI AND McNARY, INC.
1000 Main Street
ACTON, MA 01720
Engineering • Planning • Surveying

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method used:
   - ☐ Depth observed standing water in observation hole A. _____ inches B. _____ inches
   - ☐ Depth weeping from side of observation hole A. _____ inches B. _____ inches
   - ☐ Depth to soil redoximorphic features (mottles) A. _____ inches B. _____ inches
   - ☐ Groundwater adjustment (USGS methodology) A. _____ inches B. _____ inches

2. Index Well Number _____ Reading Date _____ Index Well Level _____

   Adjustment Factor _____ Adjusted Groundwater Level _____

E. Depth of Pervious Material

9/20/16; 9/21/16 & 9/30/16
TEST PITS 16-1 ⇒ 16-56

1. Depth of Naturally Occurring Pervious Material

N/A a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes ☐ No ☐ * STORMWATER SOIL OBSERVATIONS

b. If yes, at what depth was it observed? Upper boundary: _____ inches Lower boundary: _____ inches

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator — Date: 9/30/2016

RICHARD J. HARRINGTON SE1012
Typed or Printed Name of Soil Evaluator/License Number — *Date of Soil Evaluator Exam: 10/25/1994

STORMWATER SOIL OBSERVATIONS
Name of Board of Health Witness — Board of Health: UNWITNESSED

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Drainage Maps