GALE

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November 16, 2023

Town of Hamilton
Planning Board
577 Bay Road
South Hamilton, MA 01982

Re: Site Plan Review Application
Hamilton Wenham Regional High School – Athletic Campus Redevelopment
Hamilton, MA
Gale JN# 718600

Dear Planning Board Members:

Gale Associates, Inc. (Gale) is submitting a Site Plan Review Application on behalf of the Hamilton-Wenham Regional School District (HWRSD) for an Athletic Campus Redevelopment project located at Hamilton-Wenham Regional High School (HWRHS).

This submittal package includes a Site Plan Review Application, accompanying Stormwater Management Report, required Site Plan Review forms, a Stormwater Checklist, Permit Plan Set, as well as stormwater management concepts, descriptions, and supporting calculations. This project has been designed in accordance with all relevant stormwater standards as required by MassDEP.

As discussed during our pre-application meeting on October 20, 2023, it was suggested that the application addresses the recent concerns raised during the permitting process with the Conservation Commission related to the potential presence of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in synthetic turf field products, as well as traffic and athletic lighting. Gale has included pertinent studies, data, and manufacturer's information regarding PFAS as part of this submittal on behalf of Hamilton-Wenham Regional School District. Also, please find included a summary of potential traffic impacts, and information related to the athletic lighting including Illumination Plans developed for each field to show limited offsite light levels (in the plan set).

We hope you find this submittal to be complete. Please do not hesitate to contact the undersigned at (508) 259-3534 or kdh@gainc.com, if there are any questions, comments, or requirements for additional information.

Respectfully submitted,

GALE ASSOCIATES, INC.

Kathleen D. Hervol

Kathleen D. Hervol
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SITE PLAN REVIEW APPLICATION
AND ACCOMPANYING STORMWATER MANAGEMENT REPORT

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS
HAMILTON, MASSACHUSETTS 01982

NOVEMBER 2023

Hamilton-Wenham Regional School District

Prepared for:

Hamilton-Wenham Regional School District
5 School Street
Wenham, Massachusetts 01984

Prepared by:

Gale Associates, Inc.
300 Ledgewood Place – Suite 300
Rockland, MA 02370
Gale JN: 718600

COMMONWEALTH OF MASSACHUSETTS
BREE D. SULLIVAN
CIVIL
No. 48441
REGISTERED PROFESSIONAL ENGINEER

Prepared by: Ryan D. Thackeray, E.I.T.

Reviewed by: Bree D. Sullivan, P.E.

SITE PLAN REVIEW APPLICATION
AND ACCOMPANYING STORMWATER MANAGEMENT REPORT

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS
SOUTH HAMILTON, MASSACHUSETTS 01982

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ATTACHMENTS

TOWN OF HAMILTON
PLANNING BOARD

REQUEST FOR FINDINGS OF FACT
SITE PLAN REVIEW

Date Submitted:

Applicant Name: Hamilton Wenham Regional School District Phone: (978) 468-5310

Site Plan Review for Property Located at: 775 Bay Road, Hamilton, MA

1. If the proposed is an addition or alteration to an existing building, please provide the following information:
   a. Square footage of proposed new floor area: Proposed Amenities Building:
      800 SF - Team Room/Storage, Concessions, Ticketing
      800 SF - Restrooms
   b. Square footage of the current ground floor area of the existing building. (See Section 2b of the Site Plan Review By-Law for more information.): Not Applicable
   c. Estimated cost of proposed work: Estimated Cost for the entire project, as proposed, is +/- 14,000,000
   d. Current 100% assessed valuation of building: Not Applicable

2. How does the proposed development fit into the existing neighborhood in the following areas?
   a. Neighborhood character: The current site consists of existing track and ball fields adjacent to Hamilton-Wenham Regional High School. A majority of these fields will be renovated to provide synthetic turf fields, tennis courts, along with a variety of amenities including athletic lighting, grandstands with press box, amenities building, all of which are consistent with the current use of the site.
   b. Scale: One-inch equals thirty feet (1" = 30') and One-inch equals twenty feet (1" = 20')
   c. Appearance: The proposed project will provide the athletic campus at Hamilton-Wenham Regional High School with upgrades throughout, and will provide significant improvements to the appearance of the athletic campus.
   d. Natural features: Portions of the work are proposed within protected areas, such as the 100' wetland buffer zone, protected under the Massachusetts Department of Environmental Protection's Wetland Protection Act, as well as wetland buffer zones protected by the Town's Wetland Regulations. Notice of Intents for all proposed work have been filed and were approved by the Hamilton Conservation Commission.
   e. Use: Athletic campus.

Hamilton Planning Board
Site Plan Review Checklist

Applicant: Hamilton-Wenham Regional School District
Address: 775 Bay Road, Hamilton, MA
Zone: R-1B Single Residential District
Date Received:
Existing Structures: A track and football, baseball and softball fields at Hamilton-Wenham Regional High School
Proposal: Synthetic turf fields, grandstands and press box, new track, athletic lighting, amenities building, and ADA access (See Permit Plan Set attached).

Previous Proposals: Not Applicable

Requirements:

- Locations and boundaries of existing and proposed lots ✓ No new lots proposed
- Locations of adjacent streets or ways ✓
- Locations of any easements ✓
- Adjacent property owners' names. ✓ See Certified Abutters List attached
- Size of lot Not Applicable
- Frontage and yards ✓ Where Applicable
- Existing and proposed buildings and structures ✓
- Dimension of buildings and structures ✓
- Elevation drawings of building(s) with additions from each side Not Applicable
  - Additions/alterations need to show only affected side Not Applicable
- Locations and dimensions of all parking areas
  Not Applicable - Parking unaltered
- Number of parking spaces compared to requirement Not Applicable - Parking unaltered
- Handicapped parking Not Applicable - Parking unaltered
- Locations and dimensions of all loading areas Not Applicable - No new loading zones proposed
- Locations and dimensions of driveways/walkways ✓
- Locations and dimensions of access/egress ✓
- Relation to street traffic ✓
- Grading and site work ✓
- Proposed and existing topographical lines at 2' intervals ✓
- Location/description of proposed and existing sewage disposal system not shown
- Location/description of underground storage tanks Not Applicable
- Location/description of water supply ✓
- Location/description of storm drainage ✓
- Location/description of utilities ✓
- Location/description of dumpsters No new dumpsters proposed
- Location inc. height, dimension, appearance of lighting ✓ See Lighting Plans attached
- Natural Features ✓
- Location/description of landscaping inc.large trees ✓
- Location/description of proposed screening/buffers/fencing ✓
- Location/description of open space/recreation areas. ✓

Other permits required Notice of Intents from the Conservation Commission have been approved.

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
BREE D.
SULLIVAN
CIVIL
No. 48441
REGISTERED
PROFESSIONAL ENGINEER
Bree Sullivan

Bree Sullivan 11/15/2023

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 Infiltration Systems

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 (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 (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 (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 (continued)

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

- [x] 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
  - [x] 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.
- [x] 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.

- [x] 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.

3.0 PROJECT DESCRIPTION

The Hamilton-Wenham Regional School District (HWRSD) is proposing to renovate the existing athletic campus located at Hamilton-Wenham Regional High School (HWRHS). The proposed improvements include installing an infilled synthetic turf softball field, baseball/multi-purpose field, and football field, as well as the reconstruction of the bituminous concrete running track, four new bituminous concrete tennis courts, a new amenities building, new grandstand seating and press box, relocation of various track and field events, and other associated improvements. This report has been prepared in accordance with both the Massachusetts Stormwater Handbook and the Town of Hamilton Planning Board Regulations.

3.1 Existing Conditions

The athletic campus is located at HWRHS. The existing site consists of a natural grass softball field, a natural grass baseball field, a natural grass football field surrounded by a bituminous concrete track, spectator seating, as well as an open grass area with track and field events. The softball field is bound by HWRHS to the west, and wetlands the north, south, and east. The remaining athletic campus area is south of the softball field and is bound by HWRHS to the west, wetlands to the north, east, southeast, and residential to the southwest. The parcel is zoned Residential Zone 1B (R-1B).

Locus Map

3.2 Site Soils

Site Soil information was taken from the USDA Natural Resources Conservation Service (NRCS) Soil Survey Report, as well as from onsite testing. The NRCS soils mapping lists the entire softball field area, as well as the northwestern corner of the track and field area as 260A – Sudbury fine sandy loam, which generally consists of moderately well drained sandy loam (Hydrologic Soil Group B soil). The proposed tennis court area, the western half of the proposed baseball field, and the southwestern corner of the track and field is listed as 254A or 254B - Merrimac fine sandy loam which generally consists of somewhat excessively drained fine sandy loam (Hydrologic Soil Group A soil). The eastern half of the proposed baseball field and the proposed track and field event area are listed as 242A – Hinckley loamy sand which generally consists of excessively drained gravelly loamy sand (Hydrologic Soil Group A soil). The remaining track and field area, is listed as 651 – Udorthents, which generally consists of urban land built over sand and gravel.

A site soil evaluation consisting of a total of five (5) test borings (performed by Nobis Group) and seven (7) test pits (performed by Gale Associates, Inc.) was completed (Refer to Attachment 5). Four (4) test borings were performed at the four proposed athletic lighting foundations at the proposed synthetic turf softball field for soil and lighting foundation evaluation. One (1) test boring was performed in the open space area in the proposed tennis court location for soil evaluation. The boring logs and test pits indicate that the soils vary between sand, loamy sand, and sandy loam. Field observations showed the estimated seasonal high-water table (ESHWT) to be an average of 6.5 feet below grade. Curve Number (CN) values for the infiltration computations were based on the hydraulic soil group (A-B) and the surface cover material (i.e. grass, pavement). The complete list of selected curve numbers is included in the drainage calculations (Refer to Attachment 7).

4.0 STORMWATER MANAGEMENT CONCEPT

To gain an understanding of the site hydrology in its current condition, Gale completed an on-site assessment and reviewed as built and design plans for the school campus. The following section describes the watershed analysis and current hydrologic condition of the site. Rainfall events were obtained from the Northeast Regional Climate Center (NRCC).

4.1 Pre-Development Condition

The project site and surrounding areas have been broken down into six (6) existing sub watersheds that reflect the contributing areas of runoff to the design points. Existing topography was used to determine the watersheds. Refer to Sheets "PRE" for the Existing Watershed Map (Attachment 6).

4.1.1 Pre-Development Watershed Areas

Existing Watershed Area 1 (EWS-1):

EWS-1 includes runoff from the existing bituminous concrete access road, a small area of the existing parking lot to the west of the track and field, a small shed, and associated vegetated areas surrounding the access road. The runoff from this watershed flows overland in the northern direction into the existing drainage system that discharges into the Bordering Vegetated Wetlands at Design Point 1 (DP-1).

Sub-Watershed	EWS-1
Total Contributary Area (SF)	21,230
Curve Number (CN)	79
Time of Concentration (min)	6.9
Hydrologic Soil Group	A/B

Existing Watershed Area 2 (EWS-2):

EWS-2 consists of an existing natural grass football field surrounded by a bituminous concrete track, spectator seating, associated bituminous concrete walkways, and grassed and wooded areas. Runoff from this area flows northeast into the existing on-site drainage system which discharges directly into the wetlands at Design Point 1 (DP-1).

Sub-Watershed	EWS-2
Total Contributary Area (SF)	168,164
Curve Number (CN)	58
Time of Concentration (min)	12.1
Hydrologic Soil Group	A/B

Existing Watershed Area 3 (EWS-3):

EWS-3 consists of an open grassed area with two existing impervious long/triple jump areas, two concrete pads for discus and shotput, two existing garages, a press box, spectator seating, and associated bituminous concrete walkways. Runoff from this area flows north directly into the wetlands at Design Point 1 (DP-1).

Sub-Watershed	EWS-3
Total Contributary Area (SF)	64,420
Curve Number (CN)	50
Time of Concentration (min)	12.6
Hydrologic Soil Group	A/B

Existing Watershed Area 4 (EWS-4):

EWS-4 consists of the western half of the existing baseball field that consists of grassed area, a clay infield area, and associated fencing. Runoff from this area flows northeast directly into the wetlands at Design Point 2 (DP-2).

Sub-Watershed	EWS-4
Total Contributary Area (SF)	62,247
Curve Number (CN)	40
Time of Concentration (min)	12.6
Hydrologic Soil Group	A

Existing Watershed Area 5 (EWS-5):

EWS-5 consists of the eastern half of the existing baseball field that consists of grassed area, a clay infield area, fencing, and associated grassed areas and wooded areas. Runoff from this area flows southeast directly into the wetlands at Design Point 3 (DP-3).

Sub-Watershed	EWS-5
Total Contributary Area (SF)	214,321
Curve Number (CN)	41
Time of Concentration (min)	14.1
Hydrologic Soil Group	A

Existing Watershed Area 6 (EWS-6):

EWS-6 includes runoff from the existing grass softball field, including the clay infield area. The runoff from this watershed flows overland in the southern direction and directly into the Bordering Vegetated Wetlands at Design Point 1 (DP-1).

Sub-Watershed	EWS-6
Total Contributary Area (SF)	58,557
Curve Number (CN)	67
Time of Concentration (min)	7.1
Hydrologic Soil Group	B

4.2 Post-Development Condition

The HWRHS Athletic Campus Improvement Project generally includes the following scope as it relates to stormwater management:

- Installation of a synthetic turf softball field, baseball/multipurpose field, and football field with base stone and subsurface drainage system including the following:
  - Permeable turf "carpet"
  - Uniformly graded stone layer with 8-inch average thickness
  - Flat panel collector drains
  - Perforated pipe collection system
- Installation of four bituminous concrete tennis courts with associated bituminous concrete access walkways.
- Reconstruction of a bituminous concrete track with associated spectator seating, track and field events, and bituminous concrete walkways and access road.
- Construction of new amenities building with associated walkways and patio areas.

The synthetic turf fields are comprised of permeable turf "carpet" installed on top of a uniformly graded stone base with an 8-inch average depth with a 36% void space for stormwater storage. Stormwater enters the synthetic turf carpet and drains vertically into the stone base to recharge into the existing subsurface soils. During significant storms, the stormwater that does not infiltrate into subsurface soils is stored within the void space of the stone base. Excess stormwater is collected via flat panel drains which are installed within the stone base. The flat panel drains convey water to perimeter perforated collector pipes which provide additional storage and infiltration of stormwater.

4.2.1 Post-Development Watershed Areas

The proposed development results in watershed characteristics that differ from the pre-development condition as a result of revised grading and drainage patterns as well as runoff characteristics of the proposed improvement areas. The post-development Design Point 1 (DP-1), Design Point 2 (DP-2), and Design Point 3 (DP-3) are the same as the pre-development Design Points. While runoff paths and drainage areas have changed, all watersheds still discharge stormwater into the same surrounding wetlands. Refer to Sheets "POST" for the Post-Development Watershed Map (Attachment 6).

<u>Proposed Watershed Area 1 (PWS-1):</u>

PWS-1 includes runoff from the existing bituminous concrete access road, a small area of the existing parking lot to the west of the track and field, a new amenities building, bituminous concrete walkways, and patio and grassed areas. The runoff from this watershed flows overland in the northern direction and into the existing drainage system that discharges into the Bordering Vegetated Wetlands at Design Point 1 (DP-1).

Sub-Watershed	PWS-1
Total Contributary Area (SF)	29,222
Curve Number (CN)	83
Time of Concentration (min)	10.1
Hydrologic Soil Group	A/B

Proposed Watershed Area 2 (PWS-2):

PWS-2 consists of a proposed synthetic turf football field, bituminous concrete track, spectator seating, and bituminous concrete walkways. Although synthetic turf is highly permeable, the synthetic turf field area is modeled using a CN of 98, which is the same as a pond. Runoff from the turf field area enters the base stone directly. The voids in the base stone provide storage while allowing infiltration into the subsurface soils. Stormwater runoff is collected in trench and slot drains, and directed into the base stone of the synthetic turf field. Once the infiltration system reaches capacity, excess stormwater leaves the turf field to the northeast and outfalls at Design Point 1 (DP-1)

Sub-Watershed	PWS-2
Total Contributary Area (SF)	172,807
Curve Number (CN)	97
Time of Concentration (min)	6.0
Hydrologic Soil Group	A/B

Proposed Watershed Area 3 (PWS-3):

PWS-3 consists of the proposed tennis courts and surrounding bituminous concrete walkways, spectator seating areas, existing garage, and grassed area upland from the tennis courts. Runoff from these areas flows overland to the north on the tennis courts where it is directed to the open grassed area adjacent to the tennis courts. From the northeastern edge of the tennis courts, runoff flows into an infiltration trench consisting of drywells and a perforated pipe laid level in a stone trench to attenuate peak flow. In heavier rain events, this system overflows and excess runoff flows overland in the open grassed area in the northern direction towards the wetlands located at Design Point 1 (DP-1), the same location as existing conditions.

Sub-Watershed	PWS-3
Total Contributary Area (SF)	60,215
Curve Number (CN)	71
Time of Concentration (min)	6.0
Hydrologic Soil Group	A/B

Proposed Watershed Area 4 (PWS-4):

PWS-4 consists of a small area to the north of the proposed baseball field that includes several track and field events, bituminous concrete walkways, and grassed areas. Stormwater runoff flows overland to the north towards the wetlands located at Design Point 2 (DP-2).

Sub-Watershed	PWS-4
Total Contributary Area (SF)	24,518
Curve Number (CN)	58
Time of Concentration (min)	6.0
Hydrologic Soil Group	A

Proposed Watershed Area 5 (PWS-5):

PWS-5 consists of the western half of the proposed synthetic turf baseball field, bituminous concrete walkways, dugouts, and spectator seating area. Although synthetic turf is highly permeable, the synthetic turf field area is modeled using a CN of 98, which is the same as a pond. Runoff from the turf field area enters the base stone directly. The voids in the base stone provide storage while allowing infiltration into the subsurface soils. Stormwater runoff from the surrounding area is collected in trench and slot drains, and directed into the base stone of the synthetic turf field. Once the infiltration system reaches capacity, excess stormwater leaves the turf field to the northeast and outfalls at Design Point 2 (DP-2).

Sub-Watershed	PWS-5
Total Contributary Area (SF)	78,477
Curve Number (CN)	92
Time of Concentration (min)	6.0
Hydrologic Soil Group	A

Proposed Watershed Area 6 (PWS-6):

PWS-6 consists of the eastern half of the proposed synthetic turf baseball field, bituminous concrete walkways and dugout. Although synthetic turf is highly permeable, the synthetic turf field area is modeled using a CN of 98, which is the same as a pond. Runoff from the turf field area enters the base stone directly. The voids in the base stone provide storage while allowing infiltration into the subsurface soils. Stormwater runoff from the surrounding area is collected in trench and slot drains, and directed into the base stone of the synthetic turf field. Once the infiltration system reaches capacity, excess stormwater leaves the turf field to the southeast and outfalls at Design Point 3 (DP-3).

Sub-Watershed	**PWS-6**
Total Contributary Area (SF)	62,748
Curve Number (CN)	98
Time of Concentration (min)	6.0
Hydrologic Soil Group	A

<u>Proposed Watershed Area 7 (PWS-7):</u>

PWS-7 consists of the open grassed area to the east of the baseball field that includes a concrete pad for discus. Runoff from this area flows southeast directly into the wetlands at Design Point 3 (DP-3).

Sub-Watershed	**PWS-7**
Total Contributary Area (SF)	102,388
Curve Number (CN)	39
Time of Concentration (min)	13.3
Hydrologic Soil Group	A

<u>Proposed Watershed Area 8 (PWS-8):</u>

PWS-8 consists of the proposed synthetic turf softball field. Although synthetic turf is highly permeable, the synthetic turf field area is modeled using a CN of 98, which is the same as a pond. Runoff from the turf field area enters the base stone directly. The voids in the base stone provide storage while allowing infiltration into the subsurface soils. Once the infiltration system reaches capacity, excess stormwater leaves the turf field to the northeast and outfalls at Design Point 1 (DP-1) to the northeast of the softball field.

Sub-Watershed	**PWS-8**
Total Contributary Area (SF)	46,953
Curve Number (CN)	98
Time of Concentration (min)	6.0
Hydrologic Soil Group	B

Proposed Watershed Area 9 (PWS-9):

PWS-9 consists of proposed concrete pads for spectator seating, softball field dugouts, a batting cage to the north of the field, access drive, bituminous concrete walkways, and grassed areas surrounding the proposed softball field. The stormwater drains overland to the north towards the wetlands located at Design Point 1 (DP-1).

Sub-Watershed	PWS-9
Total Contributary Area (SF)	11,604
Curve Number (CN)	79
Time of Concentration (min)	6.0
Hydrologic Soil Group	B

5.0 COMPLIANCE WITH STORMWATER STANDARDS (MASWMS)

5.1 Untreated Stormwater (Standard 1)

The project is designed so that stormwater conveyances (outfalls/discharges) do not discharge untreated stormwater into or cause erosion to downstream properties, to the maximum extent practicable. The turf field and stone base attenuates peak flow and detains stormwater runoff for infiltration. The BMPs will reduce the runoff into the adjacent wetlands and prevent erosion.

5.2 Post-Development Peak Rates (Standard 2)

A Hydrologic Study was performed to determine the rate of runoff for the 2, 10 and 100-year storm events under pre-development (existing) and proposed conditions. From these analyses, it was estimated that the proposed project would not increase the peak runoff rates above existing levels for all storm events modeled. It is the intent of the Stormwater Management System to minimize impacts to drainage patterns, downstream property, and wetlands, while simultaneously provide treatment to runoff prior to its release from the site or its discharge to wetlands.

The U.S.D.A. Soil Conservation Service (SCS) Technical Release 55 (TR-55), 1986, was used as the procedure for estimating runoff. HydroCAD, a SCS TR-20-based computer program was used for estimating peak discharges. TR-55 is a generally accepted model for use on small sites and begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). The CN is based on soils, ground cover, impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph that depends on runoff travel time through segments of the watershed.

Stormwater management computations for the full-build were performed using SCS-based HydroCAD, as well as for existing and proposed conditions curve numbers, times of concentrations and unit hydrograph computations.

5.2.1 Proposed Conditions

As described under Section 6.2, the post-development curve numbers are greater than pre-development, which generally increases the runoff potential of the site. In the HydroCAD software, synthetic turf is modeled with a CN of 98, to model the direct contribution of stormwater into the dynamic base stone beneath the synthetic turf field. The dynamic base stone serves to collect, detain, and control the release of stormwater runoff, thereby attenuating the peak rate of runoff. The stone base promotes infiltration and groundwater recharge to the maximum extent feasible.

5.2.2 Peak Rate Summary

Table 6.2.3 shows the peak rate of runoff for the existing and proposed site for the 2, 10 and 100-year design storms. While proposed conditions include two Design Points (DP-1 & DP-2), both Design Points drain into the surrounding wetlands, therefore the runoff numbers below represent the total runoff into the wetlands.

TABLE 6.2.3

Analysis Point	Design Storm	Existing Runoff (CFS)	Proposed Runoff (CFS)
1*	2-yr	1.5	1.2
	10-yr	5.4	4.1
	100-yr	14.0	10.3
*Analysis Point 1 represents the total runoff from DP-1, DP-2 & DP-3 from the site into the surrounding wetlands.			

5.3 Recharge to Groundwater (Standard 3)

The project controls the stormwater runoff from the site by attenuating and treating the runoff in the base stone. After permeating through the base stone, the runoff infiltrates into the soils beneath the field, with minimal stormwater draining through perforated flat panel under drains and perforated collector pipes. An outlet control structure is used to control runoff outflow to the existing drainage system by retaining stormwater in the base stone, therefore allowing infiltration.

The total amount of impervious area in the project area = 3.642 acres = 158,689. Some of these impervious surfaces are existing but were included in these calculations in an effort to be conservative. Of the 3.642 acres of impervious, 3.183 acres are in HSG A, and 0.459 acres are in HSG B.

Required Recharge Volume for the entire site was calculated in accordance with Standard 3:

Rv = (F(A) * HSG A impervious area (acres)) + (F(B) * HSG B impervious area (acres))
Rv =((0.6/12) * 3.183 ac) + ((0.35/12) * 0.459 ac) = 0.1725 Ac-ft = 7,514 CF

Rv = Required Recharge Volume
F(A) = Target Depth Factor for HSG A = 0.6 inches
F(B) = Target Depth Factor for HSG B = 0.35 inches

The 36% voids within the stone base of all three synthetic turf fields will provide approximately 65,535 CF of storage which exceeds the Required Recharge Volume of 7,514 CF.

Required minimum surface area of the bottom of the infiltration structure was calculated in accordance with the Simple Dynamic Method, as outlined in the Massachusetts Stormwater Management Standards:

A = Rv / (D + KT)
A = 7,514 CF / (0.33 ft + 0.085 ft/h * 2h) = 15,028 SF

A = Minimum required surface area of the bottom of the infiltration structure
Rv = Required Recharge Volume = 7,514 CF
D = Depth of the Infiltration Facility capable of stormwater retention = 4 inches = 0.33 ft
K = Saturated Hydraulic Conductivity = 1.02 in/h = 0.085 ft/h
T = Allowable drawdown during the peak of the storm (2h)

The synthetic turf field's base stone is used to meet this standard, as it is separated by a minimum of two feet (2') from the Estimated Seasonal High Groundwater (ESHGW) table and therefore will provide infiltration capabilities. The surface area of the synthetic turf fields is approximately 251,108 SF in surface area. This amount of infiltrative surface area allows for the vertical transport of stormwater into the underlying base stone, which contains 36% voids equivalent to storage area, and exceeds the minimum required surface area of the bottom of the infiltration structure of 15,028 SF.

The drawdown time from the dynamic base stone for the required recharge volume is calculated as follows:

$Time_{drawdown}$ = Rv / [(K)*(Bottom Area)]
= (7,514 ft^3) / [(0.085 ft/hr)*(251,108 ft^2)]
= 0.35 hours or 21 minutes

Rv = Storage Volume (ft^3)
K = Saturated Hydraulic Conductivity (ft/hr)
Bottom Area = Bottom Area of Recharge Structure (ft^2)

The drawdown time for the infiltration areas was calculated to be 0.35 hours, or 21 minutes, well below the required drawdown time of 72 hours.

5.4 Water Quality (Standard 4)

The proposed synthetic turf athletic field has low potential for accumulation of total suspended solids (TSS). The turf is not subject to fertilization, sedimentation, irrigation, or rigorous maintenance, thus lessening the ability to acquire TSS. Runoff generated by the synthetic turf field will travel vertically, through approximately eight inches (8") of engineered stone base, where it will infiltrate into the soils below. All of the runoff directed into the synthetic turf field is "clean", because the impervious surfaces will not be subjected to vehicular loading, sanding, or salting. Therefore, they do not need to be treated for TSS removal. Despite not needing to be treated, a TSS removal worksheet was completed for the synthetic turf system, see Attachment 5.

5.5 Land Uses with Higher Potential Pollutant Loads (Standard 5)

The project is not a LUHPPL.

5.6 Critical Areas (Standard 6)

The site does not lie within a critical area and is not listed in the DEP ACEC's List, Latest Edition.

5.7 Redevelopment (Standard 7)

This project is a redevelopment project. However, the project, as designed, meets the stormwater standards for new construction.

5.8 Erosion and Sedimentation Controls (Standard 8)

An Erosion and Sedimentation Control Plan is provided as part of the plan set submitted as part of the stormwater management report to the town.
The project is covered under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) and a will require a Stormwater Pollution Prevention Plan (SWPPP). The contractor will file a

Notice of Intent (NOI) for work under the CGP and provide a SWPPP prior to the start of construction.

5.9 Operation and Maintenance Plan (Standard 9)

An Operation and Maintenance Plan is provided as part of this NOI (Refer to Attachment 8).

5.10 Prohibition of Illicit Discharges (Standard 10)

There are no illicit discharges to the proposed Stormwater Management System. A template for an illicit discharge compliance statement is included in the Operation and Management Plan. A completed statement will be submitted by the contractor prior to the discharge of stormwater to the post-construction Stormwater Management System (Refer to Attachment 8).

6.0 SUMMARY

The HWRHS Athletic Campus Improvements Project is intended to improve the quality of the athletic and recreational surfaces for the residents of the Town of Hamilton, students of HWRHS and the students at neighboring schools. The project is estimated to provide water quality improvements and peak flow reduction within the watershed. The proposed synthetic turf field eliminates the need for routine maintenance and watering of the existing natural grass field, which can negatively impact the quality of the stormwater runoff, and cause aquifer drawdown through irrigation. The proposed base stone storage capacity will provide peak runoff control and water quality improvements.

The project, as proposed, is the "best fit" for this site, and an improvement to the adjacent areas. The project proves to be a betterment to the environment by exceeding all the Massachusetts Stormwater Management Standards.

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ATTACHMENT 1

USGS Map

Project Locus Map

HAMILTON-WENHAM REGIONAL HIGH SCHOOL
ATHLETIC CAMPUS IMPROVEMENTS
HAMILTON, MA

Reference: MassGIS MassMapper - USGS Topographic Map Layer – Hamilton

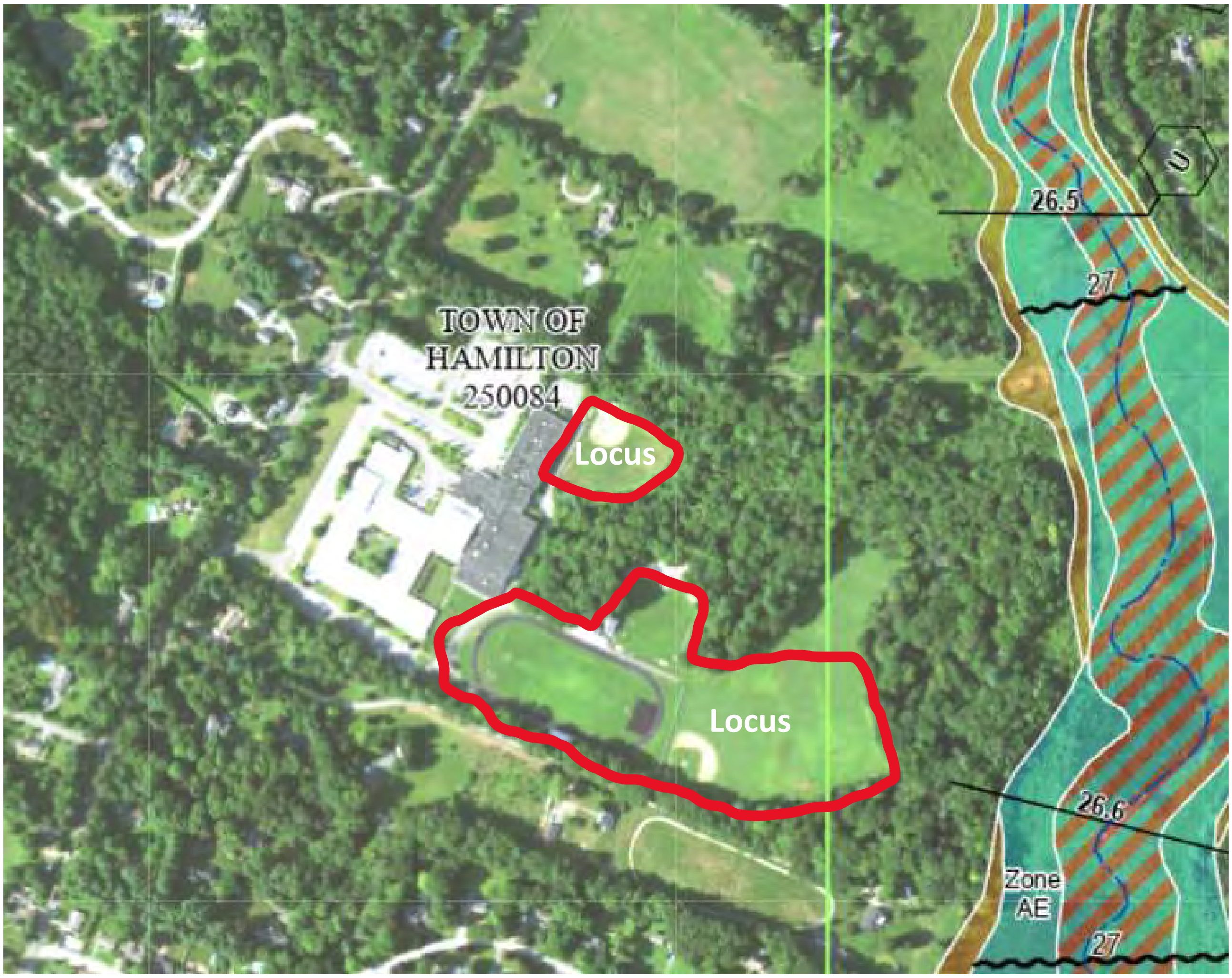
Attachment 1

ATTACHMENT 2

Flood Map (FEMA)

Flood Hazard Zones

HAMILTON-WENHAM REGIONAL HIGH SCHOOL
ATHLETIC CAMPUS IMPROVEMENTS
HAMILTON, MA



Reference: FEMA National Flood Hazard Layer (NFHL) Viewer

Legend

- 1% Annual Chance Flood (100-year)
- 0.2% Annual Chance Flood (500-year)
- Regulatory Floodway

ATTACHMENT 3

Nobis Geotechnical Report
Gale Associates Soil Test Pit Logs
NRCS Soil Map

September 30, 2022
File No. 100451.000

Gale Associates, Inc.
Ms. Kathleen D. Hervol
Project Manager
163 Libbey Parkway
Weymouth, MA 02189

Re: **Geotechnical Engineering Report**
Hamilton-Wenham Regional High School Athletic Facilities Improvements
775 Bay Road
South Hamilton, Massachusetts

Dear: Ms. Hervol:

Nobis Group® (Nobis) has completed geotechnical engineering services for the above referenced project. Services were performed in general accordance with our proposal dated March 16, 2022, and your subsequent authorization. This geotechnical engineering report presents the results of the subsurface explorations and provides geotechnical recommendations concerning the design and construction of athletic field lighting and the proposed tennis courts. This report is subject to the limitations contained in **Appendix A**.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
NOBIS GROUP®

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Brien T. Waterman, PE
Senior Project Manager

Alfred Jones, PE
Reviewer

Nobis Group®
18 Chenell Drive
Concord, NH 03301
(603) 224-4182

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TABLE OF CONTENTS

Attachments

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EXECUTIVE SUMMARY

The executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details are not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. **Appendix A** should be read for an understanding of the report limitations.

Nobis Group® (Nobis) has completed a subsurface exploration program for the proposed Hamilton-Wenham Regional High School Athletic Facilities Improvements project located at 775 Bay Road in South Hamilton, Massachusetts. Our geotechnical engineering scope of services included advancing four (4) test borings for proposed light poles around the baseball field and one (1) test boring for proposed tennis courts. During a previous boring program, boring B-2 was advanced near the proposed tennis court.

Based on the information obtained from our subsurface explorations, the following geotechnical considerations were identified:

- Subsurface conditions observed around the proposed baseball field lighting generally consist of topsoil and fill underlain by organic deposits, naturally deposited sand and gravel, sand and silt, and silts and clays. Organic deposits were observed up to 8 feet below current ground surface. Groundwater was encountered from approximately 5.3 to 8.5 feet below existing grade.
- Subsurface conditions within the existing baseball field area are generally favorable for supporting the proposed field light assemblies on drilled pier foundations or conventional shallow spread footings. For shallow spread footings we recommend a maximum net allowable bearing pressure of 3,000 pounds per square foot.
- Based on the Massachusetts State Building Code, 9th Edition, the seismic site classification for the baseball field is Site Class D. The site does not appear to be susceptible to liquefaction in the event of an earthquake.
- Subsurface conditions observed at the proposed tennis court consisted of topsoil over naturally deposited sand, silt and sand, and silts and clays. Groundwater was observed at a depth of approximately 5.5 feet below existing grade. We understand up to approximately 1-feet of fill is proposed for the tennis court area. Due to the presence of clay we estimate approximately 1.6-inches of settlement over 20 years. A

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preload/surcharge could be used to reduce the post-construction settlement, as discussed in this report.

Earthwork on the project should be evaluated by the geotechnical engineer of record (GER). The evaluation of earthwork should include review of engineered fill, subgrade preparation, and other geotechnical conditions exposed during construction. The observation and testing of engineered fill should be accomplished by a qualified testing agency.

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1.0 INTRODUCTION

This report presents the results of our geotechnical engineering evaluations performed for the proposed athletic facilities improvements at Hamilton-Wenham Regional High School in Hamilton, Massachusetts. Our geotechnical engineering scope of services included advancing four (4) test borings for proposed baseball field lighting and one (1) test boring for the proposed tennis courts. During a previous boring program, boring B-2 was advanced near the proposed tennis court. Test borings, identified as B-101 through B-105, were advanced to depths ranging from approximately 17 to 24 feet below existing grade. This report is subject to the limitations contained in **Appendix A**.

The project utilizes two different surveys. The area of the existing baseball field is around El. 43 feet and is based on the North American Vertical Datum of 1988 (NAVD 88). The area of the proposed tennis court is around El. 97 feet and appears to be based on an arbitrary site datum (ASD).

A **Site Locus Plan** and an **Exploration Location Plan** are included as **Figure 1** and **Figure 2**, respectively. Exploration logs are included in **Appendix B**. The purpose of our services is to provide information and geotechnical engineering recommendations related to the following:

- Subsurface soil conditions
- Foundation design and construction
- Seismic design considerations
- Groundwater conditions
- Earthwork construction

2.0 PROJECT INFORMATION

2.1 Site Location and Description

Location	The project is located on the campus of Hamilton-Wenham Regional High School at 775 Bay Rd in South Hamilton, Massachusetts.
Existing Improvements & Current Ground Cover	The project area is currently developed with a grassed baseball field in the area of proposed lighting and a grassed field in the area of proposed tennis courts.
Existing Topography	The baseball field appears relatively level near elevation (El) 42 feet (NAVD 88) in the vicinity of the project area. The area of

	the proposed tennis courts is relatively level at about El. 97 feet (ASD).

2.2 Project Description

Project Description	We understand the project consists of constructing four new field light assemblies at the northern baseball field and proposed new tennis courts which are to be located in an existing flat grassed area northeast of the running track.
Grading/Cut and Fill Slopes	Based on the provided 75% grading plans, there will be no grade raises in the area of the proposed light assemblies. However, the proposed tennis courts will be at approximate El. 98 feet, which consists of an approximate grade raise of 1-foot.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

Based on the results of the explorations, subsurface conditions within the area of the subsurface explorations generally consist of a surficial layer of topsoil and/or fill underlain by organic deposits, sand and gravel, and silts and clays. Not all strata were encountered at all locations. Subsurface conditions can be generalized as follows.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Approx. Thickness (feet)	Material Description	Density/ Consistency
Fill (1)	4 to 5	3.5 to 4.7	Generally described as fine to coarse SAND, varying amounts of Gravel and Silt.	Medium dense to Very Dense
Buried Topsoil/ Organic Deposits (1)(2)	5.1 to 8	0.1 to 4	Generally described as SAND, SILT or Organic SILT of varying composition.	Loose to Medium Dense
Sands and Gravels(1)	8.5 to 13.5	2 to 7.8	Generally described as fine to coarse SAND with varying amounts of gravel and silt.	Generally Medium Dense to Very Dense

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Silt / Sand & Silt[(3)]	8 to >18.5	5 to >8.5	Generally described as silt with varying amounts of sand or sand with varying amounts of silt.	Generally Medium Dense to Dense
Silts and Clays	>24.0	>16	Varies from SILT with some fine to medium Sand to Silty CLAY.	Very Stiff to Very Soft / Medium Dense

1. Not encountered in B-105.
2. Not encountered in B-104.
3. Not encountered in B-102 and B-103

Details for each of the explorations can be found on the test boring logs in **Appendix B**. Visual soil classifications and conditions encountered at each exploration location are indicated on the individual test boring logs. Stratification boundaries on the logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. A discussion of field sampling procedures is included in **Appendix B**.

3.2 Groundwater

At the time of the subsurface explorations, groundwater was observed at depths ranging approximately 5.3 to 8.5 feet below existing grades. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

3.3 Geotechnical Laboratory Testing

Laboratory testing was performed on select soil samples obtained from the explorations to assist in classification and evaluating physical engineering characteristics. Geotechnical laboratory testing included particle size distribution (sieve analysis) and Atterberg Limits test performed by ConTest Consultants, Inc. (ConTest) of Goffstown, New Hampshire. Individual test reports provided by ConTest are included in **Appendix C**.

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4.0 PROPOSED TENNIS COURTS

4.1 Settlement Evaluation

Based on boring B-105, compressible clay was encountered from a depth of approximately 8 feet below grades to a boring termination depth of 24 feet. Previously performed boring B-2 encountered clay from approximately 15 feet below grades to the termination depth of 22 feet. We understand that a raise in grades of approximately 1-foot is proposed in the northern portion of the proposed tennis court (i.e. the raise in grades starts at around the tennis court net-line and extends north).

We utilized a 3-dimensional settlement software by RocScience, Inc. to estimate the consolidation settlement in the area of the proposed tennis courts. Several assumptions were required to complete the analysis since the test boring terminated in clay. In our model we assumed that the clay was 50 feet thick. We estimate that load induced by the raise in grades will result in approximately 1.6-inches of consolidation settlement over 20 years. We anticipate that the northern portion of the tennis courts would experience most of the settlement (i.e. area of most of the proposed fill).

We also evaluated the use of a preload and surcharge. Assuming a preload duration of 9 months, with a 1-foot surcharge, we estimate approximately 1-inch of post-construction settlement over 20 years. We recommend that the surcharge load cover approximately half the area of the proposed tennis courts (i.e. starting at the tennis court net-line and extending north).

We recommend that a preload/surcharge be used and monitored with a minimum of four (4) settlement platforms. The contractor should collect measurements daily for the first two weeks, then weekly up to month 3, then monthly until the end of the preload. The actual duration of the preload should be based on the settlement platform readings.

The use of a geotextile below the recommended pavement section should be considered. A geotextile won't reduce the amount of settlement; however, it may help to reduce the impact of differential settlement across the tennis court.

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4.2 Recommended Pavement Section

Nobis recommends a pavement section consisting of a court surfacing over 1 ½-inch layer of bituminous wearing surface, 2 ½-inch bituminous binder course, and an 8-inch layer of dense graded aggregate.

5.0 FIELD LIGHTING FOUNDATIONS

We understand the project consists of construction four field light assemblies for the baseball field; however, the project is in conceptual design and the light locations have not been finalized. Based on the results of our subsurface explorations and understanding of the project, it is our opinion the proposed field light assemblies can be supported on drilled pier foundations end bearing in the naturally deposited soils. Alternatively, field light assemblies can be supported on shallow foundations bearing on native sand and gravel, as discussed herein.

Geotechnical engineering recommendations for foundation systems and other earth-connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field testing, engineering analyses and our current understanding of the proposed development.

5.1 Drilled Pier Foundations

The proposed field light assemblies can be supported on drilled pier foundations bearing on the naturally-deposited non-organic soils. It is anticipated that the length of drilled piers will be based on either compression or the lateral capacity required to resist live loading such as a combination of wind and ice. Allowable deflection at the top of the drilled pier of 0.5 inch is recommended for calculating lateral capacity. Design recommendations for drilled pier foundations are presented below.

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5.1.1 Drilled Pier Design Recommendations

Description	Value [1]
End Bearing Material	Natural Sand and Gravel or Silt and Clay
Net Allowable End Bearing Capacity [2,3]	Depth ≥10 feet: 3,000 psf
Minimum Pier Diameter	24 inches
Ultimate Average Unit Side Friction	Depth <4 feet: neglect Depth >4 feet: 65 + 5(z) psf [4,5,6,7]
Ultimate Coefficient of Friction ($\tan\delta$) [6]	Fill: 0.30 Sand and Gravel: 0.30 Silt and Clay: 0.30
Coefficient of Lateral Subgrade Reaction	Fill/Sand and Gravel: 40 (z/D) kcf [6,7] Silt and Clay: 20 (z/D) kcf
Angle of Internal Friction	Fill: 30 degrees Sand and Gravel: 30 degrees Silt and Clay: 0 degrees
Undrained Shear Strength (c_u)	Silts and Clays: 1,000 psf
Estimated In-Situ Soil Unit Weight (γ_{moist})	Existing Fill: 120 pcf Sand and Gravel: 120 pcf Silt and Clay: 105 pcf
Recommended Design Groundwater Depth	5 feet

1. Variations in subsurface conditions may occur between borings, across the site, and due to modifying effects of weather. Subsurface conditions below a depth of 24 feet for the proposed field lighting have not been verified. If design shaft lengths are greater than the exploration depth at the planned foundation location, supplemental explorations and/or recommendations will be necessary.
2. Based on our understanding of the project and experience with similar projects, drilled pier foundations are anticipated to bear approximately 15 feet below existing grade.
3. The allowable end bearing pressure assumes that unsuitable soil at the base of the pier has been removed.
4. psf – pounds per square foot; psi – pounds per square inch; pcf – pounds per cubic foot; kcf – kips per cubic foot
5. Contribution to vertical capacity of the pier from soil within the frost depth of 4 feet should be ignored. The uplift capacity of the pier will be based on side friction and the dead weight of the pier.
6. Friction values are for mass concrete; for pre-cast concrete the friction coefficient is 80 percent of the values for mass concrete.
7. z is defined as the depth below the ground surface and D is the diameter of the pier, both in feet.

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Side friction and lateral subgrade modulus values presented above are ultimate parameters based on data presented on the attached test boring logs, published values, and our experience with similar soil conditions, and do not include a factor of safety. The recommended net allowable end bearing pressure includes a factor of safety of 3.

The recommended design parameters presented above are for cast-in-place drilled pier foundations. If alternative construction methods are selected, such as installing precast piers in drilled holes, the design parameters presented above will be partially dependent on annular space backfill materials and should be re-evaluated.

The uplift capacity of the pier will be based on allowable friction of the soil and the dead weight of the pier. Compression capacity is based on side end bearing. Drilled piers designed to resist tension loads should have reinforcing steel installed the entire length of the pier.

5.2 Shallow Foundations

As an alternative to drilled pier foundations, the field light assemblies may be supported on conventional spread footing or pad-and-pier foundations bearing on a minimum 6-inch-thick layer of compacted crushed stone placed above undisturbed non-organic native sand and gravel subgrades. Due to the depth of the native sand and gravel in boring B-103 (i.e., greater than 8 feet below grade) shallow spread footings in these areas may not be feasible.

The use of crushed stone will help facilitate dewatering and provide a stable working surface. Crushed stone should be separated from soil subgrades, excavation sidewalls and backfill by a geotextile separation fabric such as Mirafi 140N, or equivalent.

5.2.1 Shallow Foundation Design Recommendations (Light Assemblies)

Bearing Material (1)	Minimum 6-inch-thick layer of compacted crushed stone placed above undisturbed sand and gravel subgrades provided subgrades are prepared as discussed herein.	
Maximum Net Allowable Bearing Pressure(2)	3,000 pounds per square foot (psf) (DL+LL)	
Minimum Foundation Depth (3)	48 inches (frost protection)	
Minimum Foundation Width	*Isolated Spread Footings*:	36 inches
Estimated Settlement (4)	*Total*:	1-inch
Ultimate Coefficient of Friction, tanδ (5)	Native Sand and Gravel	0.30
	Structural Fill/Crushed Stone:	0.60

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1. Crushed stone should be separated from soil subgrades, excavation sidewalls and backfill using a geotextile separation fabric such as Mirafi 140N, or equivalent.
2. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the foundation base elevation. Assumes unsuitable or soft soil, where present, will be replaced with compacted structural fill or crushed stone.
3. Minimum foundation depth for frost protection for exterior foundations and foundations below unheated interior spaces.
4. Foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the foundation, the thickness of compacted fill, and the quality of the earthwork operations.
5. Friction values are for mass concrete; for pre-cast concrete the friction coefficient is 80 percent of the values for mass concrete.

The allowable foundation bearing pressure applies to dead loads plus design live load conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

6.0 SEISMIC DESIGN CRITERIA

Code Used	Massachusetts State Building Code, 9th Edition
Site Class	Site Class D (1)(2)
Maximum Considered Earthquake (MCE) Spectral Acceleration (5 percent damping)	S_s= 0.253g (0.2 second spectral response acceleration) S_1= 0.075g (1.0 second spectral response acceleration)
Liquefaction Potential	Not considered susceptible to liquefaction.

1. In general accordance with the Massachusetts State Building Code, 9th Edition (780 CMR) with reference to the 2015 International Building Code (IBC); Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile. The Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope does not include the required 100-foot soil profile determination. Test borings extended to a maximum depth of 21 feet below existing grade. The seismic site class definition considers that similar soil conditions continue below the maximum depth of the subsurface explorations.
2. The recommended seismic site class of D is for the proposed light assembly area. For the proposed tennis court area we recommend a seismic site class of E, if required.

7.0 GENERAL CONSTRUCTION CONSIDERATIONS

The following sections present recommendations for site preparation, excavation, subgrade preparation, and placement of fill for the project. The recommendations presented for design and

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construction of earth-supported elements are contingent upon the recommendations outlined in this section.

7.1 Earthwork in Wet Environments

Excavated onsite soil will generally consist of existing topsoil, fill, and organic deposits. Excavated onsite soil may be selectively reused as common fill provided it is free of deleterious material and particles larger than 6 inches in diameter, and it is relatively dry such that it can be adequately compacted. Portions of the excavated onsite soil are anticipated to have an elevated percentage of silt and will be sensitive to moisture. This recommendation is applicable during periods of construction when the climate and moisture are favorable for reusing silty soil.

Contractors experienced in earthwork construction in New England should be aware of silty soil behavior and the effects that moisture and season have on its workability. If a contractor bids construction knowing that earthwork must begin during seasonally wet months, the owner should expect a contingency by the contractor to create a suitable working surface for equipment, the use of off-site suitable fill and disposal of on-site soil.

Care must be taken by the contractor to avoid the disturbance of subgrades by minimizing construction traffic (including foot traffic) to the extent practical. Subgrades disturbed by construction traffic should be over-excavated and replaced with suitable backfill material.

7.2 Drilled Pier Construction Considerations

Drilled piers should be aligned vertically. The drilling method or combination of methods selected by the contractor should be submitted for review by the geotechnical engineer, prior to mobilization of drilling equipment. Temporary casing may be required to reduce the likelihood of caving of the granular soil, particularly below the water table. Concrete should be placed by tremie methods if the drilled pier is more than 10 feet deep or concrete is placed in the wet.

Consideration should be given to the possibility of encountering cobbles and/or boulders during construction of the drilled pier foundations. The augers did not encounter refusal, however, that does not preclude the possibility of obstructions in the area.

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7.3 Subgrade Preparation (Shallow Foundations)

Following excavation to rough grade and before constructing foundations or placing new fill, the subgrades should be firm, stable, and unyielding. Subgrades should be proof-rolled with at least six passes in perpendicular directions using a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor, such as a Wacker DPU4545 or equivalent, in confined areas and/or trenches. Proof-rolling subgrades in close proximity to the water table may need to be accomplished statically to reduce the potential for disturbance. Excavations should be accomplished using a smooth edge bucket to reduce the potential for subgrade disturbance.

Where fill, buried topsoil, organics, or other unsuitable material is encountered at or below proposed foundation subgrade it should be over-excavated and replaced with compacted crushed stone or compacted structural fill. Over-excavation below foundations should include the foundation bearing zone, defined as the area beneath 1 horizontal to 1 vertical (1H:1V) lines extending downward and outward from foundation edges.

The GER, or their representative, should review the subgrade during the proof-rolling process. Soft/unstable zones should be over-excavated to competent material and replaced with compacted structural fill or crushed stone as necessary. Following proof-rolling, crushed stone may be placed and compacted to achieve design elevation. Where subgrades become wet, unstable and/or difficult to proof-roll, they should be over-excavated to more competent material and backfilled with crushed stone. Crushed stone should be separated from the excavation subgrade, sidewalls, and granular backfill above the stone with a geotextile separation fabric, such as Mirafi 140N or equivalent. Excavated subgrades should not be left exposed overnight unless the forecast calls for above-freezing, clear conditions.

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7.4 Subgrade Preparation (Proposed Tennis Court)

Following excavation to rough grade and before placing new fill, the subgrades should be firm, stable, and unyielding. Subgrades should consist of non-organic natural granular soils. Subgrades should be proof-rolled with at least six passes in perpendicular directions using a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor, such as a Wacker DPU4545 or equivalent, in confined areas. Proof-rolling subgrades in close proximity to the water table may need to be accomplished statically to reduce the potential for disturbance. Excavations should be accomplished using a smooth edge bucket to reduce the potential for subgrade disturbance.

Where buried topsoil, organics, or other unsuitable material is encountered at or below proposed tennis court subgrade it should be over-excavated and replaced with compacted crushed stone or compacted structural fill.

After removal of organics, or other unsuitable materials, then the recommended surcharge fill should be placed a minimum 1-feet above proposed final grades in the area described in the above in the proposed Tennis Courts Section (Section 4.1). After completion of the preload/surcharge, the area should be excavated to natural sandy material below the proposed tennis court pavement section.

7.5 Fill and Placement

7.5.1 Reuse of Onsite Soil – Common Fill

Excavated onsite soil may be selectively reused as common fill outside of foundation bearing zones and as backfill above foundations, provided it is free of deleterious material and particles larger than 6 inches, and it can be adequately compacted. Common fill may also be used to raise grades for the recommended 1-foot surcharge in the proposed tennis court area. We recommend that the proposed surcharge fill obtain a minimum dry density of 110 pounds per cubic foot, as determined by a modified Proctor.

7.5.2 Imported Structural Fill

Placement/Location	Material Properties
Recommended below footings, within footing bearing zones and under settlement-sensitive structures.	Imported structural fill should meet the following gradation: **Sieve Size** – **Percent Passing by Weight** 6-inch – 100* 3-inch – 70-100** ¾-inch – 45-95 No. 4 – 30-90 No. 10 – 25-80 No. 40 – 10-50 No. 200 – 0-10 * Maximum particle size limited to 2/3 the loose lift thickness. ** Maximum 3-inch particle size within 12 inches of the underside of footings.

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7.5.3 Imported Common Fill

Placement/Location	Material Properties
May be used for site grading and fill outside footing bearing zones. Common fill should not be used under settlement sensitive structures.	The maximum particle size is recommended to be limited to 6 inches. Imported common fill should be limited to no more than 30 percent by weight should pass the No. 200 sieve.

7.5.4 Crushed Stone

Placement/Location	Material Properties
Recommended below footings, within footing bearing zones, under settlement-sensitive structures, or as drainage.	Crushed stone shall meet the requirements defined by the Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges, Section M2.01.4 (¾-inch).
1. Crushed stone, if used, should be separated from soil subgrades, excavation sidewalls, and soil backfill with a geotextile separation fabric such as Mirafi 140N, or equivalent.	

7.6 Compaction Requirements

Fill Lift Thickness	*Vibratory Rollers:*	12 inches or less in loose thickness
	Plate Compactors:	8 inches or less in loose thickness
Compaction Requirements	*Structural Fill:*	95% maximum dry density
	Base/Subbase Course:	95% maximum dry density
	Common Fill:	92% maximum dry density
	Crushed Stone:	Compacted to a non-yielding state
Moisture Content	± 3% of Optimum Moisture Content	

1. Maximum dry density as determined by ASTM D-1557, Method C (Modified Proctor).
2. Fill should be tested for moisture content and percent compaction during placement. If in-place density test results indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

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7.7 Temporary Excavations, Grading and Drainage

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations or temporary bracing, as required, to maintain stability of the excavation sides and the excavation bottom. Instability in the form of slope raveling, caving, and sloughing should be expected in all excavations and trenches which extend into the granular materials with little to no cohesion. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards. Lateral earth support systems, if used, should be designed by a licensed engineer.

Construction slopes should be reviewed for signs of mass movement. If potential stability problems are observed, work should cease and the GER should be contacted immediately. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor.

Stockpiles should be placed well away from the edge of the excavation and their height should be controlled so they do not surcharge the sides of the excavation. Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction.

7.8 Dewatering

Based on observed groundwater levels and seasonal variations, anticipated finish grades, and anticipated excavation depths, dewatering may be needed for construction of the light pole foundations. Regardless of excavation depths, construction dewatering will likely be required to maintain a stable subgrade during construction and prevent surface water runoff from collecting in excavations. If dewatering becomes necessary, the contractor should select a dewatering method to lower groundwater at least 2 feet below the excavation subgrade in order to minimize bearing surface disturbance during excavation, fill placement and compaction.

Subgrade soil that becomes unstable should be replaced with crushed stone or structural fill as necessary. Crushed stone, where used, should be enveloped with a non-woven geotextile, such as Mirafi 140N or equivalent, to avoid separation of fines from the subgrade and backfill. Discharged water should be managed in accordance with local, state and federal government requirements.

8.0 DESIGN SERVICES AND CONSTRUCTION OBSERVATION

Nobis should be retained to review final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the

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design and specifications. The GER and an independent testing agency should also be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

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FIGURES

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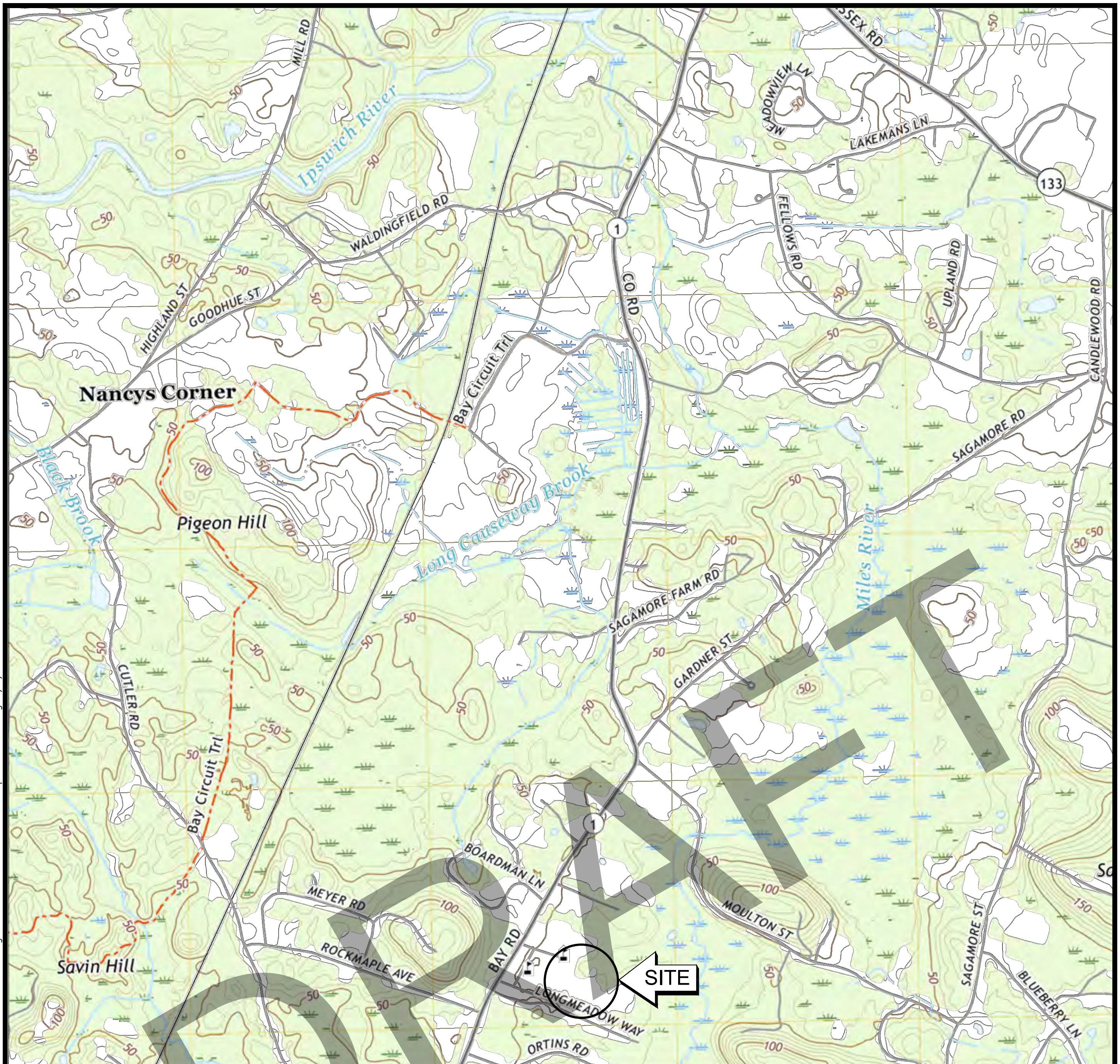

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NORTH

2021 USGS TOPOGRAPHIC MAP

IPSWICH QUADRANGLE
HAMILTON, MASSACHUSETTS
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR INTERVAL 10 FEET

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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QUADRANGLE LOCATION

FIGURE 1

SITE LOCUS PLAN

GEOTECHNICAL ENGINEERING REPORT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL
ATHLETIC FACILITIES IMPROVEMENTS
HAMILTON, MASSACHUSETTS

DRAWN BY:	SNP	CHECKED BY:	BTW
PROJECT NO.	100451.000	DATE:	AUGUST 2022

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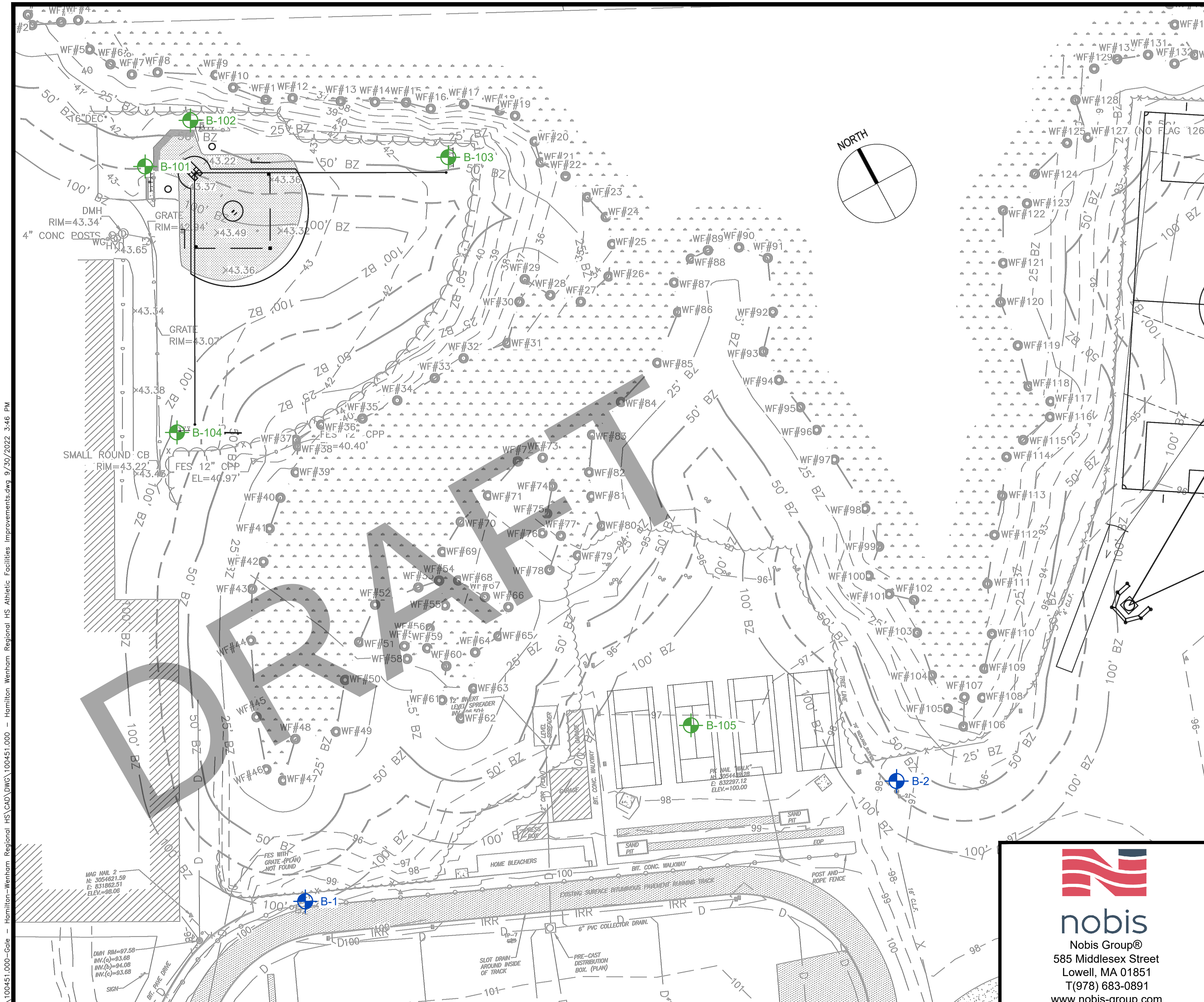

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NOTES:

1. THE BASE PLAN WAS PREPARED BY GALE ASSOCIATES, INC DATED 10 FEBRUARY 2022.
2. LOCATIONS AND SITE FEATURES DEPICTED ARE APPROXIMATE AND GIVEN FOR ILLUSTRATIVE PURPOSES.
3. SOIL BORINGS WERE DRILLED BY NEW ENGLAND BORING CONTRACTORS, OF DERRY, NEW HAMPSHIRE AND OBSERVED BY NOBIS ON 07 JULY 2022.
4. THE PROJECT UTILIZES TWO DIFFERENT SURVEYS. THE AREA OF THE EXISTING BASEBALL FIELD IS AROUND EL. 43 FEET AND IS BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). THE AREA OF THE PROPOSED TENNIS COURT IS AROUND EL. 97 FEET AND APPEARS TO BE BASED ON AN ARBITRARY SITE DATUM.

LEGEND

B-101	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS ON 07 JULY 2022
B-1	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS ON 11 AUGUST 2016

0 80' 160'

GRAPHIC SCALE

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FIGURE 2

SUBSURFACE EXPLORATION PLAN
GEOTECHNICAL ENGINEERING REPORT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL
ATHLETIC FACILITIES IMPROVEMENTS
HAMILTON, MASSACHUSETTS

DRAWN BY:	SNP	CHECKED BY:	BTW
PROJECT NO.	100451.000	DATE:	SEPTEMBER 30, 2022

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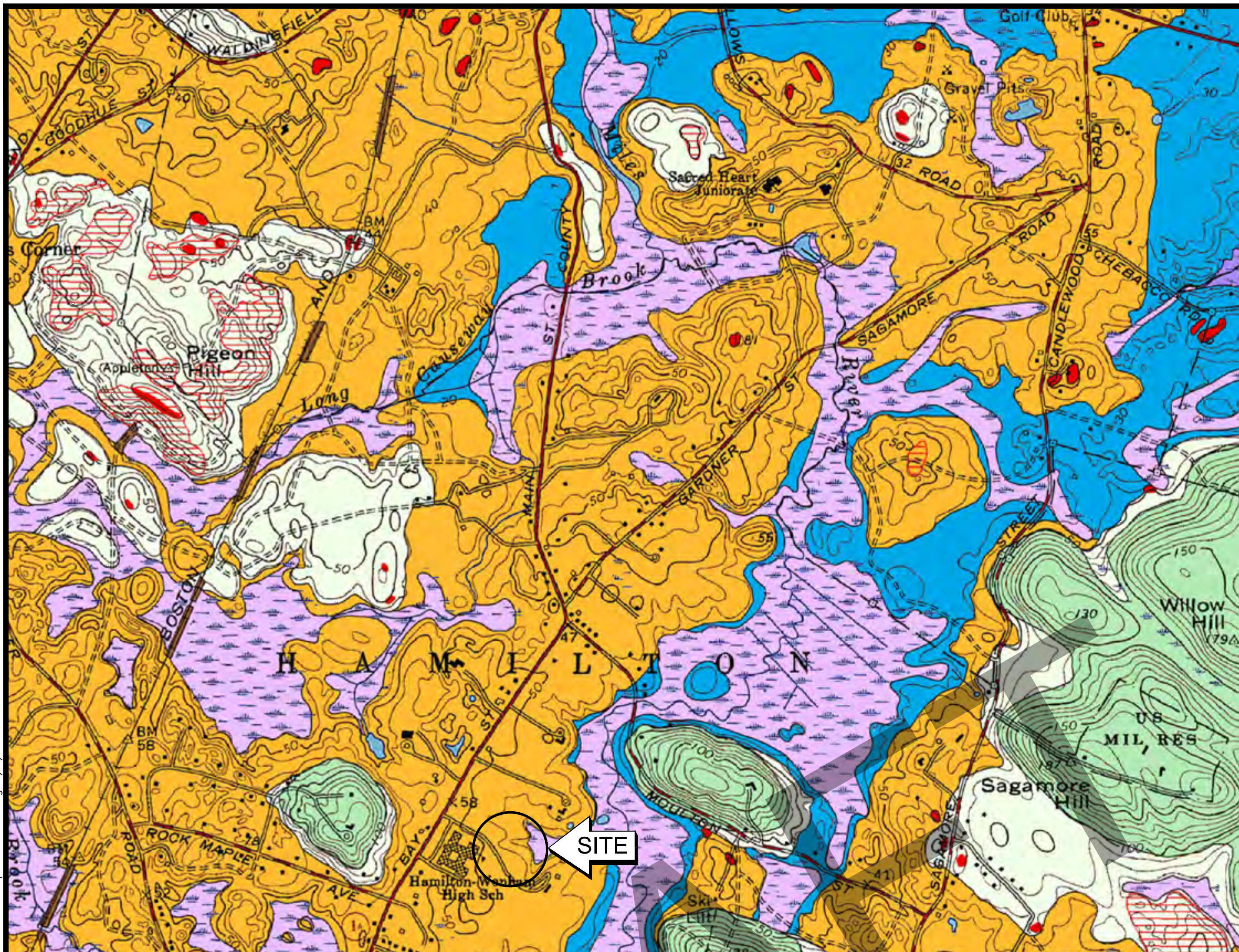

Coarse deposits consist of *gravel deposits*, *sand and gravel deposits*, and *sand deposits*, not differentiated in this report. *Gravel deposits* are composed of at least 50 percent gravel-size clasts; cobbles and boulders predominate; minor amounts of sand occur within gravel beds, and sand comprises a few separate layers. Gravel layers generally are poorly sorted, and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* occur as mixtures of gravel and sand within individual layers and as layers of sand alternating with layers of gravel. Sand and gravel layers generally range between 25 and 50 percent gravel particles and between 50 and 75 percent sand particles. Layers are well sorted to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* are composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay

Glaciomarine fine deposits include clay, silty clay, fine sand, and some fine gravel deposited in a higher-level sea in environments of low wave energy along the coast and in river estuaries. Fine to very fine sand, massive and laminated, commonly is present at the surface and grades downward into interbedded very fine sand, silt, silty clay, and clay. The lower silty clay and clay is massive and thinly laminated. Total thickness is generally a few feet to 75 ft

Thick till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered pebbles, cobbles, and boulders in the shallow subsurface; at greater depths consists of compact, nonsorted matrix of silt, very fine sand, and some clay containing scattered small gravel clasts. Mapped in areas where till is greater than 10 to 15 ft thick, mostly in drumlin landforms in which till thickness commonly exceeds 100 ft (maximum recorded thickness is 230 ft). Although upper till of late Wisconsinan age is the surface deposit, lower till of probable Illinoian age constitutes the bulk of the material in thick-till areas. Lower till is moderately to very compact and is commonly finer grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides

Swamp deposits—Organic muck and peat that contain minor amounts of sand, silt, and clay, are stratified and poorly sorted, and occur in swamps and freshwater marshes, in kettle depressions, or in poorly drained areas. Unit is shown only where deposits are estimated to be at least 3 ft thick; most deposits are less than 10 ft thick. Swamp deposits overlie glacial deposits or bedrock. They locally overlie glacial till even where they occur within thin glacial meltwater deposits

2018 USGS SURFICIAL GEOLOGIC MAP

SURFICIAL GEOLOGIC MAP OF THE IPSWICH QUADRANGLE
HAMILTON, MASSACHUSETTS
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR INTERVAL 10 FEET

NORTH

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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FIGURE 3

SURFICIAL GEOLOGY PLAN
HAMILTON-WENHAM REGIONAL HIGH SCHOOL
ATHLETIC FACILITIES IMPROVEMENTS
HAMILTON, MASSACHUSETTS

DRAWN BY: SNP	CHECKED BY: BTW
PROJECT NO. 100451.000	DATE: JULY 2022

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APPENDIX A
Limitations

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GEOTECHNICAL LIMITATIONS

Explorations and Subsurface Conditions

1. The analyses and design recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

   In preparing this report, Nobis relied on certain information provided by the Client and other parties referenced therein which were made available to Nobis at the time of our evaluation. Nobis did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the exploration logs.

3. Water level readings have been made in the explorations at times and under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made. The water table encountered in the course of the work may differ from that indicated in the Report.

   Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

4. Nobis' geotechnical services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

Additional Services

5. Nobis recommends that we be retained to provide services during future site observations, design, implementation activities, construction and/or property development/ redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our recommendations, design concepts and/or opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design recommendations; and iv) assess the consequences of changes in technologies and/or regulations.

Use of Report

6. Nobis prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in our proposal and/or report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to Nobis.

   This report is for design purposes only and is not sufficient to prepare an accurate construction bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.

7. Nobis' findings and conclusions are based on the work conducted as part of the scope of work set forth in our proposal and/or report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions considering the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the project design has been altered in any way, Nobis shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions.

8. Nobis' services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

Compliance with Codes and Regulations

9. Nobis used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

Opinion of Cost

10. This report may contain or be based on comparative cost opinions for the purpose of evaluating alternative foundation schemes. These opinions may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. In addition, since we are not professional estimators of labor and materials cost, the evaluation of construction costs should be considered as approximate guidelines and could vary significantly from actual costs. Nobis does not guarantee the accuracy of our cost opinions as compared to contractor's bids for construction costs.

END OF LIMITATIONS

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APPENDIX B
Description of Field Explorations
Exploration Logs

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DESCRIPTION OF FIELD EXPLORATIONS

In total, five test borings, identified as B-101 through B-105 were advanced within the project area on July 7, 2022. As part of a previous project at the site Nobis had advanced five test borings, identified as B-1 through B-5 on August 11, 2016.

Test borings performed in 2022 were advanced to depths ranging from approximately 17 to 24 feet below the existing ground surface by New England Boring Contractors of Derry, New Hampshire using track-mounted drilling equipment and hollow-stem auger techniques. Test boring soil samples were obtained nearly continuously from the ground surface to a depth of 12 feet and at 5-foot intervals thereafter, using a standard 2-inch outside-diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed in general accordance with industry standards. Density of soil samples are based on N-values, which is determined by the number of hammer blows required to advance the sampler from 6 to 18 inches.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Explorations were located in the field by using available site plans, paced measurement and line-of-site referencing existing site features. The accuracy of exploration locations should only be assumed to the level implied by the method used.

Visual classifications of soil are shown on the individual exploration logs included in **Appendix B** which include boring B-2 from the previous explorations. Groundwater conditions were evaluated in each exploration at the time of site exploration program.

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BORING LOG

Project:	Hamilton-Wenham Regional High School Athletic Facilities Improvements
Location:	Hamilton, Massachusetts
Nobis Project No.:	100451.000

Boring No.:	**B-101**
Boring Location:	See Exploration Location Plan
Checked by:	K.Stanway
Date Start:	July 7, 2022
Date Finish:	July 7, 2022

Contractor:	New England Boring Contractors	Rig Type / Model:	ATV Track Rig / Mobile B-57	Ground Surface Elev.:	(+/-) 43
Driller:	M. Thompson	Hammer Type:	Automatic Hammer		
Nobis Rep.:	S. Pape	Hammer Hoist:	Automatic	Datum:	NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▼ 07/07/22	08:40	7.5	4	8	While Sampling
▼ 07/07/22	09:00	6.5	10	12	While Sampling
▽ 07/07/22	09:40	5.3	OUT	Not Obs	5 min

Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.	Ground Water	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
S-1	20	0-2	4, 10, 31, 38		42.7 / 0.3 TOPSOIL	S-1A (3"): Dense, brown, fine SAND AND SILT, very few fine roots. Dry. (TOPSOIL). S-1B (17"): Dense, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Dry. (FILL).	
S-2	15	2-4	34, 27, 19, 22		FILL	S-2: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, some Silt, very few roots. Organic odor observed. Dry to moist. (FILL).	
S-3	21	4-6	7, 7, 7, 9	▽ (5.3)	38.0 / 5.0 37.9 / 5.1 BURIED TOPSOIL CLAYEY SILT 37.0 / 6.0	S-3A (12"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Organic odor observed. Moist. (FILL). S-3B (1"): Medium dense, dark brown, Organic SILT, very few fine roots. Organic odor observed. (TOPSOIL). S-3C (8"): Medium dense, gray with orange mottling, CLAY & SILT, some fine to coarse Sand, little fine to coarse Gravel. Wet. (CLAY).	
S-4	12	6-8	19, 19, 20, 22	▼ (6.5), ▼ (7.5)	SAND AND GRAVEL WITH SILT	S-4: Dense, orangish brown, fine to coarse SAND and fine to coarse Gravel, little Silt. Wet. (SAND AND GRAVEL).	
S-5	13	8-10	27, 21, 19, 19			S-5: Dense, orangish brown, fine to coarse SAND and fine to coarse Gravel, little Silt. Wet. (SAND AND GRAVEL).	
S-6	8	10-12	2, 8, 15, 24		29.5 / 13.5	S-6: Medium dense, orange-brown, fine to coarse GRAVEL and fine to coarse Sand, little Silt. Wet. (SAND AND GRAVEL).	
S-7	12	15-17	5, 17, 20, 19		SAND & SILT 24.5 / 18.5	S-7: Dense, orange-brown, fine SILT, some fine Sand. Wet. (SILT). Laboratory Analysis - Grain Size Sieve Only [0.2% GRAVEL, 31.6% SAND, 68.2% FINES].	
S-8	17	20-22	13, 11, 7, 9		SILTS & CLAYS 21.0 / 22.0	S-8A (10"): Very stiff, gray, CLAY & SILT. Wet. (CLAY). S-8B (7"): Very stiff, gray, Silty CLAY. Wet. (CLAY).	
						Boring terminated at 22 feet.	1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:
1) Borehole backfilled with soil cuttings.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 8/9/22 11:29 - J:\100451.000-GALE - HAMILTON-WENHAM REGIONAL HS\EXPLORATIONS\100451.000 HAMILTON-WENHAM BORING LOGS.GPJ

DRAFT

BORING LOG

Project:	Hamilton-Wenham Regional High School Athletic Facilities Improvements
Location:	Hamilton, Massachusetts
Nobis Project No.:	100451.000

Boring No.:	**B-102**
Boring Location:	See Exploration Location Plan
Checked by:	K.Stanway
Date Start:	July 7, 2022
Date Finish:	July 7, 2022

Contractor:	New England Boring Contractors	Rig Type / Model:	ATV Track Rig / Mobile B-57	Ground Surface Elev.:	(+/-) 42.5
Driller:	M. Thompson	Hammer Type:	Automatic Hammer		
Nobis Rep.:	S. Pape	Hammer Hoist:	Automatic	Datum:	NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 07/07/22	10:25	8.5	5	9	While Sampling

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
0–2	S-1	10	0-2	4, 14, 24, 32		42.2 / 0.3 TOPSOIL	S-1A (4"): Dense, brown, SILT, some fine to coarse Sand, Numerous fine roots. Dry. (TOPSOIL). S-1B (6"): Dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Dry. (FILL).	
2–4	S-2	12	2-4	18, 17, 17, 14		FILL	S-2: Dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Dry to moist. (FILL).	
5						37.5 / 5.0		
5–7	S-3	17	5-7	2, 6, 13, 32		ORGANIC DEPOSITS 36.8 / 5.7	S-3A (6"): Medium dense, dark brown, SILT and fine to medium Sand, some Organic Fibers. Organic odor observed. Wet. (ORGANIC DEPOSITS). S-3B (11"): Medium dense, orangish brown, fine to coarse SAND and fine to coarse Gravel, little Silt. Wet. (SAND AND GRAVEL).	
7–9	S-4	17	7-9	28, 30, 20, 25	▽ (8.5)	SAND AND GRAVEL	S-4: Very dense, orange-brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet. (SAND AND GRAVEL).	
10–12	S-5	10	10-12	16, 20, 14, 12			S-5: Dense, orange-brown, fine to coarse GRAVEL, some fine to coarse Sand, some Silt. Wet. (SAND AND GRAVEL).	
13.5						29.0 / 13.5		
15–17	S-6	16	15-17	12, 12, 15, 15		SILTS & CLAYS	S-6: Very stiff, orange-brown, Clayey SILT, trace fine to medium Sand. Redoximorphic staining present around 15 to 16 feet. Wet. (CLAY).	
17						25.5 / 17.0	Boring terminated at 17 feet.	1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:
1) Borehole backfilled with soil cuttings.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 8/9/22 11:29 - J:\100451.000-GALE - HAMILTON-WENHAM REGIONAL HS\EXPLORATIONS\100451.000 HAMILTON-WENHAM BORING LOGS.GPJ

DRAFT

BORING LOG

nobis

Project: Hamilton-Wenham Regional High School Athletic Facilities Improvements
Location: Hamilton, Massachusetts
Nobis Project No.: 100451.000

Boring No.: **B-103**
Boring Location: See Exploration Location Plan
Checked by: K.Stanway
Date Start: July 7, 2022
Date Finish: July 7, 2022

Contractor: New England Boring Contractors
Driller: M. Thompson
Nobis Rep.: S. Pape

Rig Type / Model: ATV Track Rig / Mobile B-57
Hammer Type: Automatic Hammer
Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 41.5
Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▼ 07/07/22	12:00	14.2	20	22	While Sampling
▼ 07/07/22	12:10	9	12	Not Obs	5 min
▽ 07/07/22	12:25	7.8	OUT	Not Obs	10 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.	Ground Water	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
0–2	S-1	14	0-2	2, 14, 18, 18		TOPSOIL 41.0 / 0.5; FILL	S-1A (5"): Loose, tan, SILT and fine Sand. Few fine roots. Dry. (TOPSOIL). S-1B (9"): Dense, brown, fine to coarse GRAVEL, some fine to coarse Sand, little Silt. Dry. (FILL).	
2–4	S-2	11	2-4	11, 10, 9, 11		37.5 / 4.0	S-2: Medium dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt. Dry. (FILL).	
5–7	S-3	20	5-7	3, 5, 5, 5		ORGANIC DEPOSITS	S-3: Loose, dark brown, fine to coarse SAND AND SILT, trace fine to coarse Gravel, trace Organic Silt. Moist. (ORGANIC DEPOSITS).	
7–9	S-4	18	7-9	3, 3, 12, 15	▽ (7.8), ▼ (9)	33.5 / 8.0; SAND AND GRAVEL WITH SILT 31.5 / 10.0	S-4A (6"): Loose, dark brown, fine to coarse SAND AND SILT, trace fine to coarse Gravel, trace Organic Silt. Moist. (ORGANIC DEPOSITS). S-4B (6"): Loose, black, Organic SILT, some fine to coarse Sand, some Silt, few partially decomposed organic fibers. Moist to wet. (ORGANIC DEPOSITS). S-4C (6"): Medium dense, gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet. (SAND AND GRAVEL).	
10–12	S-5	13	10-12	7, 9, 10, 10		SILTS & CLAYS	S-5: Very stiff, orange-brown, Clayey SILT, trace fine Sand. Redoximorphic staining present. Wet. (CLAY).	
14.2					▼			
15–17	S-6	15	15-17	3, 7, 10, 11			S-6: Very stiff, orange-brown, SILT & CLAY. Redoximorphic staining present. Wet. (CLAY).	
20–22	S-7	22	20-22	5, 8, 5, 4		19.5 / 22.0	S-7A (6"): Medium dense, brown, SILT, trace fine Sand. Wet. (SILT). S-7B (16"): Stiff, gray, SILT & CLAY. Wet. (CLAY).	
22							Boring terminated at 22 feet.	1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:
1) Borehole backfilled with soil cuttings.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

nobis

Project: Hamilton-Wenham Regional High School Athletic Facilities Improvements
Location: Hamilton, Massachusetts
Nobis Project No.: 100451.000

Boring No.: **B-104**
Boring Location: See Exploration Location Plan
Checked by: K.Stanway
Date Start: July 7, 2022
Date Finish: July 7, 2022

Contractor: New England Boring Contractors
Driller: M. Thompson
Nobis Rep.: S. Pape

Rig Type / Model: ATV Track Rig / Mobile B-57
Hammer Type: Automatic Hammer
Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 43
Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
⊻ 07/07/22	13:43	6	7	17	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	S-1	15	0-2	3		TOPSOIL 42.5 / 0.5	S-1A (7"): Dense, brown, Organic SILT and fine to medium Sand. Few fine roots. Dry. (TOPSOIL).	
1				11		FILL	S-1B (8"): Dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt. Dry. (FILL).	
				28				
2				11				
	S-2	10	2-3	35			S-2: Very dense, brown, fine to coarse SAND, little fine to coarse Gravel, little Silt. Dry. (FILL).	
3				80				
4								
5						38.0 / 5.0		
	S-3	14	5-7	11		CLAYEY SILT 37.5 / 5.5	S-3A (3"): Hard, gray, Clayey SILT, trace fine Sand. Redoximorphic staining present. Moist. (CLAY).	
6				25	⊻	SAND AND GRAVEL	S-3B (11"): Dense, brown, fine to coarse SAND and fine to coarse Gravel, little Silt. Moist to wet. (SAND AND GRAVEL).	
				21				
7				21				
	S-4	14	7-9	10			S-4A (12"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet. (SAND).	
8				11				
				13		34.5 / 8.5		
9				14		SANDY SILT	S-4B (2"): Medium dense, tan, SILT, some fine to medium Sand. Wet. (SILT).	
10								
	S-5	23	10-12	6			S-5: Medium dense, orange-brown, SILT, trace fine Sand. Wet. (SILT).	
11				13				
				15				
12				20				
13								
14								
15								
	S-6	22	15-17	4			S-6: Medium dense, orange-brown, SILT, little fine Sand. Redoximorphic staining present. Wet. (SILT).	
16				10				
				14				
17				18		26.0 / 17.0		
							Boring terminated at 17 feet.	1
18								
19								
20								
21								
22								
23								
24								
25								

DRAFT

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:
1) Borehole backfilled with soil cuttings.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 8/9/22 11:29 - J:\100451.000-GALE - HAMILTON-WENHAM REGIONAL HS\EXPLORATIONS\100451.000 HAMILTON-WENHAM BORING LOGS.GPJ

BORING LOG

nobis

Project:	Hamilton-Wenham Regional High School Athletic Facilities Improvements
Location:	Hamilton, Massachusetts
Nobis Project No.:	100451.000
Boring No.:	B-105
Boring Location:	See Exploration Location Plan
Checked by:	K.Stanway
Date Start:	July 7, 2022
Date Finish:	July 7, 2022
Contractor:	New England Boring Contractors
Driller:	M. Thompson
Nobis Rep.:	S. Pape
Rig Type / Model:	ATV Track Rig / Mobile B-57
Hammer Type:	Automatic Hammer
Hammer Hoist:	Automatic
Ground Surface Elev.:	
Datum:	NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
⊻ 07/07/22	15:22	5.5	OUT	24	5 min

Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.	Ground Water	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
S-1	14	0-2	4, 11, 20, 25		TOPSOIL / 1.0; SAND	S-1A (10"): Medium dense, light brown, SILT, some fine to coarse Sand, very few fine roots. Dry. (TOPSOIL). S-1B (4"): Dense, brown, fine to coarse SAND, little Silt, little fine Gravel. Dry. (SAND).	
S-2	17	2-4	19, 17, 18, 20		SAND	S-2A (3"): Dense, brown, fine to coarse SAND, little Silt, little fine Gravel. Dry. (SAND). S-2B (14"): Dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Dry to moist. (SAND).	
S-3	18	5-7	5, 7, 9, 10	⊻ (5.5)	/ 6.0; SILT AND SAND	S-3A (9"): Medium dense, brown, fine to medium SAND, trace fine Gravel, trace Silt. Wet. (SAND). S-3B (9"): Medium dense, brown, fine to medium SAND & SILT, trace fine Gravel. Wet. (SAND).	
S-4	16	7-9	9, 9, 10, 13		/ 8.0; SILTS & CLAYS	S-4A (8"): Medium dense, brown, fine to medium SAND & SILT, trace fine Gravel. Wet. (SAND). S-4B (8"): Very stiff, tan-gray, Clayey SILT, little fine Sand. Redoximorphic staining present. Wet. (CLAY).	
S-5	11	10-12	5, 7, 10, 12		SILTS & CLAYS	S-5: Very stiff, gray-tan, Clayey SILT, little fine Sand. Redoximorphic staining present. Wet. (CLAY).	
S-6	10	15-17	9, 3, 2, 5		SILTS & CLAYS	S-6A (2"): Medium stiff, tan, Clayey SILT, little fine Sand. Wet. (CLAY). S-6B (8"): Medium stiff, gray, SILT & CLAY. Wet. (CLAY).	
S-7	24	20-22	WOH/12", 1, 2		SILTS & CLAYS	S-7: Very soft, gray, Silty CLAY. Wet. (CLAY). Small Torvane: 500-750 psf, Medium Torvane: 500-700 psf, Laboratory Analysis - Atterberg [LL=42, PL=26, PI=16].	1
S-8	24	22-24	WOH/18", 2		/ 24.0	S-8: Very soft, gray, Silty CLAY. Wet. (CLAY). Medium Torvane: 600 psf at top to 200 psf at bottom.	
						Boring terminated at 24 feet.	2

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) The Torvane is intended for use on undisturbed soils. Split-spoon samples are disturbed. Values provided should be considered a lower limit of potential in-situ shear strengths.
2) Borehole backfilled with soil cuttings.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

Project: Hamilton Wenham Regional High School
775 Bay Road
Location: South Hamilton, Massachusetts
Nobis Project No.: 91770

Boring No.: **B-2**
Boring Location: See Site Plan
Checked by: SMC
Date Start: August 11, 2016
Date Finish: August 11, 2016

Contractor: New England Boring Contractors
Driller: M. Soucy
Nobis Rep.: J. Keohane

Rig Type / Model: ATV Track Rig / CME 55
Hammer Type: Safety Hammer
Hammer Hoist: Rope & Cathead

Ground Surface Elev.: (+/-) 97
Datum: Site Datum (Assumed)

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/2	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
08/11/16	00:00	7	5	7	WS

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.	Ground Water	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)
0–1	S-1	15	0-2	4, 10, 26, 29		96.8 / 0.2 TOPSOIL	3 inches topsoil moist. (TOPSOIL). S-1: Dense, brown, fine to medium SAND, little Gravel, little Silt. dry.
0.2–5						SAND; 92.0 / 5.0	
5	S-2	18	5-7	8, 10, 12, 15	▼ (7)		S-2: Medium dense, brown, fine SAND, some Silt. moist. sample wet at 7 feet.
10	S-3	18	10-12	14, 16, 21, 17		SILTY SAND; 82.0 / 15.0	S-3: Dense, alternating seams of brown and gray, fine SAND, some Silt. wet.
15	S-4	24	15-17	6, 7, 7, 6		CLAYEY SILT; 77.0 / 20.0	S-4: Stiff, gray, Clayey SILT, trace fine Sand. wet.
20	S-5	24	20-22	3, 3, 3, 3		SILTY CLAY; 75.0 / 22.0	S-5: Medium stiff, gray, Silty CLAY. wet.
22							Boring terminated at 22 feet.

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:
1) Borehole backfilled with auger cuttings upon completion.
2) WS - While Sampling

Soil descriptions are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

DRAFT

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 8/31/16 15:04 - J:\91770.00 - HAMILTON WENHAM REGIONAL HIGH SCHOOL\GEOTECHNICAL\EXPLORATIONS\BORING LOGS\GINT\91770 HAMILTON WENHAM BORING LOGS.GPJ

APPENDIX C
Laboratory Test Reports

DRAFT

ConTest Consultants, Inc.

Providing Inspection/Testing & Consulting Services

LETTER OF TRANSMITTAL

TO: Nobis Group – Brien Waterman

DATE: 7/26/2022

PROJECT: Hamilton-Wenham HS Fields (100451.000) – Hamilton, MA

CTC PROJECT NO.: 222165

Attached are the following for your use:

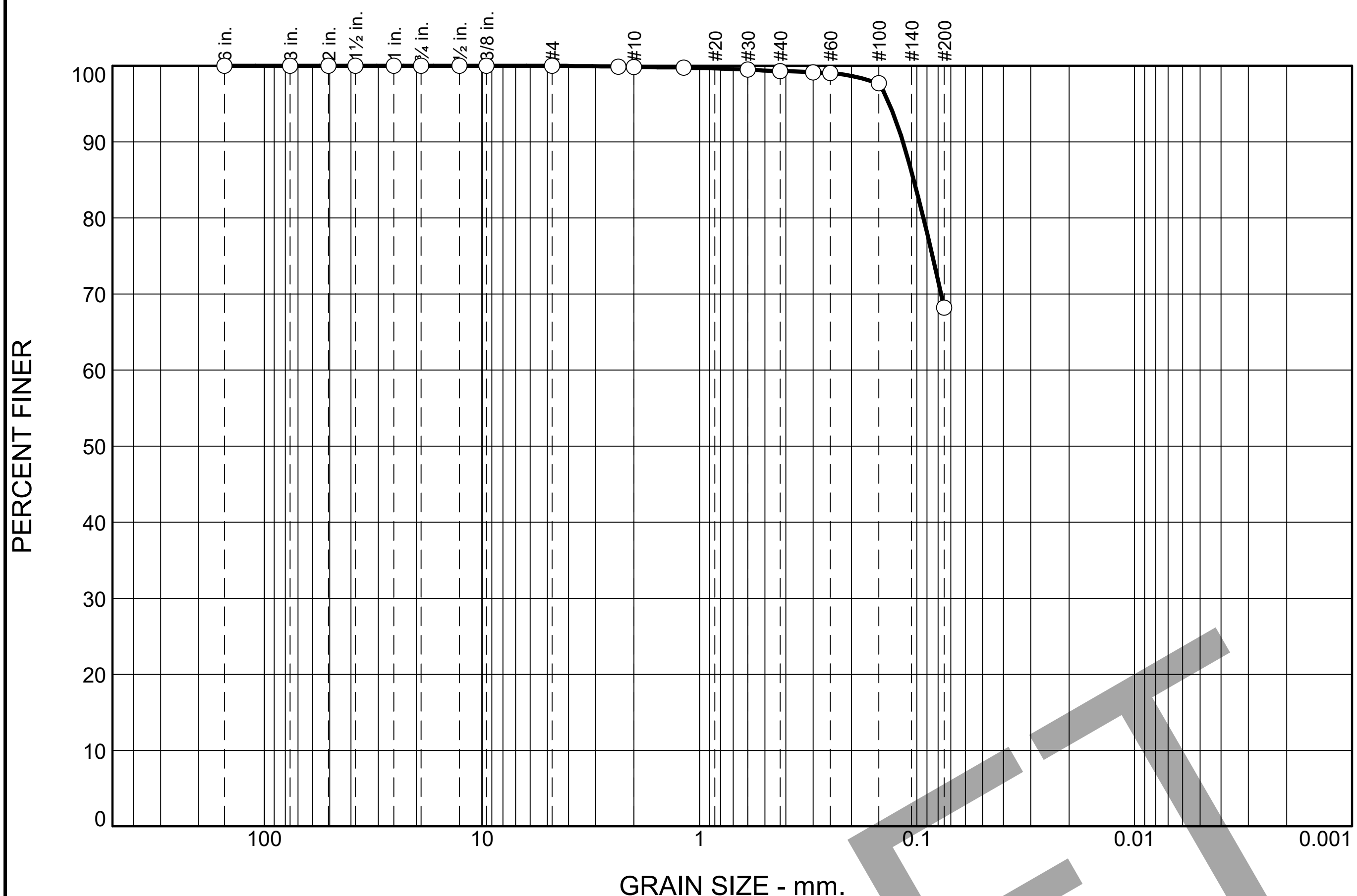
COPIES	DATE	LAB NUMBER	DESCRIPTION
			Concrete Report - Cylinders
			Concrete Inspection Report
			Reinforcing Steel Inspection Report
			Field Density Report
1		L-264-22	Particle Size Distribution Report
			Organic Content Letter
1		L-265-22	Atterberg Limit Report w/ Moisture Content

CC: Nobis Group - Serena Pape

DRAFT

Reviewed By: Donald Walden

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.2	0.3	0.5	30.8	68.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	100.0		
#8	99.9		
#10	99.8		
#16	99.8		
#30	99.5		
#40	99.3		
#50	99.1		
#60	99.0		
#100	97.7		
#200	68.2		

* (no specification provided)

Soil Description

SILT, some fine Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1161 D_{85}= 0.1035 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B-101 / S-7
Sample Number: L-264-22 **Depth:** 15.0' - 17.0' **Date:** 7/18/2022

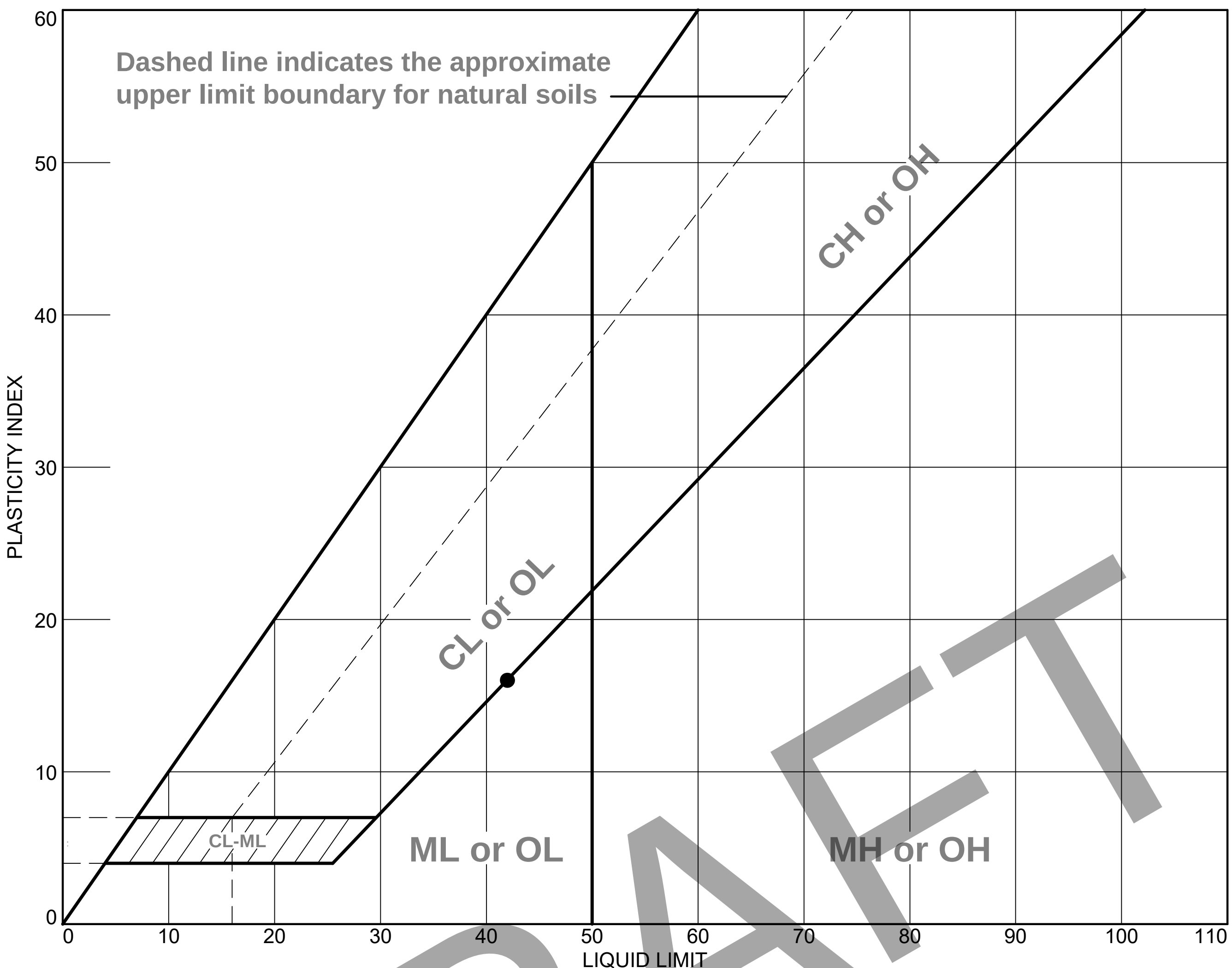
ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Hamilton-Wenham HS Fields (100451.000)
Hamilton, MA
Project No: 222165 **Figure**

DRAFT

LIQUID AND PLASTIC LIMITS TEST REPORT



DRAFT

	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Lean Clay	42	26	16			

Project No. 222165 **Client:** Nobis Group

Project: Hamilton-Wenham HS Fields (100451.000)

Hamilton, MA

● **Location:** B-105 / S-7 **Depth:** 20.0' - 22.0' **Sample Number:** L-265-22

Remarks:

● Received Moisture Content: 26.2%

ConTest Consultants, Inc.

Goffstown, New Hampshire

Figure

GALE CELEBRATING 50 YEARS

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-1 Date: 8/12/16 Time: 8:30 AM Weather: Sunny, 85° F
Location (Identify on Site Plan): behind the goal post on the school building side
Land Use: athletic field Slope (%) ≈ 0 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

Open Water Body: ______ feet Drainage Way: ______ feet
Possible Wet Area: ______ feet Property Line: ______ feet
Drinking Water Well: ______ feet Other: ______ feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 8”	A_1	Loam	10 YR 3/2	-	granular, friable
8 – 16”	B_1	Fine Sandy Loam	2.5 Y 6/4	-	friable
16 – 29”	A_2	Sandy Loam	10 YR 3/1	-	friable
29 – 39”	Fill	-	-	-	buried chunks of asphalt found
39 – 46”	A_3	Sandy Loam	10 YR 3/1	-	friable
46 – 58” +	B_2	Loamy Sand	7.5 YR 5/6	-	loose, SG

Notes:

- chunks of asphalt observed at 29 – 39” below the surface

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	
Photo 1: Location of TP-1.	Photo 2: Observed profile of TP-1.
	
Photo 3: Observed profile of TP-1.	Photo 4: Observed asphalt pavement fill layer.

CELEBRATING 50 YEARS GALE

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-2 Date: 8/12/16 Time: 9:00 AM Weather: Sunny, 90° F
Location (Identify on Site Plan): behind the goal post on the far side of the field
Land Use: athletic field Slope (%) ≈ 0 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

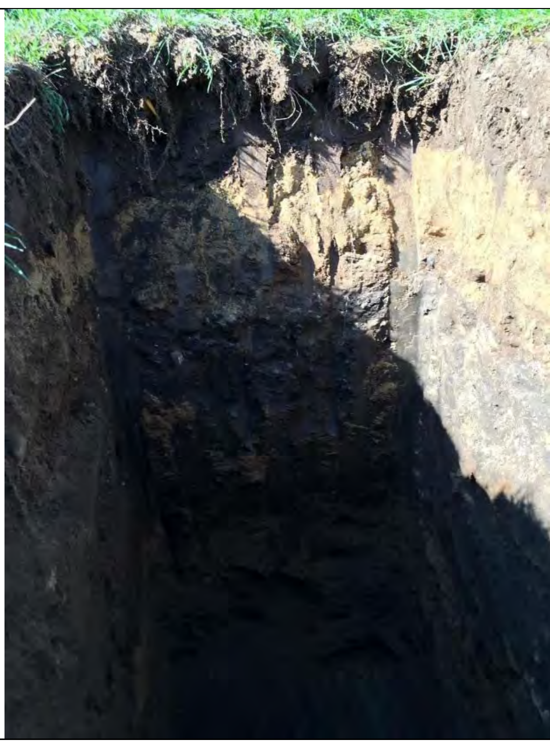
Open Water Body: ______ feet Drainage Way: ______ feet
Possible Wet Area: ______ feet Property Line: ______ feet
Drinking Water Well: ______ feet Other: ______ feet

DEEP OBSERVATION HOLE LOG					
Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 9”	A_1	Loam	10 YR 3/2	-	granular, friable
9 – 18”	B_1	Fine Sandy Loam	2.5 Y 6/4	-	friable
18 – 43”	A_2	Sandy Loam	10 YR 3/2	-	friable
43 – 73” +	C	Medium Sand	10 YR 5/6	-	5% gravel, loose, SG

Notes:

-

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	
Photo 1: Location of TP-2.	Photo 2: Observed profile of TP-2.
	**Intentionally Left Blank**
Photo 3: Observed profile of TP-2.	

CELEBRATING 50 YEARS GALE

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-3 Date: 8/12/16 Time: 9:30 AM Weather: Sunny, 90° F
Location (Identify on Site Plan): behind the pitcher's mound at the baseball field
Land Use: baseball field Slope (%) ≈ 0 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

Open Water Body: ______ feet Drainage Way: ______ feet
Possible Wet Area: ______ feet Property Line: ______ feet
Drinking Water Well: ______ feet Other: ______ feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 15"	A	Loam	10 YR 3/3	-	granular, friable
15 – 32"	B	Very Fine Sand	10 YR 6/8	-	loose, SG
32 – 78" +	C	Medium Sand	10 YR 5/6	-	2% gravel, loose, SG

Notes:

-

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	**Intentionally Left Blank**
Photo 1: Location of TP-3.	
Intentionally Left Blank	**Intentionally Left Blank**

GALE — CELEBRATING 50 YEARS

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-4 Date: 8/12/16 Time: 10:00 AM Weather: Sunny, 90° F
Location (Identify on Site Plan): right field of the baseball
Land Use: baseball field Slope (%) ≈ 0 - 2 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

Open Water Body: ________ feet Drainage Way: ________ feet
Possible Wet Area: ________ feet Property Line: ________ feet
Drinking Water Well: ________ feet Other: ________ feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 12”	A_1	Loam	10 YR 3/3	-	granular, friable
12 – 20”	B_1 (sand layer)	Very Fine Sand	2.5 Y 7/6	-	loose, SG
20 – 56”	Fill	-	10 YR 3/4	-	15% cobbles / stones
56 – 64”	C_1	Coarse Sand	2.5 Y 5/3	-	loose, SG

Notes:

- bricks, stones, roots, leaves and sticks observed in fill layer
- large cobbles (some stones) observed beneath the B_1 (sand layer)

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	
Photo 1: Location of TP-4	Photo 2: Observed profile of TP-4
	
Photo 3: Observed profile of TP-4	Photo 4: Observed sticks, roots and bricks.

CELEBRATING 50 YEARS GALE

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-5 Date: 8/12/16 Time: 10:30 AM Weather: Sunny, 90° F
Location (Identify on Site Plan): left field of the baseball field
Land Use: baseball field Slope (%) ≈ 0 - 2 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

Open Water Body: ______ feet Drainage Way: ______ feet
Possible Wet Area: ______ feet Property Line: ______ feet
Drinking Water Well: ______ feet Other: ______ feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 16”	A	Sandy Loam	10 YR 3/3	-	granular, friable
16 – 18”	B (sand layer)	Fine Sand	10 YR 5/6	-	loose, SG
18 – 35”	Fill	-	10 YR 4/3	-	10% cobbles
35 – 82” +	C	Loamy Sand	10 YR 5/6	-	WM, friable

Notes:

- cobbles and trash bag pieces observed in the fill layer

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	
Photo 1: Location of TP-5.	Photo 2: Observed profile of TP-5.
	**Intentionally Left Blank**
Photo 3: Observed profile of TP-5.	

CELEBRATING 50 YEARS GALE

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number: TP-6 Date: 8/12/16 Time: 11:00 AM Weather: Sunny, 90° F
Location (Identify on Site Plan): inside the track at the 50-yard line on the visitor bleacher side
Land Use: athletic field Slope (%) ≈ 0 % Surface Stones: none
Vegetation: grass
Landform: -
Position on Landscape: (see plan)

Distances from:

Open Water Body: ______ feet Drainage Way: ______ feet
Possible Wet Area: ______ feet Property Line: ______ feet
Drinking Water Well: ______ feet Other: ______ feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 14”	A_1	Loam	10 YR 3/2	-	granular, friable
14 – 22”	B (sand layer)	Fine Sand	2.5 Y 3/2	-	loose, SG
22 – 30”	A_2	Loamy Sand	10 YR 3/3	-	buried topsoil (granular)
30 – 64” +	C	Medium Sand	10 YR 5/6	-	loose, SG

Notes:

- buried topsoil layer observed

Parent Material (Geologic): - Depth to Bedrock: -
Depth to Groundwater: - Weeping from Pit Face: -
Estimated Seasonal High Ground Water: -

	
Photo 1: Location of TP-6.	Photo 2: Location of TP-6.
	**Intentionally Left Blank**
Photo 3: Observed profile of TP-6.	

SOIL EVALUATOR FORM

Hamilton-Wenham Regional High School

ON-SITE REVIEW

Deep Hole Number:	TP-7 Date: 8/12/16 Time: 11:30 AM Weather: Sunny, 90° F
Location (Identify on Site Plan):	inside the track at the 50-yard line on the home bleacher side
Land Use:	athletic field Slope (%) ≈ 0 % Surface Stones: none
Vegetation:	grass
Landform:	-
Position on Landscape:	(see plan)

Distances from:

Open Water Body:		feet	Drainage Way:		feet
Possible Wet Area:		feet	Property Line:		feet
Drinking Water Well:		feet	Other:		feet

DEEP OBSERVATION HOLE LOG

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Redox / Mottles	Other (Structure, Stone, Boulders, Consistency, % Gravel)
0 – 9"	A_1	Loam	10 YR 3/2	-	granular, friable
9 – 18"	B (sand layer)	Fine Sand	2.5 Y 6/6	-	loose, SG
18 – 48"	A_2	Loamy Sand	10 YR 3/3	-	cobbles / gravel 5%
48 – 68"	C	Very Coarse Sand	2.5 Y 5/4	-	loose, SG

Notes:

- A_2 layer contained roots, cobbles and sticks

Parent Material (Geologic):		Depth to Bedrock:	
Depth to Groundwater:		Weeping from Pit Face:	
Estimated Seasonal High Ground Water:			

Photo 1: Location of TP-7.

Photo 2: Location of TP-7.

Photo 3: Observed profile of TP-7.

Photo 4: Observed stockpile of material from TP-7.

Map Scale: 1:2,580 if printed on B landscape (17" x 11") sheet.

N

0 35 70 140 210 Meters

0 100 200 400 600 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 20, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

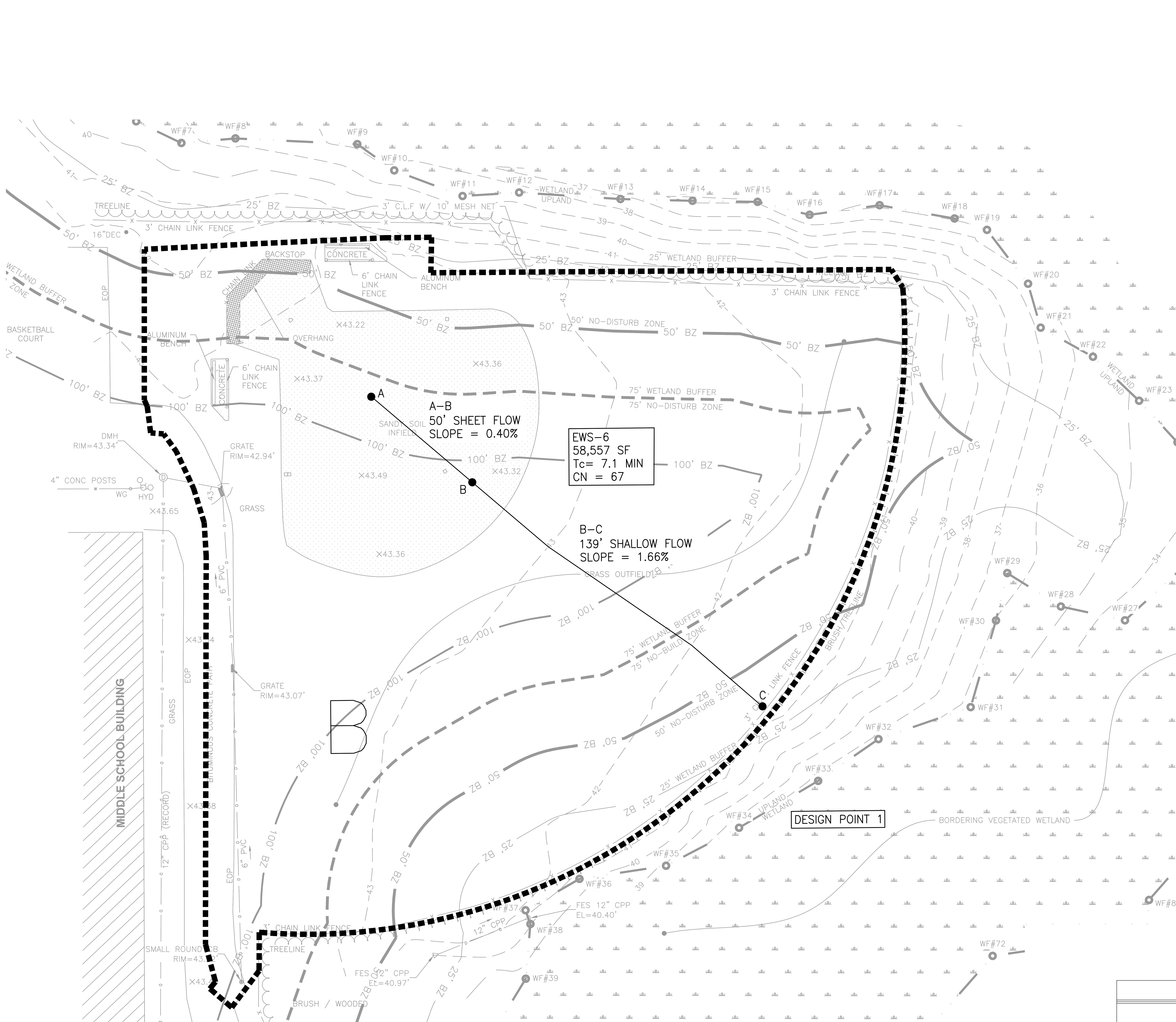
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
43A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	6.5	13.0%
225B	Belgrade very fine sandy loam, 0 to 8 percent slopes	0.0	0.0%
242A	Hinckley loamy sand, 0 to 3 percent slopes	5.6	11.1%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	9.6	19.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	12.0	24.0%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	7.2	14.4%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	0.6	1.2%
602	Urban land	5.6	11.3%
651	Udorthents, smoothed	2.9	5.8%
Totals for Area of Interest		**49.9**	**100.0%**

ATTACHMENT 4

Pre & Post Development Conditions Maps



LEGEND	
▪▪▪▪▪▪▪▪▪▪	WATERSHED BOUNDARY
———	TIME OF CONC. / FLOW PATH
. . . .	SOIL MAP BOUNDARY
A	HYDRAULIC SOIL GROUP

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PROJECT
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HAMILTON-WENHAM REGIONAL HIGH SCHOOL
775 BAY ROAD
SOUTH HAMILTON, MA 01982

OWNER
HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPRE
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 20'

GRAPHIC SCALE
0 10' 20' 40'

SHEET TITLE

EXISTING WATERSHED PLAN SHEET 1 OF 3

DRAWING NO.

PRE-1

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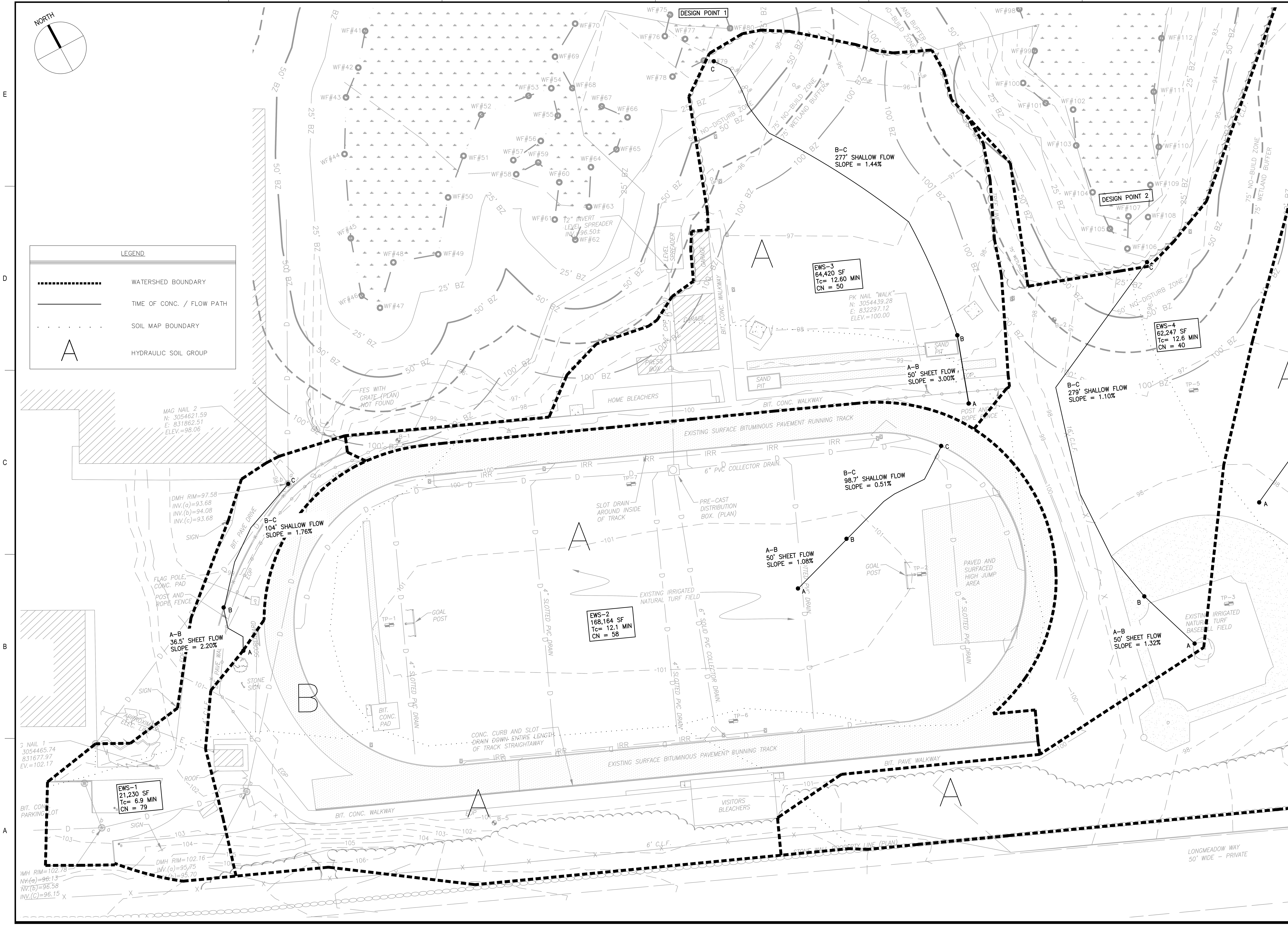

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OWNER

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5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPRE
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 30'

GRAPHIC SCALE

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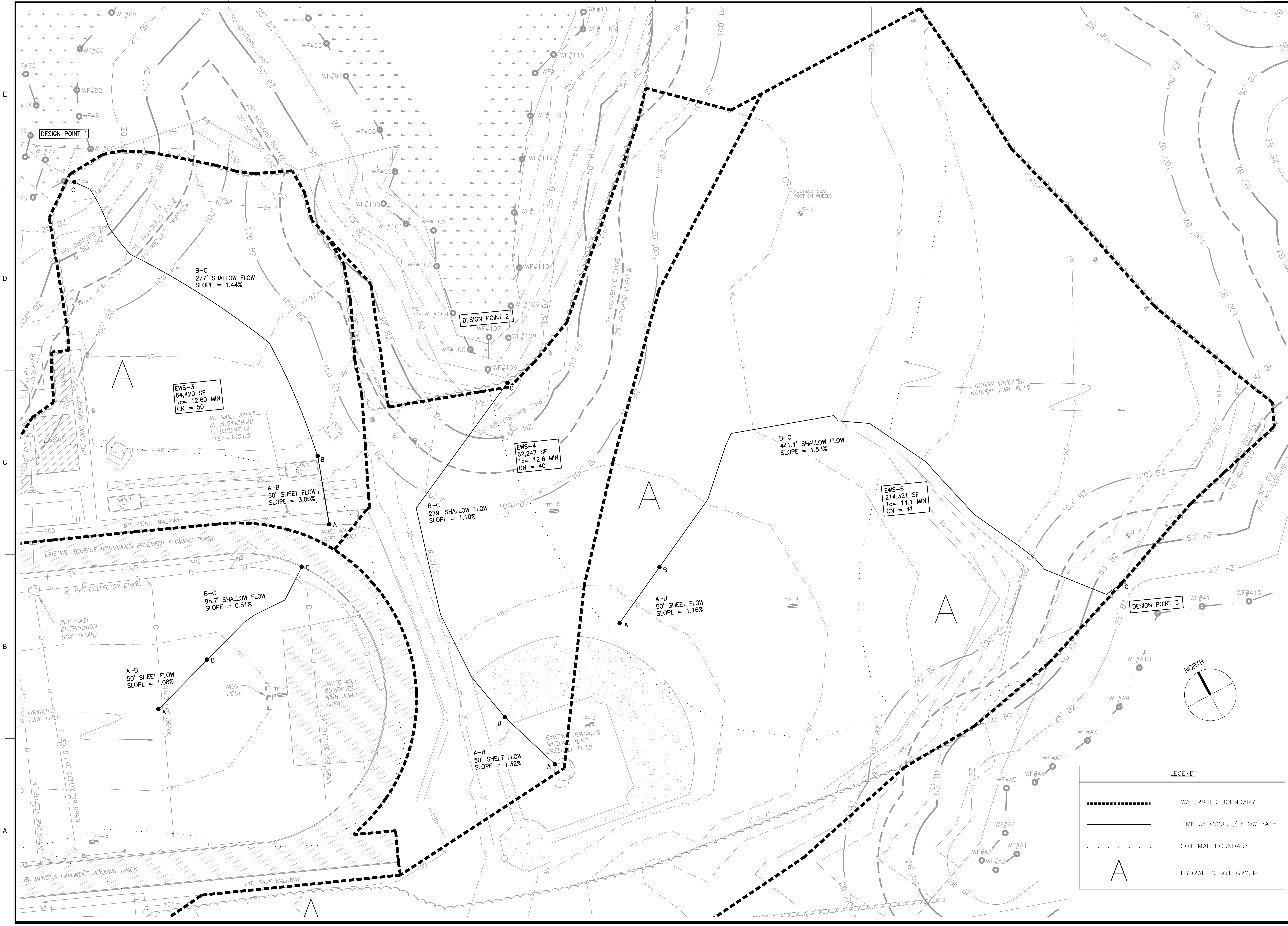
SHEET TITLE

EXISTING WATERSHED PLAN SHEET 2 OF 3

DRAWING NO.

PRE-2



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5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPRE
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 30'

GRAPHIC SCALE
0 30' 60'

SHEET TITLE
EXISTING WATERSHED PLAN
SHEET 3 OF 3

DRAWING NO.
PRE-3

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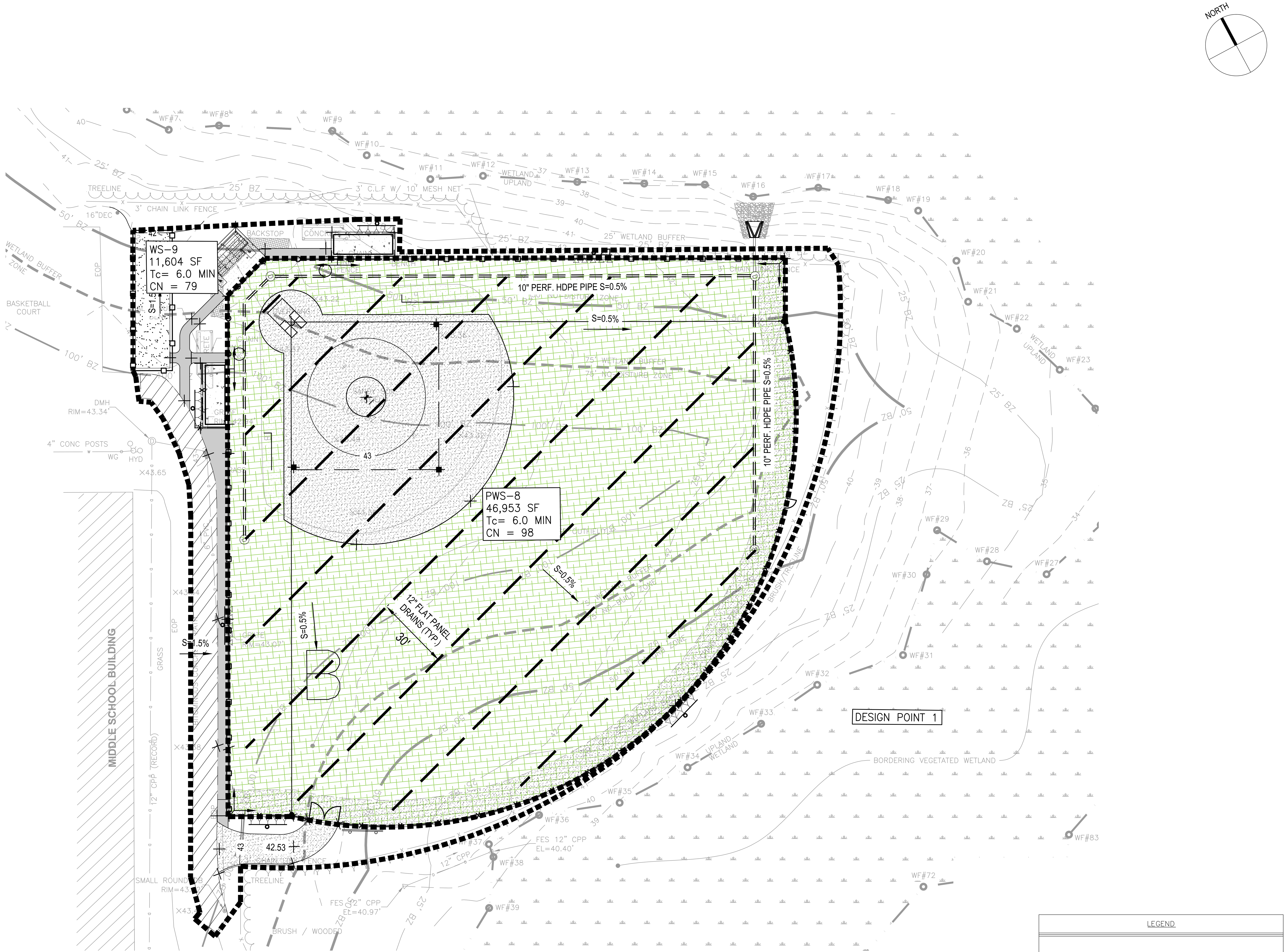

LEGEND

(heavy dotted line)	WATERSHED BOUNDARY
(solid line)	TIME OF CONC. / FLOW PATH
(light dotted line)	SOIL MAP BOUNDARY
A	HYDRAULIC SOIL GROUP

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5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPOST
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 20'

GRAPHIC SCALE
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SHEET TITLE

PROPOSED WATERSHED PLAN SHEET 1 OF 3

DRAWING NO.

POST-1

4 OF 6

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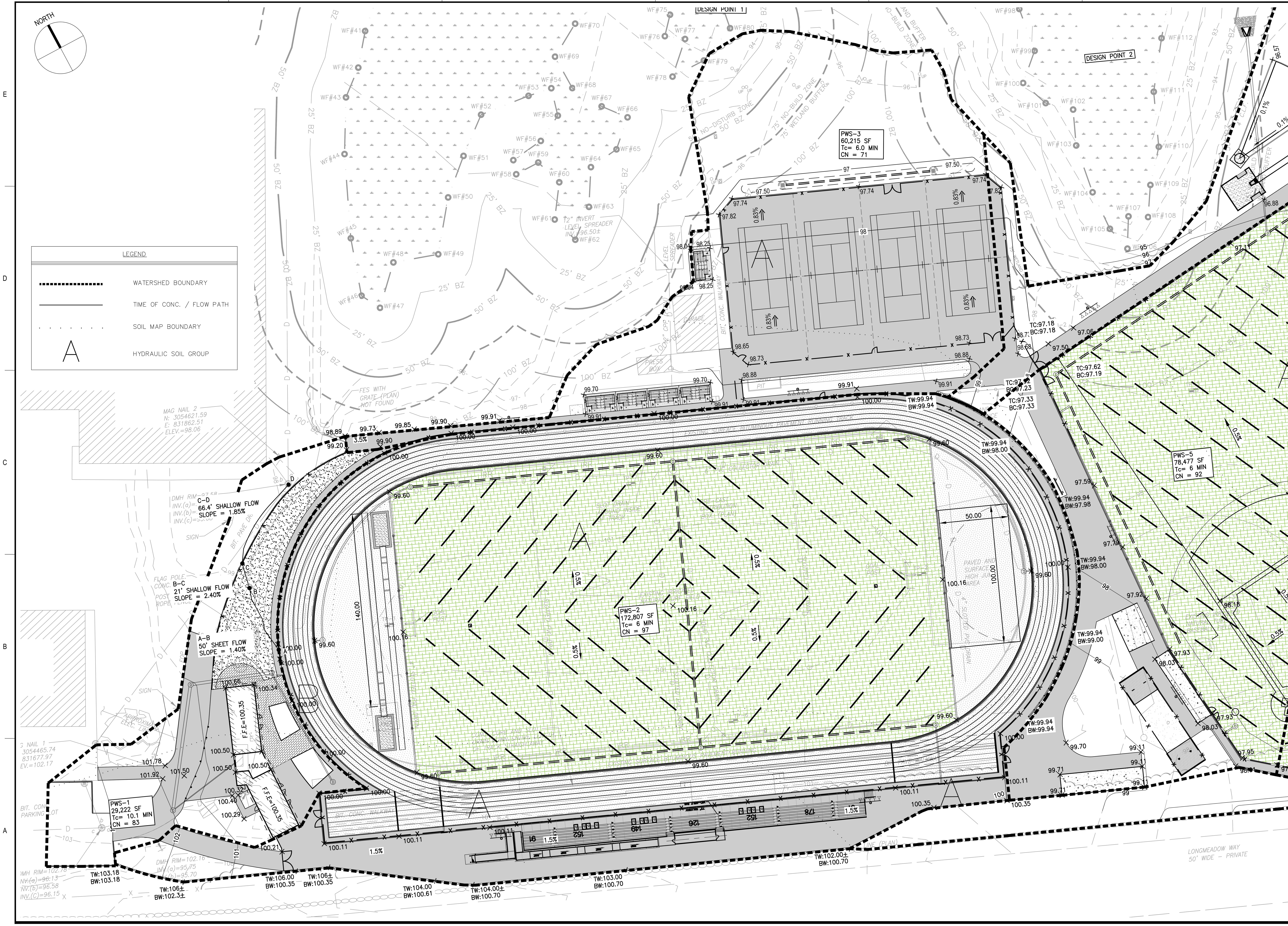

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OWNER

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5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPOST
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 30'

GRAPHIC SCALE

0 30' 60'

SHEET TITLE

PROPOSED
WATERSHED PLAN
SHEET 2 OF 3

DRAWING NO.

POST-2

5 OF 6

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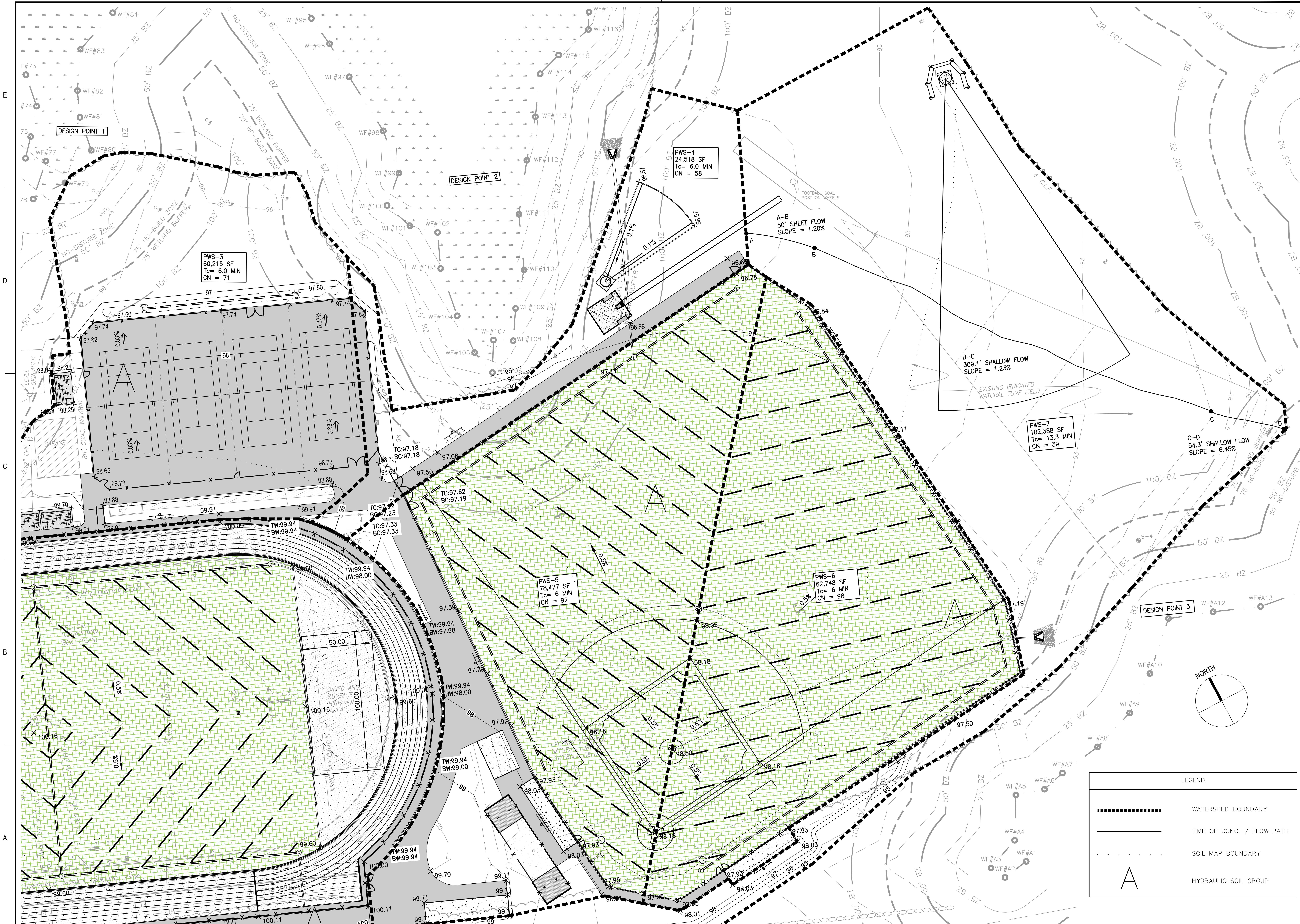

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HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
5 SCHOOL STREET
WENHAM, MA 01984

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	718600
CADD FILE	718600_wsPOST
DESIGNED BY	RDT
DRAWN BY	RDT
CHECKED BY	KDH
DATE	11/16/2023
DRAWING SCALE	1" = 30'

GRAPHIC SCALE
0 30' 60'

SHEET TITLE

PROPOSED WATERSHED PLAN SHEET 3 OF 3

DRAWING NO.
POST-3
6 OF 6

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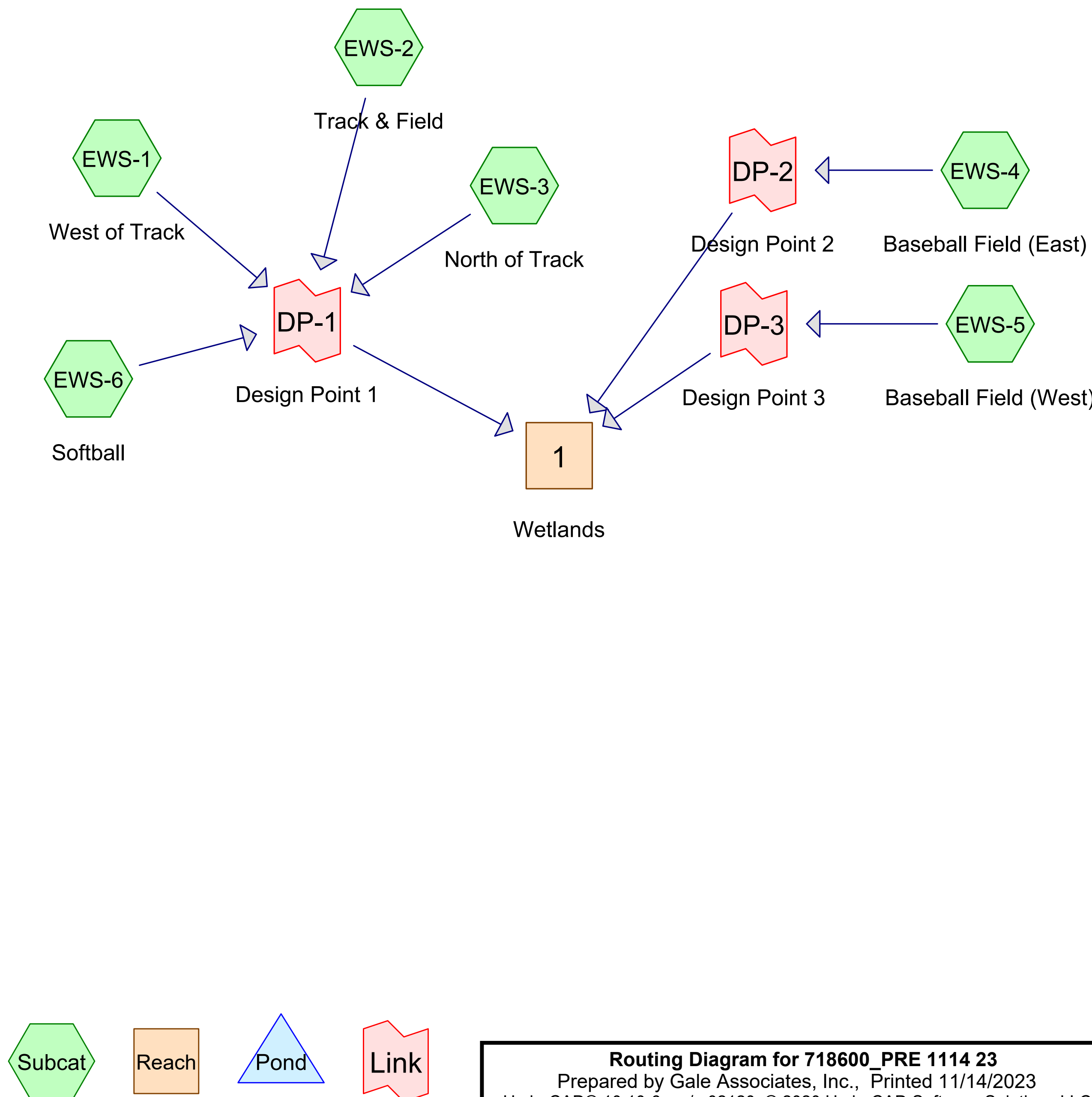
ATTACHMENT 5

Pre & Post Development Hydrology Reports



Routing Diagram for 718600_PRE 1114 23
Prepared by Gale Associates, Inc., Printed 11/14/2023
HydroCAD® 10.10-6a s/n 02120 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.391	39	>75% Grass cover, Good, HSG A (EWS-1, EWS-2, EWS-3, EWS-4, EWS-5)
1.324	61	>75% Grass cover, Good, HSG B (EWS-1, EWS-2, EWS-6)
0.219	85	Gravel roads, HSG B (EWS-6)
0.053	96	Gravel surface, HSG B (EWS-6)
1.330	98	Unconnected pavement, HSG A (EWS-1, EWS-2, EWS-3)
0.337	98	Unconnected pavement, HSG B (EWS-1, EWS-2, EWS-3, EWS-6)
0.089	98	Unconnected roofs, HSG A (EWS-1, EWS-2, EWS-3)
0.777	36	Woods, Fair, HSG A (EWS-2, EWS-4, EWS-5)
13.520	**50**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
11.587	HSG A	EWS-1, EWS-2, EWS-3, EWS-4, EWS-5
1.933	HSG B	EWS-1, EWS-2, EWS-3, EWS-6
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.520		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
9.391	1.324	0.000	0.000	0.000	10.715	>75% Grass cover, Good	EWS-1, EWS-2, EWS-3, EWS-4, EWS-5, EWS-6
0.000	0.219	0.000	0.000	0.000	0.219	Gravel roads	EWS-6
0.000	0.053	0.000	0.000	0.000	0.053	Gravel surface	EWS-6
1.330	0.337	0.000	0.000	0.000	1.667	Unconnected pavement	EWS-1, EWS-2, EWS-3, EWS-6
0.089	0.000	0.000	0.000	0.000	0.089	Unconnected roofs	EWS-1, EWS-2, EWS-3
0.777	0.000	0.000	0.000	0.000	0.777	Woods, Fair	EWS-2, EWS-4, EWS-5
11.587	**1.933**	**0.000**	**0.000**	**0.000**	**13.520**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: West of Track Runoff Area=21,230 sf 61.93% Impervious Runoff Depth>1.26"
Flow Length=141' Tc=6.9 min CN=79 Runoff=0.68 cfs 0.051 af

Subcatchment EWS-2: Track & Field Runoff Area=168,164 sf 30.17% Impervious Runoff Depth>0.31"
Flow Length=149' Tc=12.1 min CN=58 Runoff=0.54 cfs 0.098 af

Subcatchment EWS-3: North of Track Runoff Area=64,420 sf 19.15% Impervious Runoff Depth>0.03"
Flow Length=327' Tc=12.6 min UI Adjusted CN=45 Runoff=0.01 cfs 0.004 af

Subcatchment EWS-4: Baseball Field (East) Runoff Area=62,247 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=329' Tc=12.6 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment EWS-5: Baseball Field Runoff Area=214,321 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=491' Tc=14.1 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment EWS-6: Softball Runoff Area=58,557 sf 0.48% Impervious Runoff Depth>0.59"
Flow Length=189' Tc=7.1 min CN=66 Runoff=0.69 cfs 0.066 af

Reach 1: Wetlands Inflow=1.54 cfs 0.220 af
Outflow=1.54 cfs 0.220 af

Link DP-1: Design Point 1 Inflow=1.54 cfs 0.220 af
Primary=1.54 cfs 0.220 af

Link DP-2: Design Point 2 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP-3: Design Point 3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 13.520 ac Runoff Volume = 0.220 af Average Runoff Depth = 0.20"
87.01% Pervious = 11.764 ac 12.99% Impervious = 1.756 ac

Summary for Subcatchment EWS-1: West of Track

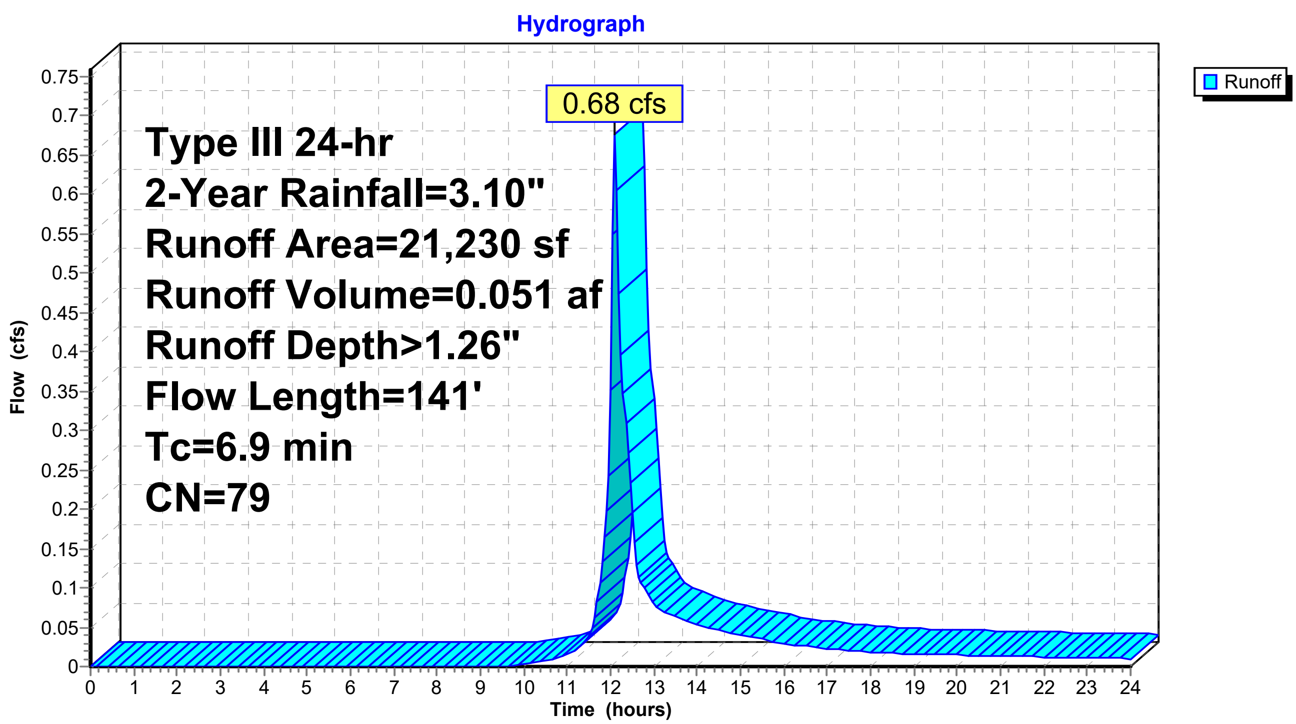
Runoff = 0.68 cfs @ 12.11 hrs, Volume= 0.051 af, Depth> 1.26"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	7,149	98	Unconnected pavement, HSG B
	3,634	61	>75% Grass cover, Good, HSG B
*	82	98	Unconnected roofs, HSG A
	4,449	39	>75% Grass cover, Good, HSG A
*	5,916	98	Unconnected pavement, HSG A
	21,230	79	Weighted Average
	8,083		38.07% Pervious Area
	13,147		61.93% Impervious Area
	13,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	37	0.0220	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.6	104	0.0176	2.69		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
6.9	141	Total			

Subcatchment EWS-1: West of Track



Summary for Subcatchment EWS-2: Track & Field

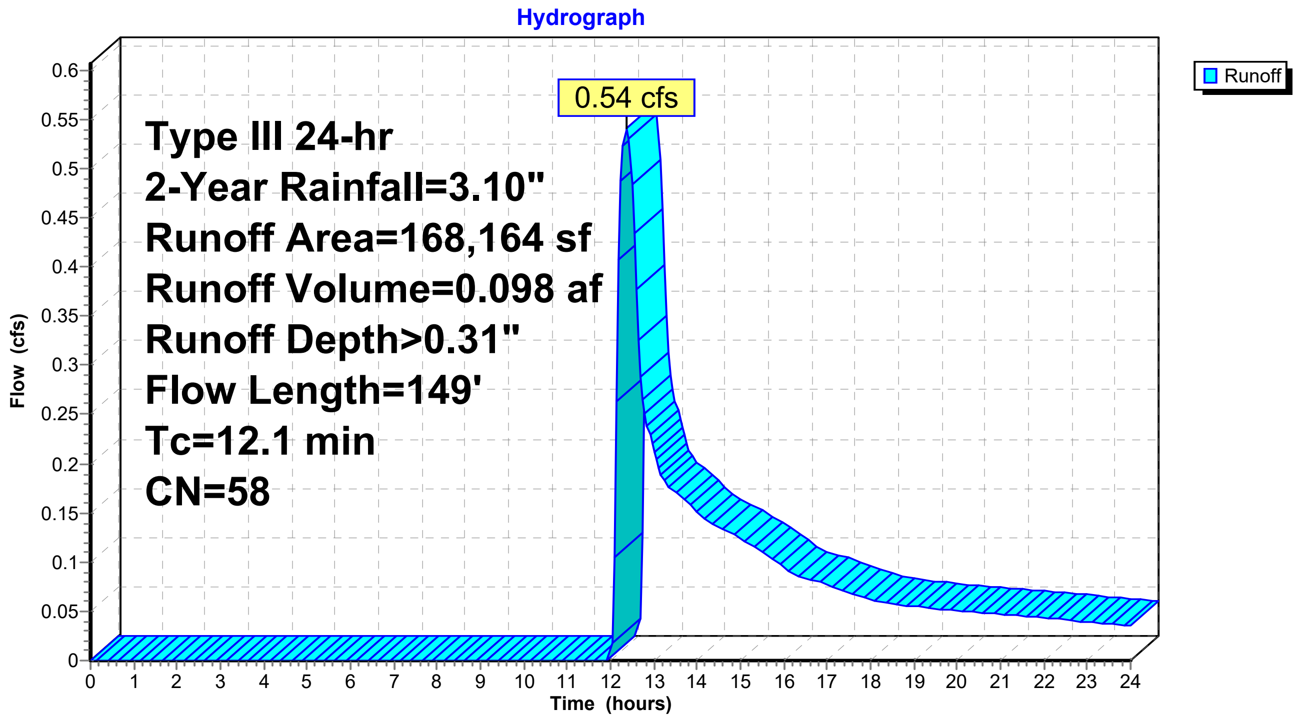
Runoff = 0.54 cfs @ 12.37 hrs, Volume= 0.098 af, Depth> 0.31"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

	Area (sf)	CN	Description
	7,597	61	>75% Grass cover, Good, HSG B
*	258	98	Unconnected roofs, HSG A
	6,042	98	Unconnected pavement, HSG B
	9,872	36	Woods, Fair, HSG A
*	44,435	98	Unconnected pavement, HSG A
	99,960	39	>75% Grass cover, Good, HSG A
	168,164	58	Weighted Average
	117,429		69.83% Pervious Area
	50,735		30.17% Impervious Area
	50,735		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0108	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.4	99	0.0051	1.15		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.1	149	Total			

Subcatchment EWS-2: Track & Field



Summary for Subcatchment EWS-3: North of Track

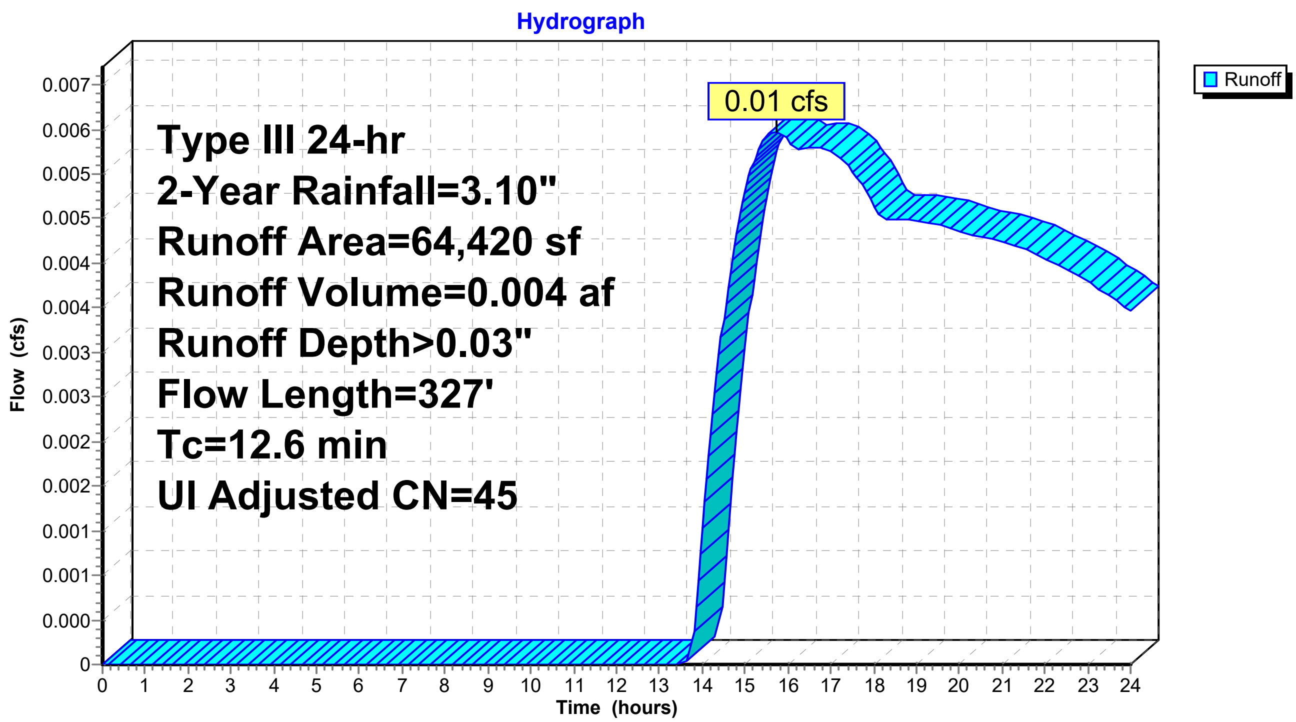
Runoff = 0.01 cfs @ 15.71 hrs, Volume= 0.004 af, Depth> 0.03"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
52,081	39		>75% Grass cover, Good, HSG A
3,547	98		Unconnected roofs, HSG A
7,570	98		Unconnected pavement, HSG A
1,222	98		Unconnected pavement, HSG B
64,420	50	45	Weighted Average, UI Adjusted
52,081			80.85% Pervious Area
12,339			19.15% Impervious Area
12,339			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
5.5	277	0.0144	0.84		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
12.6	327	Total			

Subcatchment EWS-3: North of Track



Summary for Subcatchment EWS-4: Baseball Field (East)

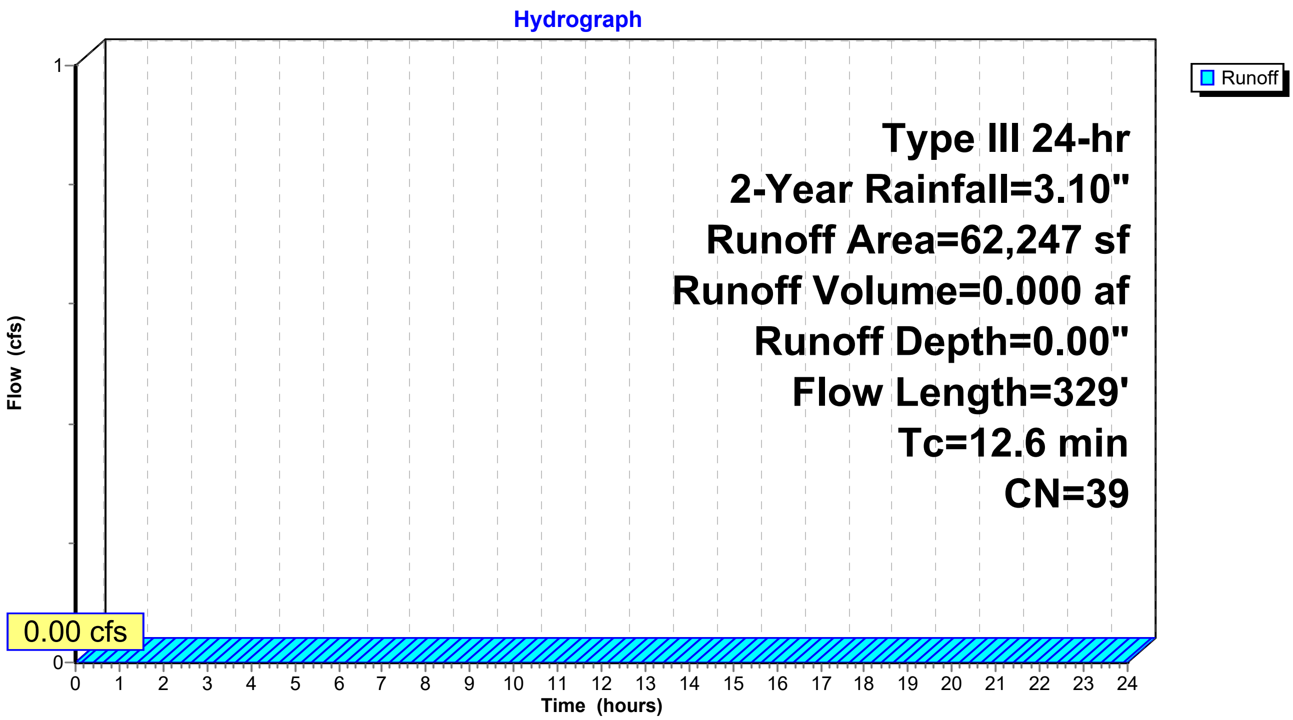
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
60,403	39	>75% Grass cover, Good, HSG A
1,844	36	Woods, Fair, HSG A
62,247	39	Weighted Average
62,247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0132	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.8	279	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.6	329	Total			

Subcatchment EWS-4: Baseball Field (East)



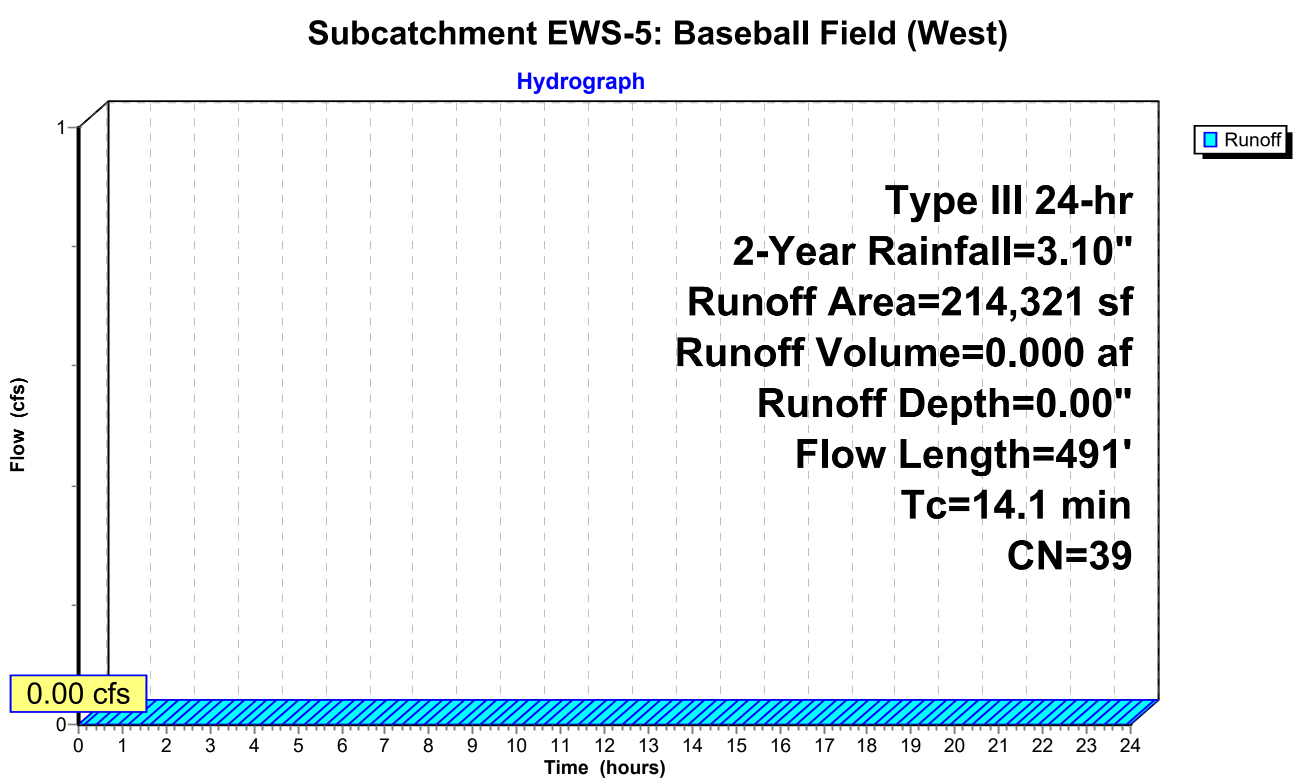
Summary for Subcatchment EWS-5: Baseball Field (West)

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
192,178	39	>75% Grass cover, Good, HSG A
22,143	36	Woods, Fair, HSG A
214,321	39	Weighted Average
214,321		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0116	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
3.7	441	0.0153	1.99		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
14.1	491	Total			



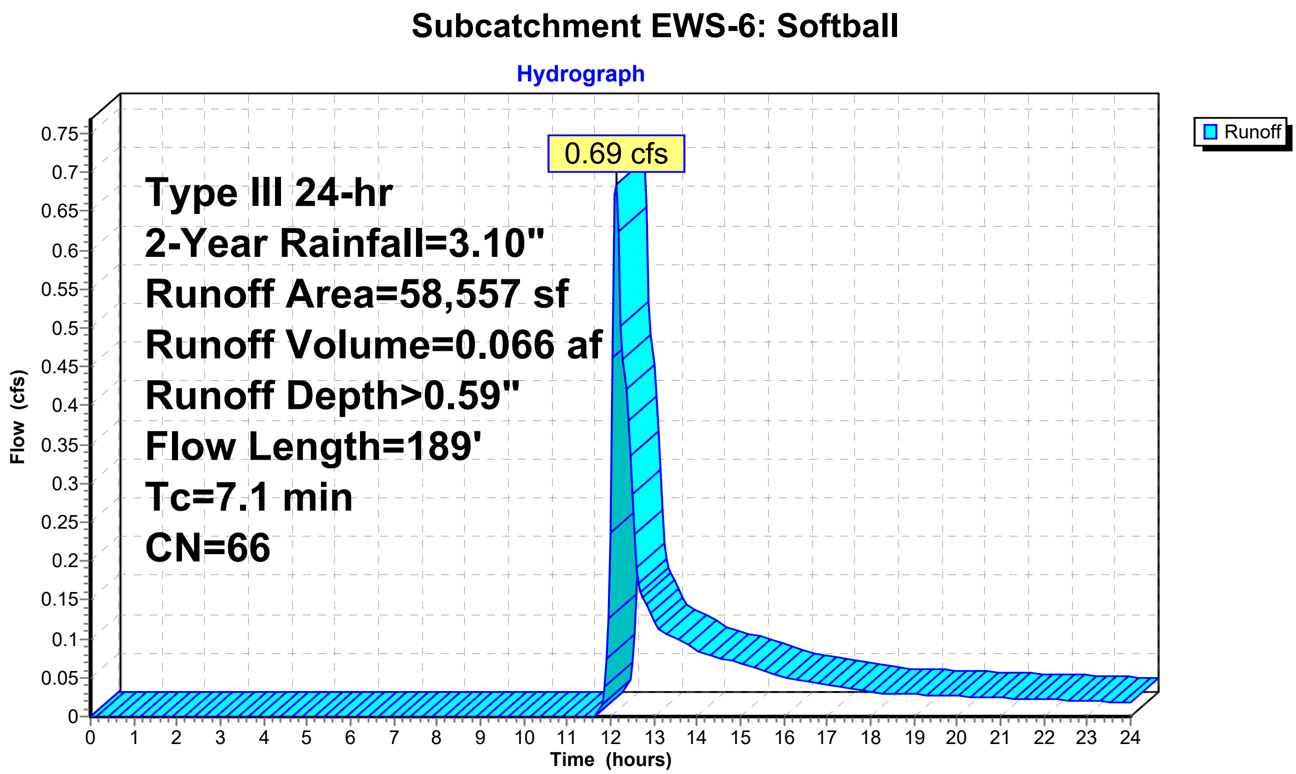
Summary for Subcatchment EWS-6: Softball

Runoff = 0.69 cfs @ 12.13 hrs, Volume= 0.066 af, Depth> 0.59"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
9,539	85	Gravel roads, HSG B
2,302	96	Gravel surface, HSG B
282	98	Unconnected pavement, HSG B
46,434	61	>75% Grass cover, Good, HSG B
58,557	66	Weighted Average
58,275		99.52% Pervious Area
282		0.48% Impervious Area
282		100.00% Unconnected

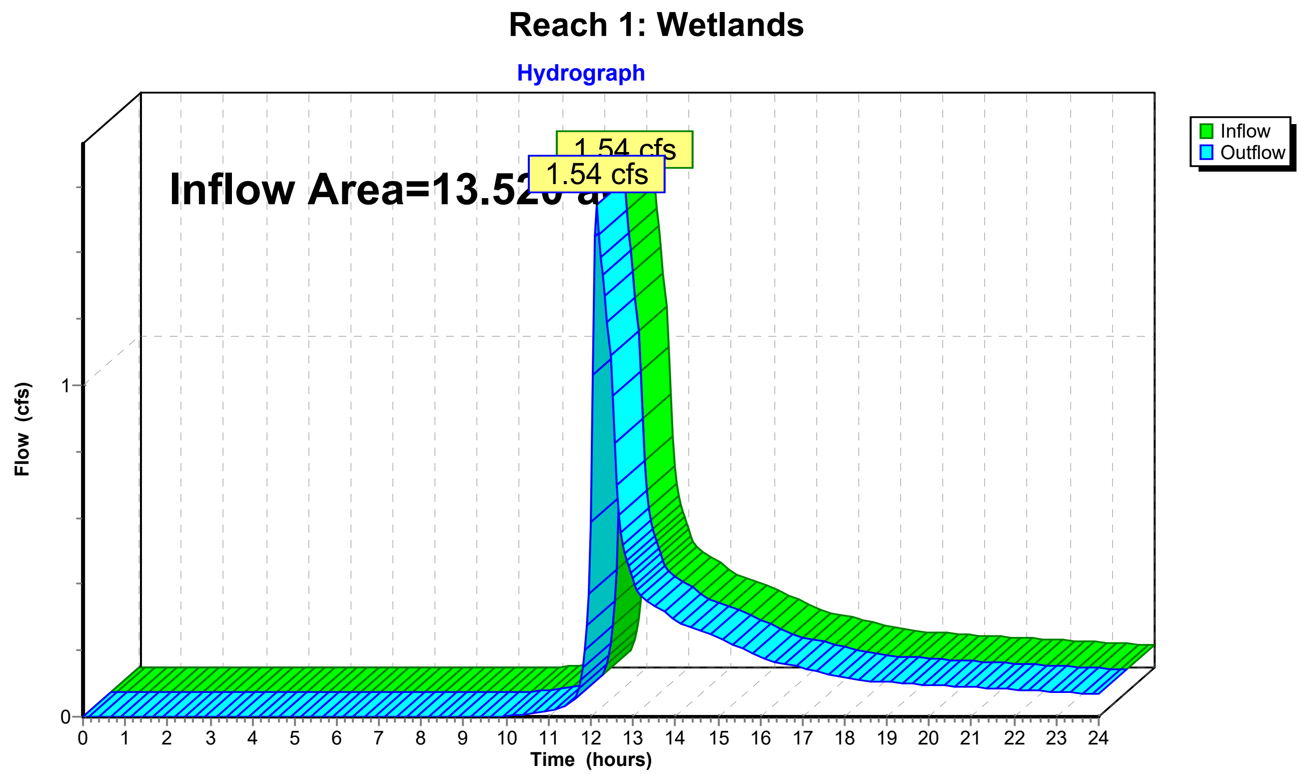
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0040	0.18		**Sheet Flow, A-B** Fallow n= 0.050 P2= 3.10"
2.6	139	0.0166	0.90		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.1	189	Total			



Summary for Reach 1: Wetlands

Inflow Area =	13.520 ac, 12.99% Impervious, Inflow Depth > 0.20"	for 2-Year event	
Inflow =	1.54 cfs @ 12.15 hrs, Volume=	0.220 af	
Outflow =	1.54 cfs @ 12.15 hrs, Volume=	0.220 af, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

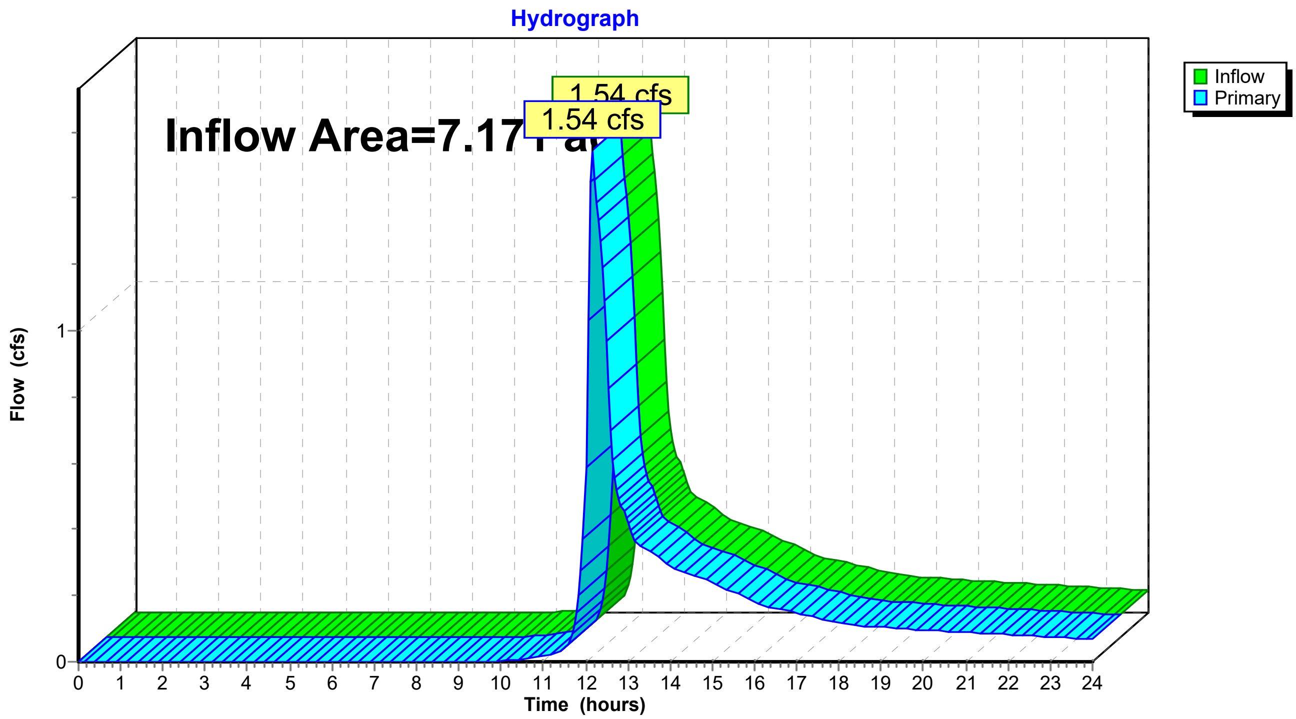


Summary for Link DP-1: Design Point 1

Inflow Area = 7.171 ac, 24.49% Impervious, Inflow Depth > 0.37" for 2-Year event
Inflow = 1.54 cfs @ 12.15 hrs, Volume= 0.220 af
Primary = 1.54 cfs @ 12.15 hrs, Volume= 0.220 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-1: Design Point 1

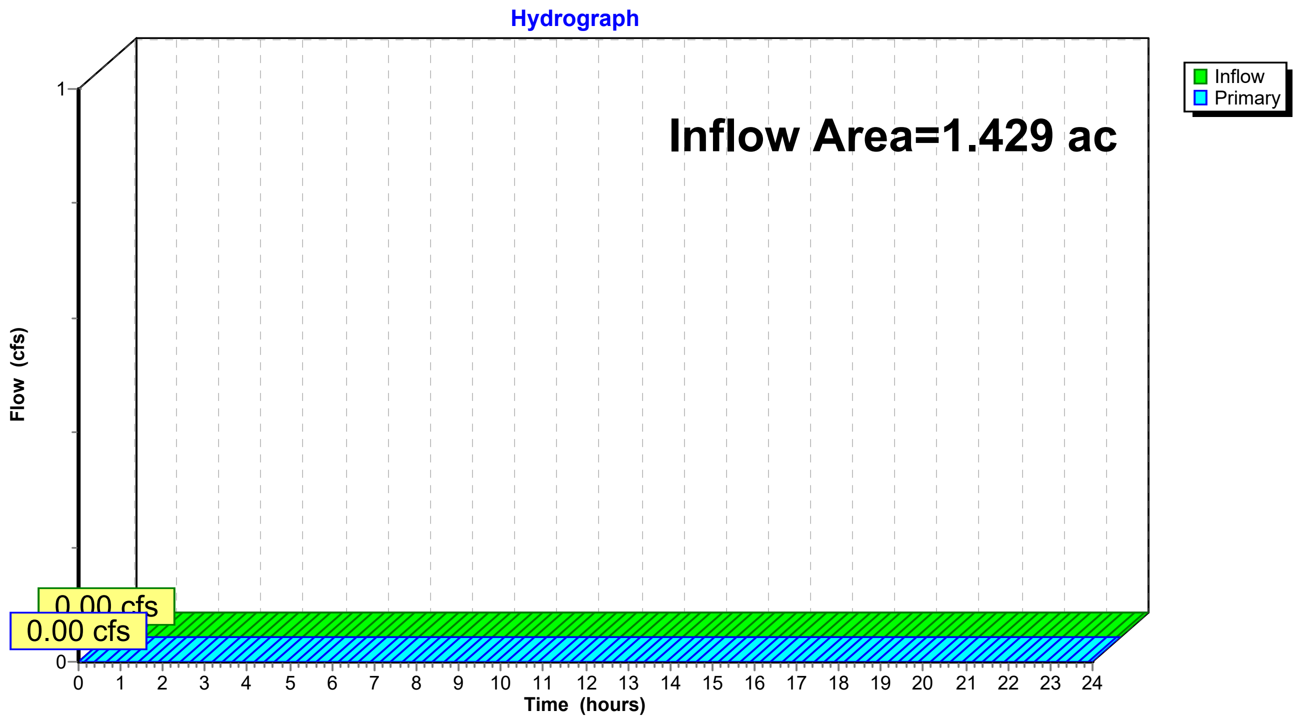


Summary for Link DP-2: Design Point 2

Inflow Area = 1.429 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-2: Design Point 2

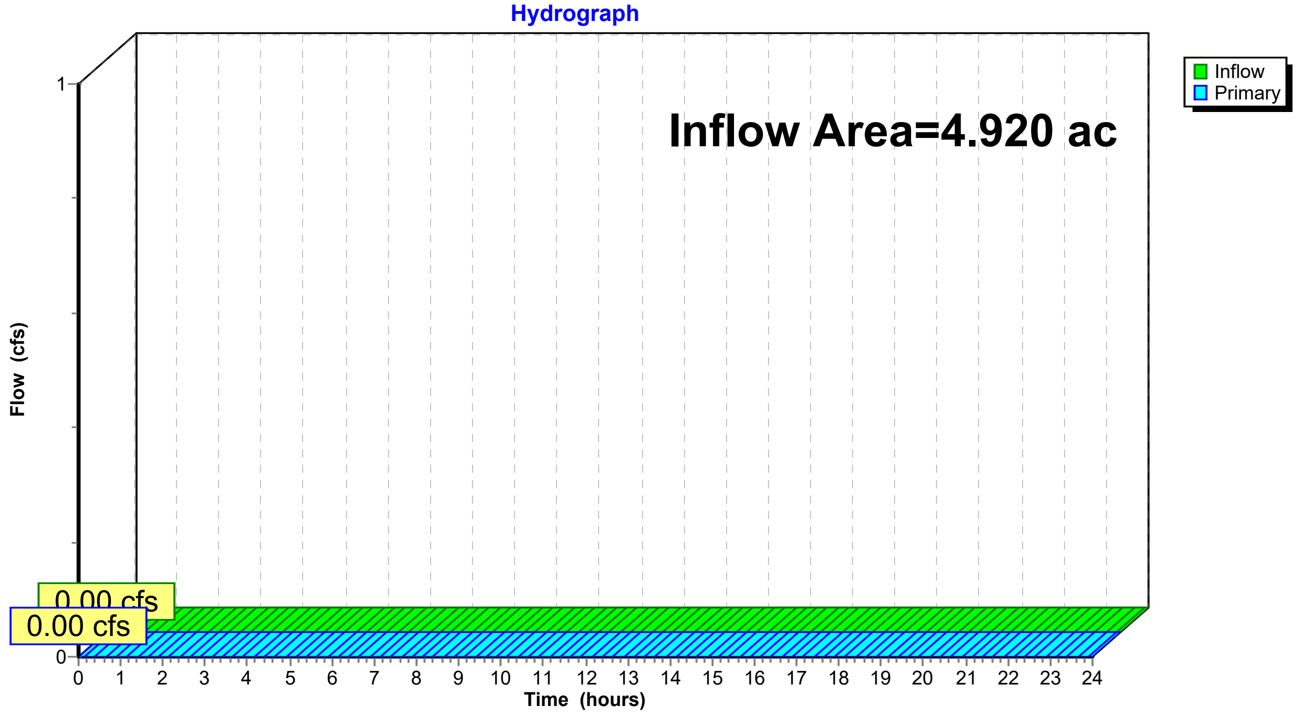


Summary for Link DP-3: Design Point 3

Inflow Area = 4.920 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: West of Track Runoff Area=21,230 sf 61.93% Impervious Runoff Depth>2.37"
Flow Length=141' Tc=6.9 min CN=79 Runoff=1.30 cfs 0.096 af

Subcatchment EWS-2: Track & Field Runoff Area=168,164 sf 30.17% Impervious Runoff Depth>0.90"
Flow Length=149' Tc=12.1 min CN=58 Runoff=2.66 cfs 0.290 af

Subcatchment EWS-3: North of Track Runoff Area=64,420 sf 19.15% Impervious Runoff Depth>0.29"
Flow Length=327' Tc=12.6 min UI Adjusted CN=45 Runoff=0.15 cfs 0.036 af

Subcatchment EWS-4: Baseball Field (East) Runoff Area=62,247 sf 0.00% Impervious Runoff Depth>0.11"
Flow Length=329' Tc=12.6 min CN=39 Runoff=0.02 cfs 0.013 af

Subcatchment EWS-5: Baseball Field Runoff Area=214,321 sf 0.00% Impervious Runoff Depth>0.11"
Flow Length=491' Tc=14.1 min CN=39 Runoff=0.07 cfs 0.045 af

Subcatchment EWS-6: Softball Runoff Area=58,557 sf 0.48% Impervious Runoff Depth>1.39"
Flow Length=189' Tc=7.1 min CN=66 Runoff=1.96 cfs 0.156 af

Reach 1: Wetlands Inflow=5.41 cfs 0.637 af
Outflow=5.41 cfs 0.637 af

Link DP-1: Design Point 1 Inflow=5.41 cfs 0.579 af
Primary=5.41 cfs 0.579 af

Link DP-2: Design Point 2 Inflow=0.02 cfs 0.013 af
Primary=0.02 cfs 0.013 af

Link DP-3: Design Point 3 Inflow=0.07 cfs 0.045 af
Primary=0.07 cfs 0.045 af

Total Runoff Area = 13.520 ac Runoff Volume = 0.637 af Average Runoff Depth = 0.57"
87.01% Pervious = 11.764 ac 12.99% Impervious = 1.756 ac

Summary for Subcatchment EWS-1: West of Track

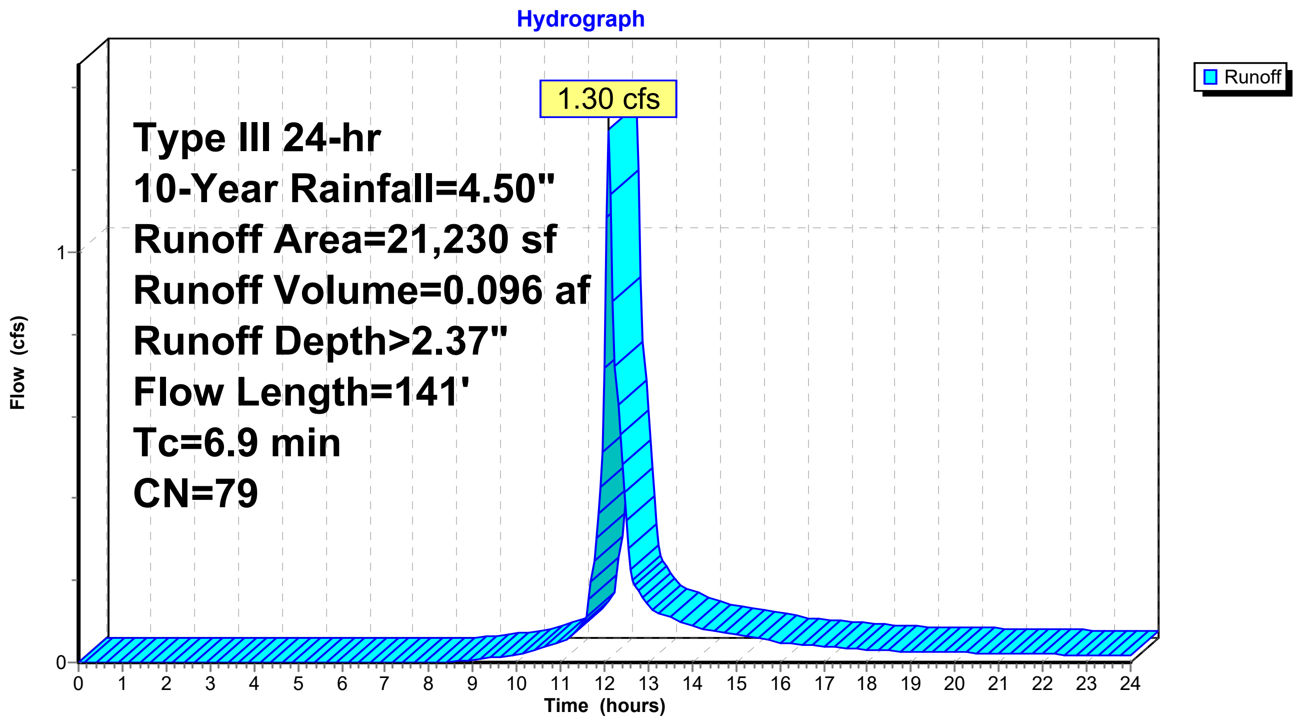
Runoff = 1.30 cfs @ 12.10 hrs, Volume= 0.096 af, Depth> 2.37"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	7,149	98	Unconnected pavement, HSG B
	3,634	61	>75% Grass cover, Good, HSG B
*	82	98	Unconnected roofs, HSG A
	4,449	39	>75% Grass cover, Good, HSG A
*	5,916	98	Unconnected pavement, HSG A
	21,230	79	Weighted Average
	8,083		38.07% Pervious Area
	13,147		61.93% Impervious Area
	13,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	37	0.0220	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.6	104	0.0176	2.69		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
6.9	141	Total			

Subcatchment EWS-1: West of Track



Summary for Subcatchment EWS-2: Track & Field

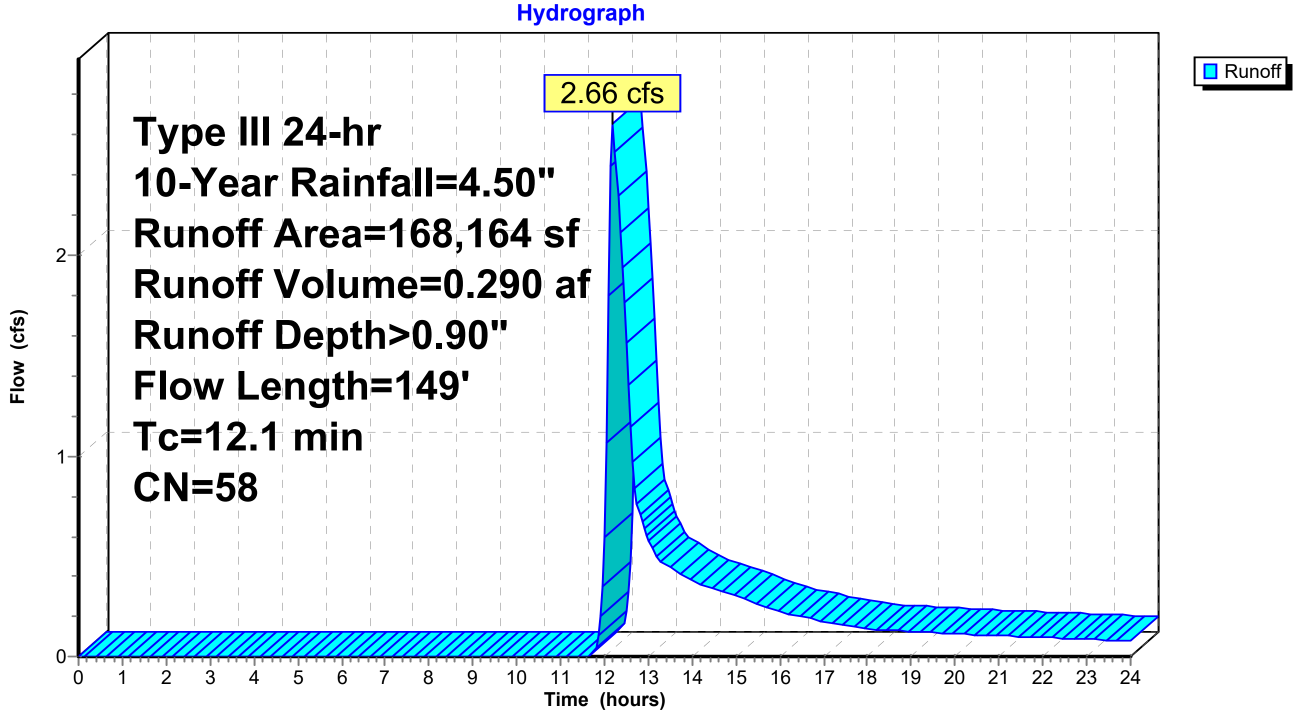
Runoff = 2.66 cfs @ 12.21 hrs, Volume= 0.290 af, Depth> 0.90"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

	Area (sf)	CN	Description
	7,597	61	>75% Grass cover, Good, HSG B
*	258	98	Unconnected roofs, HSG A
	6,042	98	Unconnected pavement, HSG B
	9,872	36	Woods, Fair, HSG A
*	44,435	98	Unconnected pavement, HSG A
	99,960	39	>75% Grass cover, Good, HSG A
	168,164	58	Weighted Average
	117,429		69.83% Pervious Area
	50,735		30.17% Impervious Area
	50,735		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0108	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.4	99	0.0051	1.15		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.1	149	Total			

Subcatchment EWS-2: Track & Field



Summary for Subcatchment EWS-3: North of Track

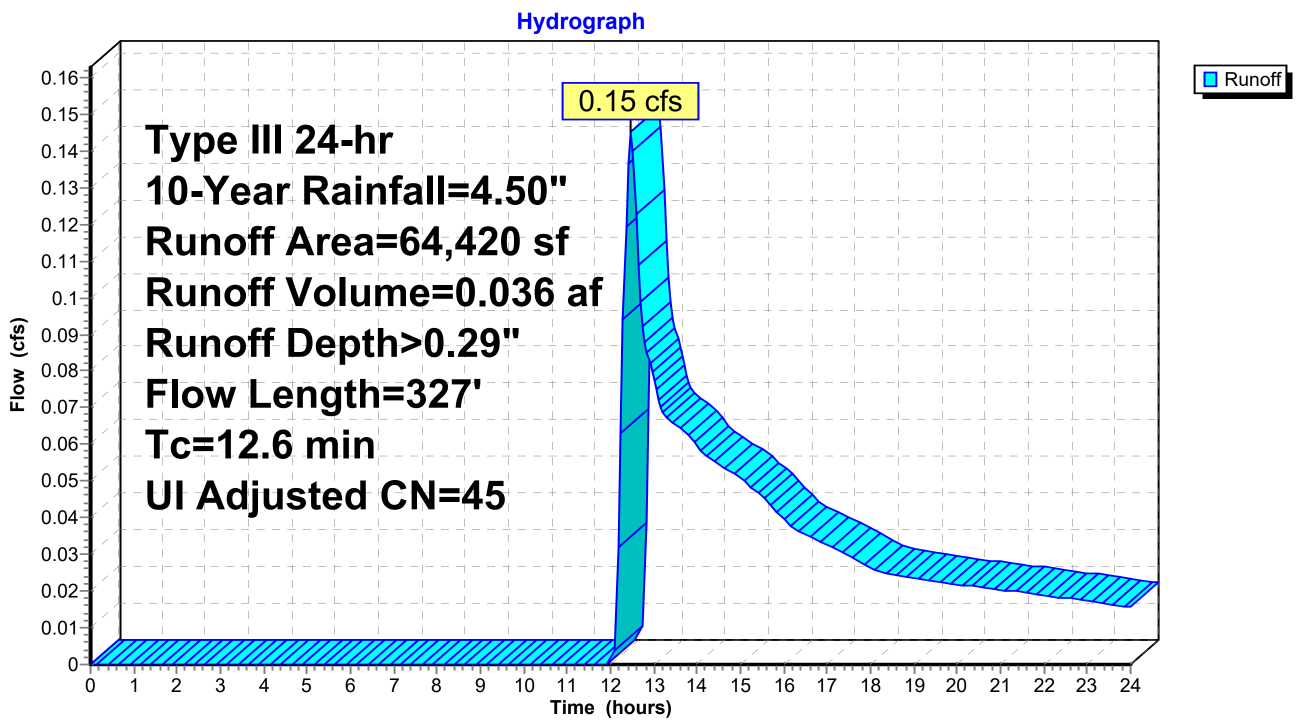
Runoff = 0.15 cfs @ 12.47 hrs, Volume= 0.036 af, Depth> 0.29"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
52,081	39		>75% Grass cover, Good, HSG A
3,547	98		Unconnected roofs, HSG A
7,570	98		Unconnected pavement, HSG A
1,222	98		Unconnected pavement, HSG B
64,420	50	45	Weighted Average, UI Adjusted
52,081			80.85% Pervious Area
12,339			19.15% Impervious Area
12,339			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
5.5	277	0.0144	0.84		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
12.6	327	Total			

Subcatchment EWS-3: North of Track



Summary for Subcatchment EWS-4: Baseball Field (East)

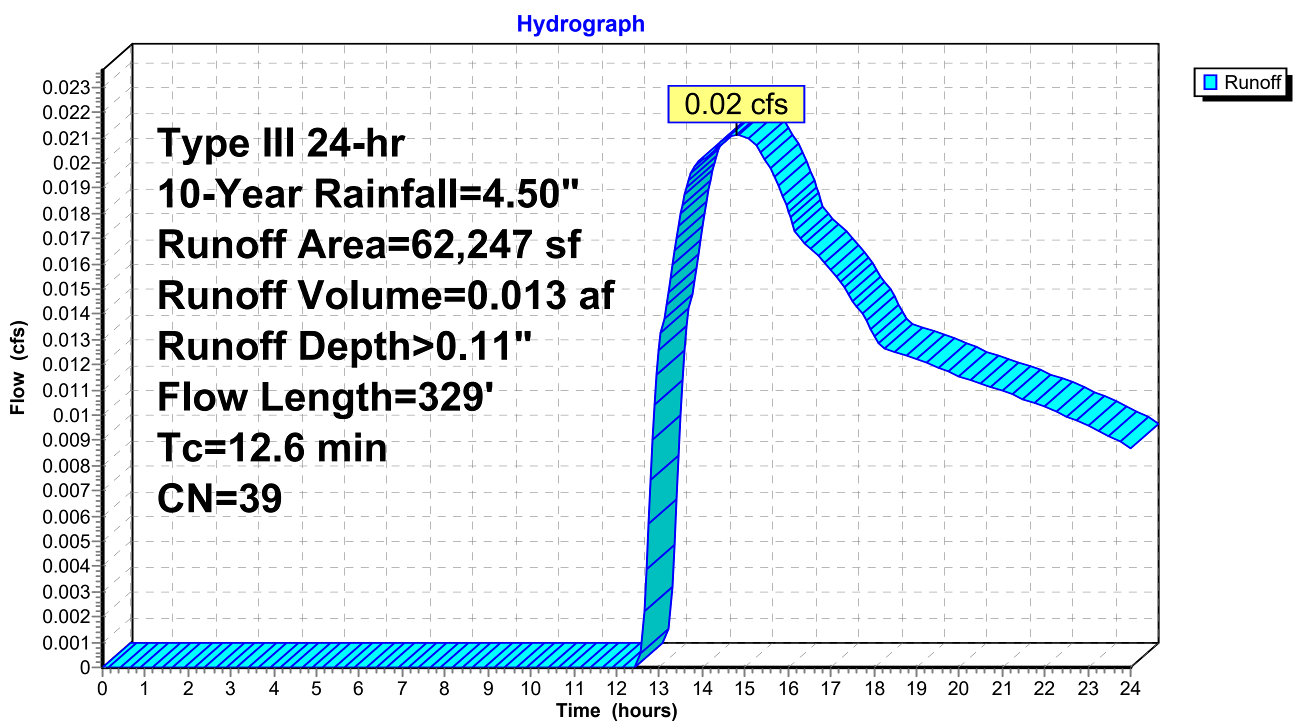
Runoff = 0.02 cfs @ 14.81 hrs, Volume= 0.013 af, Depth> 0.11"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
60,403	39	>75% Grass cover, Good, HSG A
1,844	36	Woods, Fair, HSG A
62,247	39	Weighted Average
62,247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0132	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.8	279	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.6	329	Total			

Subcatchment EWS-4: Baseball Field (East)



Summary for Subcatchment EWS-5: Baseball Field (West)

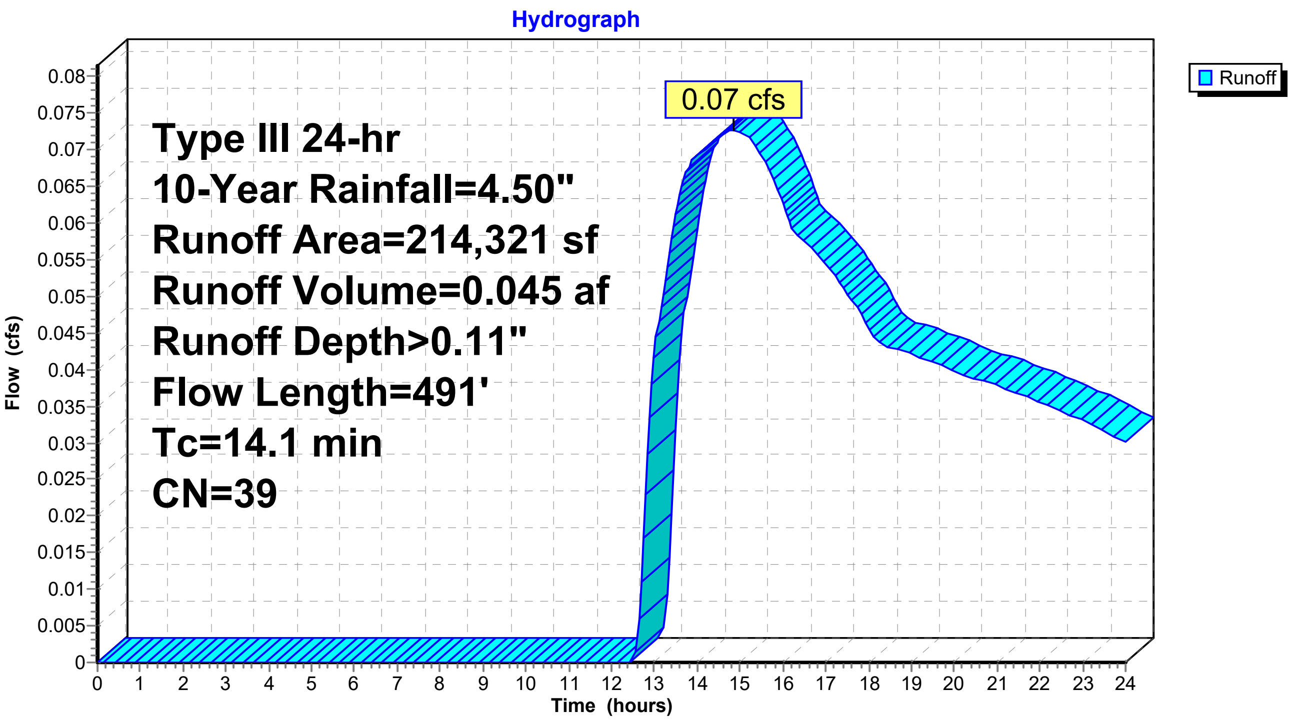
Runoff = 0.07 cfs @ 14.84 hrs, Volume= 0.045 af, Depth> 0.11"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
192,178	39	>75% Grass cover, Good, HSG A
22,143	36	Woods, Fair, HSG A
214,321	39	Weighted Average
214,321		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0116	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
3.7	441	0.0153	1.99		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
14.1	491	Total			

Subcatchment EWS-5: Baseball Field (West)



Summary for Subcatchment EWS-6: Softball

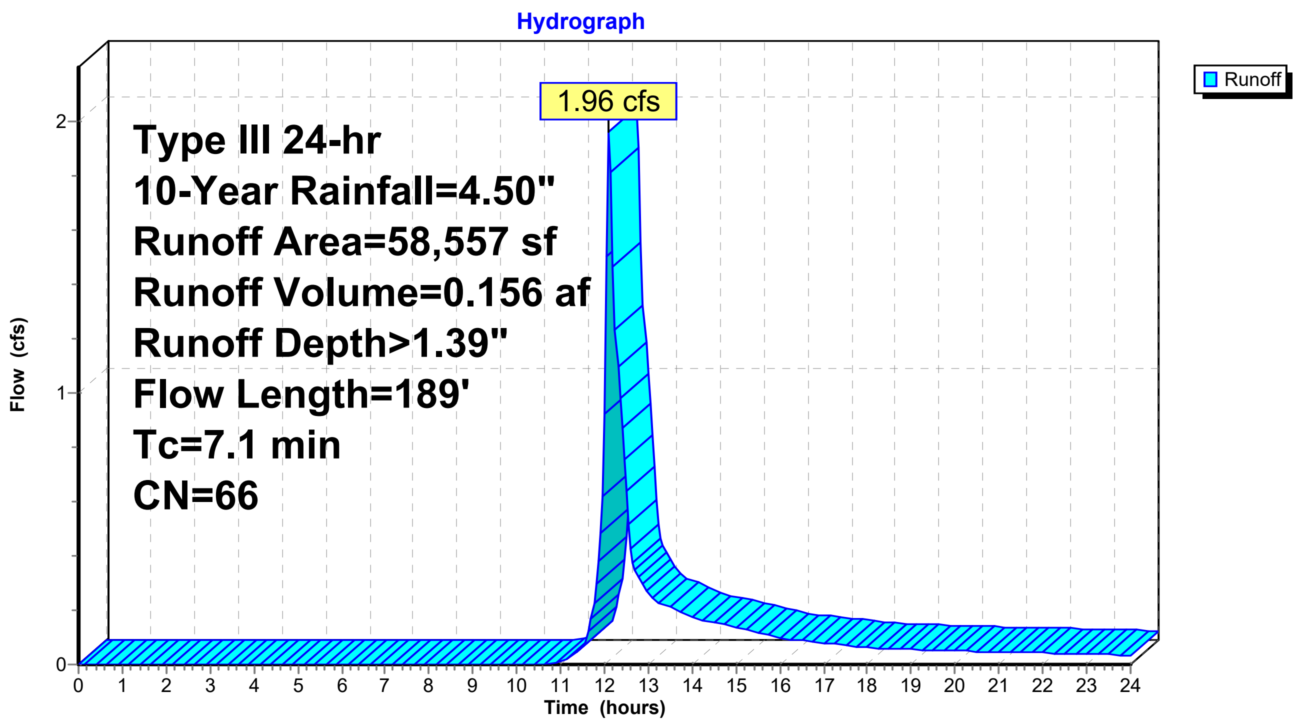
Runoff = 1.96 cfs @ 12.11 hrs, Volume= 0.156 af, Depth> 1.39"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
9,539	85	Gravel roads, HSG B
2,302	96	Gravel surface, HSG B
282	98	Unconnected pavement, HSG B
46,434	61	>75% Grass cover, Good, HSG B
58,557	66	Weighted Average
58,275		99.52% Pervious Area
282		0.48% Impervious Area
282		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0040	0.18		**Sheet Flow, A-B** Fallow n= 0.050 P2= 3.10"
2.6	139	0.0166	0.90		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.1	189	Total			

Subcatchment EWS-6: Softball

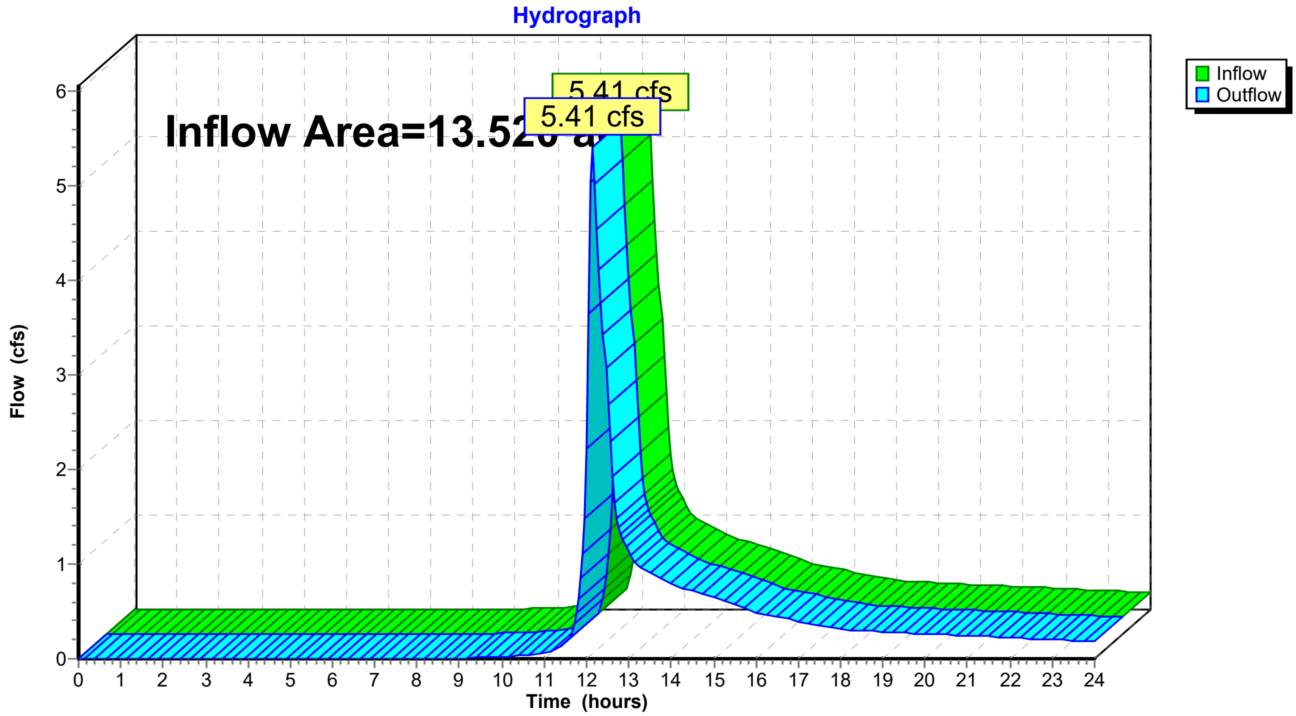


Summary for Reach 1: Wetlands

Inflow Area =	13.520 ac, 12.99% Impervious,	Inflow Depth > 0.57"	for 10-Year event
Inflow =	5.41 cfs @ 12.15 hrs,	Volume=	0.637 af
Outflow =	5.41 cfs @ 12.15 hrs,	Volume=	0.637 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

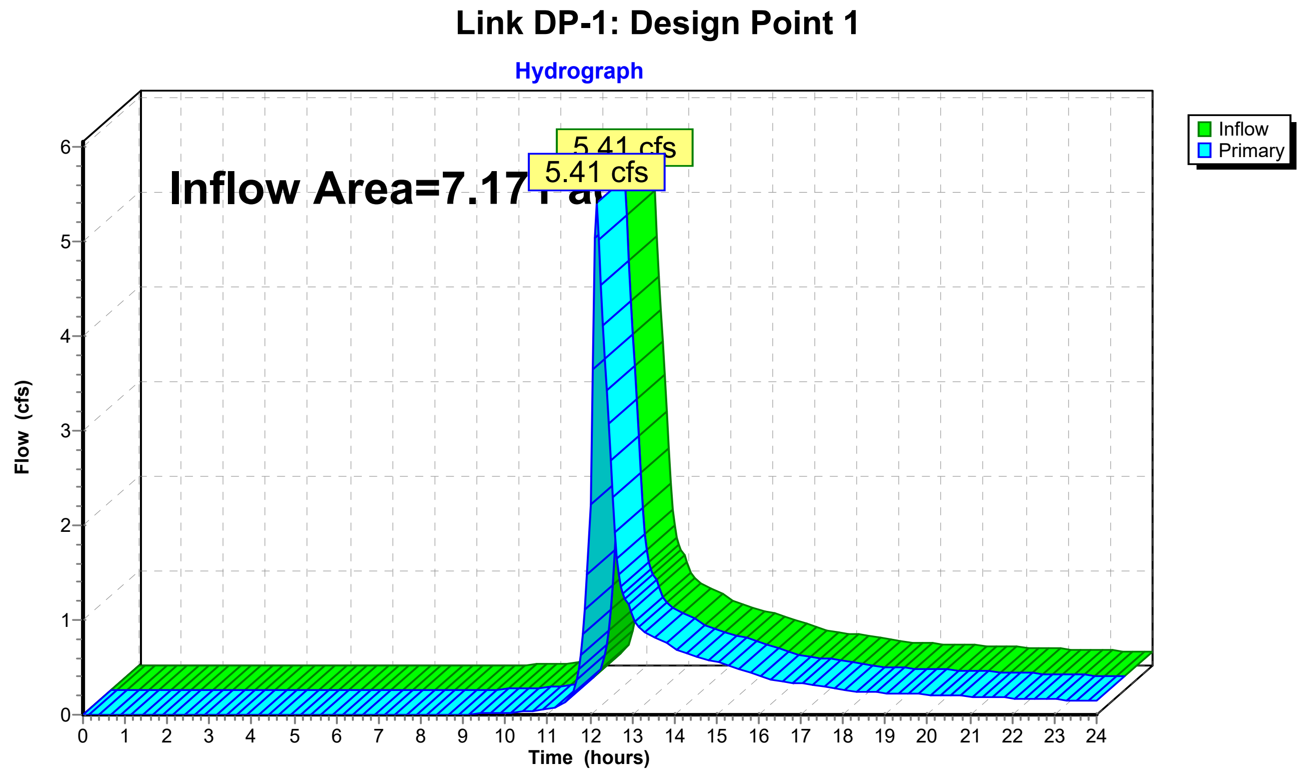
Reach 1: Wetlands



Summary for Link DP-1: Design Point 1

Inflow Area = 7.171 ac, 24.49% Impervious, Inflow Depth > 0.97" for 10-Year event
Inflow = 5.41 cfs @ 12.15 hrs, Volume= 0.579 af
Primary = 5.41 cfs @ 12.15 hrs, Volume= 0.579 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

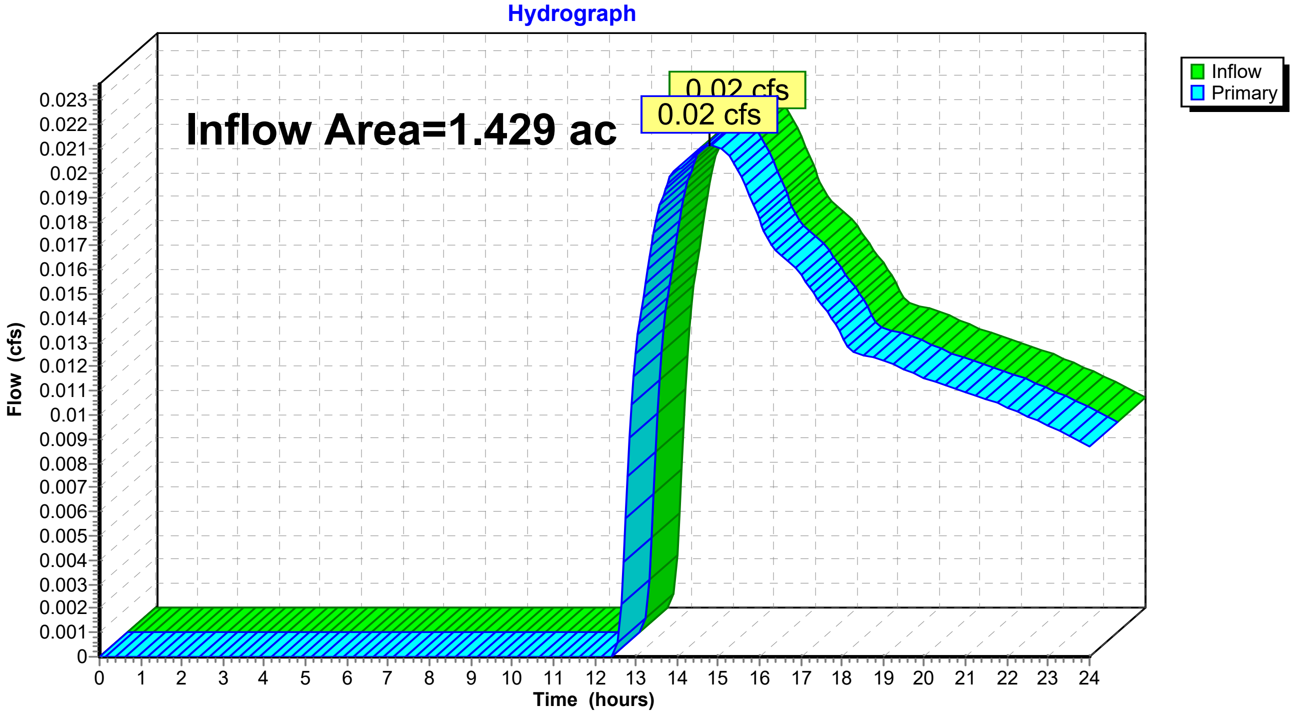


Summary for Link DP-2: Design Point 2

Inflow Area = 1.429 ac, 0.00% Impervious, Inflow Depth > 0.11" for 10-Year event
Inflow = 0.02 cfs @ 14.81 hrs, Volume= 0.013 af
Primary = 0.02 cfs @ 14.81 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-2: Design Point 2

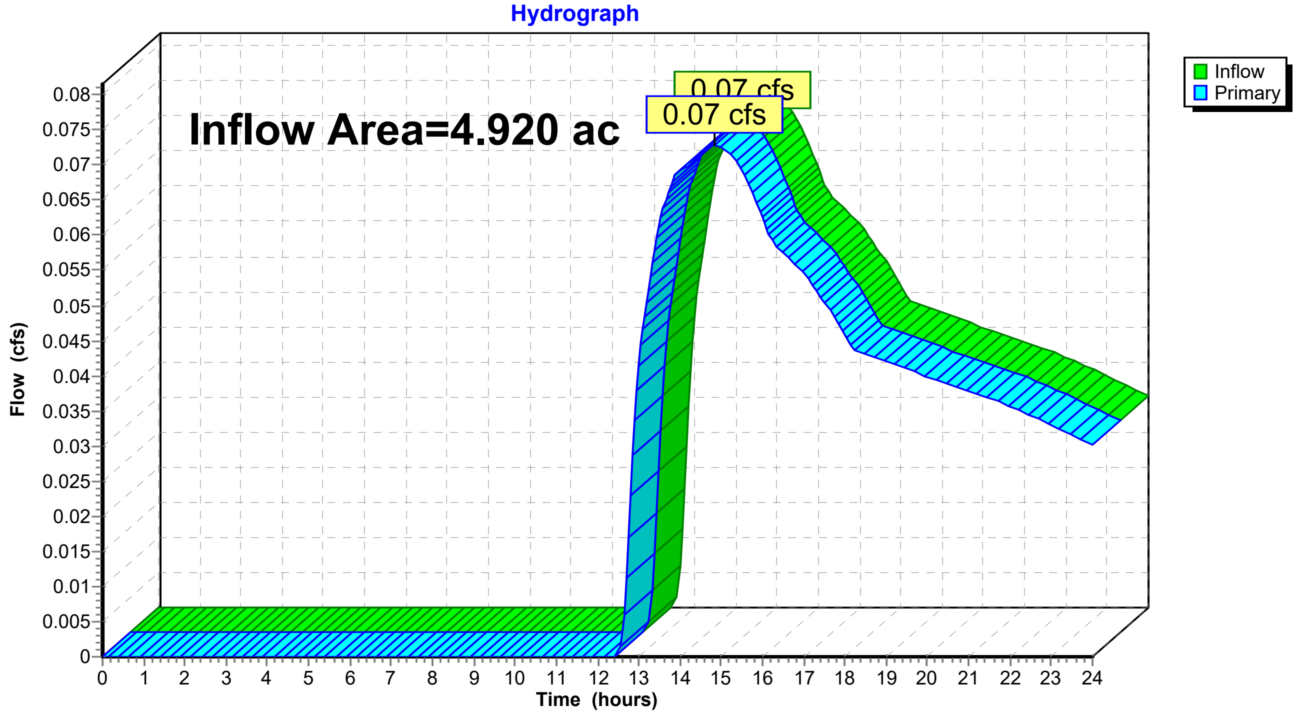


Summary for Link DP-3: Design Point 3

Inflow Area = 4.920 ac, 0.00% Impervious, Inflow Depth > 0.11" for 10-Year event
Inflow = 0.07 cfs @ 14.84 hrs, Volume= 0.045 af
Primary = 0.07 cfs @ 14.84 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: West of Track Runoff Area=21,230 sf 61.93% Impervious Runoff Depth>4.13"
Flow Length=141' Tc=6.9 min CN=79 Runoff=2.25 cfs 0.168 af

Subcatchment EWS-2: Track & Field Runoff Area=168,164 sf 30.17% Impervious Runoff Depth>2.07"
Flow Length=149' Tc=12.1 min CN=58 Runoff=7.13 cfs 0.666 af

Subcatchment EWS-3: North of Track Runoff Area=64,420 sf 19.15% Impervious Runoff Depth>1.01"
Flow Length=327' Tc=12.6 min UI Adjusted CN=45 Runoff=0.95 cfs 0.124 af

Subcatchment EWS-4: Baseball Field (East) Runoff Area=62,247 sf 0.00% Impervious Runoff Depth>0.59"
Flow Length=329' Tc=12.6 min CN=39 Runoff=0.37 cfs 0.071 af

Subcatchment EWS-5: Baseball Field Runoff Area=214,321 sf 0.00% Impervious Runoff Depth>0.59"
Flow Length=491' Tc=14.1 min CN=39 Runoff=1.25 cfs 0.244 af

Subcatchment EWS-6: Softball Runoff Area=58,557 sf 0.48% Impervious Runoff Depth>2.81"
Flow Length=189' Tc=7.1 min CN=66 Runoff=4.17 cfs 0.315 af

Reach 1: Wetlands Inflow=13.97 cfs 1.587 af
Outflow=13.97 cfs 1.587 af

Link DP-1: Design Point 1 Inflow=13.44 cfs 1.273 af
Primary=13.44 cfs 1.273 af

Link DP-2: Design Point 2 Inflow=0.37 cfs 0.071 af
Primary=0.37 cfs 0.071 af

Link DP-3: Design Point 3 Inflow=1.25 cfs 0.244 af
Primary=1.25 cfs 0.244 af

Total Runoff Area = 13.520 ac Runoff Volume = 1.587 af Average Runoff Depth = 1.41"
87.01% Pervious = 11.764 ac 12.99% Impervious = 1.756 ac

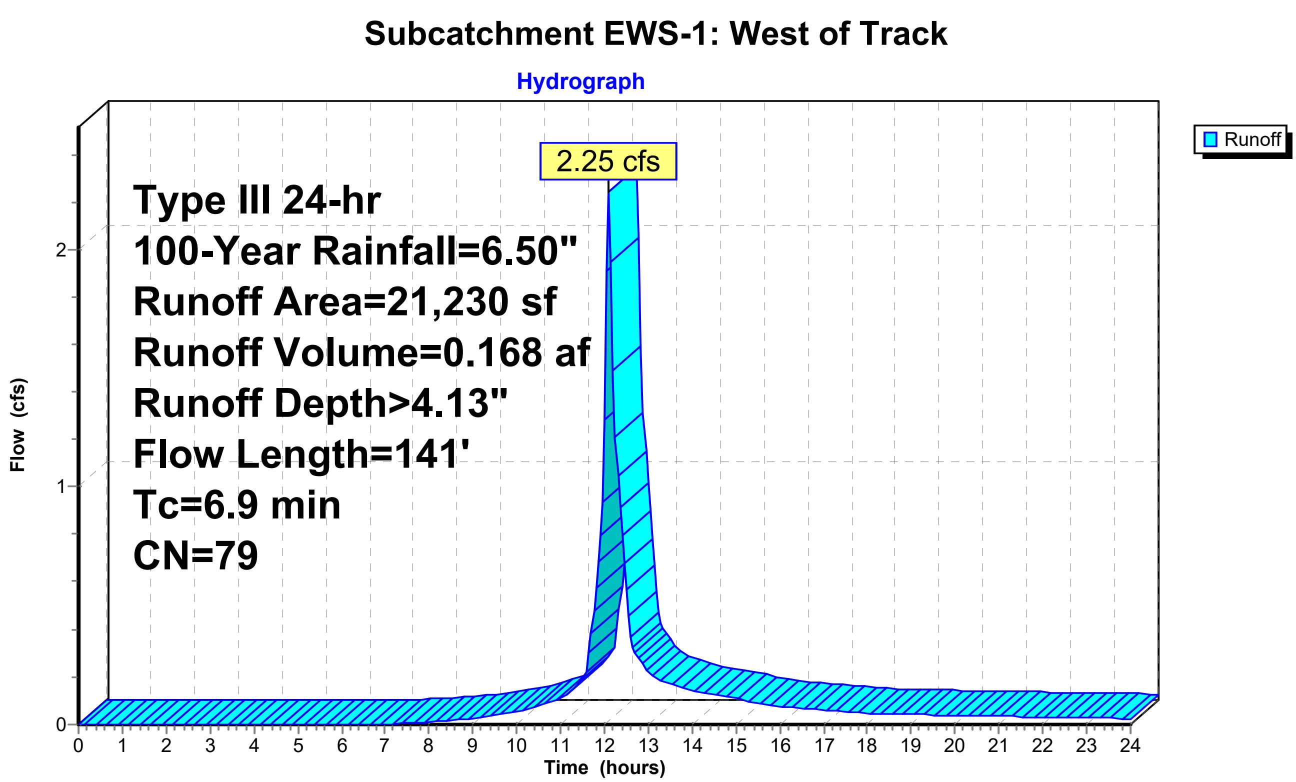
Summary for Subcatchment EWS-1: West of Track

Runoff = 2.25 cfs @ 12.10 hrs, Volume= 0.168 af, Depth> 4.13"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	7,149	98	Unconnected pavement, HSG B
	3,634	61	>75% Grass cover, Good, HSG B
*	82	98	Unconnected roofs, HSG A
	4,449	39	>75% Grass cover, Good, HSG A
*	5,916	98	Unconnected pavement, HSG A
	21,230	79	Weighted Average
	8,083		38.07% Pervious Area
	13,147		61.93% Impervious Area
	13,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	37	0.0220	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.6	104	0.0176	2.69		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
6.9	141	Total			



Summary for Subcatchment EWS-2: Track & Field

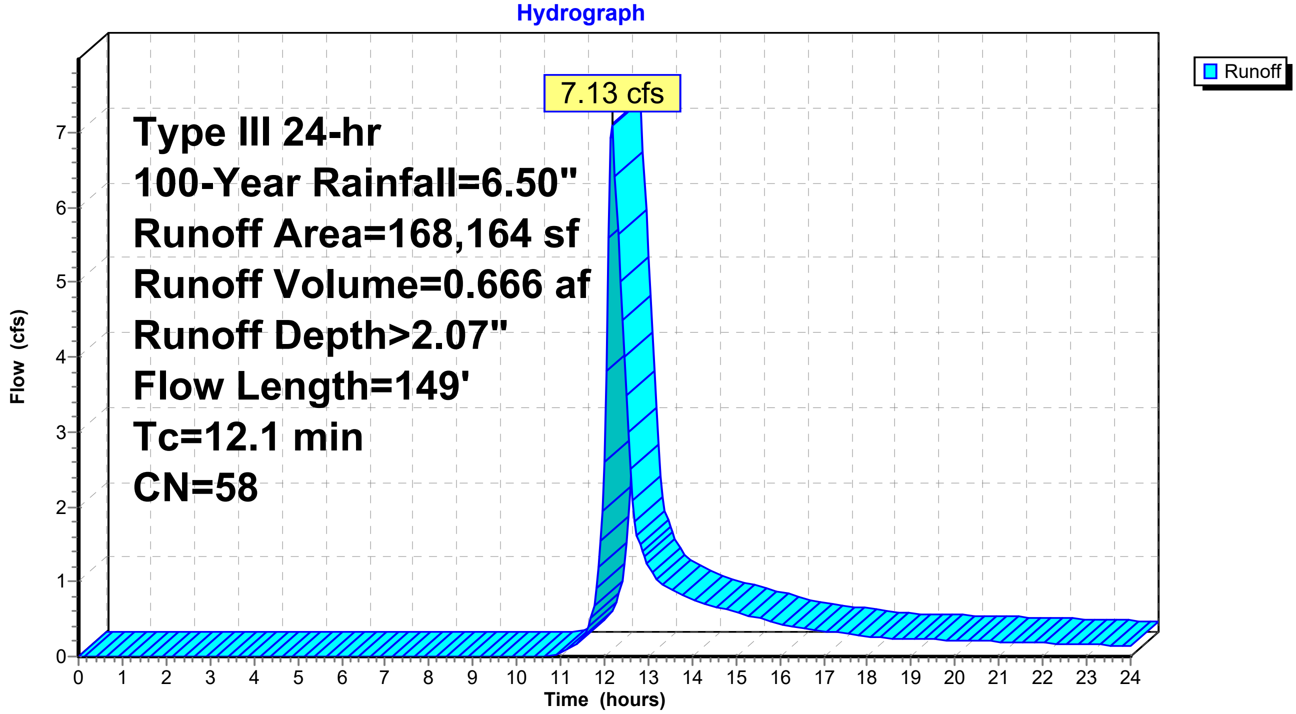
Runoff = 7.13 cfs @ 12.18 hrs, Volume= 0.666 af, Depth> 2.07"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

	Area (sf)	CN	Description
	7,597	61	>75% Grass cover, Good, HSG B
*	258	98	Unconnected roofs, HSG A
	6,042	98	Unconnected pavement, HSG B
	9,872	36	Woods, Fair, HSG A
*	44,435	98	Unconnected pavement, HSG A
	99,960	39	>75% Grass cover, Good, HSG A
	168,164	58	Weighted Average
	117,429		69.83% Pervious Area
	50,735		30.17% Impervious Area
	50,735		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0108	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.4	99	0.0051	1.15		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.1	149	Total			

Subcatchment EWS-2: Track & Field



Summary for Subcatchment EWS-3: North of Track

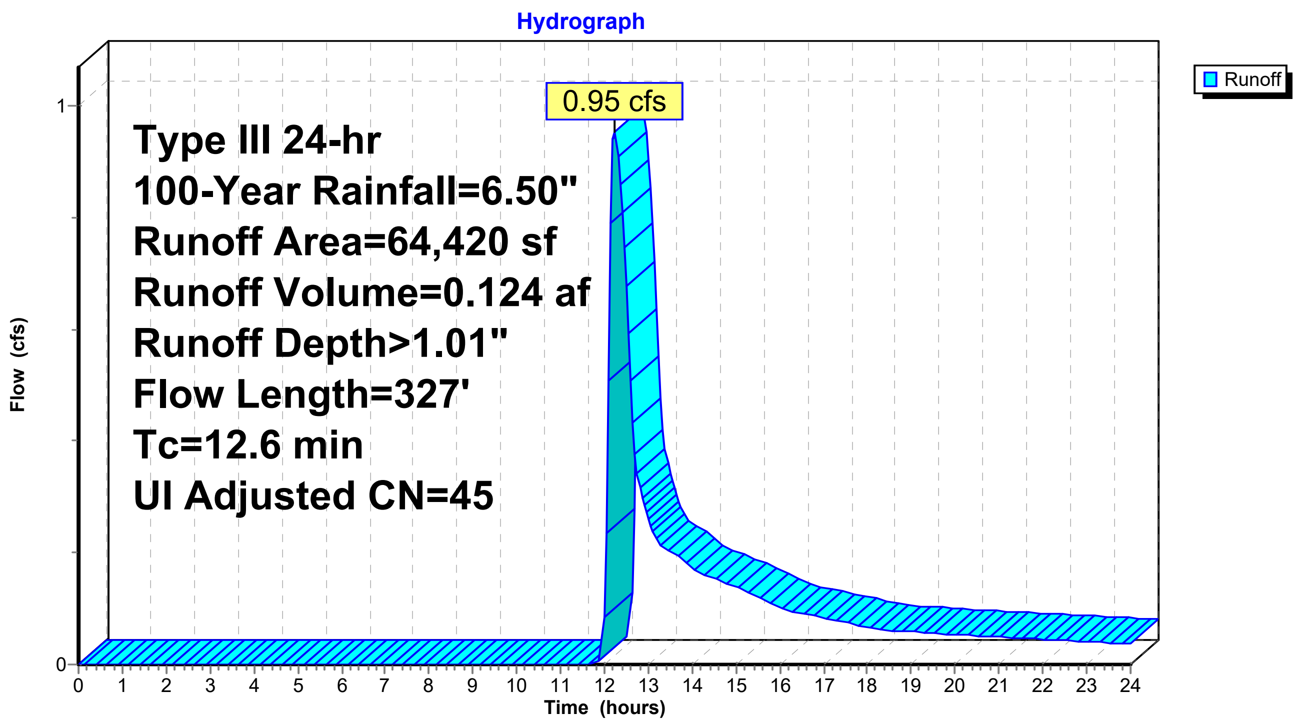
Runoff = 0.95 cfs @ 12.24 hrs, Volume= 0.124 af, Depth> 1.01"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
52,081	39		>75% Grass cover, Good, HSG A
3,547	98		Unconnected roofs, HSG A
7,570	98		Unconnected pavement, HSG A
1,222	98		Unconnected pavement, HSG B
64,420	50	45	Weighted Average, UI Adjusted
52,081			80.85% Pervious Area
12,339			19.15% Impervious Area
12,339			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
5.5	277	0.0144	0.84		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
12.6	327	Total			

Subcatchment EWS-3: North of Track



Summary for Subcatchment EWS-4: Baseball Field (East)

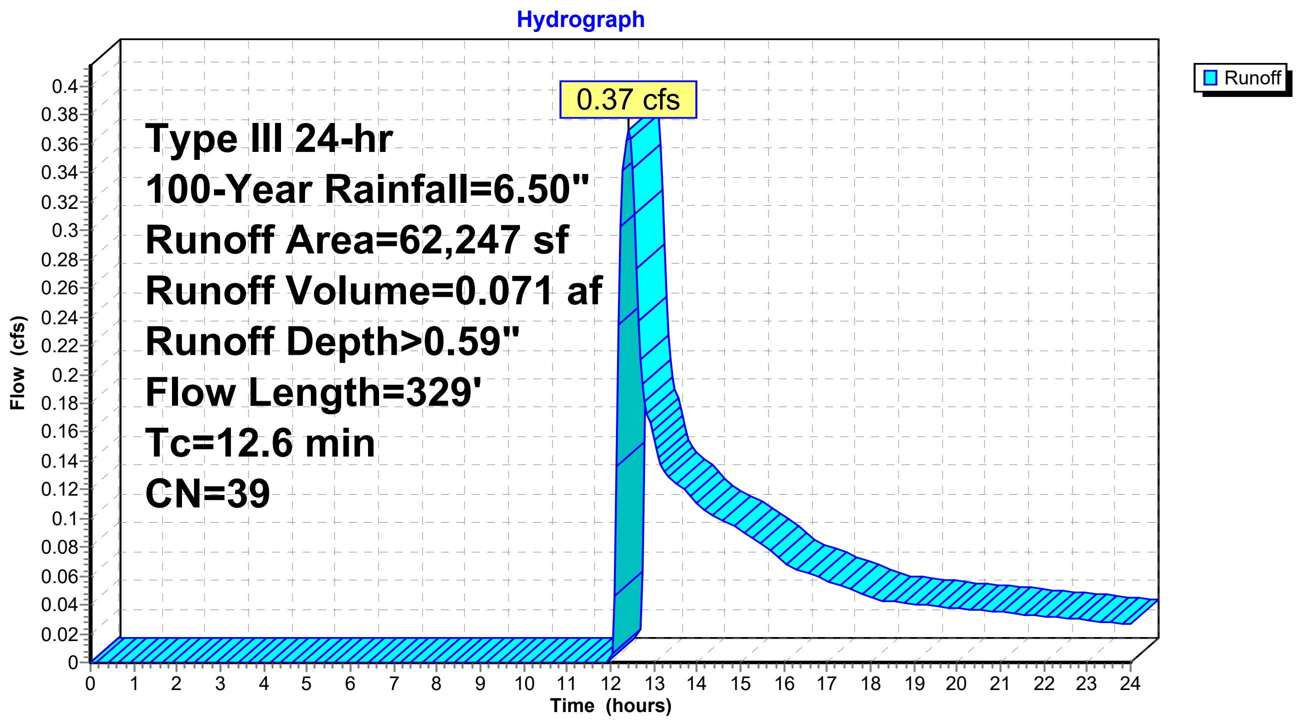
Runoff = 0.37 cfs @ 12.40 hrs, Volume= 0.071 af, Depth> 0.59"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
60,403	39	>75% Grass cover, Good, HSG A
1,844	36	Woods, Fair, HSG A
62,247	39	Weighted Average
62,247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0132	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.8	279	0.0110	1.69		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
12.6	329	Total			

Subcatchment EWS-4: Baseball Field (East)



Summary for Subcatchment EWS-5: Baseball Field (West)

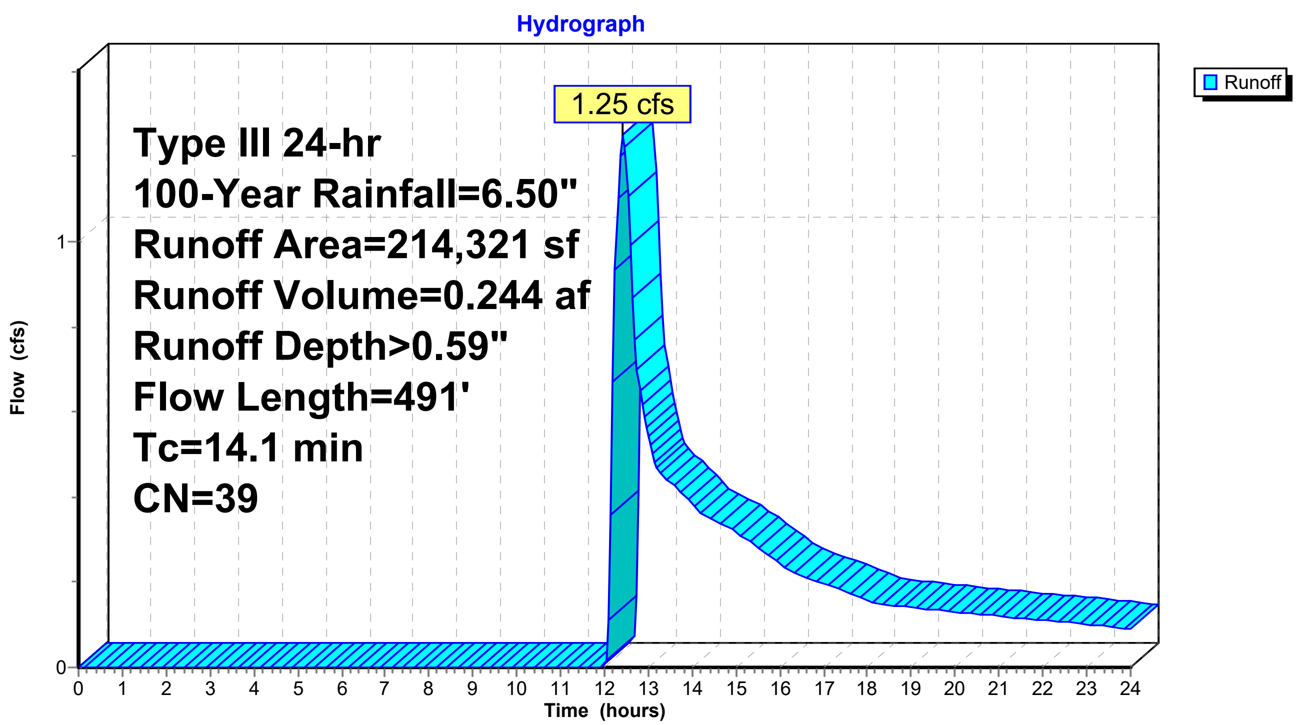
Runoff = 1.25 cfs @ 12.42 hrs, Volume= 0.244 af, Depth> 0.59"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
192,178	39	>75% Grass cover, Good, HSG A
22,143	36	Woods, Fair, HSG A
214,321	39	Weighted Average
214,321		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0116	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
3.7	441	0.0153	1.99		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
14.1	491	Total			

Subcatchment EWS-5: Baseball Field (West)



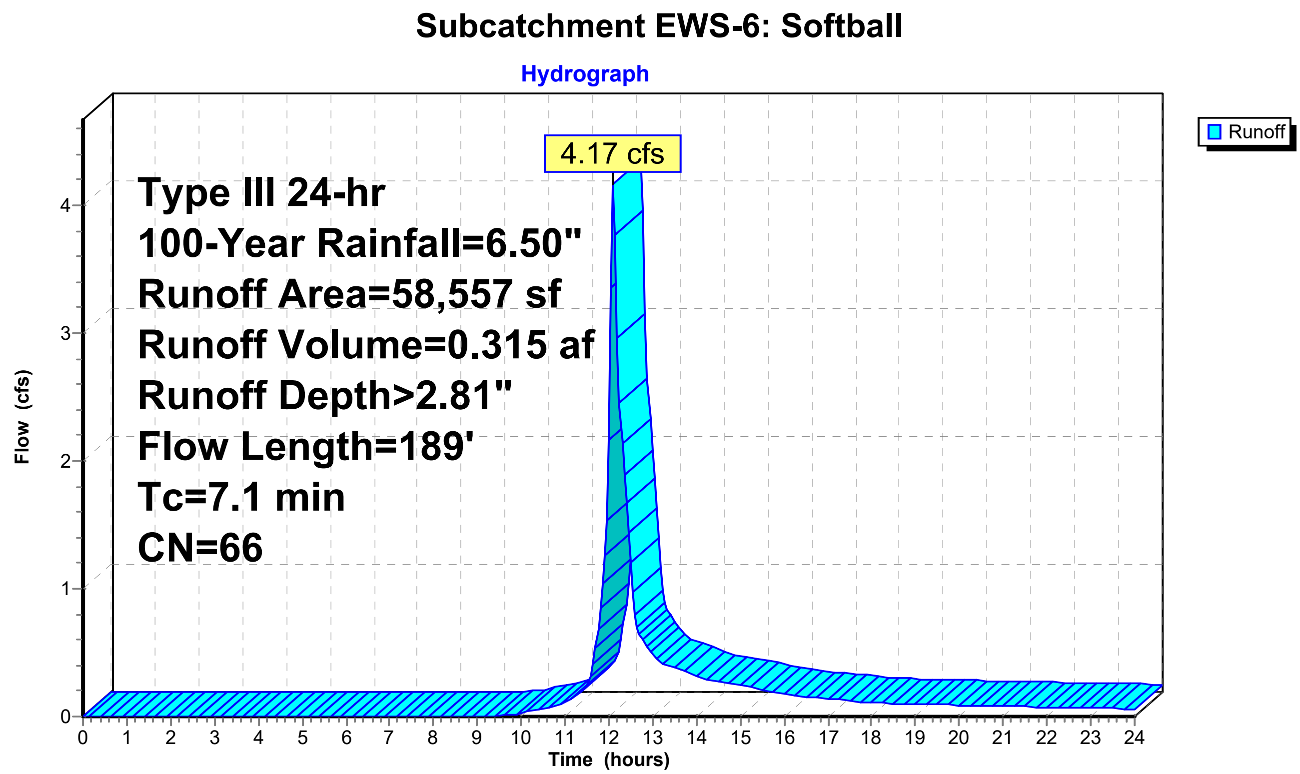
Summary for Subcatchment EWS-6: Softball

Runoff = 4.17 cfs @ 12.11 hrs, Volume= 0.315 af, Depth> 2.81"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
9,539	85	Gravel roads, HSG B
2,302	96	Gravel surface, HSG B
282	98	Unconnected pavement, HSG B
46,434	61	>75% Grass cover, Good, HSG B
58,557	66	Weighted Average
58,275		99.52% Pervious Area
282		0.48% Impervious Area
282		100.00% Unconnected

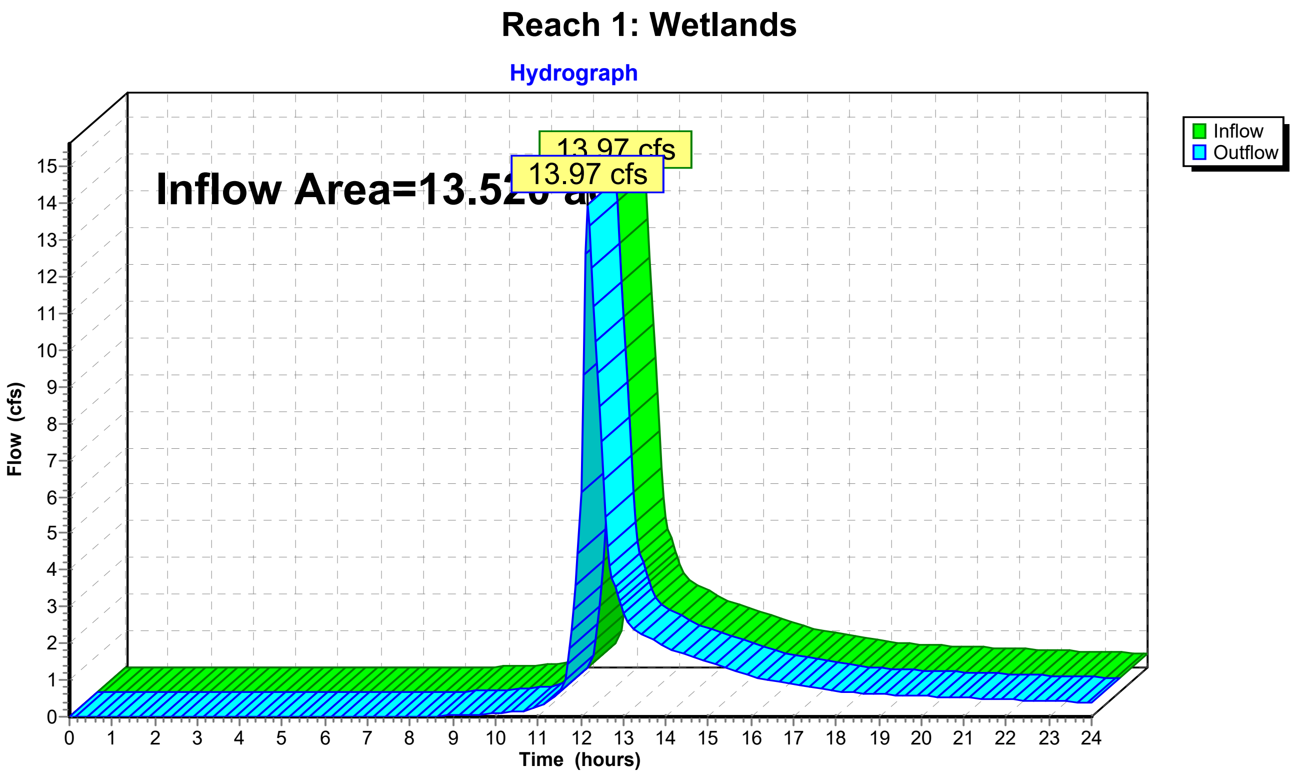
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0040	0.18		**Sheet Flow, A-B** Fallow n= 0.050 P2= 3.10"
2.6	139	0.0166	0.90		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.1	189	Total			



Summary for Reach 1: Wetlands

Inflow Area = 13.520 ac, 12.99% Impervious, Inflow Depth > 1.41" for 100-Year event
Inflow = 13.97 cfs @ 12.16 hrs, Volume= 1.587 af
Outflow = 13.97 cfs @ 12.16 hrs, Volume= 1.587 af, Atten= 0%, Lag= 0.0 min

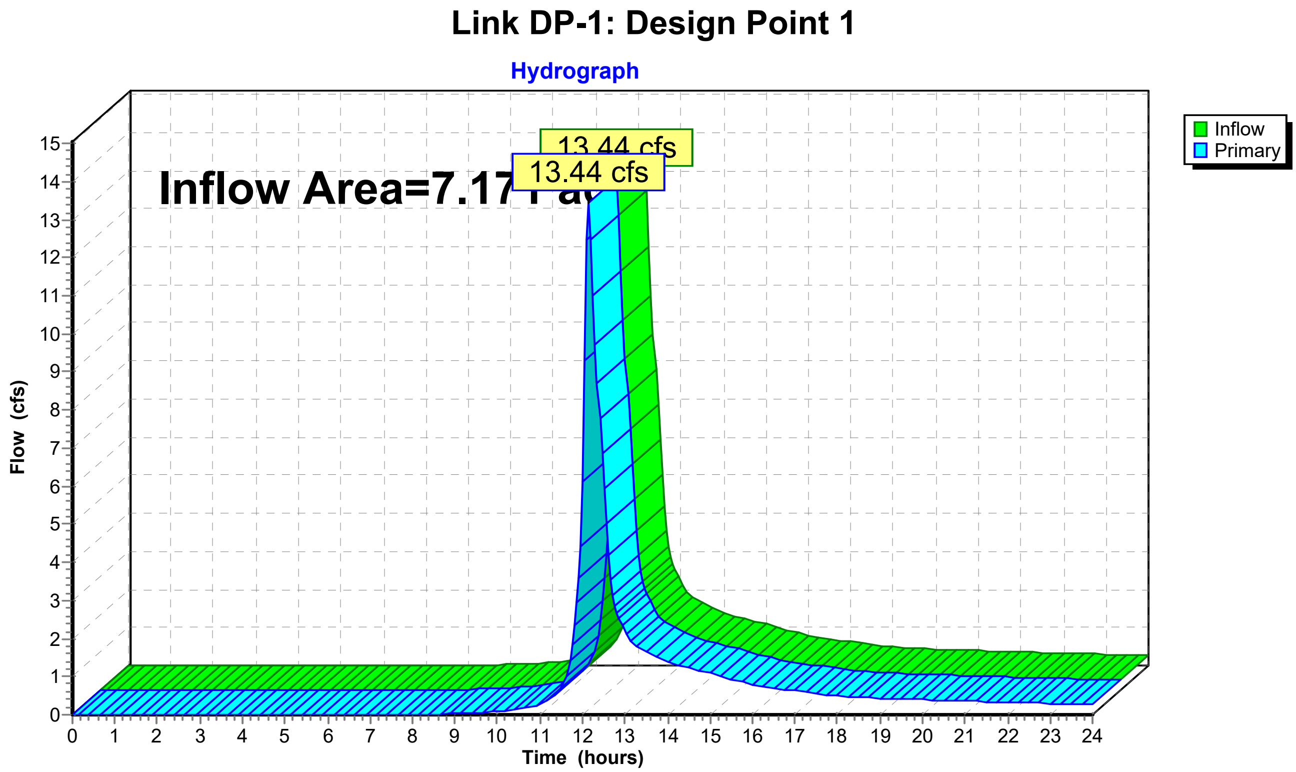
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs



Summary for Link DP-1: Design Point 1

Inflow Area = 7.171 ac, 24.49% Impervious, Inflow Depth > 2.13" for 100-Year event
Inflow = 13.44 cfs @ 12.15 hrs, Volume= 1.273 af
Primary = 13.44 cfs @ 12.15 hrs, Volume= 1.273 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

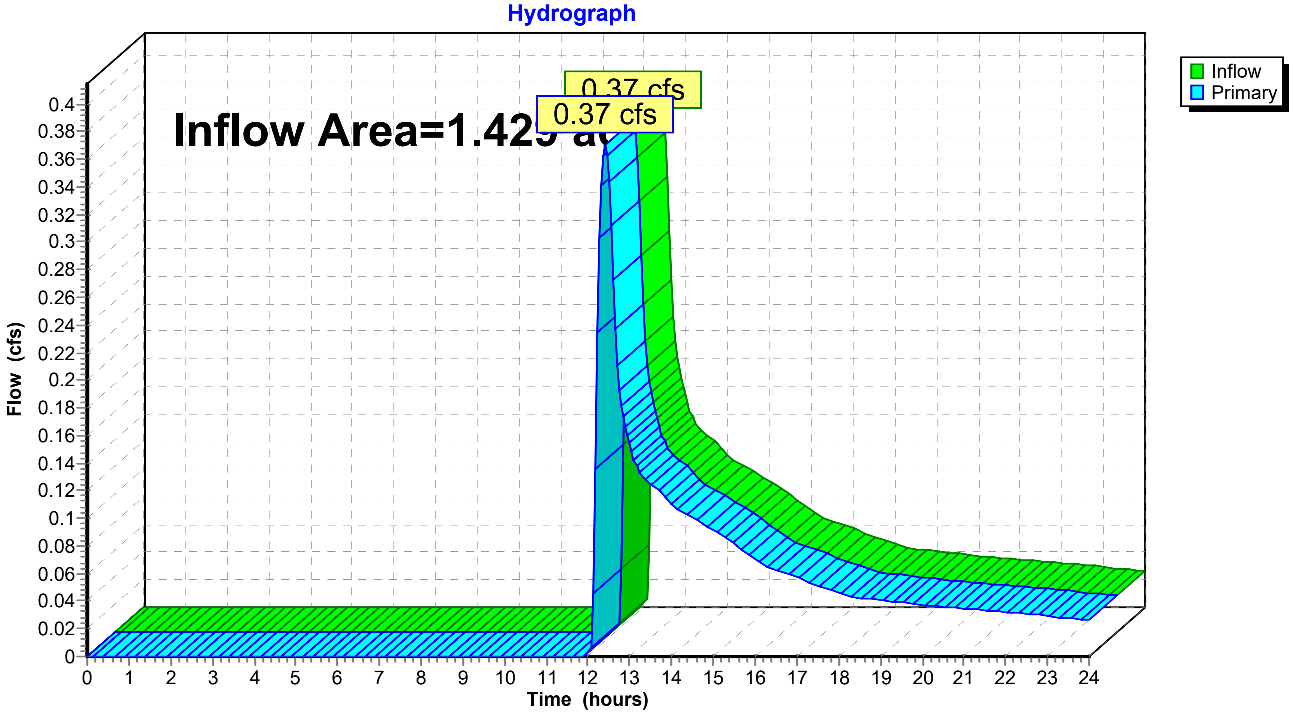


Summary for Link DP-2: Design Point 2

Inflow Area = 1.429 ac, 0.00% Impervious, Inflow Depth > 0.59" for 100-Year event
Inflow = 0.37 cfs @ 12.40 hrs, Volume= 0.071 af
Primary = 0.37 cfs @ 12.40 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-2: Design Point 2

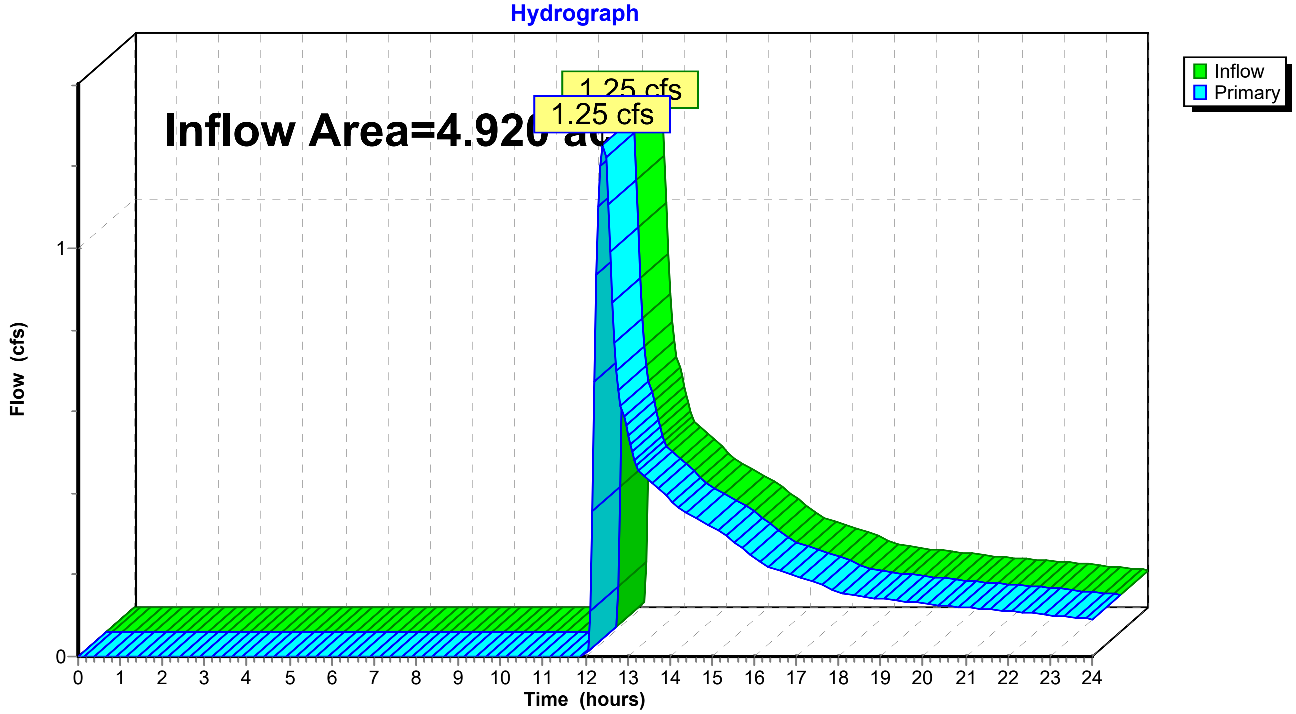


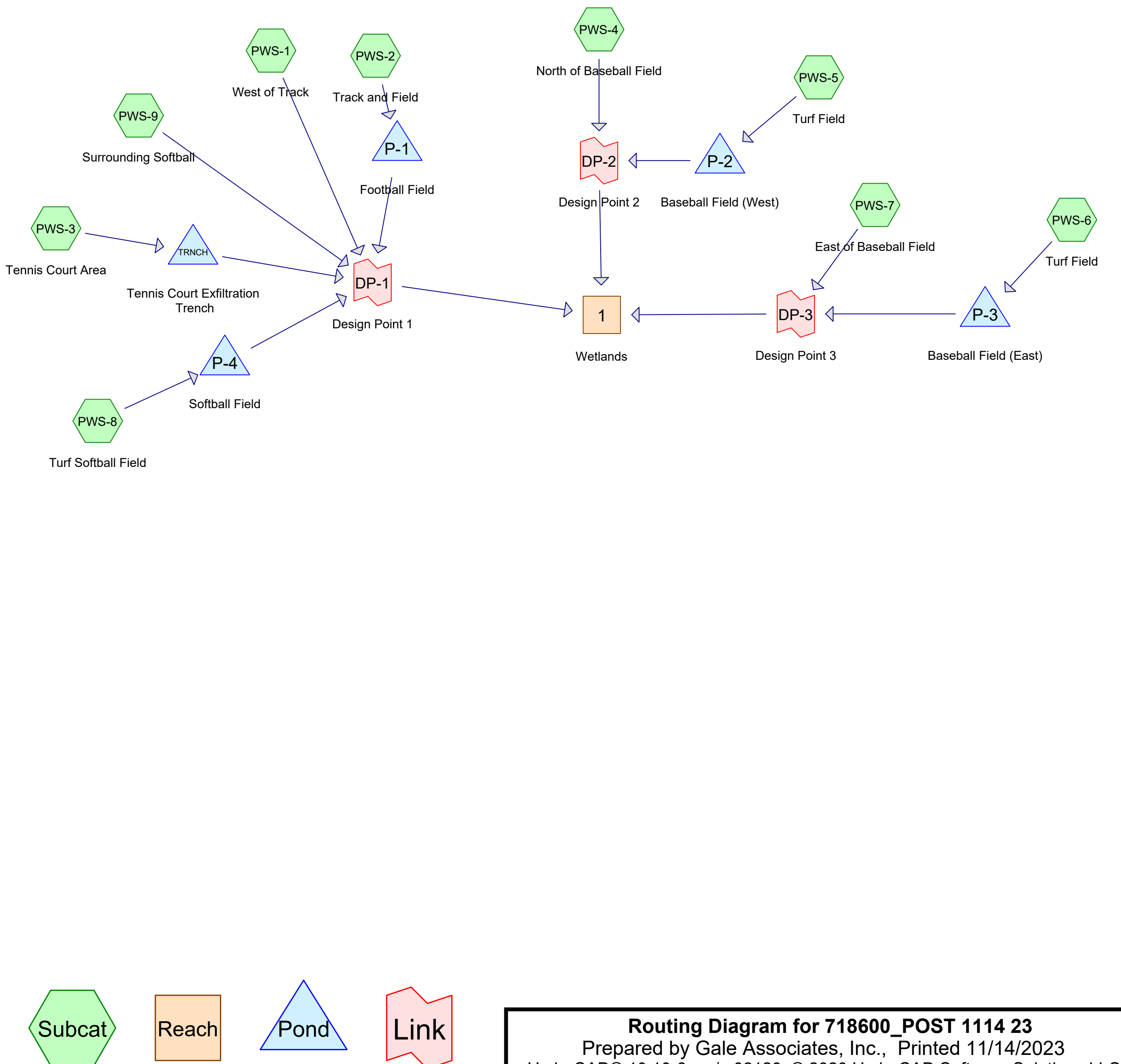
Summary for Link DP-3: Design Point 3

Inflow Area = 4.920 ac, 0.00% Impervious, Inflow Depth > 0.59" for 100-Year event
Inflow = 1.25 cfs @ 12.42 hrs, Volume= 0.244 af
Primary = 1.25 cfs @ 12.42 hrs, Volume= 0.244 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3





Routing Diagram for 718600_POST 1114 23
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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-year	Type III 24-hr		Default	24.00	1	4.50	2
3	100-year	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.643	39	>75% Grass cover, Good, HSG A (PWS-1, PWS-2, PWS-3, PWS-4, PWS-5, PWS-7)
0.322	61	>75% Grass cover, Good, HSG B (PWS-1, PWS-9)
0.050	76	Gravel roads, HSG A (PWS-4)
0.032	85	Gravel roads, HSG B (PWS-9)
0.031	98	Roofs, HSG A (PWS-1)
0.016	98	Roofs, HSG B (PWS-1)
2.731	98	Turf, 0% imp, HSG A (PWS-5, PWS-6)
2.013	98	Turf, 0% imp., HSG A (PWS-2)
0.003	98	Turf, 0% imp., HSG B (PWS-2)
3.123	98	Unconnected pavement, HSG A (PWS-1, PWS-2, PWS-3, PWS-4, PWS-5, PWS-6, PWS-7)
0.443	98	Unconnected pavement, HSG B (PWS-1, PWS-2, PWS-3, PWS-9)
0.029	98	Unconnected roofs, HSG A (PWS-3)
1.078	98	Water Surface, 0% imp, HSG B (PWS-8)
13.512	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
11.619	HSG A	PWS-1, PWS-2, PWS-3, PWS-4, PWS-5, PWS-6, PWS-7
1.894	HSG B	PWS-1, PWS-2, PWS-3, PWS-8, PWS-9
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.512		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
3.643	0.322	0.000	0.000	0.000	3.965	>75% Grass cover, Good	PWS-1, PWS-2, PWS-3, PWS-4, PWS-5, PWS-7, PWS-9
0.050	0.032	0.000	0.000	0.000	0.082	Gravel roads	PWS-4, PWS-9
0.031	0.016	0.000	0.000	0.000	0.047	Roofs	PWS-1
2.731	0.000	0.000	0.000	0.000	2.731	Turf, 0% imp	PWS-5, PWS-6
2.013	0.003	0.000	0.000	0.000	2.016	Turf, 0% imp.	PWS-2
3.123	0.443	0.000	0.000	0.000	3.566	Unconnected pavement	PWS-1, PWS-2, PWS-3, PWS-4, PWS-5, PWS-6, PWS-7, PWS-9
0.029	0.000	0.000	0.000	0.000	0.029	Unconnected roofs	PWS-3
0.000	1.078	0.000	0.000	0.000	1.078	Water Surface, 0% imp	PWS-8
11.619	**1.894**	**0.000**	**0.000**	**0.000**	**13.512**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	P-1	97.20	96.50	139.0	0.0050	0.013	0.0	12.0	0.0
2	P-2	95.70	95.00	140.7	0.0050	0.013	0.0	10.0	0.0
3	P-3	93.44	93.37	14.0	0.0050	0.013	0.0	10.0	0.0
4	P-4	39.07	39.00	10.0	0.0070	0.013	0.0	10.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: West of Track Runoff Area=28,893 sf 58.33% Impervious Runoff Depth>1.22"
Flow Length=137' Tc=10.1 min CN=80 Runoff=0.88 cfs 0.067 af

Subcatchment PWS-2: Track and Field Runoff Area=172,807 sf 48.15% Impervious Runoff Depth>2.59"
Tc=6.0 min CN=97 Runoff=11.46 cfs 0.858 af

Subcatchment PWS-3: Tennis Court Area Runoff Area=60,215 sf 54.57% Impervious Runoff Depth>0.74"
Tc=6.0 min CN=71 Runoff=1.18 cfs 0.085 af

Subcatchment PWS-4: North of Baseball Runoff Area=24,518 sf 27.39% Impervious Runoff Depth>0.10"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.01 cfs 0.005 af

Subcatchment PWS-5: Turf Field Runoff Area=78,477 sf 16.47% Impervious Runoff Depth>2.04"
Tc=6.0 min UI Adjusted CN=91 Runoff=4.41 cfs 0.306 af

Subcatchment PWS-6: Turf Field Runoff Area=62,748 sf 1.88% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=4.23 cfs 0.322 af

Subcatchment PWS-7: East of Baseball Runoff Area=102,388 sf 0.23% Impervious Runoff Depth=0.00"
Flow Length=413' Tc=13.3 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment PWS-8: Turf Softball Field Runoff Area=46,953 sf 0.00% Impervious Runoff Depth>2.68"
Tc=6.0 min CN=98 Runoff=3.17 cfs 0.241 af

Subcatchment PWS-9: Surrounding Runoff Area=11,604 sf 40.06% Impervious Runoff Depth>1.16"
Tc=6.0 min CN=79 Runoff=0.38 cfs 0.026 af

Reach 1: Wetlands Inflow=1.20 cfs 0.098 af
Outflow=1.20 cfs 0.098 af

Pond P-1: Football Field Peak Elev=99.06' Storage=10,292 cf Inflow=11.46 cfs 0.858 af
Discarded=2.07 cfs 0.857 af Primary=0.00 cfs 0.000 af Outflow=2.07 cfs 0.857 af

Pond P-2: Baseball Field (West) Peak Elev=96.62' Storage=2,497 cf Inflow=4.41 cfs 0.306 af
Discarded=1.35 cfs 0.306 af Primary=0.00 cfs 0.000 af Outflow=1.35 cfs 0.306 af

Pond P-3: Baseball Field (East) Peak Elev=96.61' Storage=2,132 cf Inflow=4.23 cfs 0.322 af
Discarded=1.45 cfs 0.322 af Primary=0.00 cfs 0.000 af Outflow=1.45 cfs 0.322 af

Pond P-4: Softball Field Peak Elev=41.48' Storage=1,559 cf Inflow=3.17 cfs 0.241 af
Discarded=1.11 cfs 0.241 af Primary=0.00 cfs 0.000 af Outflow=1.11 cfs 0.241 af

Pond TRNCH: Tennis Court Exfiltration Peak Elev=97.44' Storage=2,646 cf Inflow=1.18 cfs 0.085 af
Discarded=0.05 cfs 0.027 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.027 af

Link DP-1: Design Point 1 Inflow=1.20 cfs 0.093 af
Primary=1.20 cfs 0.093 af

Link DP-2: Design Point 2 Inflow=0.01 cfs 0.005 af
Primary=0.01 cfs 0.005 af

Link DP-3: Design Point 3 Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Total Runoff Area = 13.512 ac Runoff Volume = 1.910 af Average Runoff Depth = 1.70"
73.05% Pervious = 9.871 ac 26.95% Impervious = 3.641 ac

Summary for Subcatchment PWS-1: West of Track

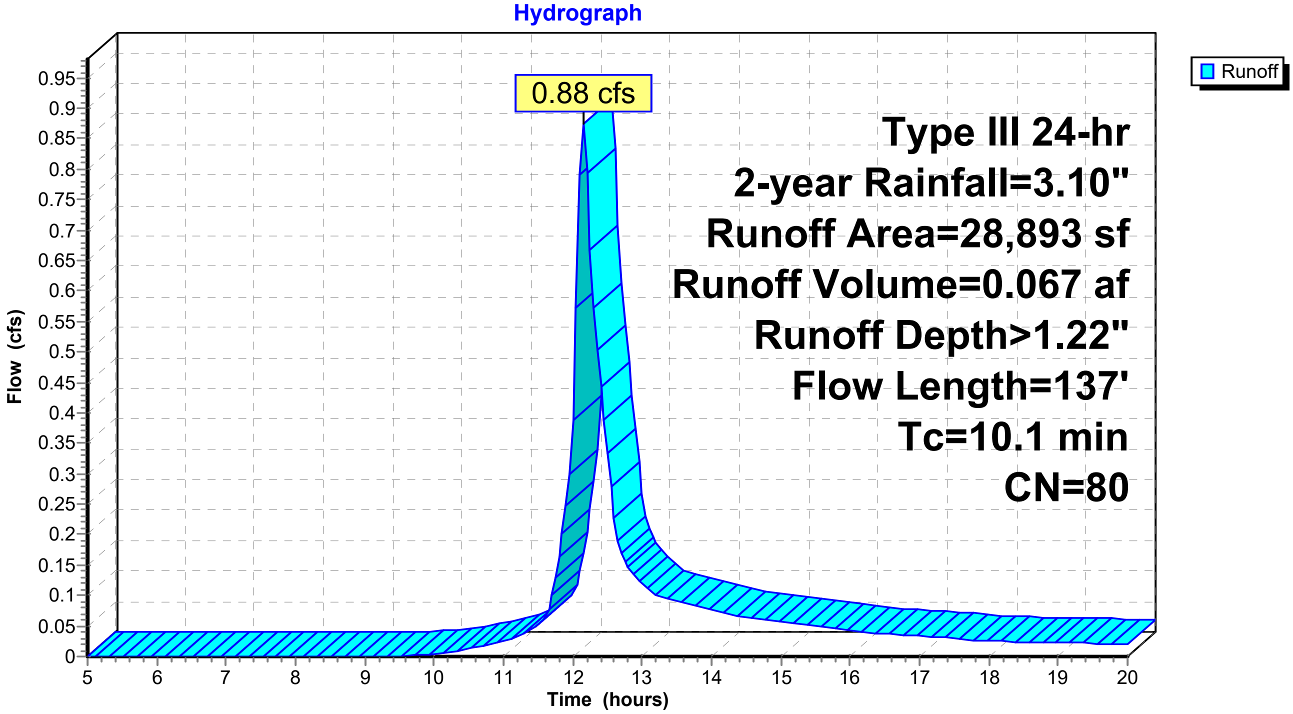
Runoff = 0.88 cfs @ 12.15 hrs, Volume= 0.067 af, Depth> 1.22"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
4,766	98	Unconnected pavement, HSG B
8,437	61	>75% Grass cover, Good, HSG B
711	98	Roofs, HSG B
3,604	39	>75% Grass cover, Good, HSG A
1,335	98	Roofs, HSG A
10,040	98	Unconnected pavement, HSG A
28,893	80	Weighted Average
12,041		41.67% Pervious Area
16,852		58.33% Impervious Area
14,806		87.86% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0140	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.1	21	0.0240	2.49		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.4	66	0.0185	2.76		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
10.1	137	Total			

Subcatchment PWS-1: West of Track



Summary for Subcatchment PWS-2: Track and Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aformentioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

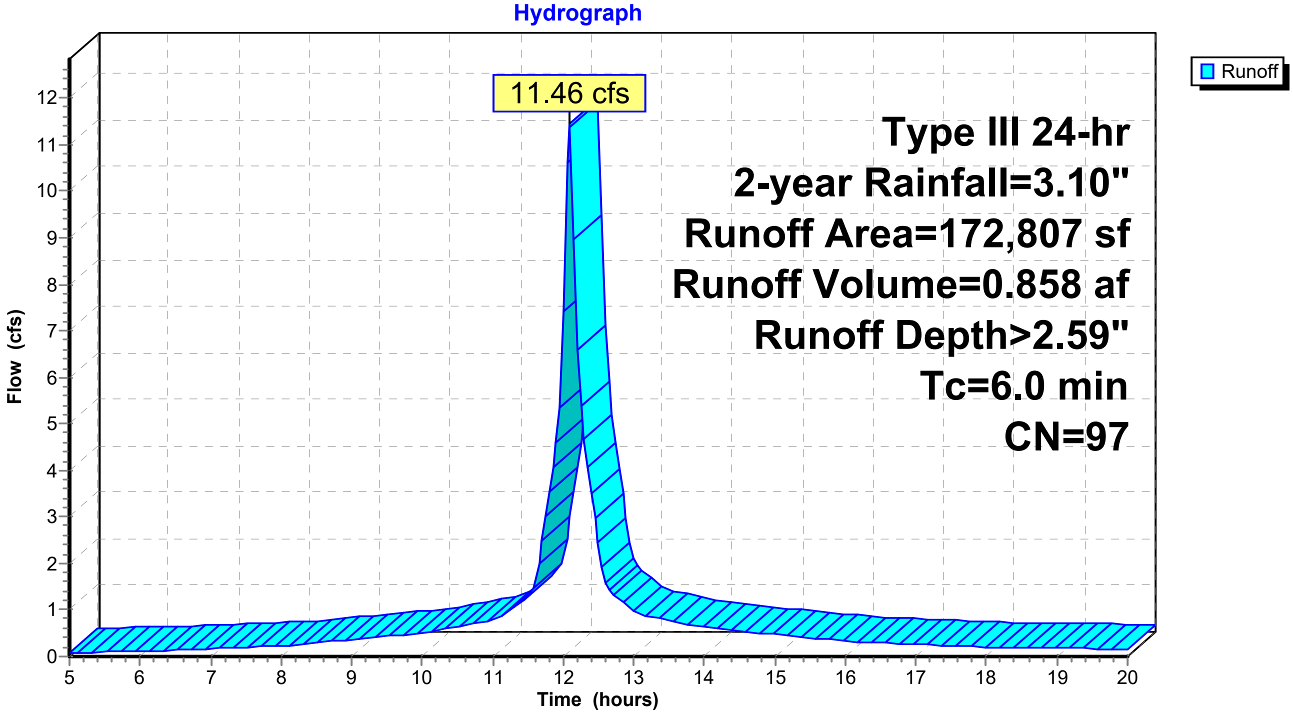
Runoff = 11.46 cfs @ 12.09 hrs, Volume= 0.858 af, Depth> 2.59"
Routed to Pond P-1 : Football Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

	Area (sf)	CN	Description
*	87,675	98	Turf, 0% imp., HSG A
	74,089	98	Unconnected pavement, HSG A
	1,780	39	>75% Grass cover, Good, HSG A
	9,111	98	Unconnected pavement, HSG B
*	152	98	Turf, 0% imp., HSG B
	172,807	97	Weighted Average
	89,607		51.85% Pervious Area
	83,200		48.15% Impervious Area
	83,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-2: Track and Field



Summary for Subcatchment PWS-3: Tennis Court Area

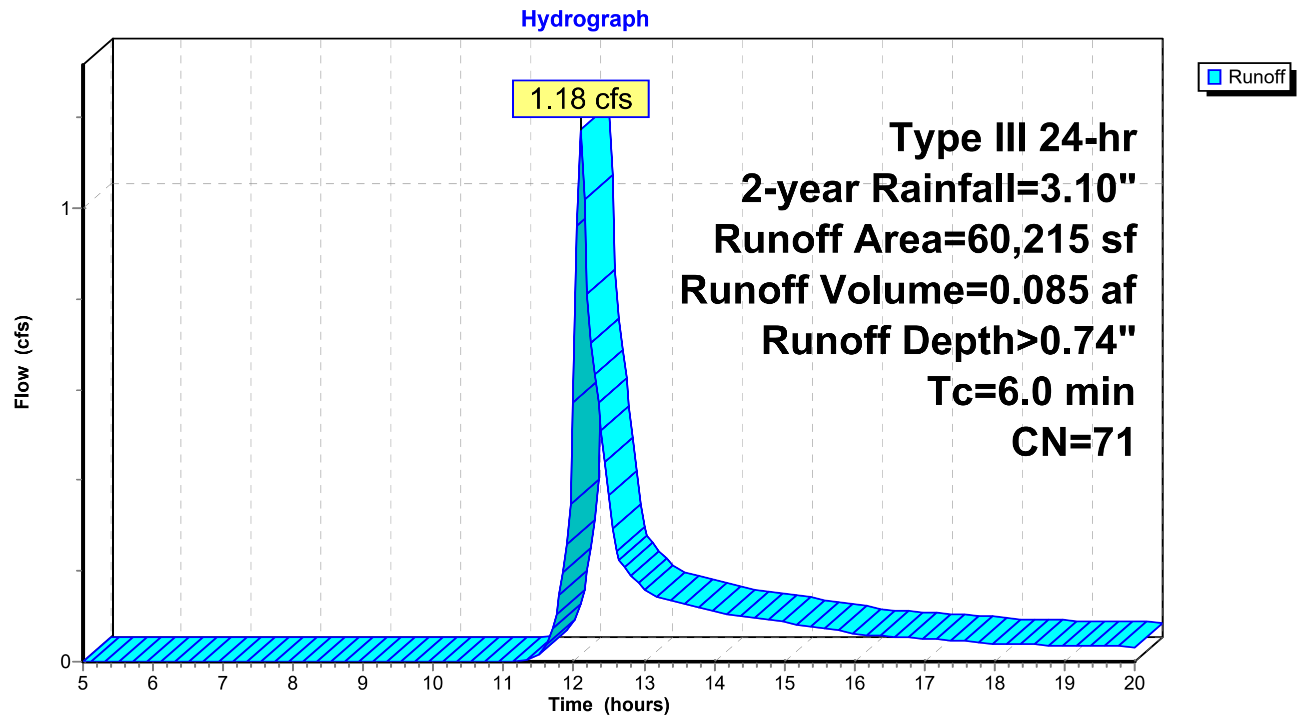
Runoff = 1.18 cfs @ 12.10 hrs, Volume= 0.085 af, Depth> 0.74"
Routed to Pond TRNCH : Tennis Court Exfiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
30,852	98	Unconnected pavement, HSG A
27,355	39	>75% Grass cover, Good, HSG A
1,250	98	Unconnected roofs, HSG A
758	98	Unconnected pavement, HSG B
60,215	71	Weighted Average
27,355		45.43% Pervious Area
32,860		54.57% Impervious Area
32,860		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-3: Tennis Court Area



Summary for Subcatchment PWS-4: North of Baseball Field

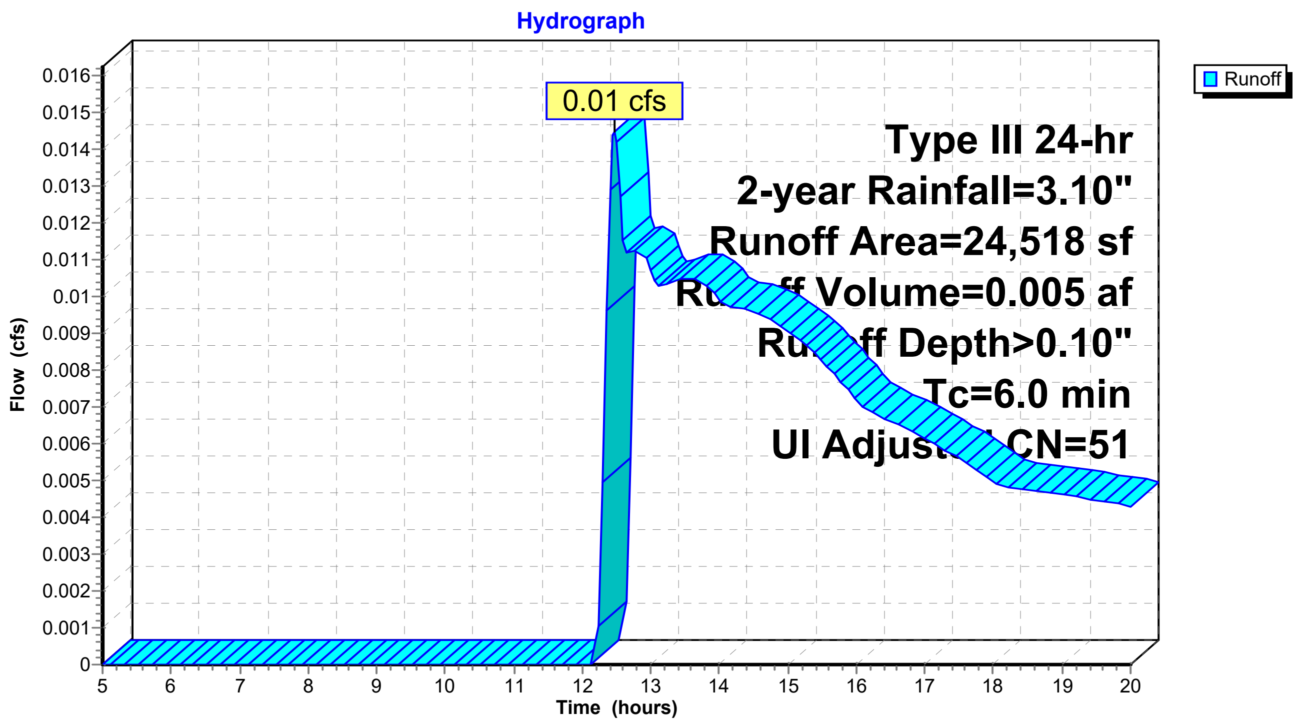
Runoff = 0.01 cfs @ 12.47 hrs, Volume= 0.005 af, Depth> 0.10"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Adj	Description
2,185	76		Gravel roads, HSG A
15,617	39		>75% Grass cover, Good, HSG A
6,716	98		Unconnected pavement, HSG A
24,518	58	51	Weighted Average, UI Adjusted
17,802			72.61% Pervious Area
6,716			27.39% Impervious Area
6,716			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-4: North of Baseball Field



Summary for Subcatchment PWS-5: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aformentioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

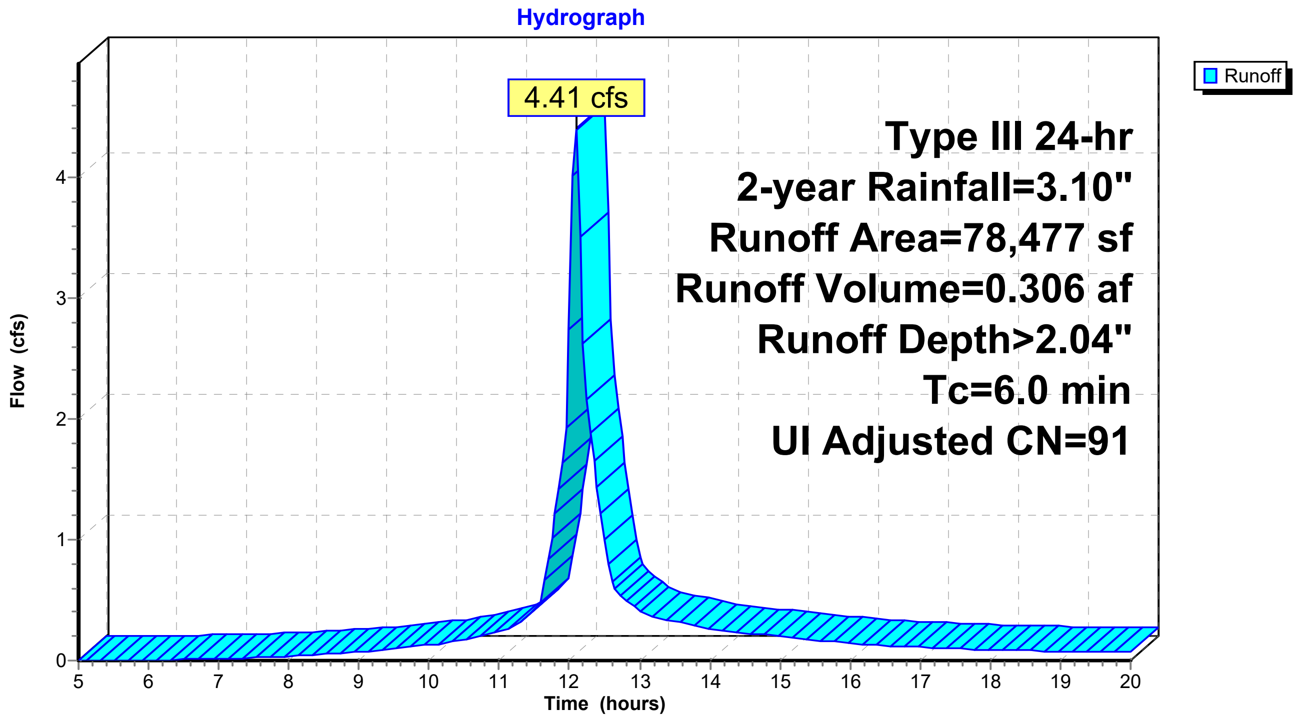
Runoff = 4.41 cfs @ 12.09 hrs, Volume= 0.306 af, Depth> 2.04"
Routed to Pond P-2 : Baseball Field (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

	Area (sf)	CN	Adj	Description
*	57,379	98		Turf, 0% imp, HSG A
	8,176	39		>75% Grass cover, Good, HSG A
	12,922	98		Unconnected pavement, HSG A
	78,477	92	91	Weighted Average, UI Adjusted
	65,555			83.53% Pervious Area
	12,922			16.47% Impervious Area
	12,922			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-5: Turf Field



Summary for Subcatchment PWS-6: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

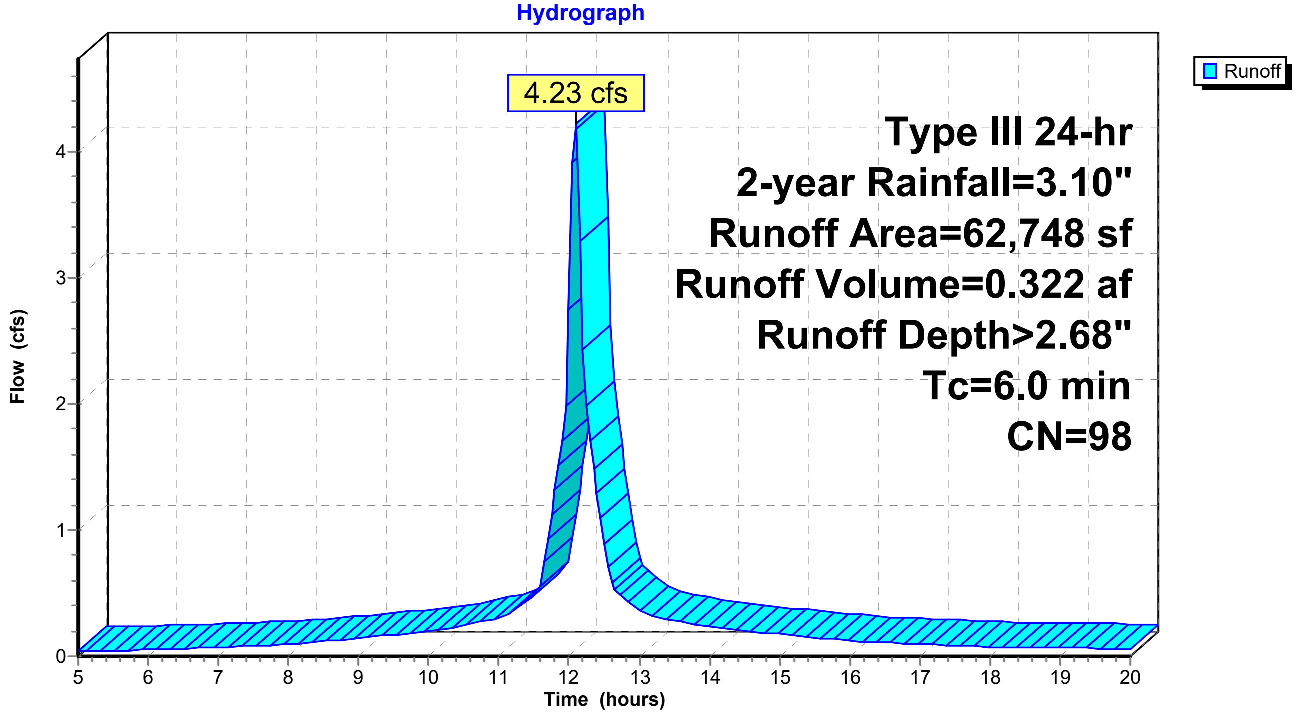
Runoff = 4.23 cfs @ 12.09 hrs, Volume= 0.322 af, Depth> 2.68"
Routed to Pond P-3 : Baseball Field (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

	Area (sf)	CN	Description
*	61,566	98	Turf, 0% imp, HSG A
*	1,182	98	Unconnected pavement, HSG A
	62,748	98	Weighted Average
	61,566		98.12% Pervious Area
	1,182		1.88% Impervious Area
	1,182		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-6: Turf Field



Summary for Subcatchment PWS-7: East of Baseball Field

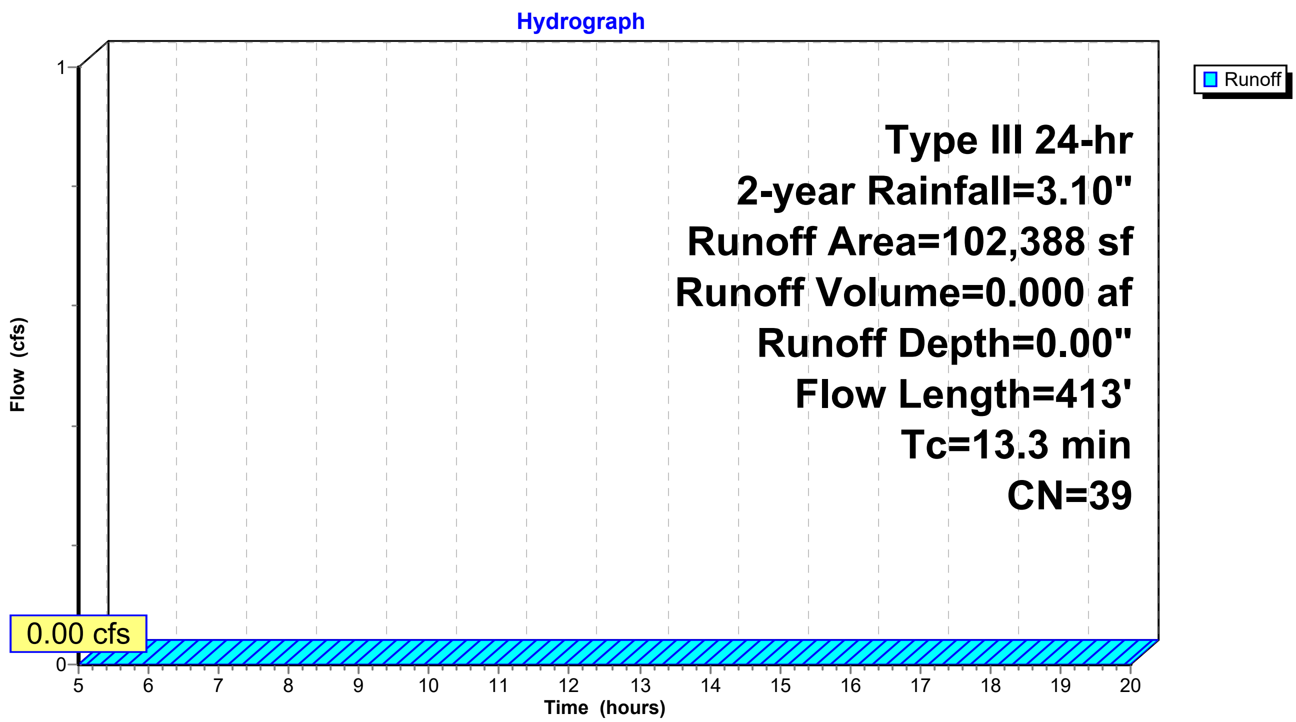
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
102,151	39	>75% Grass cover, Good, HSG A
237	98	Unconnected pavement, HSG A
102,388	39	Weighted Average
102,151		99.77% Pervious Area
237		0.23% Impervious Area
237		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0120	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.9	309	0.0123	1.79		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	54	0.0645	4.09		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.3	413	Total			

Subcatchment PWS-7: East of Baseball Field



Summary for Subcatchment PWS-8: Turf Softball Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

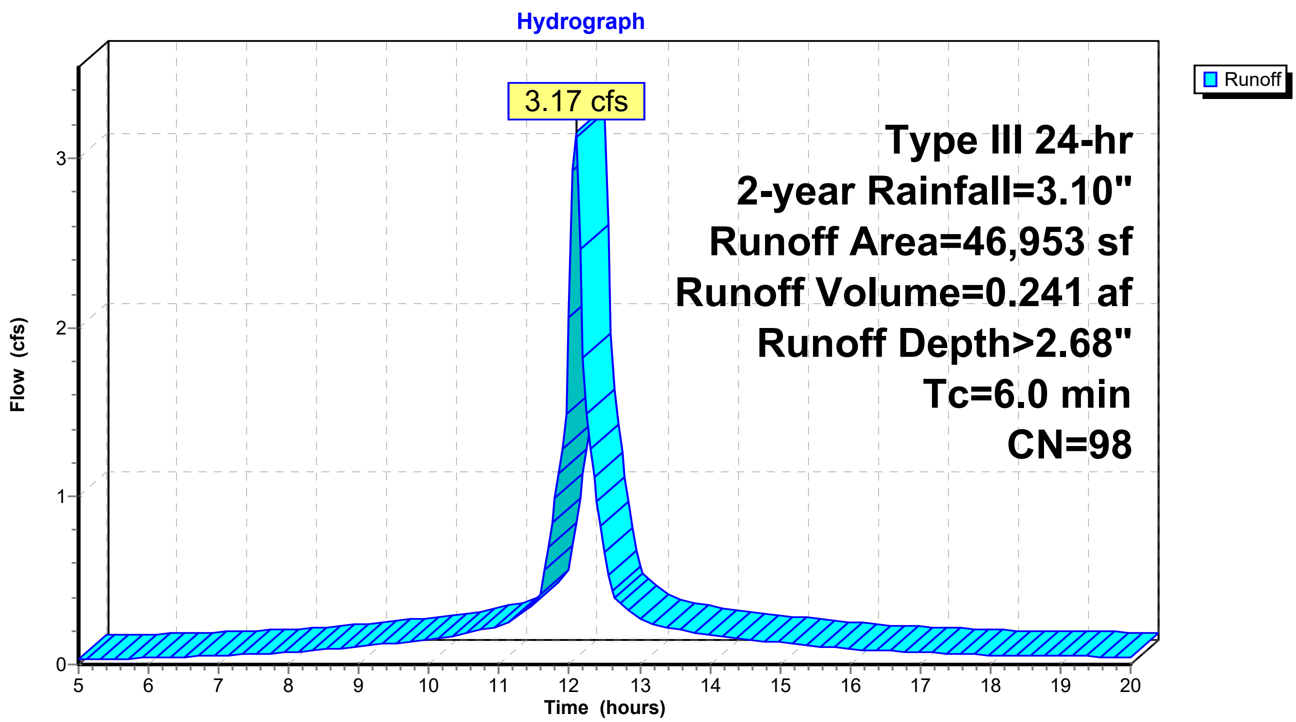
Runoff = 3.17 cfs @ 12.09 hrs, Volume= 0.241 af, Depth> 2.68"
Routed to Pond P-4 : Softball Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
46,953	98	Water Surface, 0% imp, HSG B
46,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-8: Turf Softball Field



Summary for Subcatchment PWS-9: Surrounding Softball

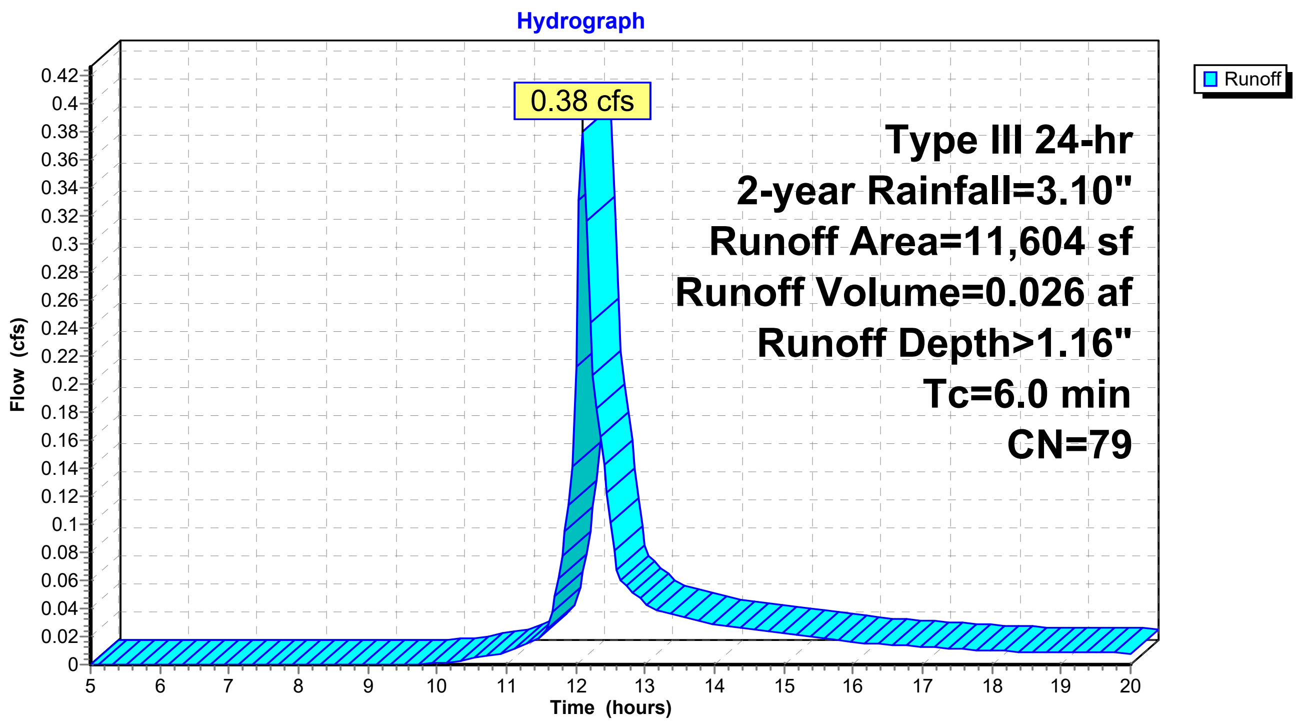
Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.026 af, Depth> 1.16"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.10"

Area (sf)	CN	Description
4,648	98	Unconnected pavement, HSG B
1,376	85	Gravel roads, HSG B
5,580	61	>75% Grass cover, Good, HSG B
11,604	79	Weighted Average
6,956		59.94% Pervious Area
4,648		40.06% Impervious Area
4,648		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

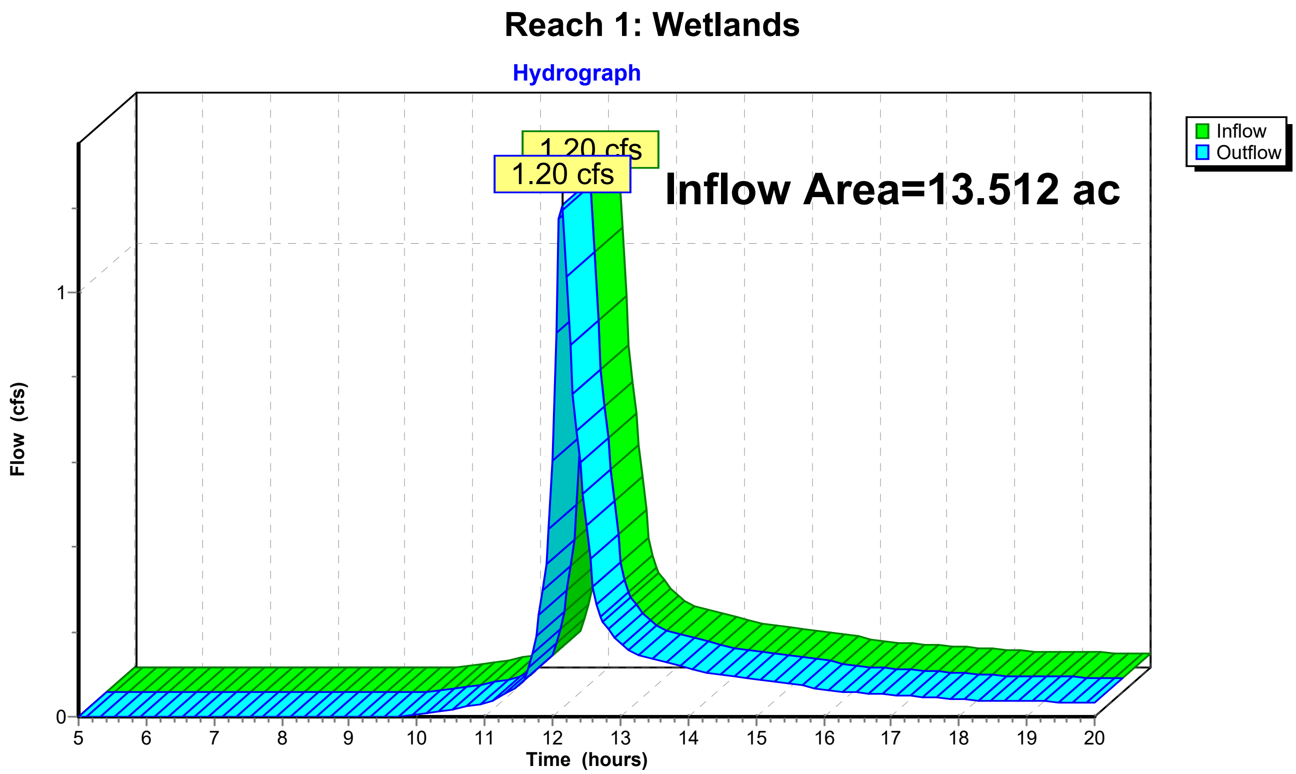
Subcatchment PWS-9: Surrounding Softball



Summary for Reach 1: Wetlands

Inflow Area = 13.512 ac, 26.95% Impervious, Inflow Depth > 0.09" for 2-year event
Inflow = 1.20 cfs @ 12.13 hrs, Volume= 0.098 af
Outflow = 1.20 cfs @ 12.13 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Pond P-1: Football Field

Inflow Area = 3.967 ac, 48.15% Impervious, Inflow Depth > 2.59" for 2-year event
Inflow = 11.46 cfs @ 12.09 hrs, Volume= 0.858 af
Outflow = 2.07 cfs @ 11.70 hrs, Volume= 0.857 af, Atten= 82%, Lag= 0.0 min
Discarded = 2.07 cfs @ 11.70 hrs, Volume= 0.857 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.06' @ 12.54 hrs Surf.Area= 87,827 sf Storage= 10,292 cf

Plug-Flow detention time= 29.6 min calculated for 0.854 af (100% of inflow)
Center-of-Mass det. time= 29.1 min (773.2 - 744.1)

Volume	Invert	Avail.Storage	Storage Description
#1	98.77'	29,159 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 72,896 cf Overall x 40.0% Voids

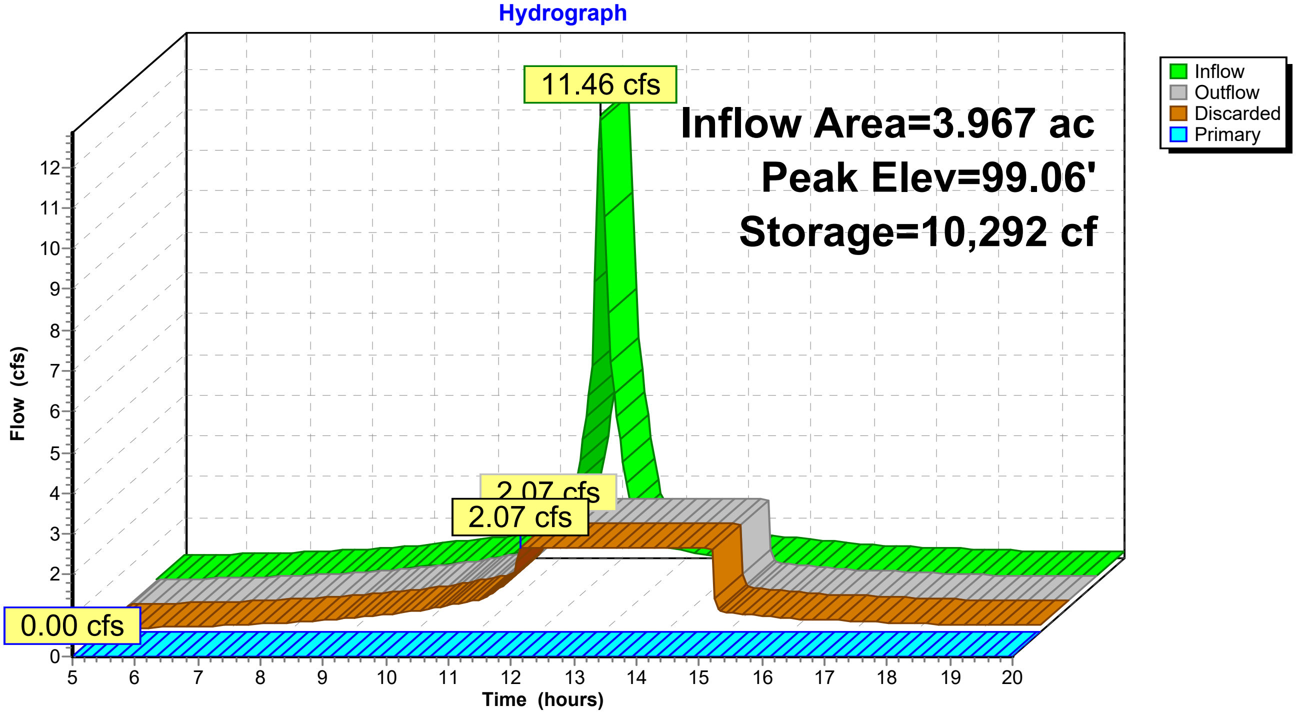
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.77	87,827	0	0
99.60	87,827	72,896	72,896

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.77'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.20'	**12.0" Round Culvert** L= 139.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.20' / 96.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.18'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=2.07 cfs @ 11.70 hrs HW=98.78' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.07 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=98.77' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 2.93 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-1: Football Field



Summary for Pond P-2: Baseball Field (West)

Inflow Area = 1.802 ac, 16.47% Impervious, Inflow Depth > 2.04" for 2-year event
Inflow = 4.41 cfs @ 12.09 hrs, Volume= 0.306 af
Outflow = 1.35 cfs @ 11.90 hrs, Volume= 0.306 af, Atten= 69%, Lag= 0.0 min
Discarded = 1.35 cfs @ 11.90 hrs, Volume= 0.306 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.62' @ 12.42 hrs Surf.Area= 57,379 sf Storage= 2,497 cf

Plug-Flow detention time= 10.2 min calculated for 0.305 af (100% of inflow)
Center-of-Mass det. time= 10.0 min (781.8 - 771.8)

Volume	Invert	Avail.Storage	Storage Description
#1	96.51'	15,378 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 38,444 cf Overall x 40.0% Voids

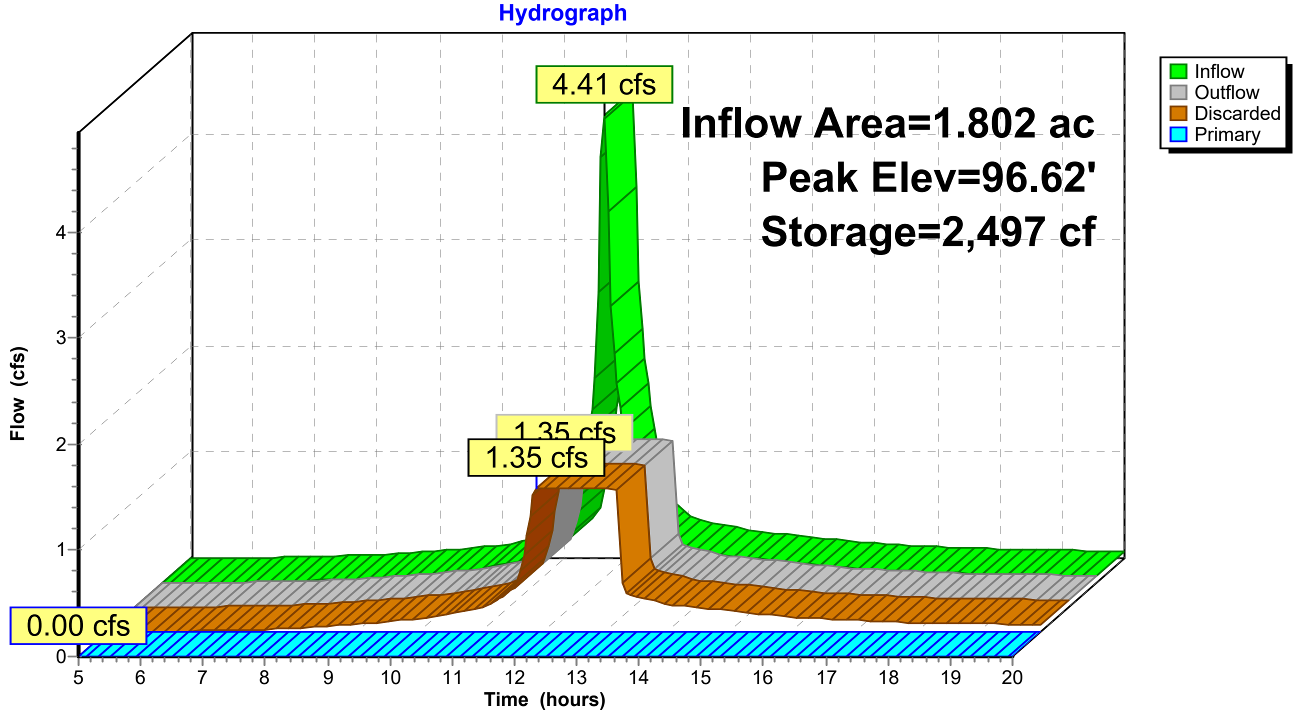
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.51	57,379	0	0
97.18	57,379	38,444	38,444

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.51'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	95.70'	**10.0" Round Culvert** L= 140.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.70' / 95.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.84'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.35 cfs @ 11.90 hrs HW=96.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=96.51' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 1.33 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-2: Baseball Field (West)



Summary for Pond P-3: Baseball Field (East)

Inflow Area = 1.440 ac, 1.88% Impervious, Inflow Depth > 2.68" for 2-year event
Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.322 af
Outflow = 1.45 cfs @ 11.90 hrs, Volume= 0.322 af, Atten= 66%, Lag= 0.0 min
Discarded = 1.45 cfs @ 11.90 hrs, Volume= 0.322 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-3 : Design Point 3

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.61' @ 12.36 hrs Surf.Area= 61,566 sf Storage= 2,132 cf

Plug-Flow detention time= 7.6 min calculated for 0.321 af (100% of inflow)
Center-of-Mass det. time= 7.3 min (746.2 - 738.9)

Volume	Invert	Avail.Storage	Storage Description
#1	96.52'	16,500 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 41,249 cf Overall x 40.0% Voids

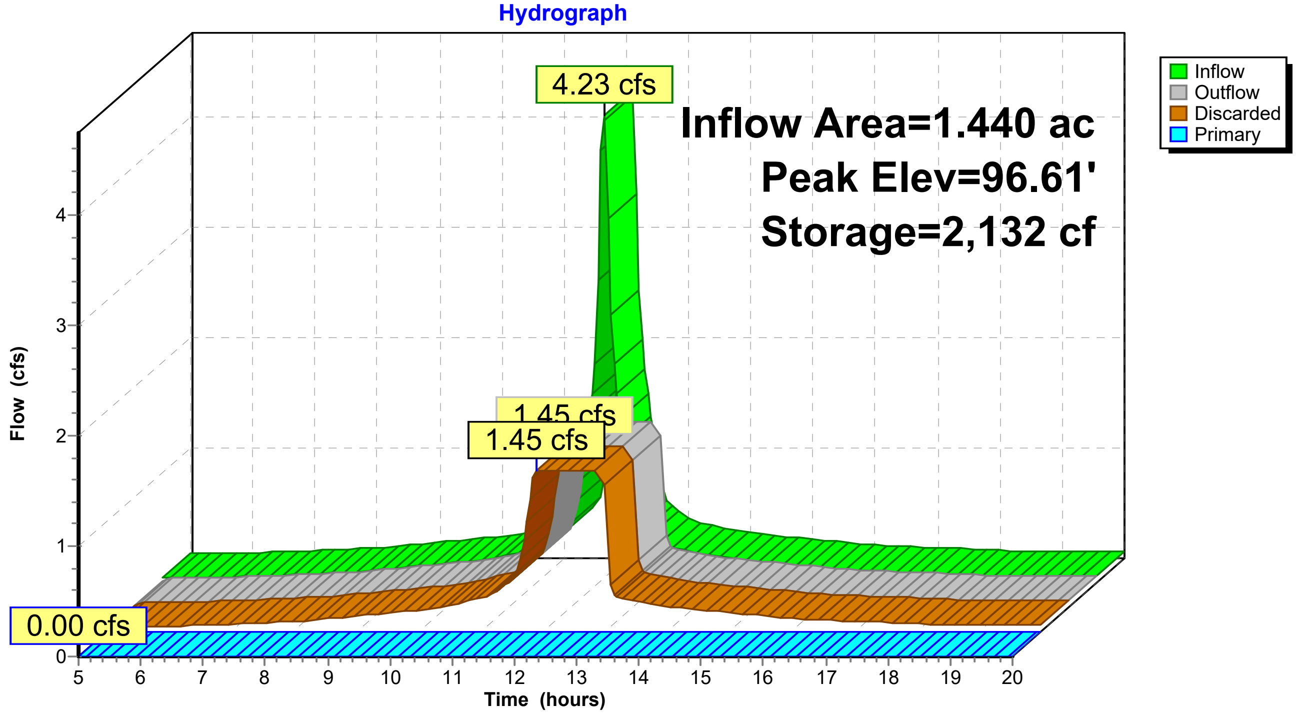
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.52	61,566	0	0
97.19	61,566	41,249	41,249

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.52'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	93.44'	**10.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.44' / 93.37' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.85'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.45 cfs @ 11.90 hrs HW=96.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.45 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=96.52' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 4.29 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-3: Baseball Field (East)



Summary for Pond P-4: Softball Field

Inflow Area = 1.078 ac, 0.00% Impervious, Inflow Depth > 2.68" for 2-year event
Inflow = 3.17 cfs @ 12.09 hrs, Volume= 0.241 af
Outflow = 1.11 cfs @ 11.90 hrs, Volume= 0.241 af, Atten= 65%, Lag= 0.0 min
Discarded = 1.11 cfs @ 11.90 hrs, Volume= 0.241 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 41.48' @ 12.35 hrs Surf.Area= 46,953 sf Storage= 1,559 cf

Plug-Flow detention time= 7.3 min calculated for 0.241 af (100% of inflow)
Center-of-Mass det. time= 7.0 min (745.9 - 738.9)

Volume	Invert	Avail.Storage	Storage Description
#1	41.40'	12,583 cf	**Custom Stage Data (Irregular)**Listed below (Recalc) 31,459 cf Overall x 40.0% Voids

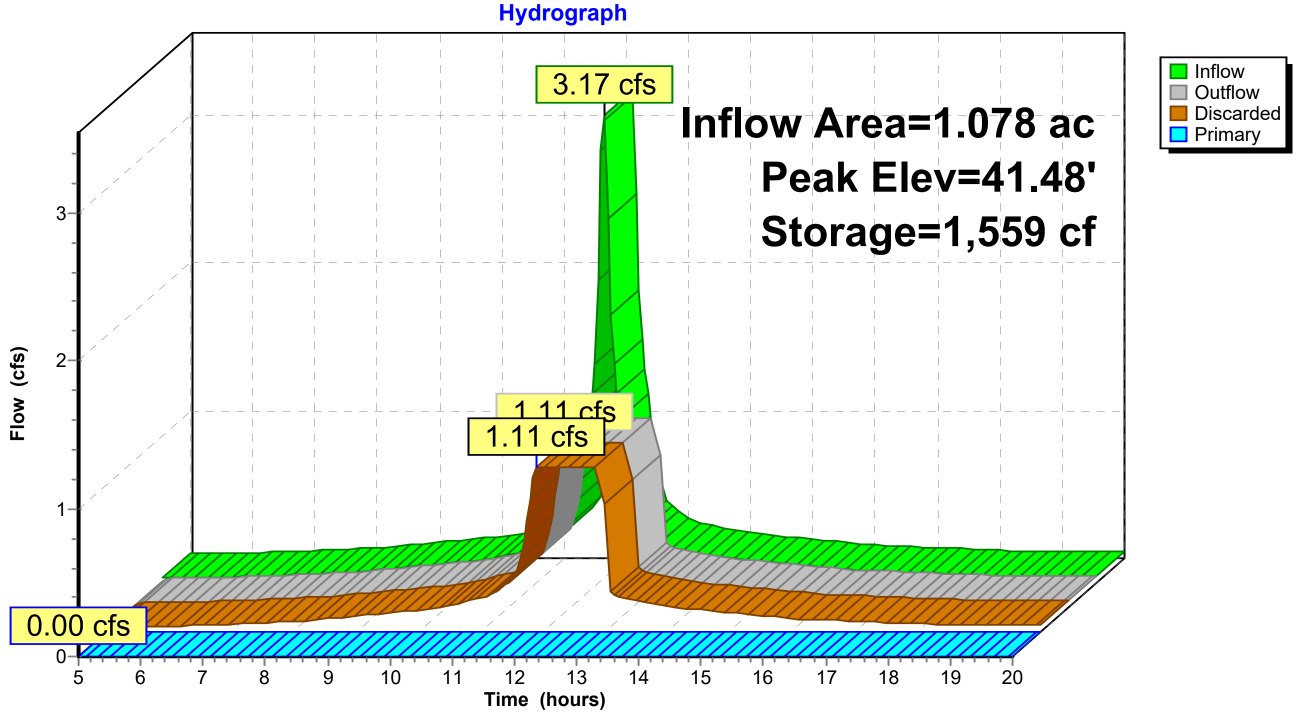
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.40	46,953	836.0	0	0	46,953
42.07	46,953	836.0	31,459	31,459	47,513

Device	Routing	Invert	Outlet Devices
#1	Discarded	41.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	39.07'	**10.0" Round 12" RCP Outlet** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.07' / 39.00' S= 0.0070 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.55 sf
#3	Device 2	41.73'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.11 cfs @ 11.90 hrs HW=41.41' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.11 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=41.40' (Free Discharge)
└─**2=12" RCP Outlet** (Passes 0.00 cfs of 2.87 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-4: Softball Field



Summary for Pond TRNCH: Tennis Court Exfiltration Trench

Inflow Area = 1.382 ac, 54.57% Impervious, Inflow Depth > 0.74" for 2-year event
Inflow = 1.18 cfs @ 12.10 hrs, Volume= 0.085 af
Outflow = 0.05 cfs @ 17.00 hrs, Volume= 0.027 af, Atten= 96%, Lag= 293.9 min
Discarded = 0.05 cfs @ 17.00 hrs, Volume= 0.027 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 97.44' @ 17.00 hrs Surf.Area= 2,155 sf Storage= 2,646 cf

Plug-Flow detention time= 265.8 min calculated for 0.027 af (31% of inflow)
Center-of-Mass det. time= 163.0 min (990.5 - 827.5)

Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	600 cf	**Drywell Storage (Prismatic)**Listed below (Recalc) x 2
#2	91.00'	1,752 cf	**Exfiltration stone Layer (Prismatic)**Listed below (Recalc) 4,380 cf Overall x 40.0% Voids
#3	97.00'	377 cf	**Freeboard above basins (Prismatic)**Listed below (Recalc)
		2,729 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	50	0	0
97.00	50	300	300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	730	0	0
97.00	730	4,380	4,380

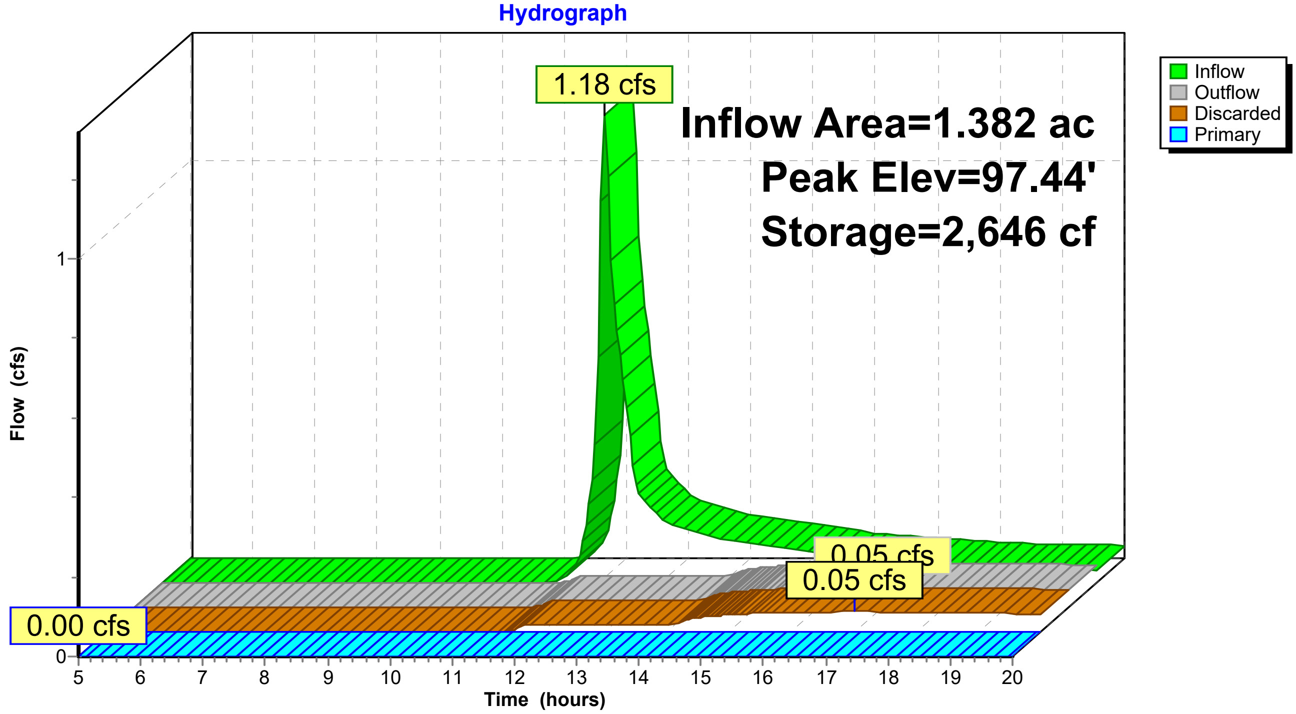
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	6	0	0
97.50	1,500	377	377

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**150.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.05 cfs @ 17.00 hrs HW=97.44' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=91.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

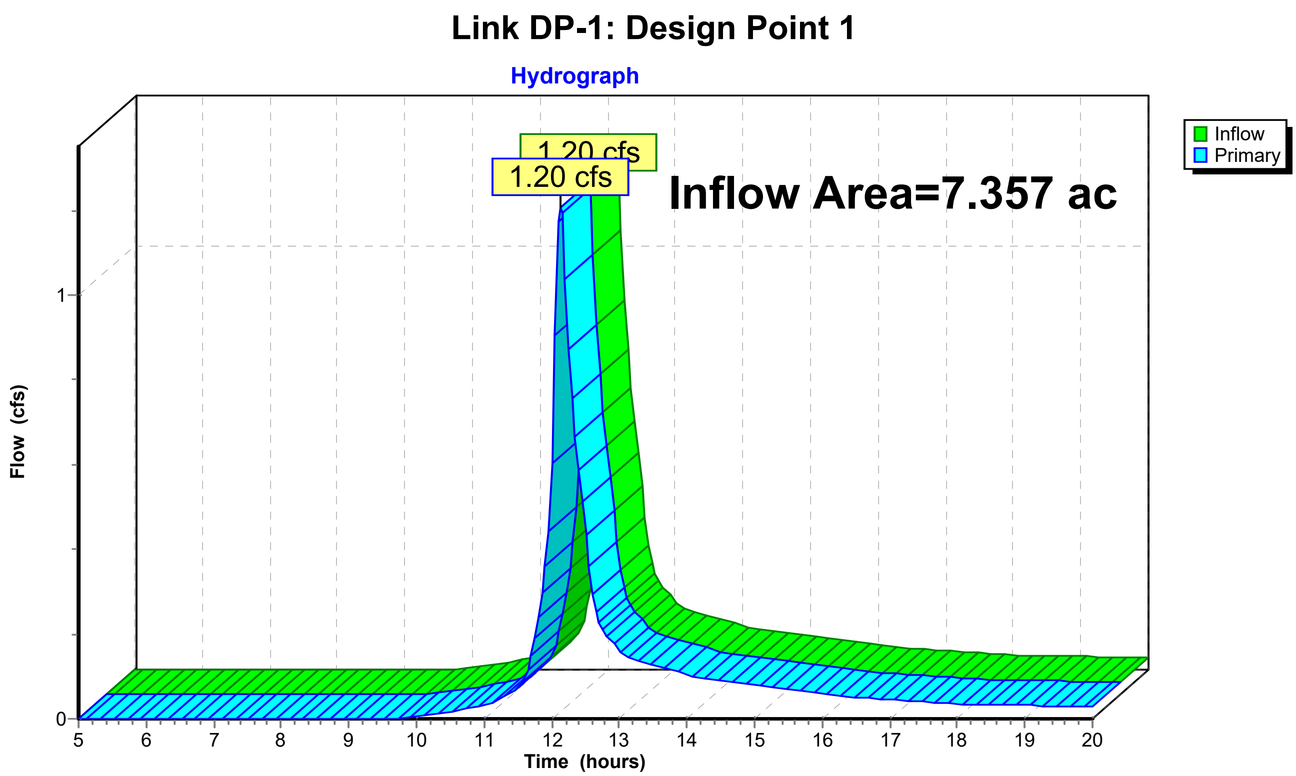
Pond TRNCH: Tennis Court Exfiltration Trench



Summary for Link DP-1: Design Point 1

Inflow Area = 7.357 ac, 42.92% Impervious, Inflow Depth > 0.15" for 2-year event
Inflow = 1.20 cfs @ 12.13 hrs, Volume= 0.093 af
Primary = 1.20 cfs @ 12.13 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

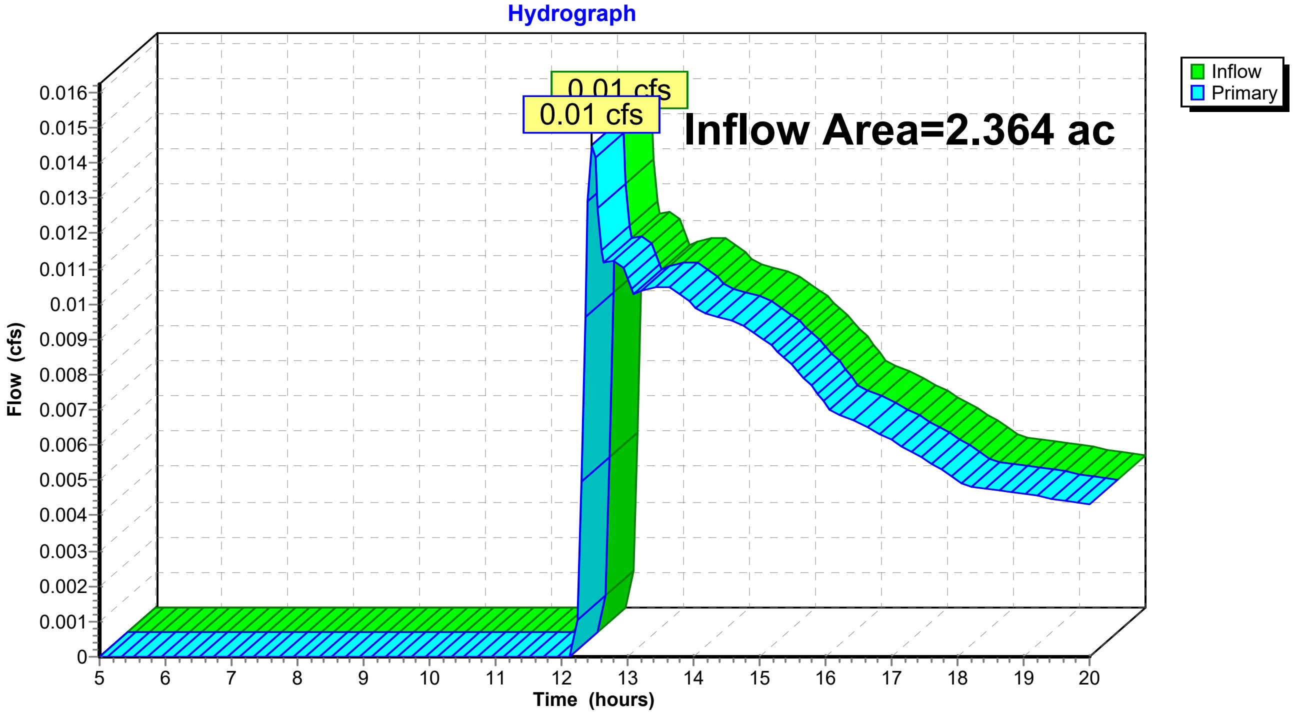


Summary for Link DP-2: Design Point 2

Inflow Area = 2.364 ac, 19.07% Impervious, Inflow Depth > 0.02" for 2-year event
Inflow = 0.01 cfs @ 12.47 hrs, Volume= 0.005 af
Primary = 0.01 cfs @ 12.47 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP-2: Design Point 2

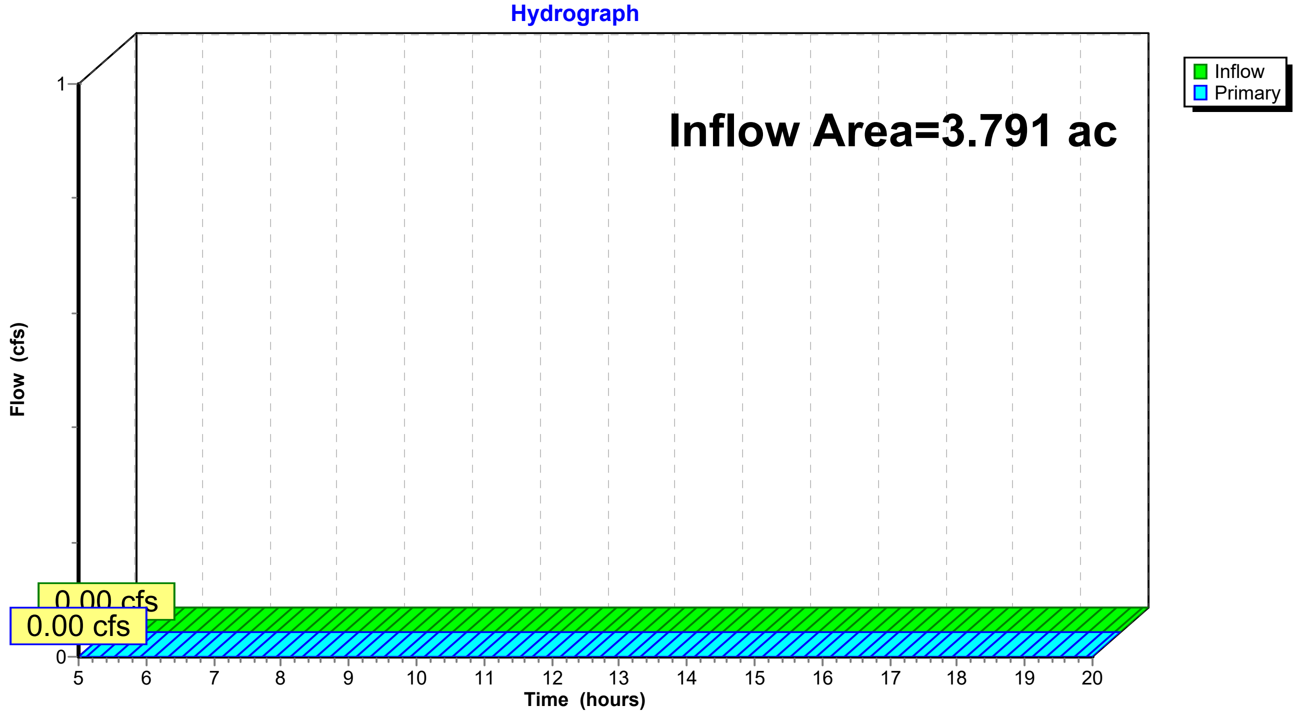


Summary for Link DP-3: Design Point 3

Inflow Area = 3.791 ac, 0.86% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: West of Track Runoff Area=28,893 sf 58.33% Impervious Runoff Depth>2.29"
Flow Length=137' Tc=10.1 min CN=80 Runoff=1.65 cfs 0.127 af

Subcatchment PWS-2: Track and Field Runoff Area=172,807 sf 48.15% Impervious Runoff Depth>3.88"
Tc=6.0 min CN=97 Runoff=16.89 cfs 1.284 af

Subcatchment PWS-3: Tennis Court Area Runoff Area=60,215 sf 54.57% Impervious Runoff Depth>1.60"
Tc=6.0 min CN=71 Runoff=2.72 cfs 0.185 af

Subcatchment PWS-4: North of Baseball Runoff Area=24,518 sf 27.39% Impervious Runoff Depth>0.47"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.19 cfs 0.022 af

Subcatchment PWS-5: Turf Field Runoff Area=78,477 sf 16.47% Impervious Runoff Depth>3.31"
Tc=6.0 min UI Adjusted CN=91 Runoff=6.96 cfs 0.496 af

Subcatchment PWS-6: Turf Field Runoff Area=62,748 sf 1.88% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=6.18 cfs 0.476 af

Subcatchment PWS-7: East of Baseball Runoff Area=102,388 sf 0.23% Impervious Runoff Depth>0.08"
Flow Length=413' Tc=13.3 min CN=39 Runoff=0.03 cfs 0.016 af

Subcatchment PWS-8: Turf Softball Field Runoff Area=46,953 sf 0.00% Impervious Runoff Depth>3.96"
Tc=6.0 min CN=98 Runoff=4.63 cfs 0.356 af

Subcatchment PWS-9: Surrounding Runoff Area=11,604 sf 40.06% Impervious Runoff Depth>2.21"
Tc=6.0 min CN=79 Runoff=0.73 cfs 0.049 af

Reach 1: Wetlands Inflow=4.13 cfs 0.322 af
Outflow=4.13 cfs 0.322 af

Pond P-1: Football Field Peak Elev=99.29' Storage=18,173 cf Inflow=16.89 cfs 1.284 af
Discarded=2.07 cfs 1.258 af Primary=0.36 cfs 0.024 af Outflow=2.43 cfs 1.283 af

Pond P-2: Baseball Field (West) Peak Elev=96.77' Storage=5,883 cf Inflow=6.96 cfs 0.496 af
Discarded=1.35 cfs 0.496 af Primary=0.00 cfs 0.000 af Outflow=1.35 cfs 0.496 af

Pond P-3: Baseball Field (East) Peak Elev=96.71' Storage=4,595 cf Inflow=6.18 cfs 0.476 af
Discarded=1.45 cfs 0.475 af Primary=0.00 cfs 0.000 af Outflow=1.45 cfs 0.475 af

Pond P-4: Softball Field Peak Elev=41.58' Storage=3,382 cf Inflow=4.63 cfs 0.356 af
Discarded=1.11 cfs 0.356 af Primary=0.00 cfs 0.000 af Outflow=1.11 cfs 0.356 af

Pond TRNCH: Tennis Court Exfiltration Peak Elev=97.53' Storage=2,729 cf Inflow=2.72 cfs 0.185 af
Discarded=0.06 cfs 0.038 af Primary=2.36 cfs 0.084 af Outflow=2.41 cfs 0.122 af

Link DP-1: Design Point 1 Inflow=3.97 cfs 0.284 af
Primary=3.97 cfs 0.284 af

Link DP-2: Design Point 2 Inflow=0.19 cfs 0.022 af
Primary=0.19 cfs 0.022 af

Link DP-3: Design Point 3 Inflow=0.03 cfs 0.016 af
Primary=0.03 cfs 0.016 af

Total Runoff Area = 13.512 ac Runoff Volume = 3.010 af Average Runoff Depth = 2.67"
73.05% Pervious = 9.871 ac 26.95% Impervious = 3.641 ac

Summary for Subcatchment PWS-1: West of Track

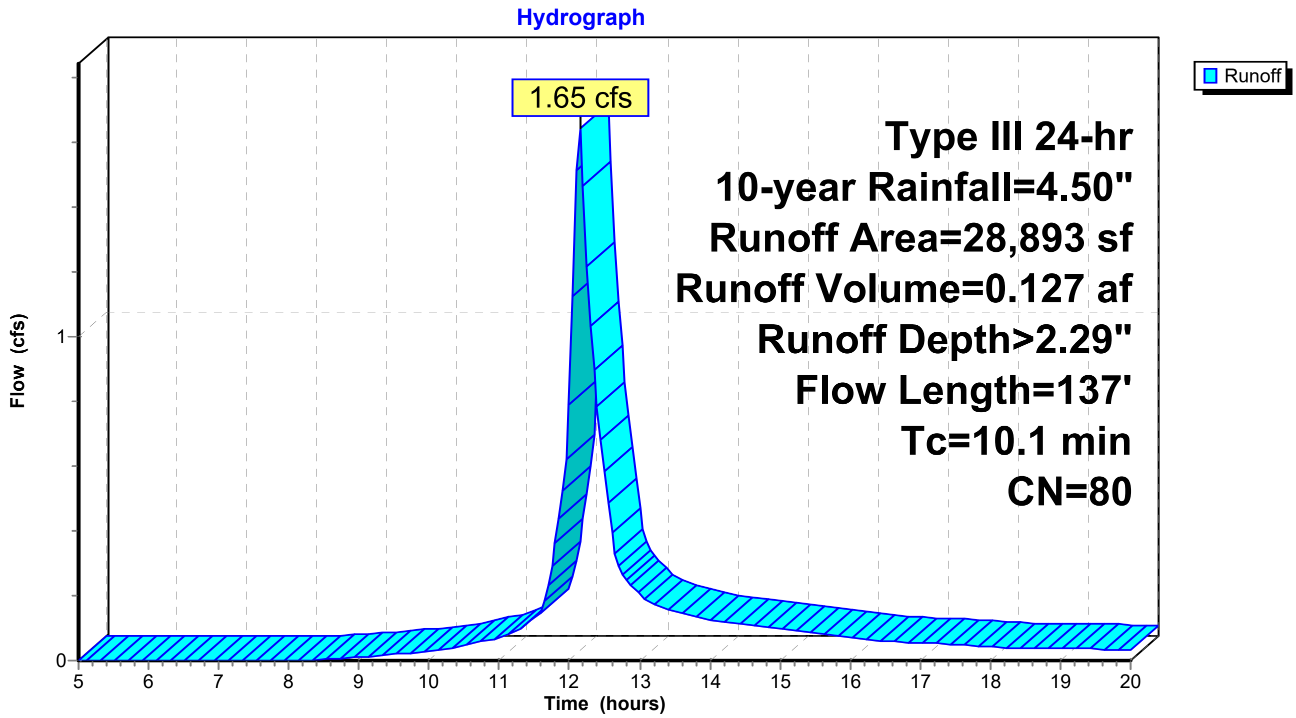
Runoff = 1.65 cfs @ 12.15 hrs, Volume= 0.127 af, Depth> 2.29"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Description
4,766	98	Unconnected pavement, HSG B
8,437	61	>75% Grass cover, Good, HSG B
711	98	Roofs, HSG B
3,604	39	>75% Grass cover, Good, HSG A
1,335	98	Roofs, HSG A
10,040	98	Unconnected pavement, HSG A
28,893	80	Weighted Average
12,041		41.67% Pervious Area
16,852		58.33% Impervious Area
14,806		87.86% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0140	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.1	21	0.0240	2.49		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.4	66	0.0185	2.76		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
10.1	137	Total			

Subcatchment PWS-1: West of Track



Summary for Subcatchment PWS-2: Track and Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aformentioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

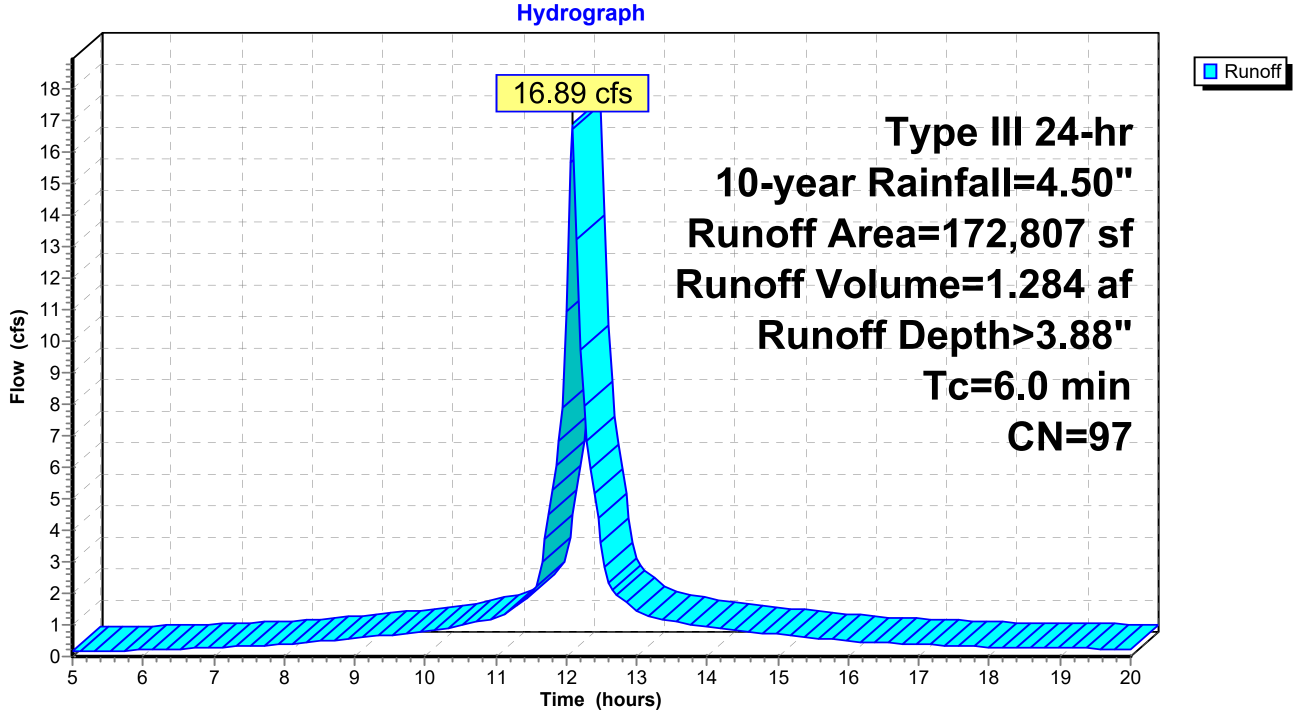
Runoff = 16.89 cfs @ 12.09 hrs, Volume= 1.284 af, Depth> 3.88"
Routed to Pond P-1 : Football Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

	Area (sf)	CN	Description
*	87,675	98	Turf, 0% imp., HSG A
	74,089	98	Unconnected pavement, HSG A
	1,780	39	>75% Grass cover, Good, HSG A
	9,111	98	Unconnected pavement, HSG B
*	152	98	Turf, 0% imp., HSG B
	172,807	97	Weighted Average
	89,607		51.85% Pervious Area
	83,200		48.15% Impervious Area
	83,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-2: Track and Field



Summary for Subcatchment PWS-3: Tennis Court Area

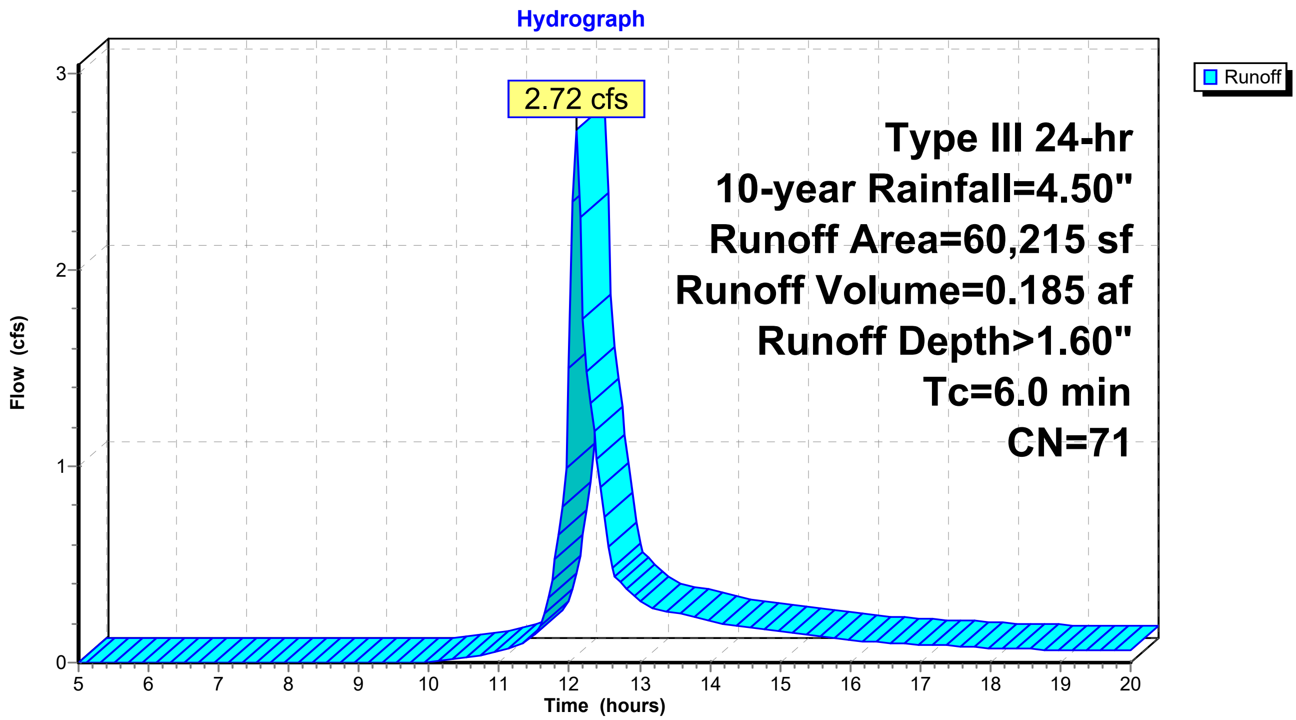
Runoff = 2.72 cfs @ 12.10 hrs, Volume= 0.185 af, Depth> 1.60"
Routed to Pond TRNCH : Tennis Court Exfiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Description
30,852	98	Unconnected pavement, HSG A
27,355	39	>75% Grass cover, Good, HSG A
1,250	98	Unconnected roofs, HSG A
758	98	Unconnected pavement, HSG B
60,215	71	Weighted Average
27,355		45.43% Pervious Area
32,860		54.57% Impervious Area
32,860		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-3: Tennis Court Area



Summary for Subcatchment PWS-4: North of Baseball Field

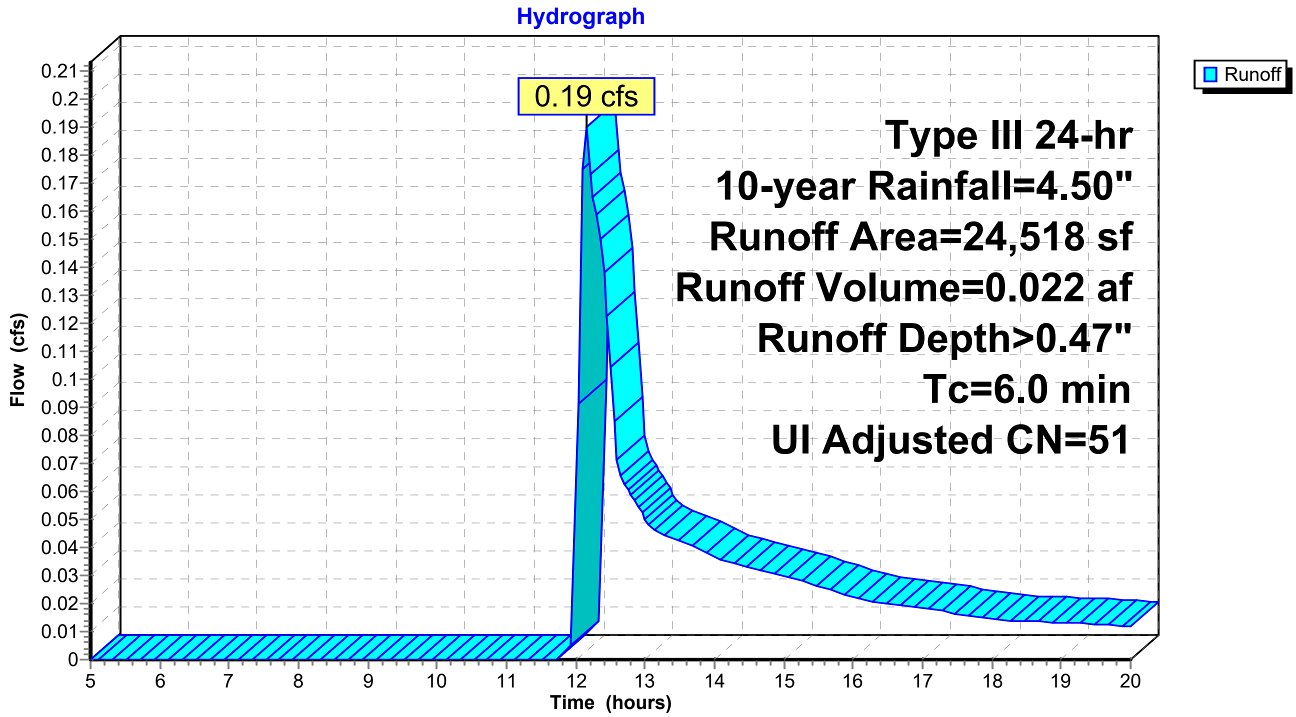
Runoff = 0.19 cfs @ 12.15 hrs, Volume= 0.022 af, Depth> 0.47"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Adj	Description
2,185	76		Gravel roads, HSG A
15,617	39		>75% Grass cover, Good, HSG A
6,716	98		Unconnected pavement, HSG A
24,518	58	51	Weighted Average, UI Adjusted
17,802			72.61% Pervious Area
6,716			27.39% Impervious Area
6,716			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-4: North of Baseball Field



Summary for Subcatchment PWS-5: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

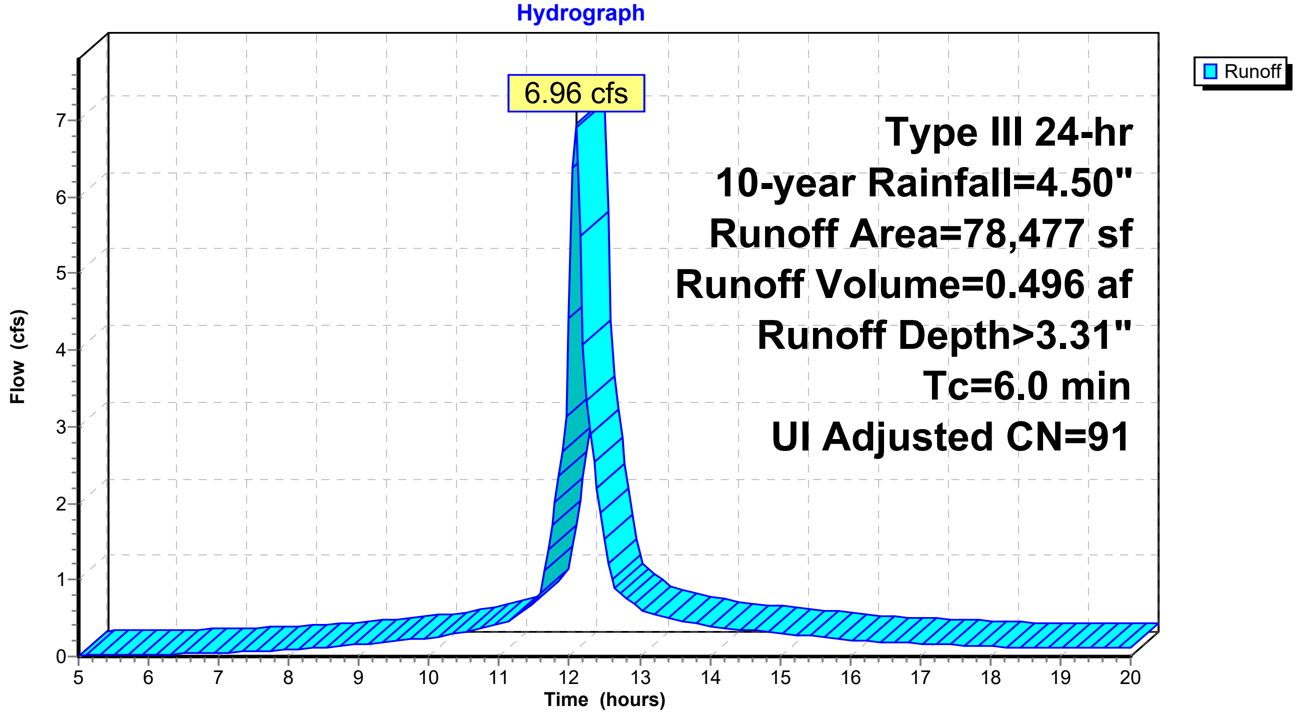
Runoff = 6.96 cfs @ 12.09 hrs, Volume= 0.496 af, Depth> 3.31"
Routed to Pond P-2 : Baseball Field (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

	Area (sf)	CN	Adj	Description
*	57,379	98		Turf, 0% imp, HSG A
	8,176	39		>75% Grass cover, Good, HSG A
	12,922	98		Unconnected pavement, HSG A
	78,477	92	91	Weighted Average, UI Adjusted
	65,555			83.53% Pervious Area
	12,922			16.47% Impervious Area
	12,922			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-5: Turf Field



Summary for Subcatchment PWS-6: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aformentioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

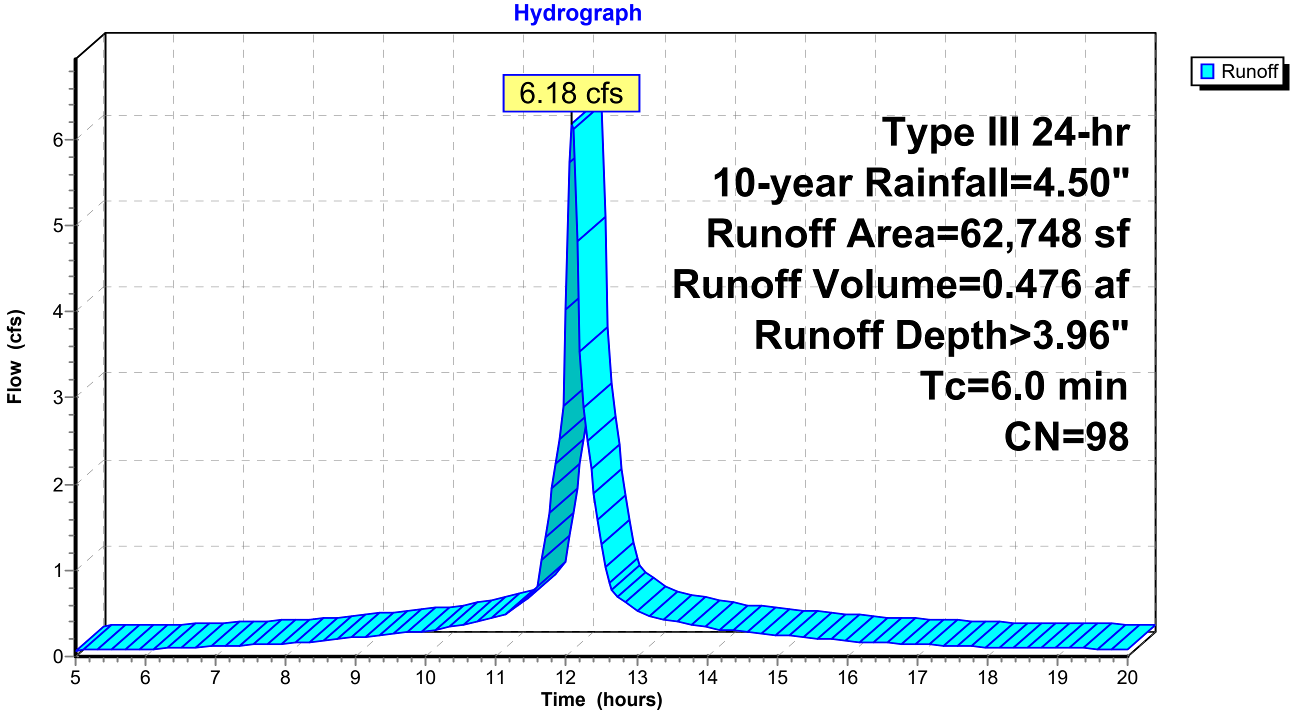
Runoff = 6.18 cfs @ 12.09 hrs, Volume= 0.476 af, Depth> 3.96"
Routed to Pond P-3 : Baseball Field (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

	Area (sf)	CN	Description
*	61,566	98	Turf, 0% imp, HSG A
*	1,182	98	Unconnected pavement, HSG A
	62,748	98	Weighted Average
	61,566		98.12% Pervious Area
	1,182		1.88% Impervious Area
	1,182		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-6: Turf Field



Summary for Subcatchment PWS-7: East of Baseball Field

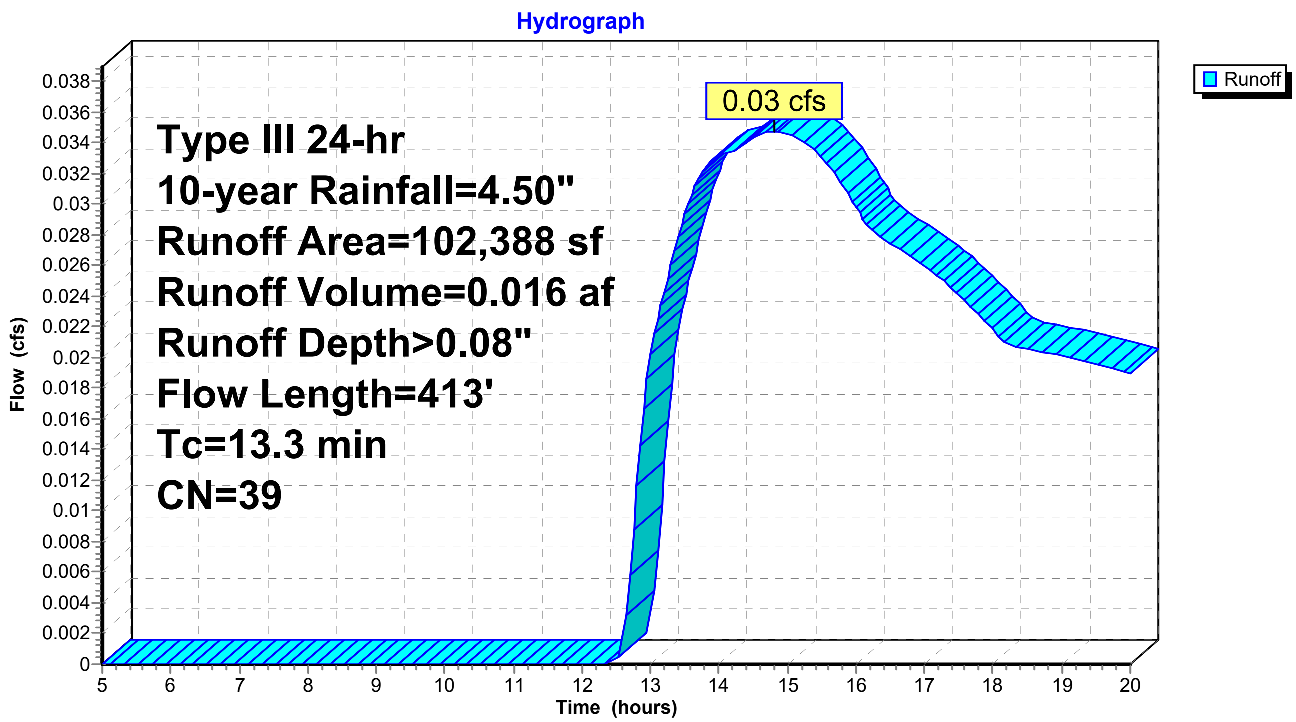
Runoff = 0.03 cfs @ 14.81 hrs, Volume= 0.016 af, Depth> 0.08"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Description
102,151	39	>75% Grass cover, Good, HSG A
237	98	Unconnected pavement, HSG A
102,388	39	Weighted Average
102,151		99.77% Pervious Area
237		0.23% Impervious Area
237		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0120	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.9	309	0.0123	1.79		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	54	0.0645	4.09		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.3	413	Total			

Subcatchment PWS-7: East of Baseball Field



Summary for Subcatchment PWS-8: Turf Softball Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

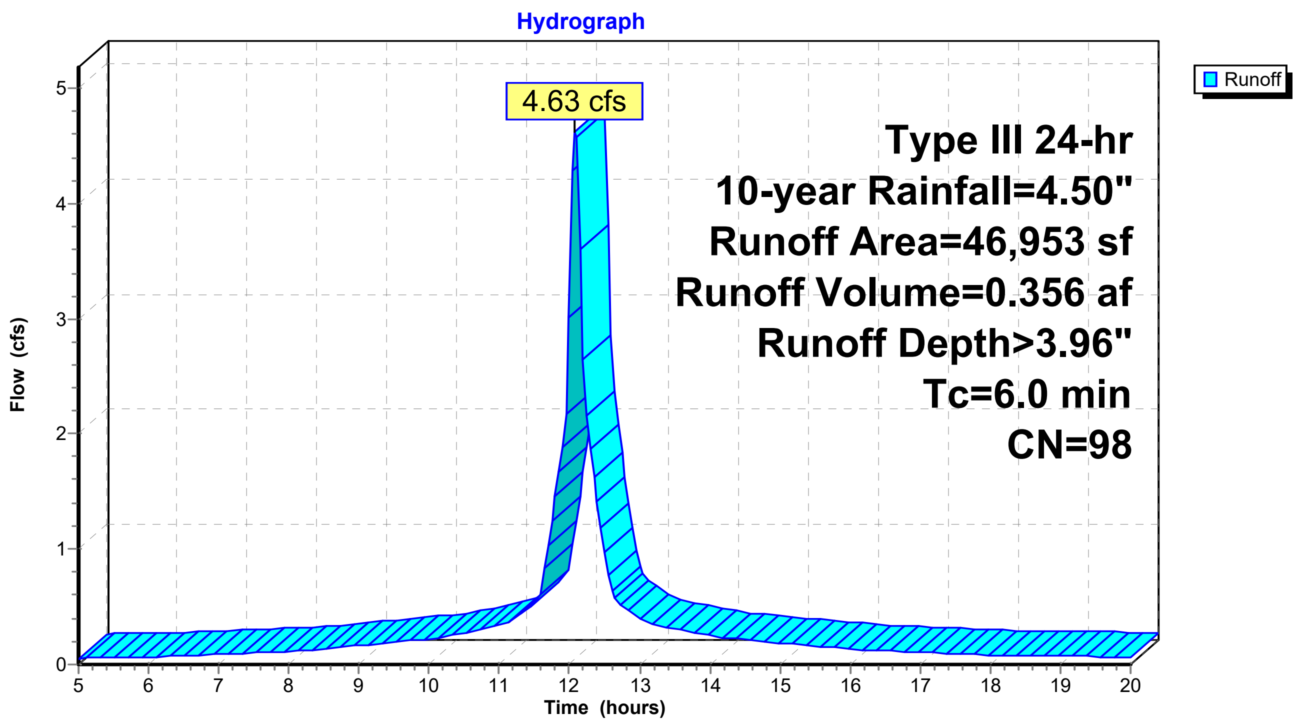
Runoff = 4.63 cfs @ 12.09 hrs, Volume= 0.356 af, Depth> 3.96"
Routed to Pond P-4 : Softball Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Description
46,953	98	Water Surface, 0% imp, HSG B
46,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-8: Turf Softball Field



Summary for Subcatchment PWS-9: Surrounding Softball

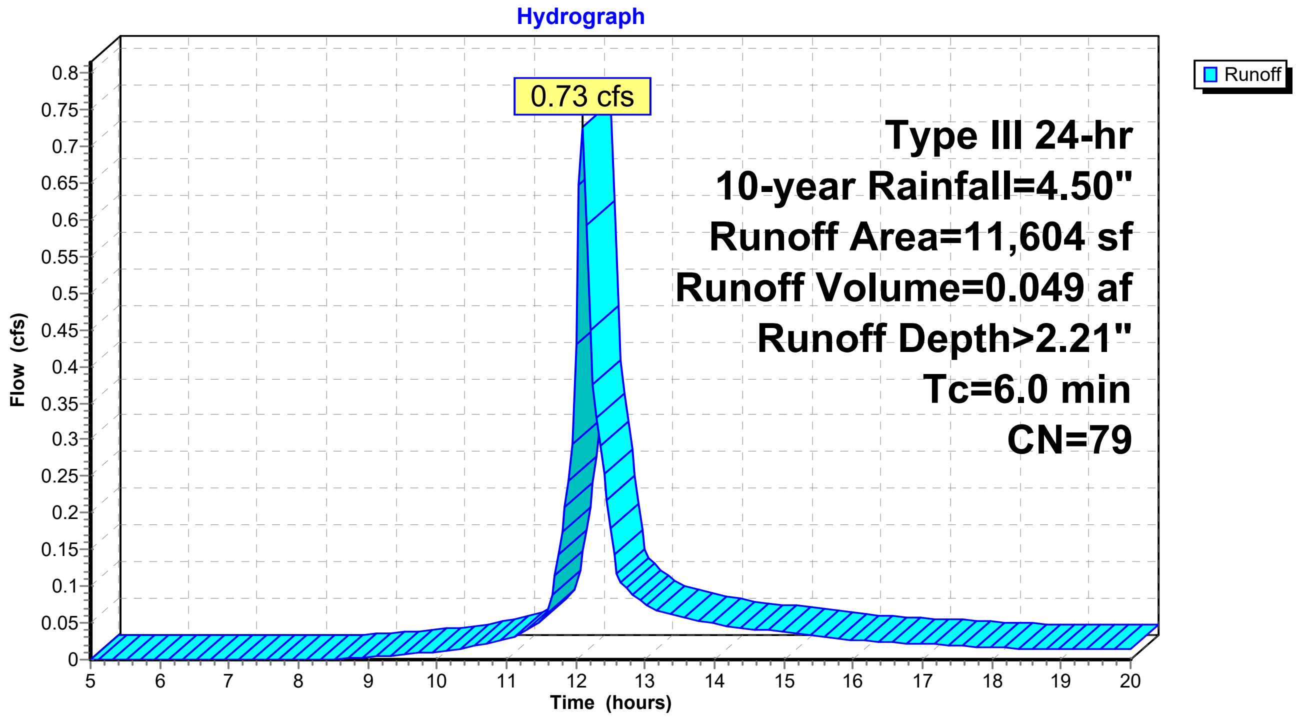
Runoff = 0.73 cfs @ 12.09 hrs, Volume= 0.049 af, Depth> 2.21"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.50"

Area (sf)	CN	Description
4,648	98	Unconnected pavement, HSG B
1,376	85	Gravel roads, HSG B
5,580	61	>75% Grass cover, Good, HSG B
11,604	79	Weighted Average
6,956		59.94% Pervious Area
4,648		40.06% Impervious Area
4,648		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-9: Surrounding Softball

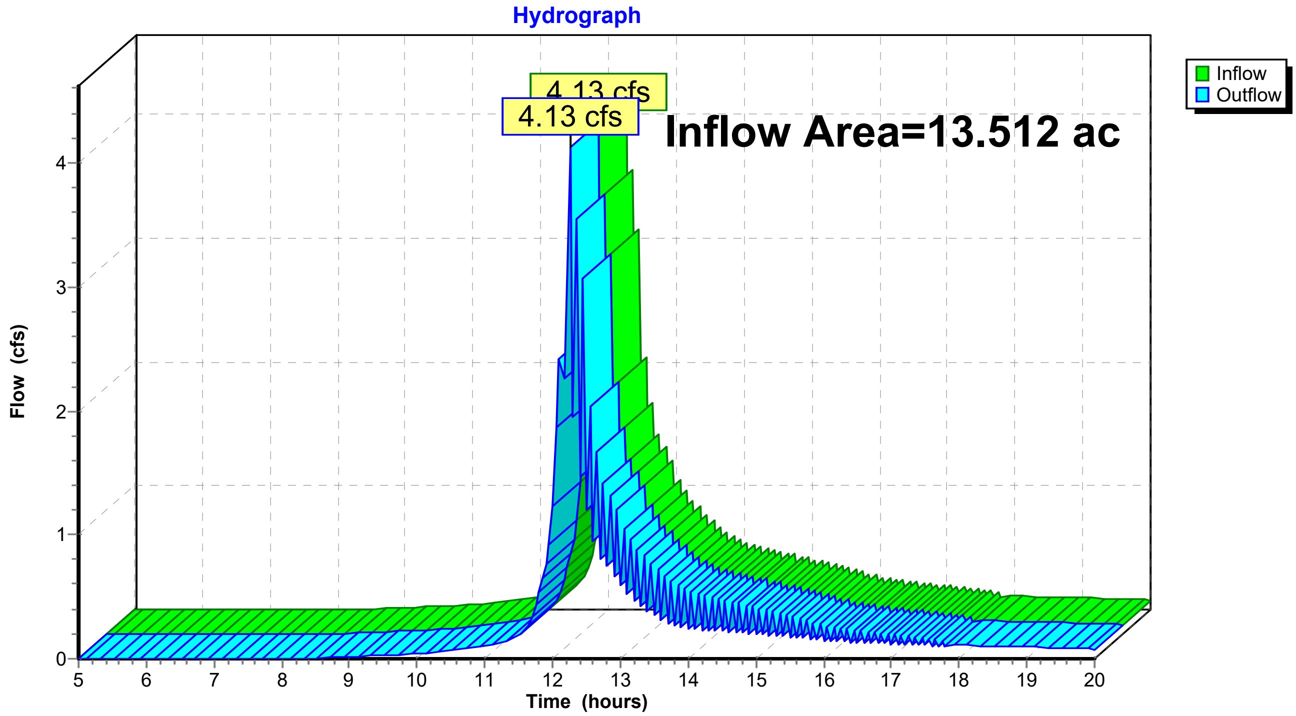


Summary for Reach 1: Wetlands

Inflow Area = 13.512 ac, 26.95% Impervious, Inflow Depth > 0.29" for 10-year event
Inflow = 4.13 cfs @ 12.25 hrs, Volume= 0.322 af
Outflow = 4.13 cfs @ 12.25 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 1: Wetlands



Summary for Pond P-1: Football Field

Inflow Area = 3.967 ac, 48.15% Impervious, Inflow Depth > 3.88" for 10-year event
Inflow = 16.89 cfs @ 12.09 hrs, Volume= 1.284 af
Outflow = 2.43 cfs @ 12.59 hrs, Volume= 1.283 af, Atten= 86%, Lag= 30.5 min
Discarded = 2.07 cfs @ 11.60 hrs, Volume= 1.258 af
Primary = 0.36 cfs @ 12.59 hrs, Volume= 0.024 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.29' @ 12.59 hrs Surf.Area= 87,827 sf Storage= 18,173 cf

Plug-Flow detention time= 55.8 min calculated for 1.283 af (100% of inflow)
Center-of-Mass det. time= 55.4 min (794.7 - 739.3)

Volume	Invert	Avail.Storage	Storage Description
#1	98.77'	29,159 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 72,896 cf Overall x 40.0% Voids

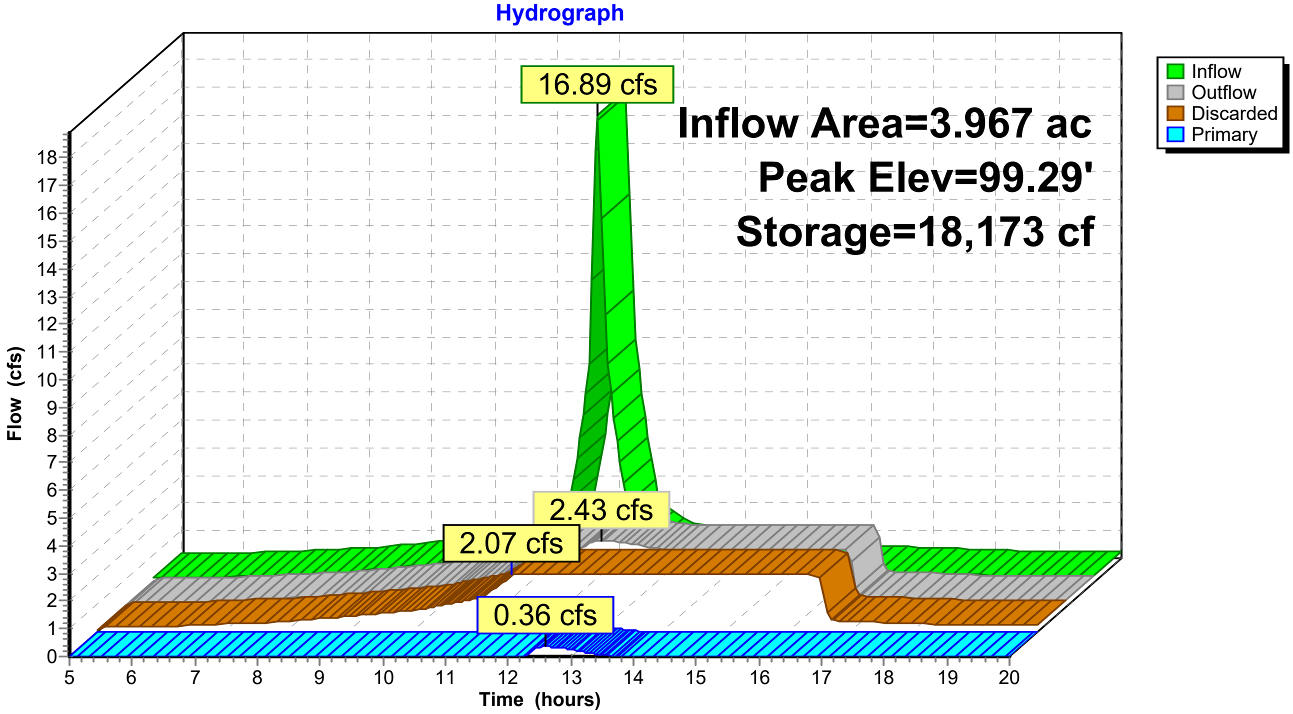
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.77	87,827	0	0
99.60	87,827	72,896	72,896

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.77'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.20'	**12.0" Round Culvert** L= 139.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.20' / 96.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.18'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=2.07 cfs @ 11.60 hrs HW=98.78' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.07 cfs)

Primary OutFlow Max=0.36 cfs @ 12.59 hrs HW=99.29' (Free Discharge)
└─**2=Culvert** (Passes 0.36 cfs of 3.48 cfs potential flow)
  └─**3=Orifice/Grate** (Weir Controls 0.36 cfs @ 1.07 fps)

Pond P-1: Football Field



Summary for Pond P-2: Baseball Field (West)

Inflow Area = 1.802 ac, 16.47% Impervious, Inflow Depth > 3.31" for 10-year event
Inflow = 6.96 cfs @ 12.09 hrs, Volume= 0.496 af
Outflow = 1.35 cfs @ 11.75 hrs, Volume= 0.496 af, Atten= 81%, Lag= 0.0 min
Discarded = 1.35 cfs @ 11.75 hrs, Volume= 0.496 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.77' @ 12.53 hrs Surf.Area= 57,379 sf Storage= 5,883 cf

Plug-Flow detention time= 26.2 min calculated for 0.496 af (100% of inflow)
Center-of-Mass det. time= 25.9 min (786.4 - 760.5)

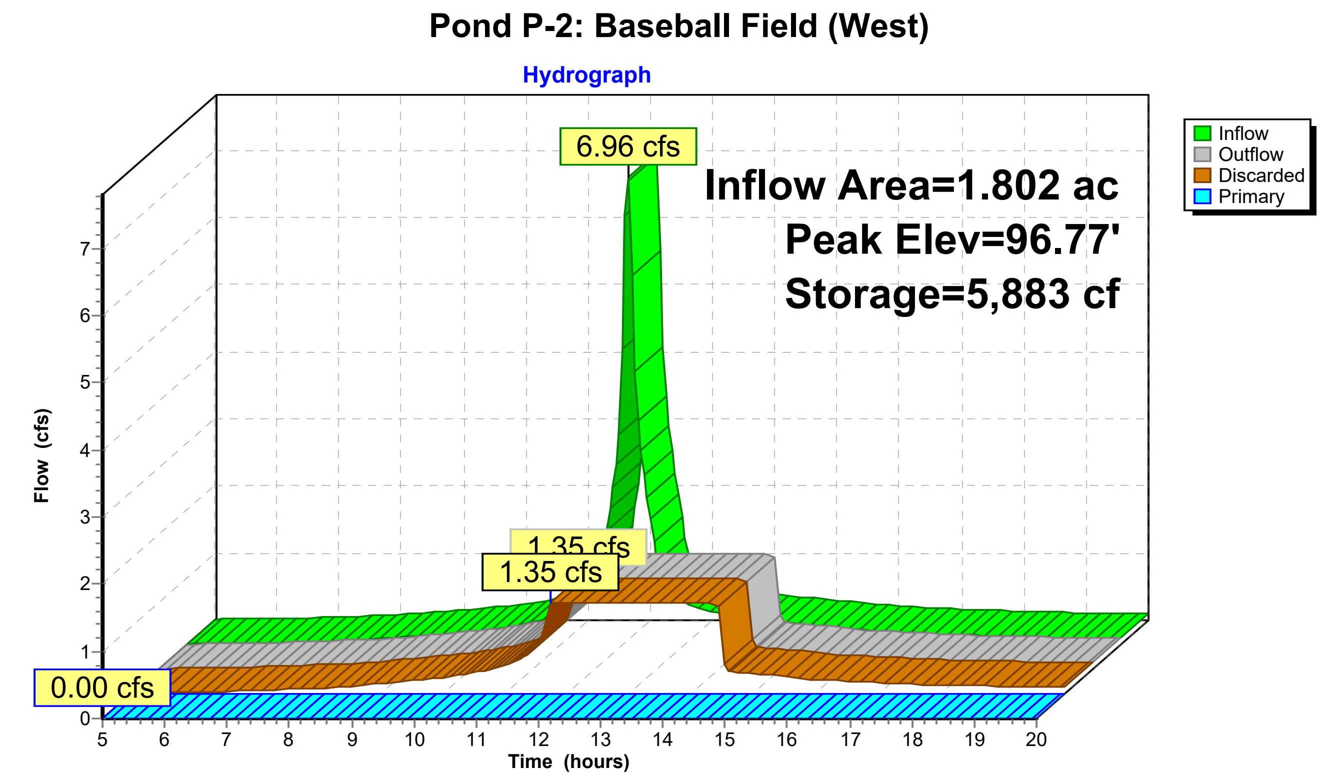
Volume	Invert	Avail.Storage	Storage Description
#1	96.51'	15,378 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 38,444 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.51	57,379	0	0
97.18	57,379	38,444	38,444

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.51'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	95.70'	**10.0" Round Culvert** L= 140.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.70' / 95.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.84'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.35 cfs @ 11.75 hrs HW=96.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=96.51' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 1.33 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)


Pond P-2: Baseball Field (West)
Hydrograph
6.96 cfs
Inflow Area=1.802 ac
Peak Elev=96.77'
Storage=5,883 cf
1.35 cfs
1.35 cfs
0.00 cfs
Inflow
Outflow
Discarded
Primary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Summary for Pond P-3: Baseball Field (East)

Inflow Area = 1.440 ac, 1.88% Impervious, Inflow Depth > 3.96" for 10-year event
Inflow = 6.18 cfs @ 12.09 hrs, Volume= 0.476 af
Outflow = 1.45 cfs @ 11.75 hrs, Volume= 0.475 af, Atten= 76%, Lag= 0.0 min
Discarded = 1.45 cfs @ 11.75 hrs, Volume= 0.475 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-3 : Design Point 3

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.71' @ 12.47 hrs Surf.Area= 61,566 sf Storage= 4,595 cf

Plug-Flow detention time= 16.8 min calculated for 0.474 af (100% of inflow)
Center-of-Mass det. time= 16.4 min (752.2 - 735.8)

Volume	Invert	Avail.Storage	Storage Description
#1	96.52'	16,500 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 41,249 cf Overall x 40.0% Voids

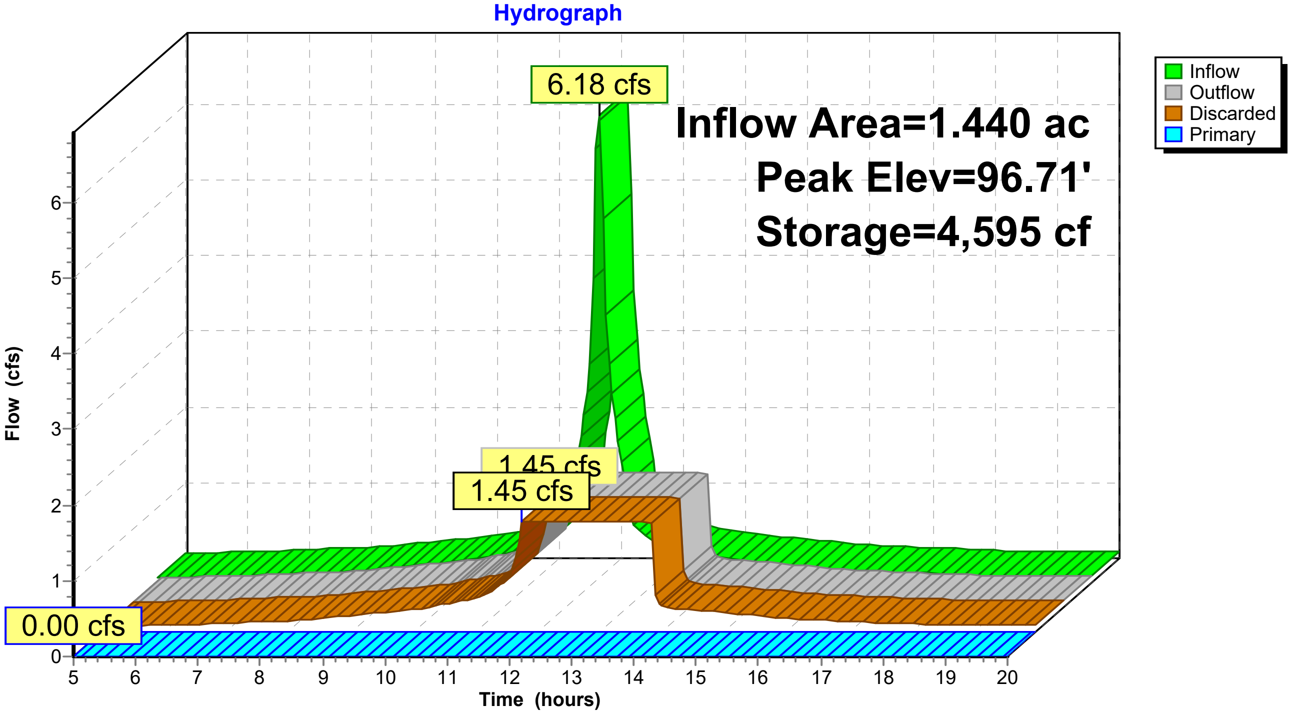
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.52	61,566	0	0
97.19	61,566	41,249	41,249

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.52'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	93.44'	**10.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.44' / 93.37' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.85'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.45 cfs @ 11.75 hrs HW=96.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.45 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=96.52' (Free Discharge)
└─**2=Culvert** (Passes 0.00 cfs of 4.29 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-3: Baseball Field (East)



Summary for Pond P-4: Softball Field

Inflow Area = 1.078 ac, 0.00% Impervious, Inflow Depth > 3.96" for 10-year event
Inflow = 4.63 cfs @ 12.09 hrs, Volume= 0.356 af
Outflow = 1.11 cfs @ 11.75 hrs, Volume= 0.356 af, Atten= 76%, Lag= 0.0 min
Discarded = 1.11 cfs @ 11.75 hrs, Volume= 0.356 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 41.58' @ 12.47 hrs Surf.Area= 46,953 sf Storage= 3,382 cf

Plug-Flow detention time= 16.2 min calculated for 0.355 af (100% of inflow)
Center-of-Mass det. time= 15.8 min (751.5 - 735.8)

Volume	Invert	Avail.Storage	Storage Description
#1	41.40'	12,583 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 31,459 cf Overall x 40.0% Voids

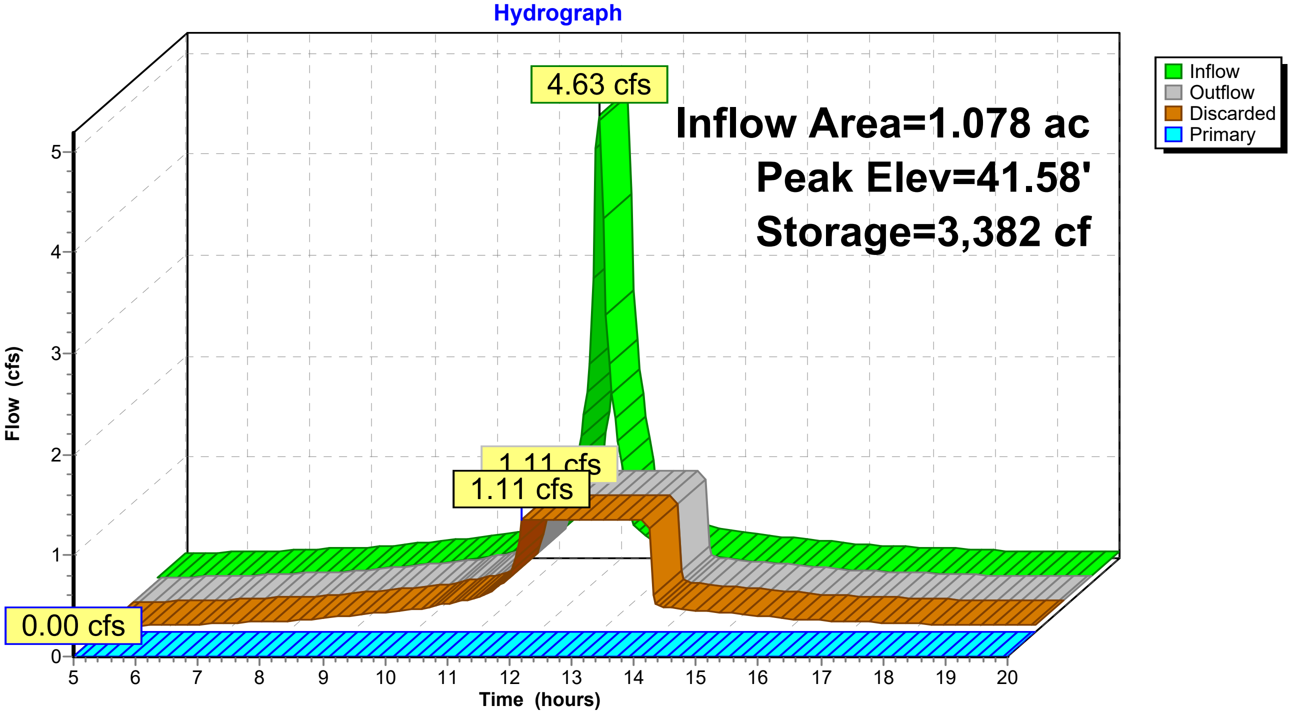
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.40	46,953	836.0	0	0	46,953
42.07	46,953	836.0	31,459	31,459	47,513

Device	Routing	Invert	Outlet Devices
#1	Discarded	41.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	39.07'	**10.0" Round 12" RCP Outlet** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.07' / 39.00' S= 0.0070 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.55 sf
#3	Device 2	41.73'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.11 cfs @ 11.75 hrs HW=41.41' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.11 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=41.40' (Free Discharge)
└─**2=12" RCP Outlet** (Passes 0.00 cfs of 2.87 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P-4: Softball Field



Summary for Pond TRNCH: Tennis Court Exfiltration Trench

Inflow Area = 1.382 ac, 54.57% Impervious, Inflow Depth > 1.60" for 10-year event
Inflow = 2.72 cfs @ 12.10 hrs, Volume= 0.185 af
Outflow = 2.41 cfs @ 12.25 hrs, Volume= 0.122 af, Atten= 11%, Lag= 9.3 min
Discarded = 0.06 cfs @ 12.25 hrs, Volume= 0.038 af
Primary = 2.36 cfs @ 12.25 hrs, Volume= 0.084 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 97.53' @ 12.25 hrs Surf.Area= 2,330 sf Storage= 2,729 cf

Plug-Flow detention time= 121.0 min calculated for 0.122 af (66% of inflow)
Center-of-Mass det. time= 47.3 min (857.2 - 809.9)

Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	600 cf	**Drywell Storage (Prismatic)** Listed below (Recalc) x 2
#2	91.00'	1,752 cf	**Exfiltration stone Layer (Prismatic)** Listed below (Recalc) 4,380 cf Overall x 40.0% Voids
#3	97.00'	377 cf	**Freeboard above basins (Prismatic)** Listed below (Recalc)
		2,729 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	50	0	0
97.00	50	300	300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	730	0	0
97.00	730	4,380	4,380

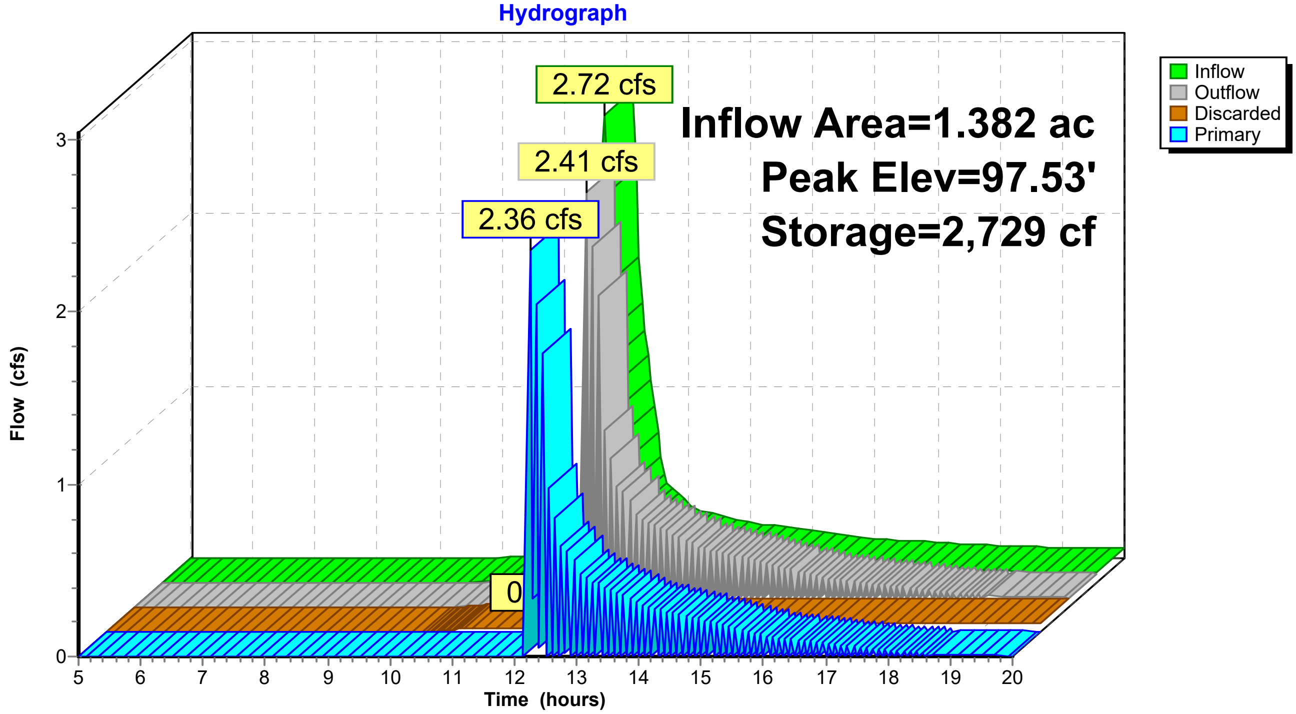
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	6	0	0
97.50	1,500	377	377

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**150.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.06 cfs @ 12.25 hrs HW=97.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.41 cfs @ 12.25 hrs HW=97.52' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.41 cfs @ 0.38 fps)

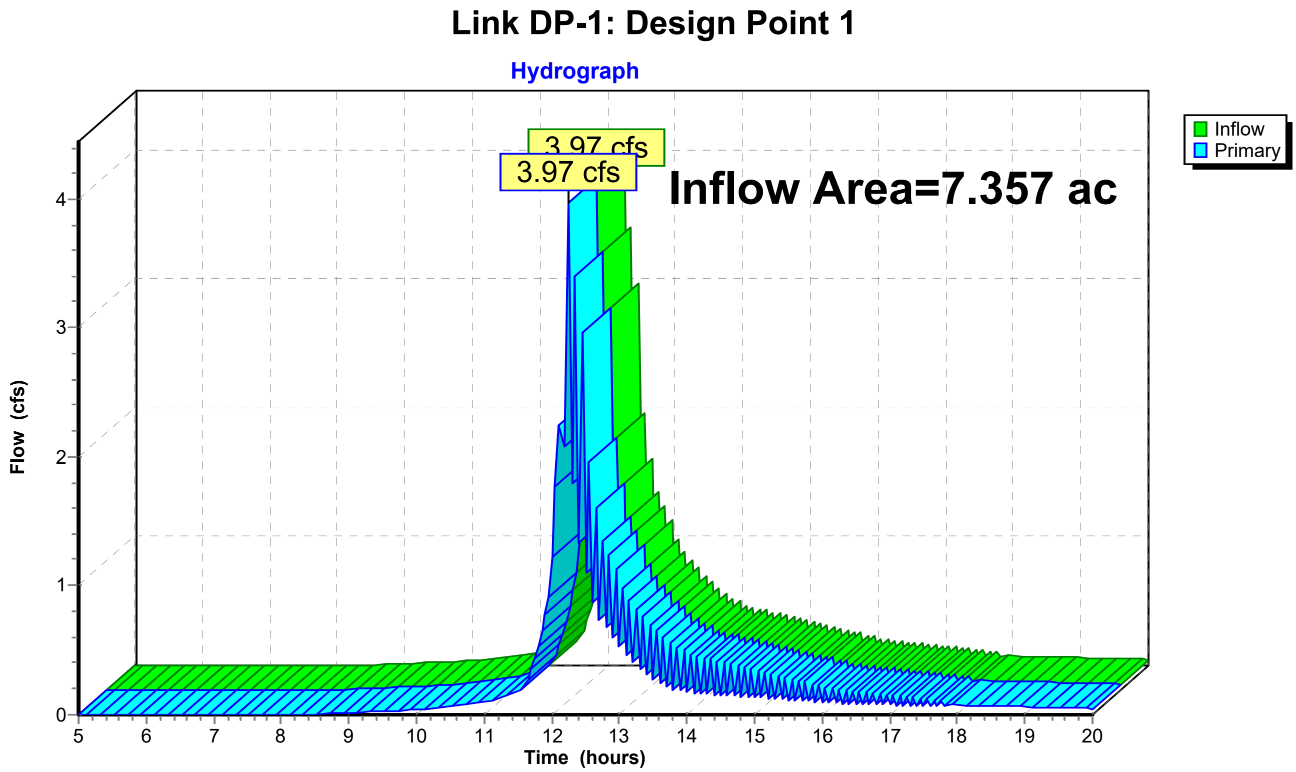
Pond TRNCH: Tennis Court Exfiltration Trench



Summary for Link DP-1: Design Point 1

Inflow Area = 7.357 ac, 42.92% Impervious, Inflow Depth > 0.46" for 10-year event
Inflow = 3.97 cfs @ 12.25 hrs, Volume= 0.284 af
Primary = 3.97 cfs @ 12.25 hrs, Volume= 0.284 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

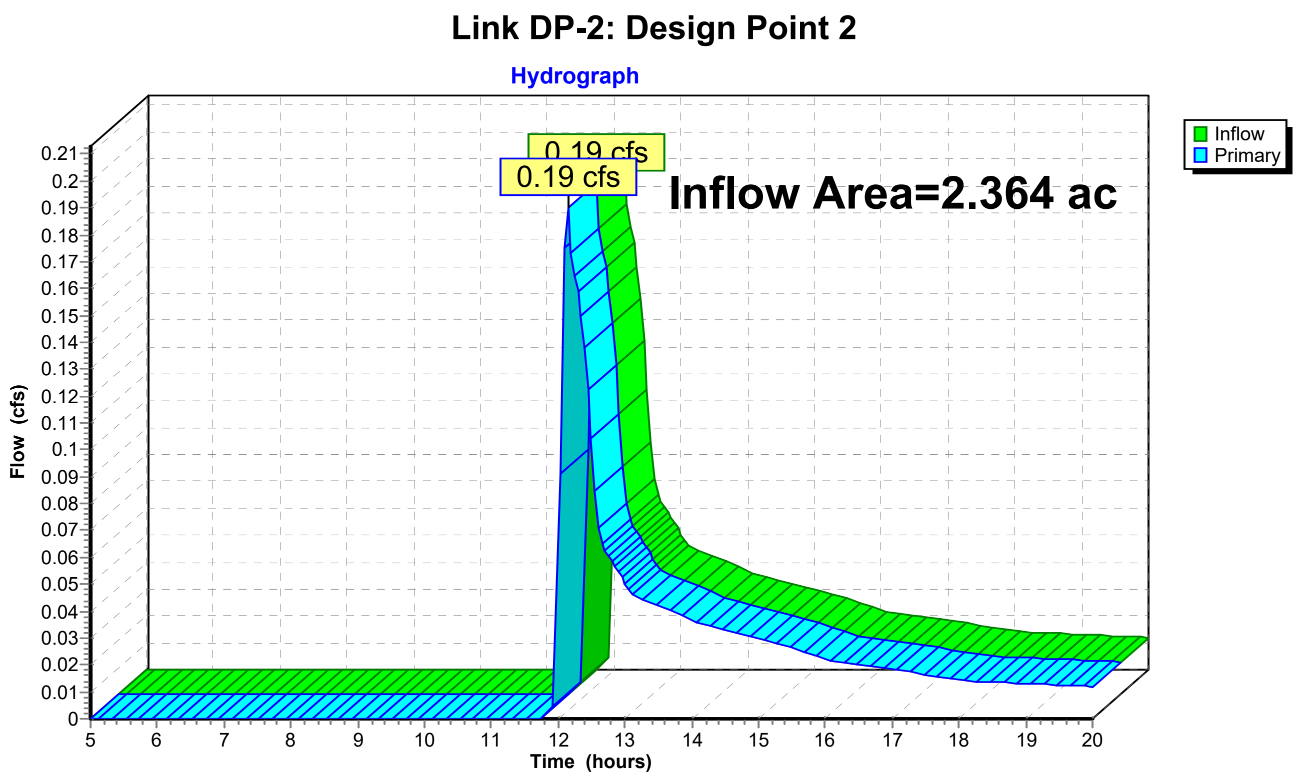
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Link DP-2: Design Point 2

Inflow Area = 2.364 ac, 19.07% Impervious, Inflow Depth > 0.11" for 10-year event
Inflow = 0.19 cfs @ 12.15 hrs, Volume= 0.022 af
Primary = 0.19 cfs @ 12.15 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

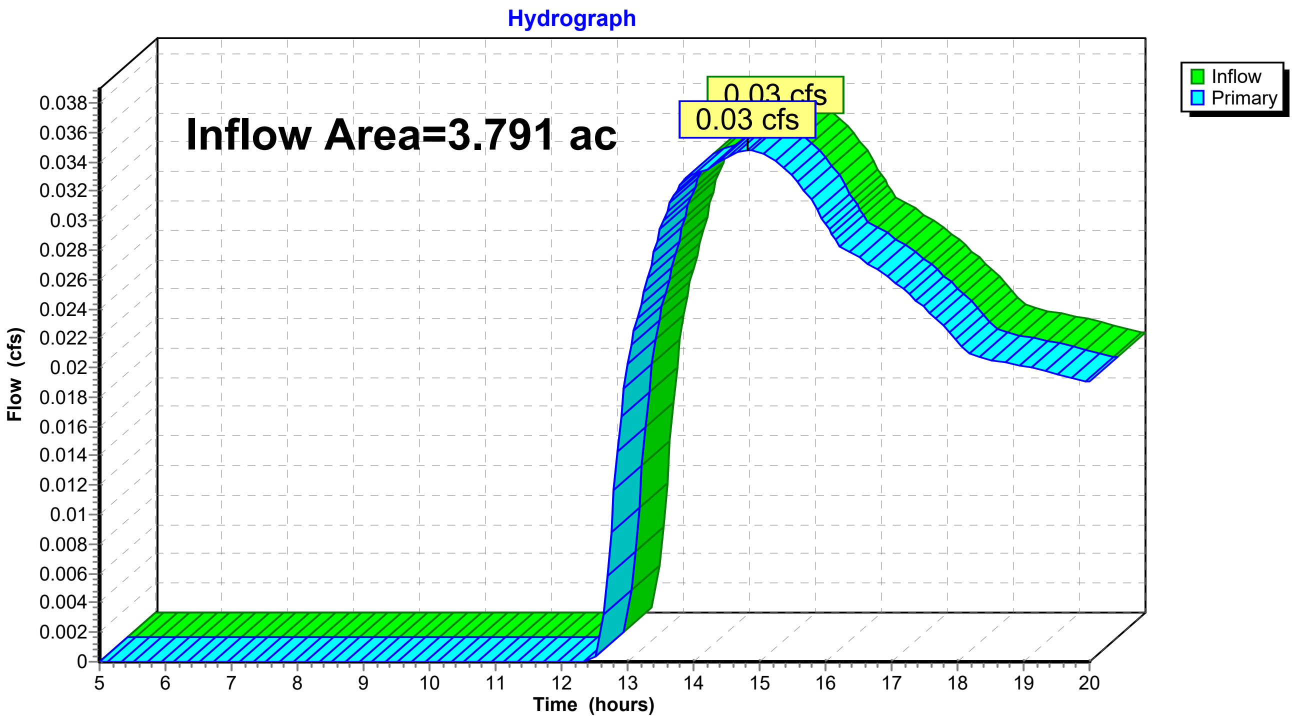


Summary for Link DP-3: Design Point 3

Inflow Area = 3.791 ac, 0.86% Impervious, Inflow Depth > 0.05" for 10-year event
Inflow = 0.03 cfs @ 14.81 hrs, Volume= 0.016 af
Primary = 0.03 cfs @ 14.81 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: West of Track Runoff Area=28,893 sf 58.33% Impervious Runoff Depth>3.97"
Flow Length=137' Tc=10.1 min CN=80 Runoff=2.82 cfs 0.219 af

Subcatchment PWS-2: Track and Field Runoff Area=172,807 sf 48.15% Impervious Runoff Depth>5.71"
Tc=6.0 min CN=97 Runoff=24.58 cfs 1.889 af

Subcatchment PWS-3: Tennis Court Area Runoff Area=60,215 sf 54.57% Impervious Runoff Depth>3.07"
Tc=6.0 min CN=71 Runoff=5.25 cfs 0.354 af

Subcatchment PWS-4: North of Baseball Runoff Area=24,518 sf 27.39% Impervious Runoff Depth>1.33"
Tc=6.0 min UI Adjusted CN=51 Runoff=0.82 cfs 0.062 af

Subcatchment PWS-5: Turf Field Runoff Area=78,477 sf 16.47% Impervious Runoff Depth>5.15"
Tc=6.0 min UI Adjusted CN=91 Runoff=10.57 cfs 0.772 af

Subcatchment PWS-6: Turf Field Runoff Area=62,748 sf 1.88% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=8.97 cfs 0.694 af

Subcatchment PWS-7: East of Baseball Runoff Area=102,388 sf 0.23% Impervious Runoff Depth>0.51"
Flow Length=413' Tc=13.3 min CN=39 Runoff=0.60 cfs 0.099 af

Subcatchment PWS-8: Turf Softball Field Runoff Area=46,953 sf 0.00% Impervious Runoff Depth>5.78"
Tc=6.0 min CN=98 Runoff=6.71 cfs 0.519 af

Subcatchment PWS-9: Surrounding Runoff Area=11,604 sf 40.06% Impervious Runoff Depth>3.87"
Tc=6.0 min CN=79 Runoff=1.26 cfs 0.086 af

Reach 1: Wetlands Inflow=10.32 cfs 1.016 af
Outflow=10.32 cfs 1.016 af

Pond P-1: Football Field Peak Elev=99.56' Storage=27,873 cf Inflow=24.58 cfs 1.889 af
Discarded=2.07 cfs 1.625 af Primary=2.34 cfs 0.263 af Outflow=4.42 cfs 1.888 af

Pond P-2: Baseball Field (West) Peak Elev=96.98' Storage=10,737 cf Inflow=10.57 cfs 0.772 af
Discarded=1.35 cfs 0.737 af Primary=0.53 cfs 0.035 af Outflow=1.88 cfs 0.772 af

Pond P-3: Baseball Field (East) Peak Elev=96.87' Storage=8,571 cf Inflow=8.97 cfs 0.694 af
Discarded=1.45 cfs 0.693 af Primary=0.02 cfs 0.001 af Outflow=1.48 cfs 0.694 af

Pond P-4: Softball Field Peak Elev=41.74' Storage=6,352 cf Inflow=6.71 cfs 0.519 af
Discarded=1.11 cfs 0.519 af Primary=0.01 cfs 0.000 af Outflow=1.12 cfs 0.519 af

Pond TRNCH: Tennis Court Exfiltration Peak Elev=97.56' Storage=2,729 cf Inflow=5.25 cfs 0.354 af
Discarded=0.06 cfs 0.041 af Primary=5.36 cfs 0.250 af Outflow=5.41 cfs 0.291 af

Link DP-1: Design Point 1 Inflow=9.41 cfs 0.819 af
Primary=9.41 cfs 0.819 af

Link DP-2: Design Point 2

Inflow=0.82 cfs 0.097 af
Primary=0.82 cfs 0.097 af

Link DP-3: Design Point 3

Inflow=0.61 cfs 0.100 af
Primary=0.61 cfs 0.100 af

Total Runoff Area = 13.512 ac Runoff Volume = 4.696 af Average Runoff Depth = 4.17"
73.05% Pervious = 9.871 ac 26.95% Impervious = 3.641 ac

Summary for Subcatchment PWS-1: West of Track

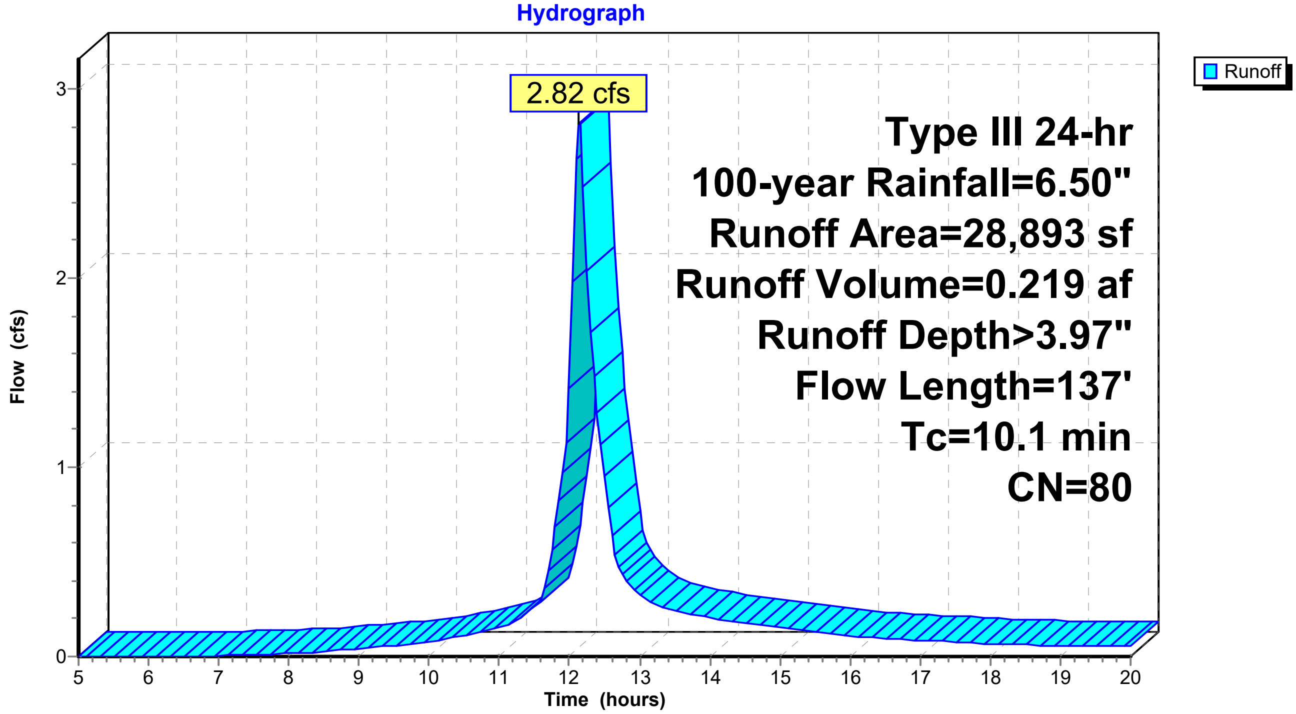
Runoff = 2.82 cfs @ 12.14 hrs, Volume= 0.219 af, Depth> 3.97"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Description
4,766	98	Unconnected pavement, HSG B
8,437	61	>75% Grass cover, Good, HSG B
711	98	Roofs, HSG B
3,604	39	>75% Grass cover, Good, HSG A
1,335	98	Roofs, HSG A
10,040	98	Unconnected pavement, HSG A
28,893	80	Weighted Average
12,041		41.67% Pervious Area
16,852		58.33% Impervious Area
14,806		87.86% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0140	0.09		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.1	21	0.0240	2.49		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.4	66	0.0185	2.76		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
10.1	137	Total			

Subcatchment PWS-1: West of Track



Summary for Subcatchment PWS-2: Track and Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

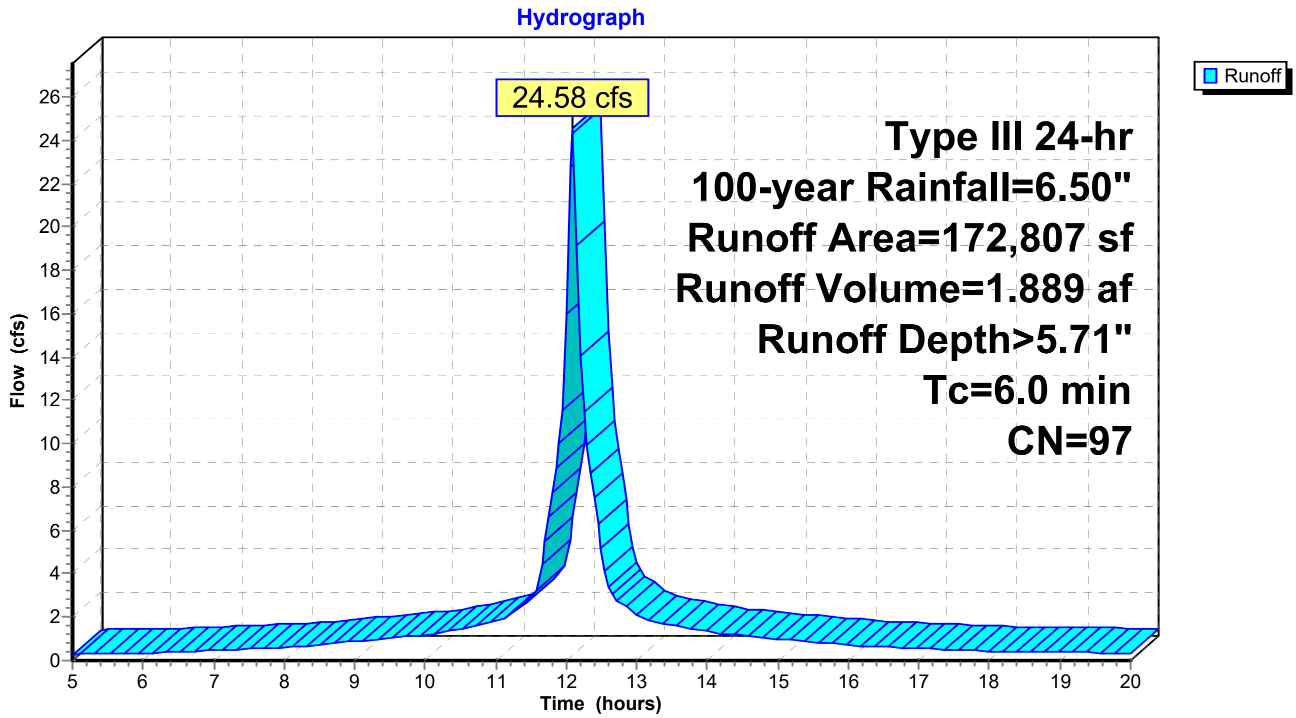
Runoff = 24.58 cfs @ 12.09 hrs, Volume= 1.889 af, Depth> 5.71"
Routed to Pond P-1 : Football Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

	Area (sf)	CN	Description
*	87,675	98	Turf, 0% imp., HSG A
	74,089	98	Unconnected pavement, HSG A
	1,780	39	>75% Grass cover, Good, HSG A
	9,111	98	Unconnected pavement, HSG B
*	152	98	Turf, 0% imp., HSG B
	172,807	97	Weighted Average
	89,607		51.85% Pervious Area
	83,200		48.15% Impervious Area
	83,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-2: Track and Field



Summary for Subcatchment PWS-3: Tennis Court Area

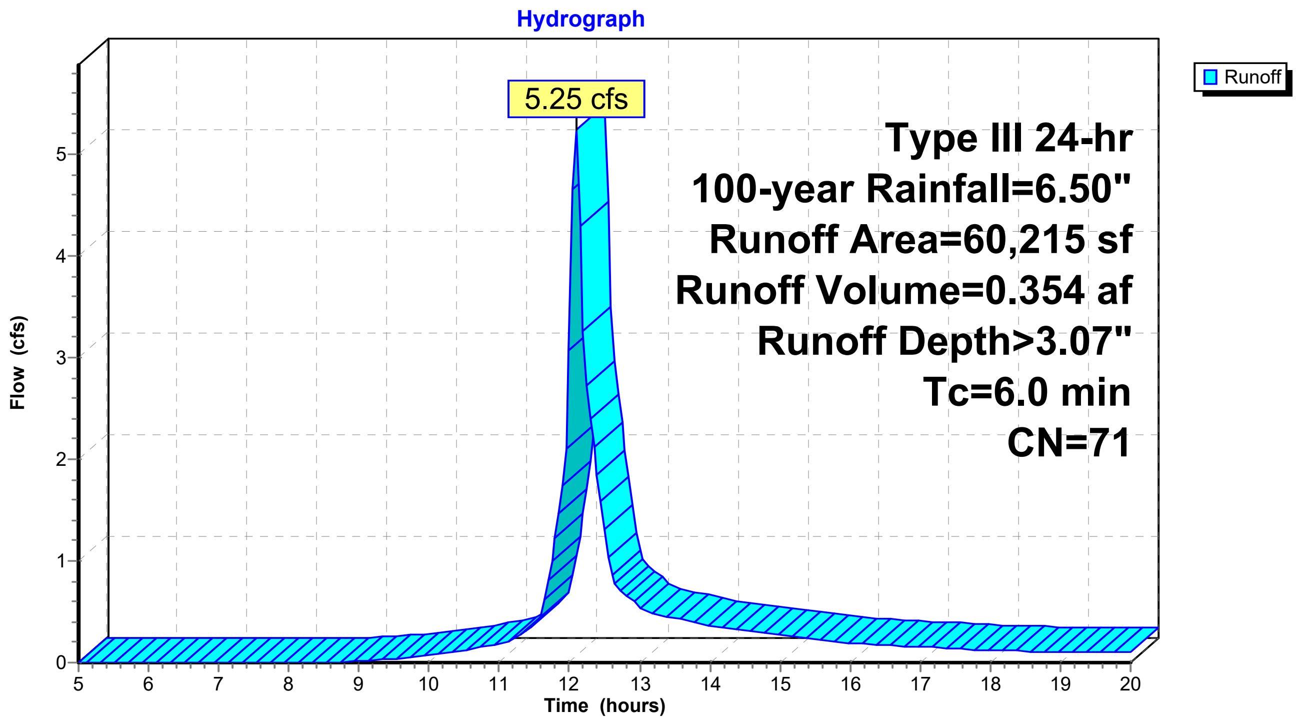
Runoff = 5.25 cfs @ 12.09 hrs, Volume= 0.354 af, Depth> 3.07"
Routed to Pond TRNCH : Tennis Court Exfiltration Trench

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Description
30,852	98	Unconnected pavement, HSG A
27,355	39	>75% Grass cover, Good, HSG A
1,250	98	Unconnected roofs, HSG A
758	98	Unconnected pavement, HSG B
60,215	71	Weighted Average
27,355		45.43% Pervious Area
32,860		54.57% Impervious Area
32,860		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-3: Tennis Court Area



Summary for Subcatchment PWS-4: North of Baseball Field

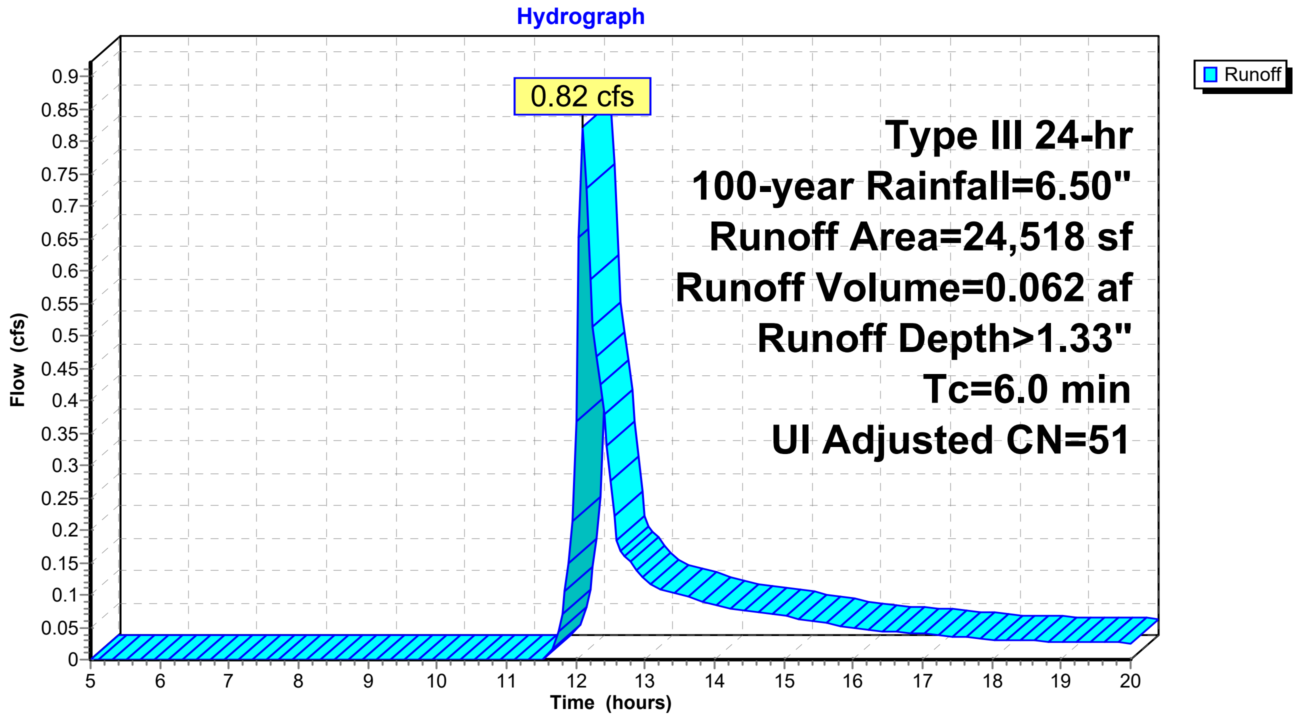
Runoff = 0.82 cfs @ 12.11 hrs, Volume= 0.062 af, Depth> 1.33"
Routed to Link DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Adj	Description
2,185	76		Gravel roads, HSG A
15,617	39		>75% Grass cover, Good, HSG A
6,716	98		Unconnected pavement, HSG A
24,518	58	51	Weighted Average, UI Adjusted
17,802			72.61% Pervious Area
6,716			27.39% Impervious Area
6,716			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-4: North of Baseball Field



Summary for Subcatchment PWS-5: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aformentioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

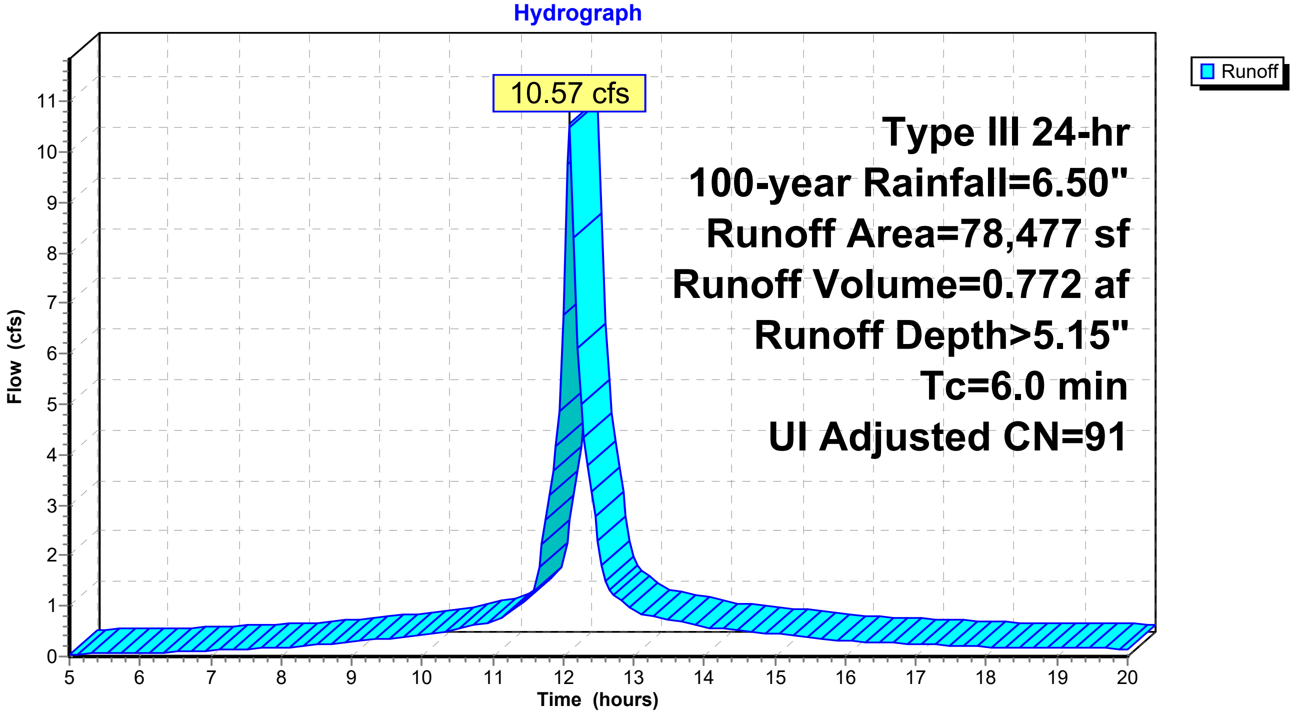
Runoff = 10.57 cfs @ 12.09 hrs, Volume= 0.772 af, Depth> 5.15"
Routed to Pond P-2 : Baseball Field (West)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

	Area (sf)	CN	Adj	Description
*	57,379	98		Turf, 0% imp, HSG A
	8,176	39		>75% Grass cover, Good, HSG A
	12,922	98		Unconnected pavement, HSG A
	78,477	92	91	Weighted Average, UI Adjusted
	65,555			83.53% Pervious Area
	12,922			16.47% Impervious Area
	12,922			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-5: Turf Field



Summary for Subcatchment PWS-6: Turf Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

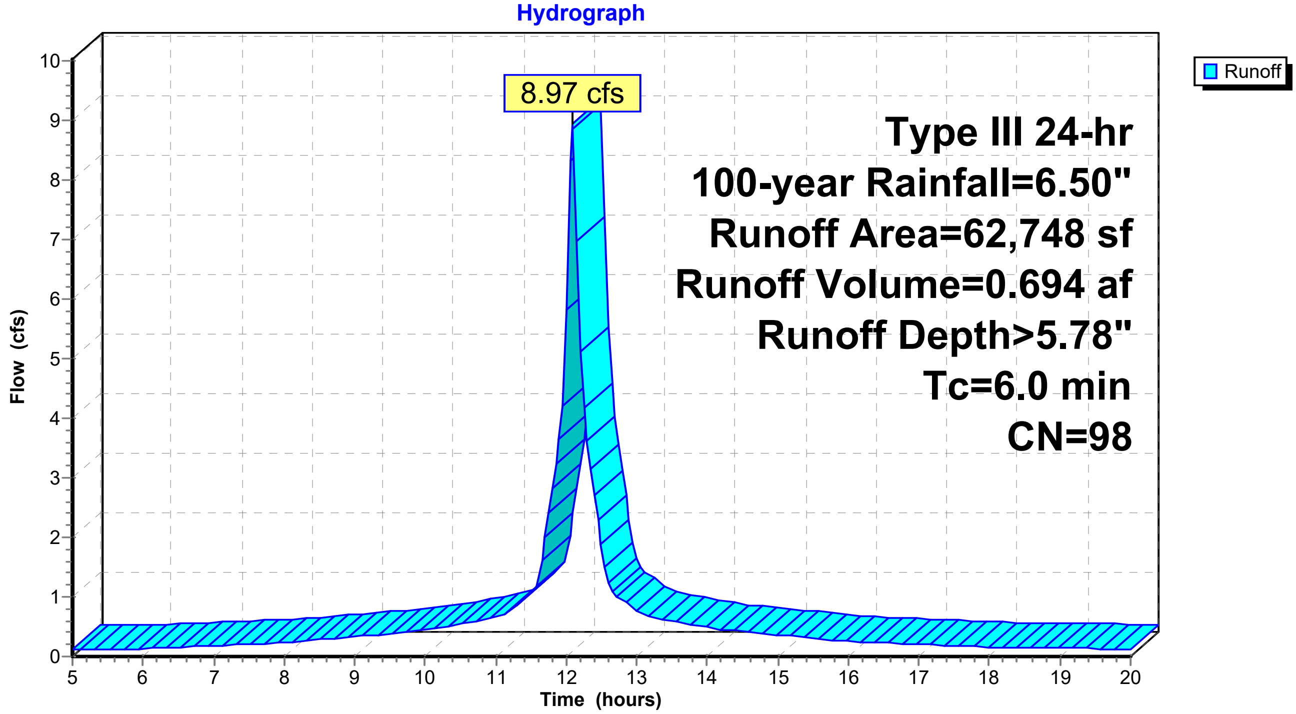
Runoff = 8.97 cfs @ 12.09 hrs, Volume= 0.694 af, Depth> 5.78"
Routed to Pond P-3 : Baseball Field (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

	Area (sf)	CN	Description
*	61,566	98	Turf, 0% imp, HSG A
*	1,182	98	Unconnected pavement, HSG A
	62,748	98	Weighted Average
	61,566		98.12% Pervious Area
	1,182		1.88% Impervious Area
	1,182		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-6: Turf Field



Summary for Subcatchment PWS-7: East of Baseball Field

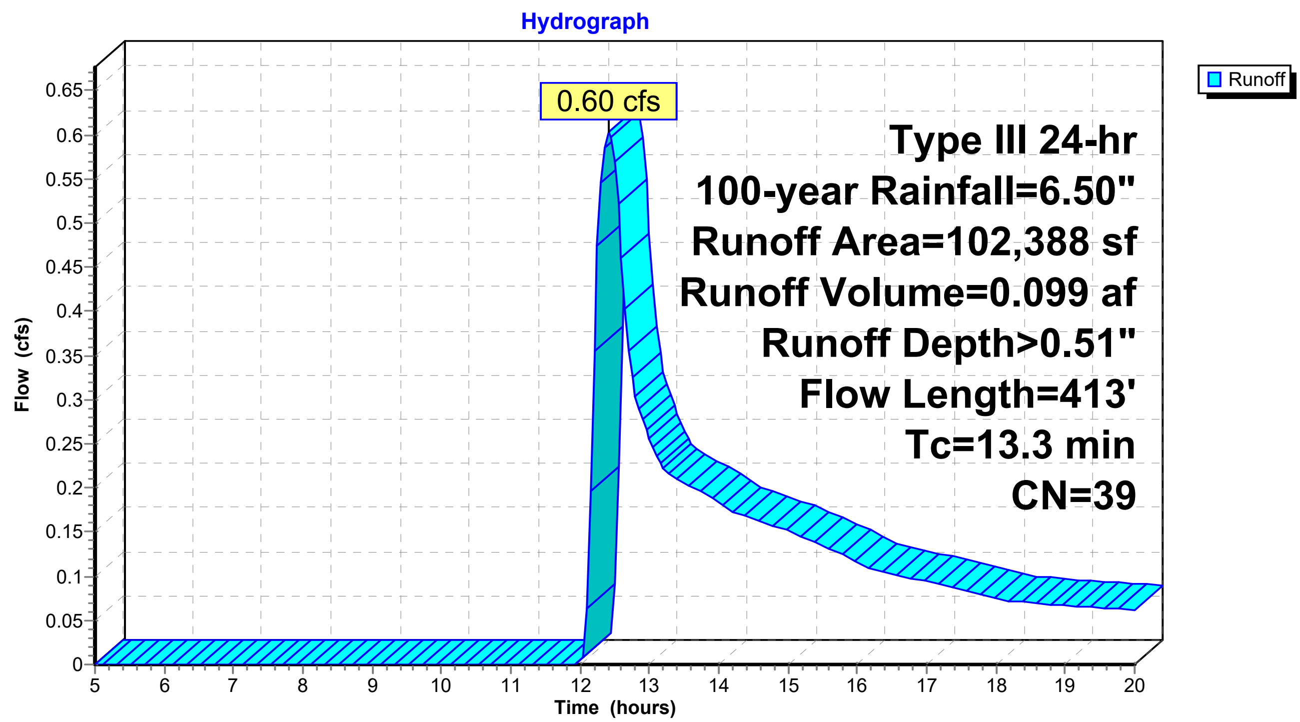
Runoff = 0.60 cfs @ 12.41 hrs, Volume= 0.099 af, Depth> 0.51"
Routed to Link DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Description
102,151	39	>75% Grass cover, Good, HSG A
237	98	Unconnected pavement, HSG A
102,388	39	Weighted Average
102,151		99.77% Pervious Area
237		0.23% Impervious Area
237		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	50	0.0120	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
2.9	309	0.0123	1.79		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	54	0.0645	4.09		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.3	413	Total			

Subcatchment PWS-7: East of Baseball Field



Summary for Subcatchment PWS-8: Turf Softball Field

Explanation for "Tc to Account for Porous Pavers/Infiltration Beds"
Per HydroCAD.net - When modeling infiltration beds, a Tc value of 790 minutes has produced good predictions for final discharge from infiltration beds with a 41" base (this approach has been studied by UNH Stormwater Center). It is believed that a proportional Tc can be used for smaller base thicknesses, as long as the layers remain proportional and in accordance with the UNH Specifications.
Since the proposed infiltration bed thickness is 8", a proportional Tc value of 193 min would be consistent with the aforementioned
information from HydroCAD.net. A factor of safety of 2 has been added to the Tc values in an effort to be conservative. As a result, a direct value of 97 minutes is being entered for the subcatchment.

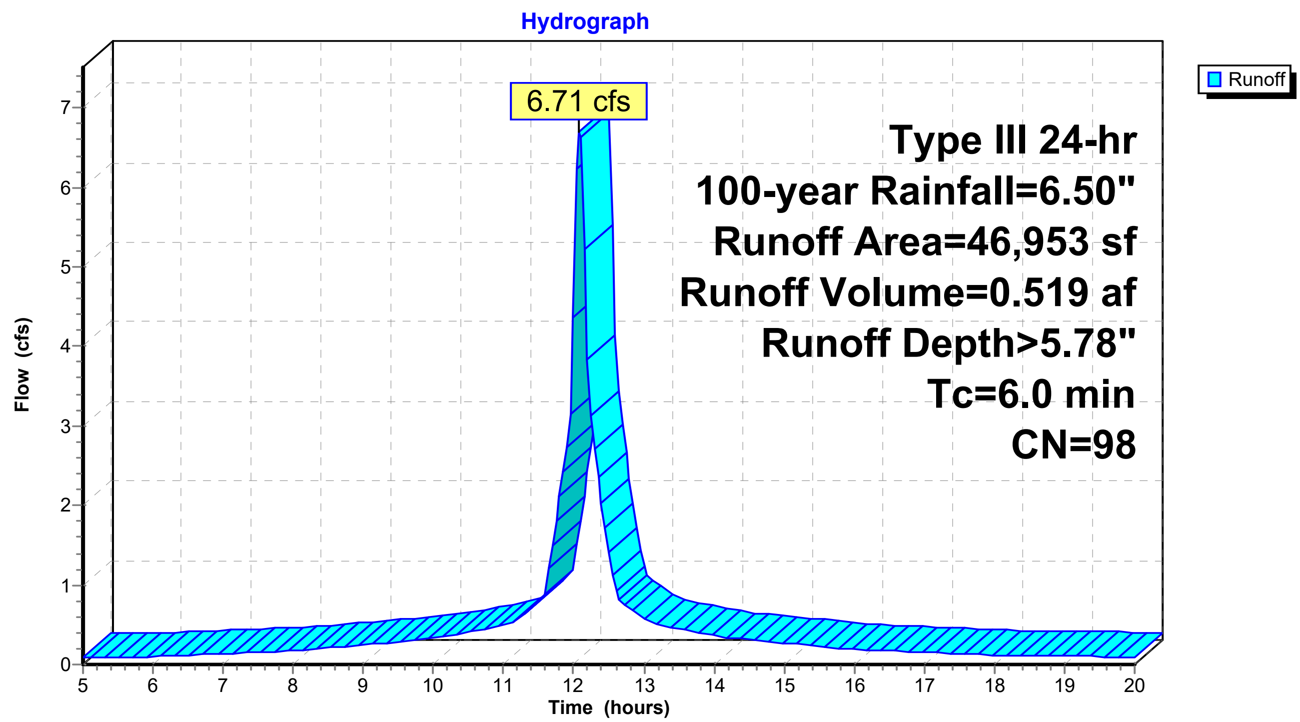
Runoff = 6.71 cfs @ 12.09 hrs, Volume= 0.519 af, Depth> 5.78"
Routed to Pond P-4 : Softball Field

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Description
46,953	98	Water Surface, 0% imp, HSG B
46,953		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment PWS-8: Turf Softball Field



Summary for Subcatchment PWS-9: Surrounding Softball

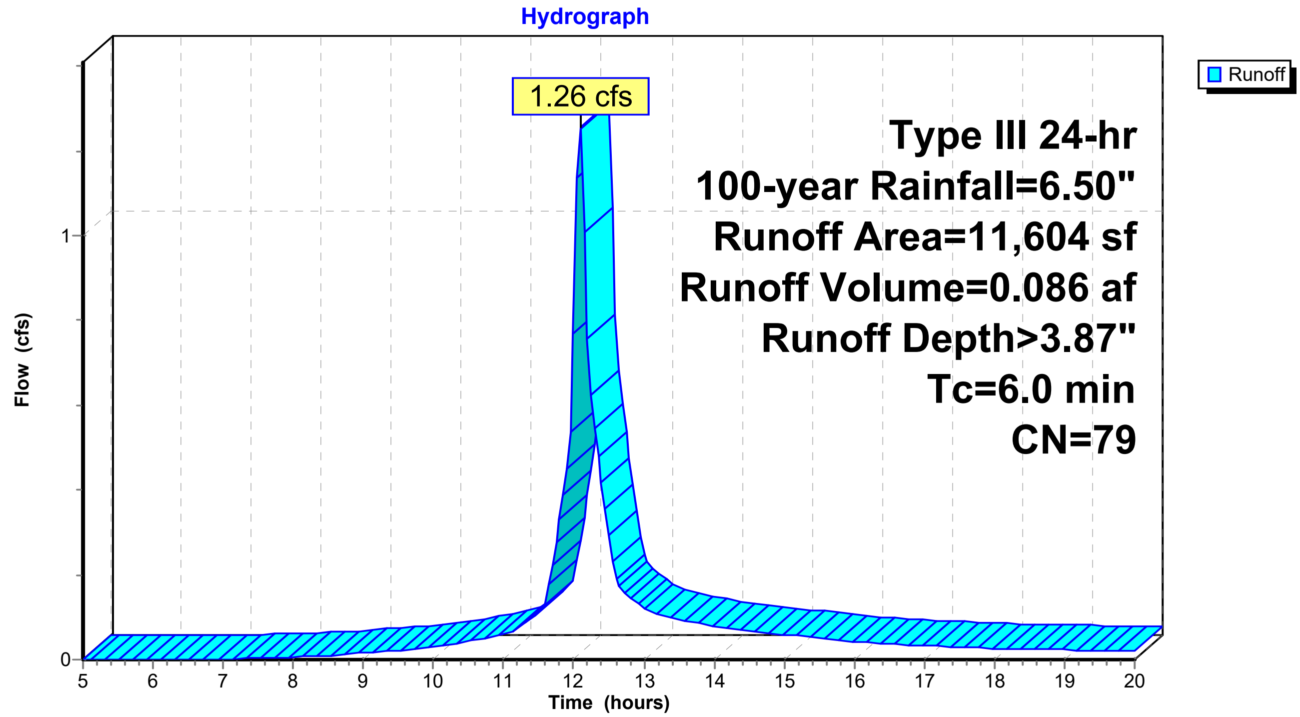
Runoff = 1.26 cfs @ 12.09 hrs, Volume= 0.086 af, Depth> 3.87"
Routed to Link DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=6.50"

Area (sf)	CN	Description
4,648	98	Unconnected pavement, HSG B
1,376	85	Gravel roads, HSG B
5,580	61	>75% Grass cover, Good, HSG B
11,604	79	Weighted Average
6,956		59.94% Pervious Area
4,648		40.06% Impervious Area
4,648		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

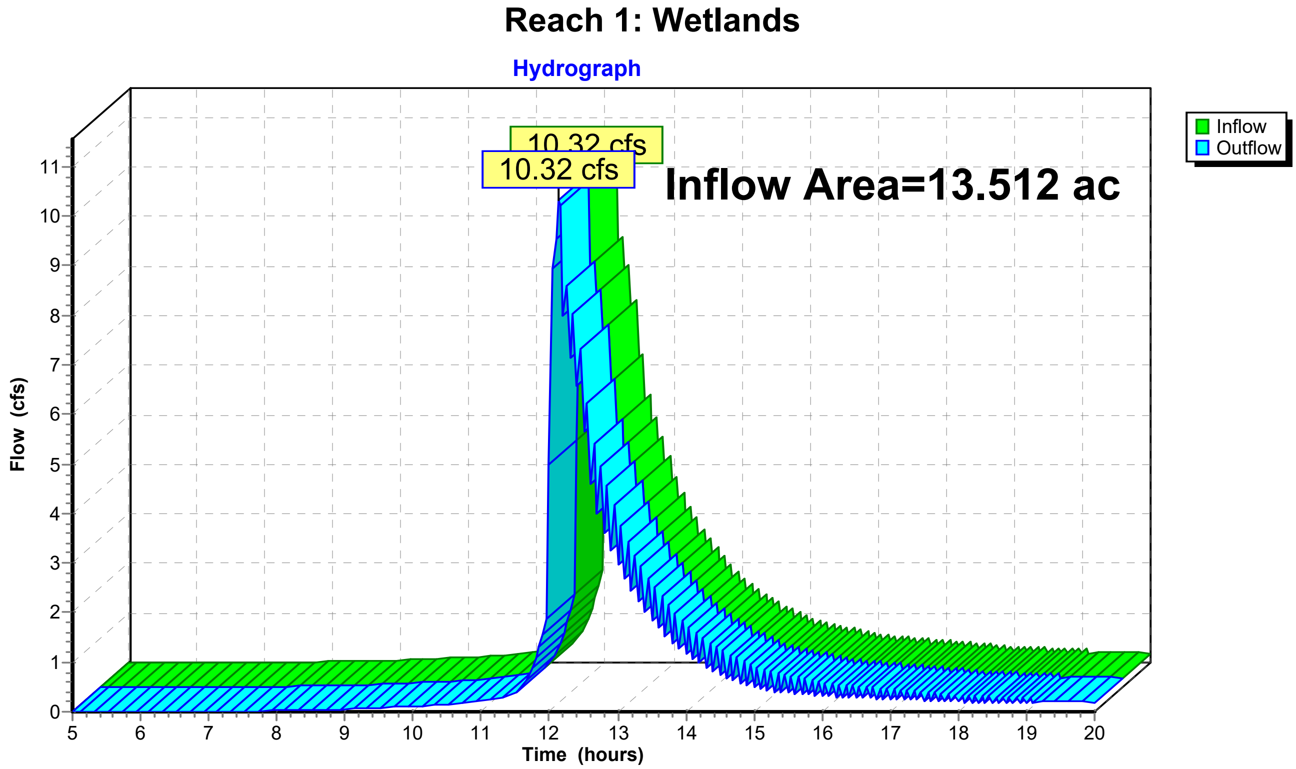
Subcatchment PWS-9: Surrounding Softball



Summary for Reach 1: Wetlands

Inflow Area = 13.512 ac, 26.95% Impervious, Inflow Depth > 0.90" for 100-year event
Inflow = 10.32 cfs @ 12.14 hrs, Volume= 1.016 af
Outflow = 10.32 cfs @ 12.14 hrs, Volume= 1.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Pond P-1: Football Field

Inflow Area = 3.967 ac, 48.15% Impervious, Inflow Depth > 5.71" for 100-year event
Inflow = 24.58 cfs @ 12.09 hrs, Volume= 1.889 af
Outflow = 4.42 cfs @ 12.54 hrs, Volume= 1.888 af, Atten= 82%, Lag= 27.1 min
Discarded = 2.07 cfs @ 11.25 hrs, Volume= 1.625 af
Primary = 2.34 cfs @ 12.54 hrs, Volume= 0.263 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.56' @ 12.54 hrs Surf.Area= 87,827 sf Storage= 27,873 cf

Plug-Flow detention time= 67.3 min calculated for 1.887 af (100% of inflow)
Center-of-Mass det. time= 66.8 min (802.9 - 736.1)

Volume	Invert	Avail.Storage	Storage Description
#1	98.77'	29,159 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 72,896 cf Overall x 40.0% Voids

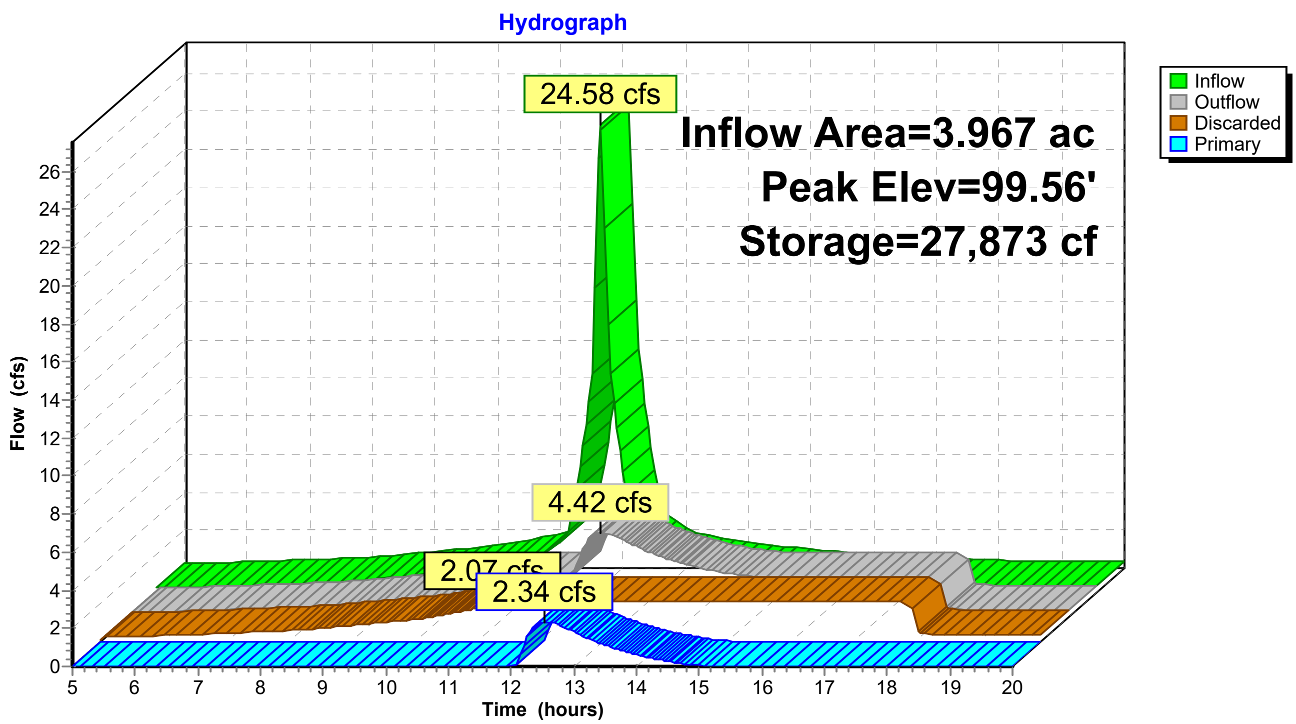
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.77	87,827	0	0
99.60	87,827	72,896	72,896

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.77'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.20'	**12.0" Round Culvert** L= 139.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.20' / 96.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	99.18'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=2.07 cfs @ 11.25 hrs HW=98.78' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.07 cfs)

Primary OutFlow Max=2.34 cfs @ 12.54 hrs HW=99.56' (Free Discharge)
└─**2=Culvert** (Passes 2.34 cfs of 3.74 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 2.34 cfs @ 2.98 fps)

Pond P-1: Football Field



Summary for Pond P-2: Baseball Field (West)

Inflow Area = 1.802 ac, 16.47% Impervious, Inflow Depth > 5.15" for 100-year event
Inflow = 10.57 cfs @ 12.09 hrs, Volume= 0.772 af
Outflow = 1.88 cfs @ 12.55 hrs, Volume= 0.772 af, Atten= 82%, Lag= 27.5 min
Discarded = 1.35 cfs @ 11.65 hrs, Volume= 0.737 af
Primary = 0.53 cfs @ 12.55 hrs, Volume= 0.035 af
Routed to Link DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.98' @ 12.55 hrs Surf.Area= 57,379 sf Storage= 10,737 cf

Plug-Flow detention time= 47.7 min calculated for 0.772 af (100% of inflow)
Center-of-Mass det. time= 47.4 min (799.1 - 751.7)

Volume	Invert	Avail.Storage	Storage Description
#1	96.51'	15,378 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 38,444 cf Overall x 40.0% Voids

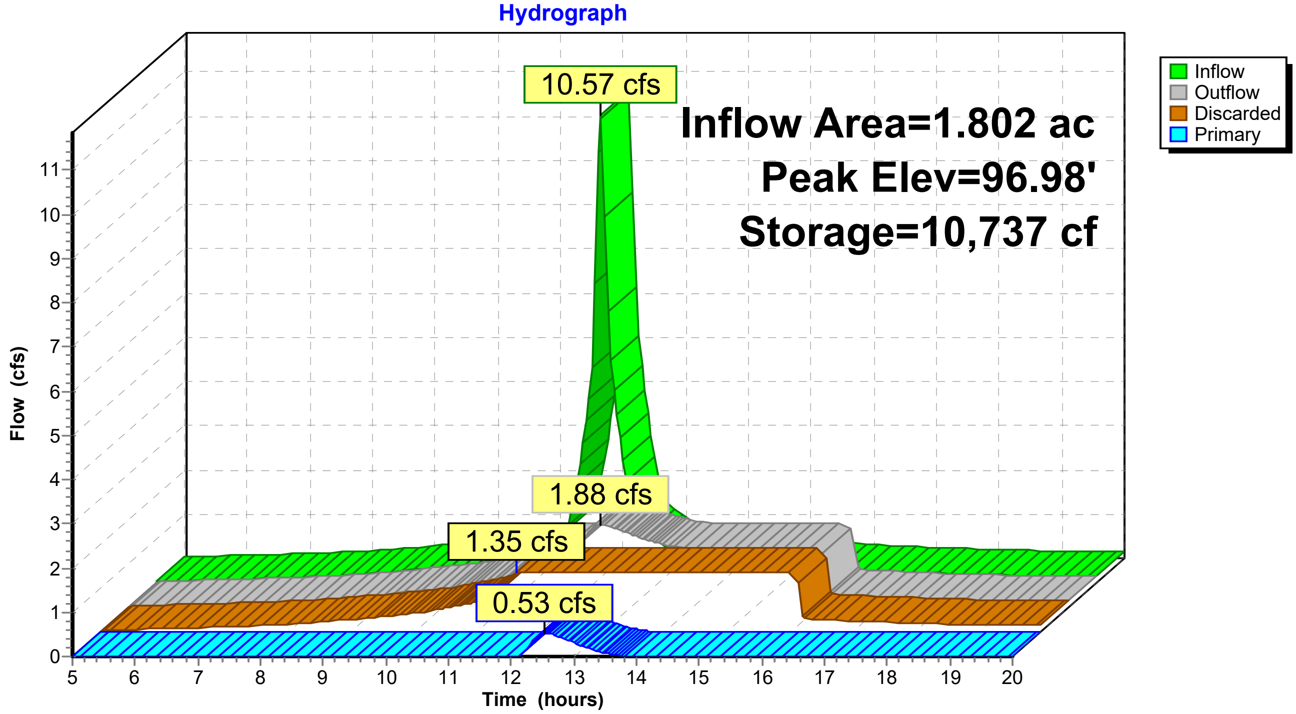
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.51	57,379	0	0
97.18	57,379	38,444	38,444

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.51'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	95.70'	**10.0" Round Culvert** L= 140.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.70' / 95.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.84'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.35 cfs @ 11.65 hrs HW=96.52' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.35 cfs)

Primary OutFlow Max=0.52 cfs @ 12.55 hrs HW=96.98' (Free Discharge)
└─**2=Culvert** (Passes 0.52 cfs of 1.75 cfs potential flow)
  └─**3=Orifice/Grate** (Weir Controls 0.52 cfs @ 1.21 fps)

Pond P-2: Baseball Field (West)



Summary for Pond P-3: Baseball Field (East)

Inflow Area = 1.440 ac, 1.88% Impervious, Inflow Depth > 5.78" for 100-year event
Inflow = 8.97 cfs @ 12.09 hrs, Volume= 0.694 af
Outflow = 1.48 cfs @ 12.56 hrs, Volume= 0.694 af, Atten= 84%, Lag= 28.3 min
Discarded = 1.45 cfs @ 11.70 hrs, Volume= 0.693 af
Primary = 0.02 cfs @ 12.56 hrs, Volume= 0.001 af
Routed to Link DP-3 : Design Point 3

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 96.87' @ 12.56 hrs Surf.Area= 61,566 sf Storage= 8,571 cf

Plug-Flow detention time= 35.0 min calculated for 0.691 af (100% of inflow)
Center-of-Mass det. time= 34.5 min (768.3 - 733.8)

Volume	Invert	Avail.Storage	Storage Description
#1	96.52'	16,500 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 41,249 cf Overall x 40.0% Voids

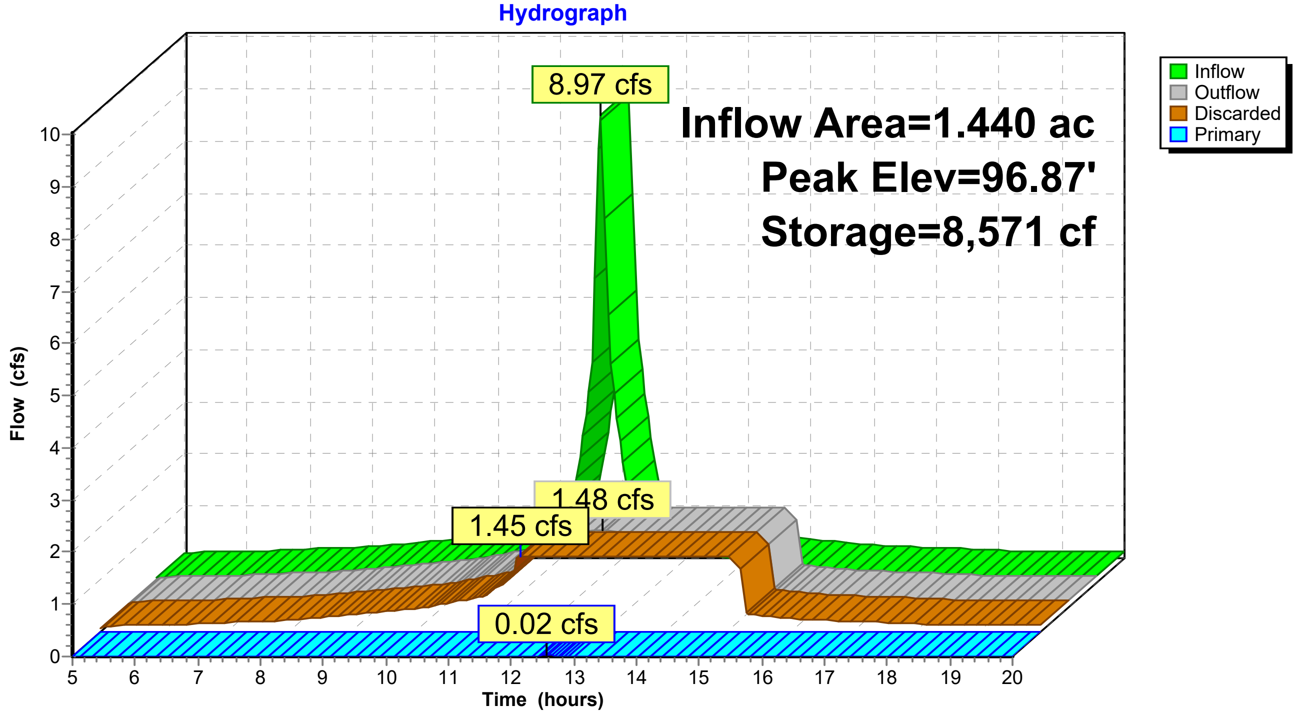
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
96.52	61,566	0	0
97.19	61,566	41,249	41,249

Device	Routing	Invert	Outlet Devices
#1	Discarded	96.52'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	93.44'	**10.0" Round Culvert** L= 14.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.44' / 93.37' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	96.85'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.45 cfs @ 11.70 hrs HW=96.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.45 cfs)

Primary OutFlow Max=0.02 cfs @ 12.56 hrs HW=96.87' (Free Discharge)
└─**2=Culvert** (Passes 0.02 cfs of 4.56 cfs potential flow)
  └─**3=Orifice/Grate** (Weir Controls 0.02 cfs @ 0.44 fps)

Pond P-3: Baseball Field (East)



Summary for Pond P-4: Softball Field

Inflow Area = 1.078 ac, 0.00% Impervious, Inflow Depth > 5.78" for 100-year event
Inflow = 6.71 cfs @ 12.09 hrs, Volume= 0.519 af
Outflow = 1.12 cfs @ 12.56 hrs, Volume= 0.519 af, Atten= 83%, Lag= 28.1 min
Discarded = 1.11 cfs @ 11.70 hrs, Volume= 0.519 af
Primary = 0.01 cfs @ 12.56 hrs, Volume= 0.000 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 41.74' @ 12.56 hrs Surf.Area= 46,953 sf Storage= 6,352 cf

Plug-Flow detention time= 33.7 min calculated for 0.519 af (100% of inflow)
Center-of-Mass det. time= 33.3 min (767.1 - 733.8)

Volume	Invert	Avail.Storage	Storage Description
#1	41.40'	12,583 cf	**Custom Stage Data (Irregular)**Listed below (Recalc) 31,459 cf Overall x 40.0% Voids

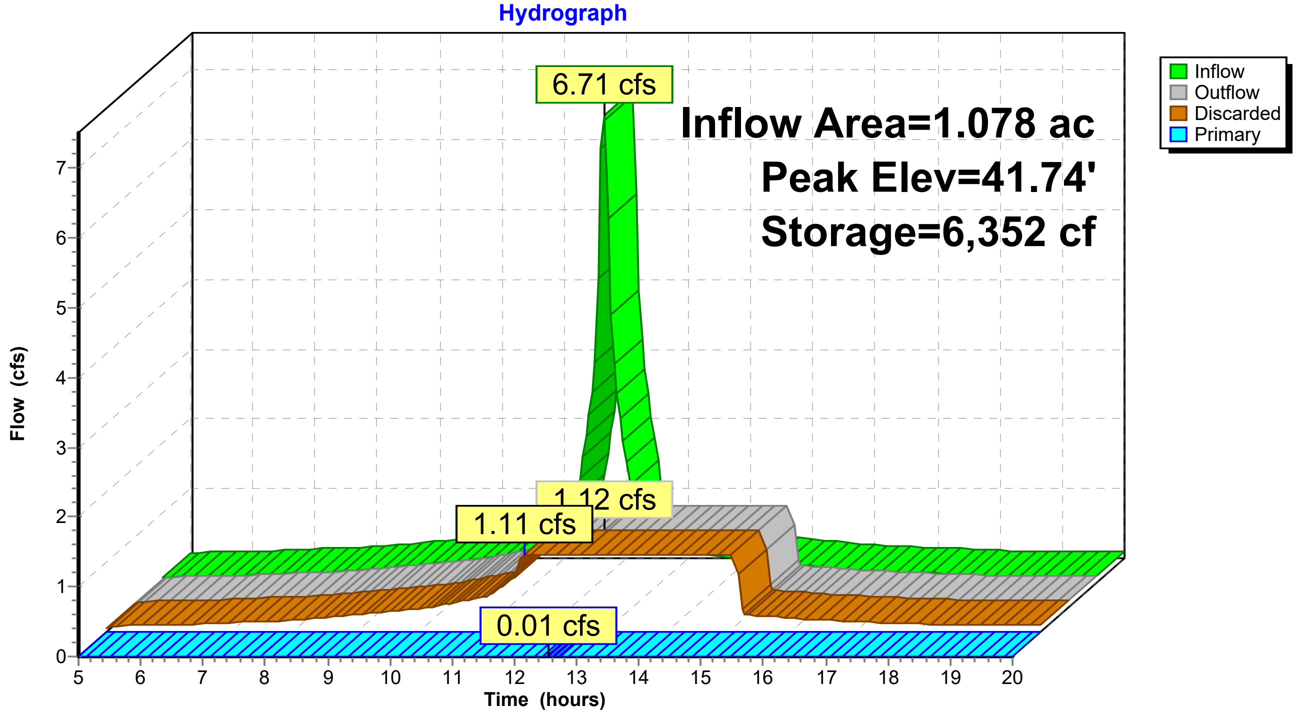
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
41.40	46,953	836.0	0	0	46,953
42.07	46,953	836.0	31,459	31,459	47,513

Device	Routing	Invert	Outlet Devices
#1	Discarded	41.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	39.07'	**10.0" Round 12" RCP Outlet** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 39.07' / 39.00' S= 0.0070 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.55 sf
#3	Device 2	41.73'	**10.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=1.11 cfs @ 11.70 hrs HW=41.41' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.11 cfs)

Primary OutFlow Max=0.01 cfs @ 12.56 hrs HW=41.74' (Free Discharge)
└─**2=12" RCP Outlet** (Passes 0.01 cfs of 3.11 cfs potential flow)
  └─**3=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.29 fps)

Pond P-4: Softball Field



Summary for Pond TRNCH: Tennis Court Exfiltration Trench

Inflow Area = 1.382 ac, 54.57% Impervious, Inflow Depth > 3.07" for 100-year event
Inflow = 5.25 cfs @ 12.09 hrs, Volume= 0.354 af
Outflow = 5.41 cfs @ 12.07 hrs, Volume= 0.291 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.06 cfs @ 12.00 hrs, Volume= 0.041 af
Primary = 5.36 cfs @ 12.07 hrs, Volume= 0.250 af
Routed to Link DP-1 : Design Point 1

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 97.56' @ 12.05 hrs Surf.Area= 2,330 sf Storage= 2,729 cf

Plug-Flow detention time= 71.4 min calculated for 0.290 af (82% of inflow)
Center-of-Mass det. time= 22.8 min (818.1 - 795.3)

Volume	Invert	Avail.Storage	Storage Description
#1	91.00'	600 cf	**Drywell Storage (Prismatic)**Listed below (Recalc) x 2
#2	91.00'	1,752 cf	**Exfiltration stone Layer (Prismatic)**Listed below (Recalc) 4,380 cf Overall x 40.0% Voids
#3	97.00'	377 cf	**Freeboard above basins (Prismatic)**Listed below (Recalc)
		2,729 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	50	0	0
97.00	50	300	300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
91.00	730	0	0
97.00	730	4,380	4,380

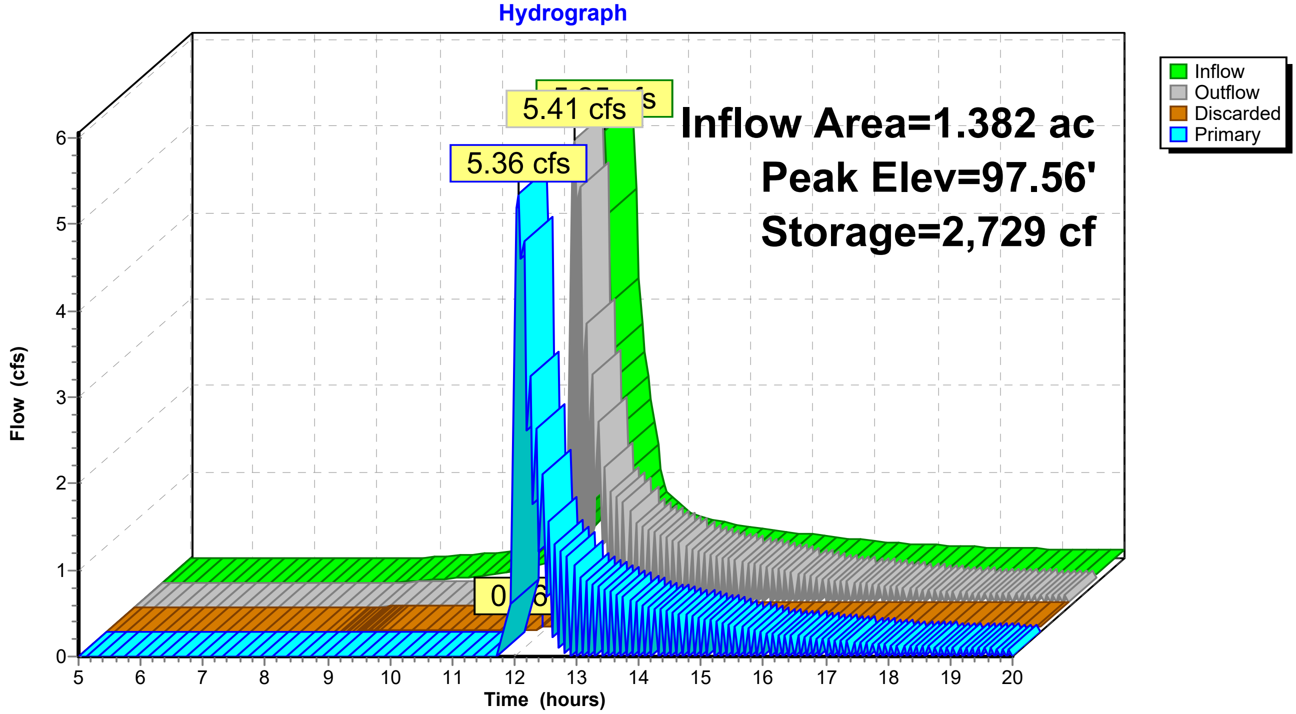
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.00	6	0	0
97.50	1,500	377	377

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	97.50'	**150.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.06 cfs @ 12.00 hrs HW=97.53' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=4.59 cfs @ 12.07 hrs HW=97.55' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 4.59 cfs @ 0.56 fps)

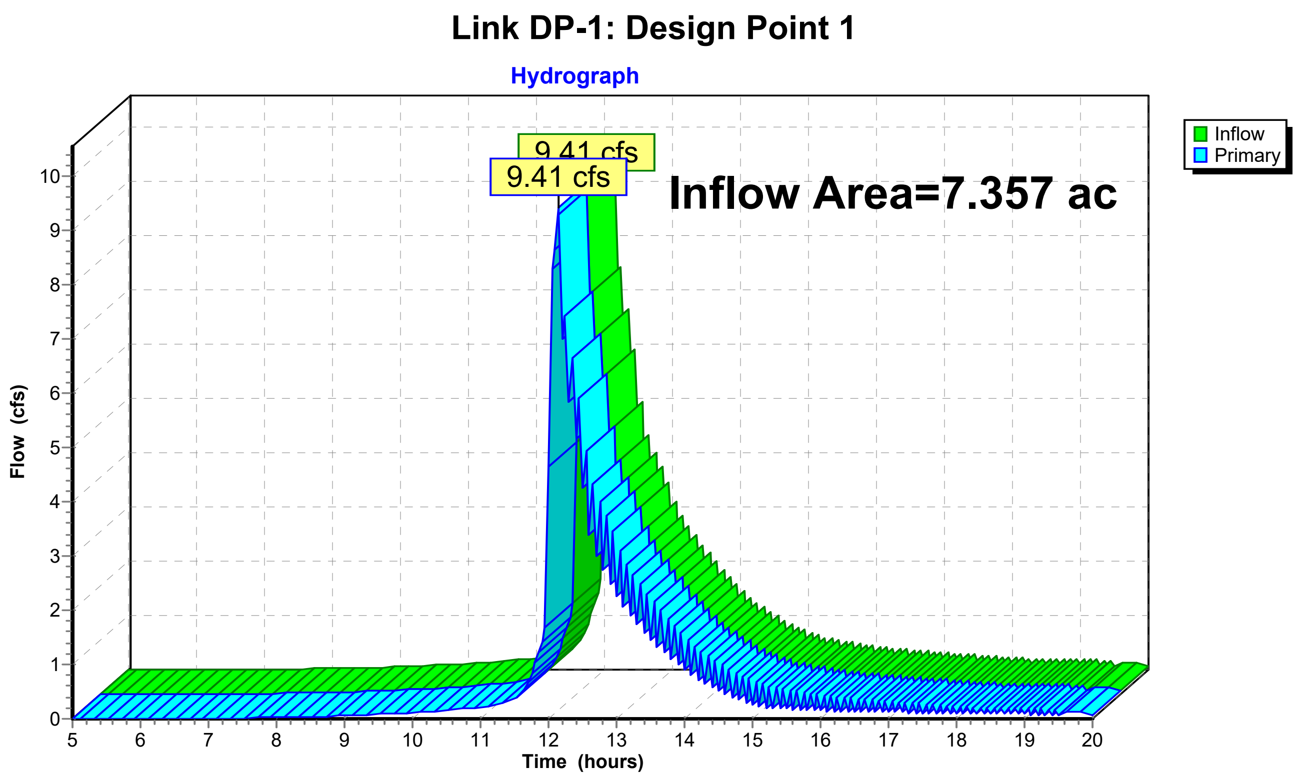
Pond TRNCH: Tennis Court Exfiltration Trench



Summary for Link DP-1: Design Point 1

Inflow Area = 7.357 ac, 42.92% Impervious, Inflow Depth > 1.34" for 100-year event
Inflow = 9.41 cfs @ 12.14 hrs, Volume= 0.819 af
Primary = 9.41 cfs @ 12.14 hrs, Volume= 0.819 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

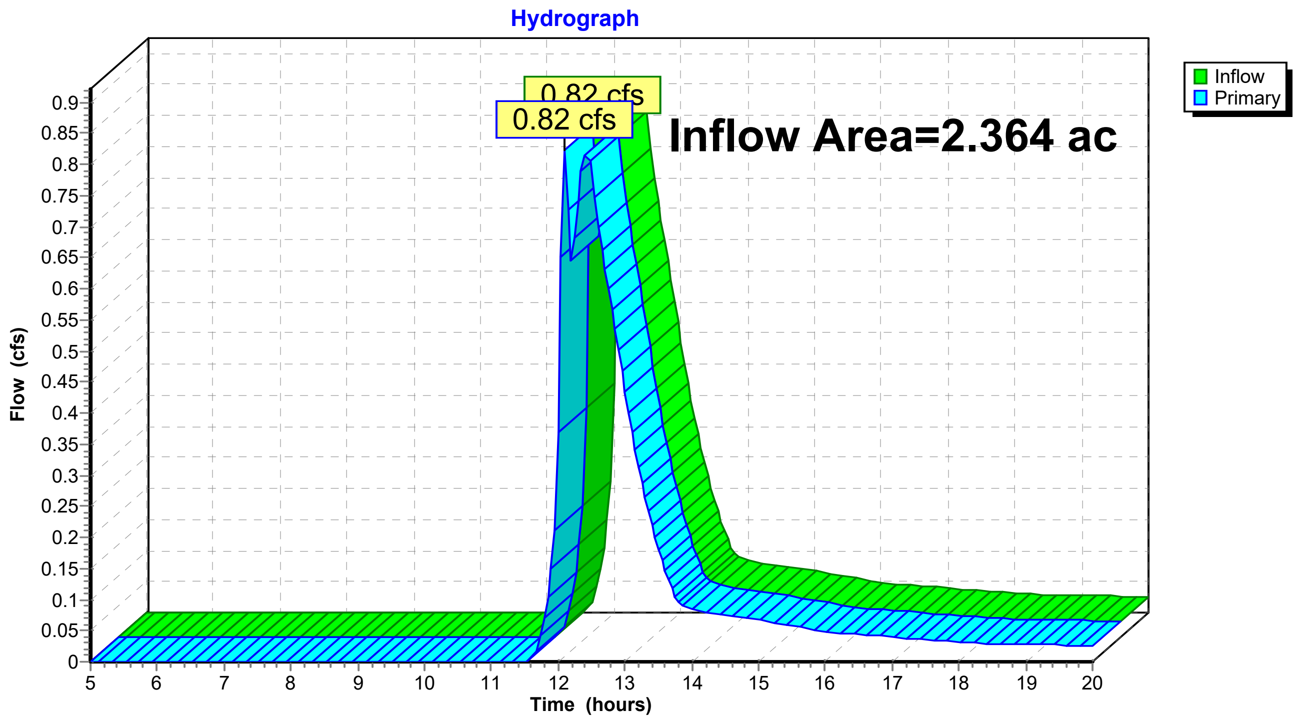


Summary for Link DP-2: Design Point 2

Inflow Area = 2.364 ac, 19.07% Impervious, Inflow Depth > 0.49" for 100-year event
Inflow = 0.82 cfs @ 12.11 hrs, Volume= 0.097 af
Primary = 0.82 cfs @ 12.11 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP-2: Design Point 2

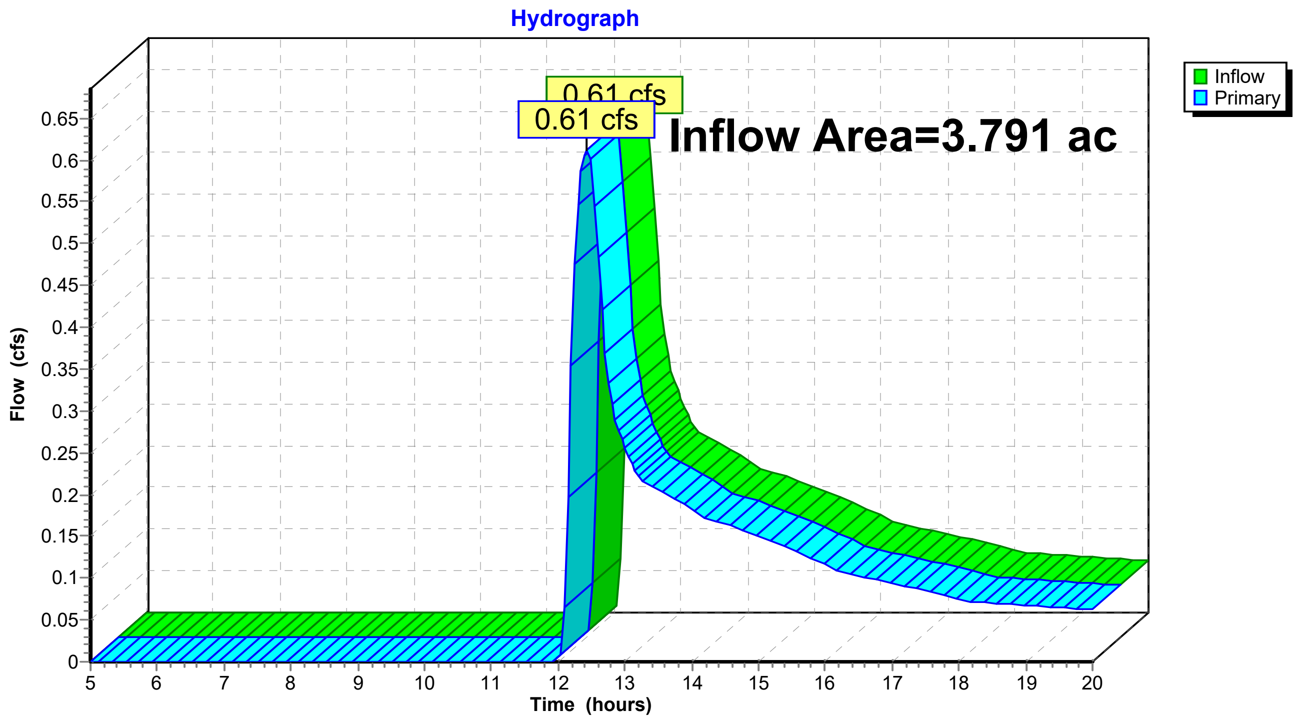


Summary for Link DP-3: Design Point 3

Inflow Area = 3.791 ac, 0.86% Impervious, Inflow Depth > 0.32" for 100-year event
Inflow = 0.61 cfs @ 12.43 hrs, Volume= 0.100 af
Primary = 0.61 cfs @ 12.43 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1 : Wetlands

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link DP-3: Design Point 3



INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Hamilton, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
Drainage Channel	**0.00**	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **HWRHS Athletic Campus**
Prepared By: **RDT**
Date: **11/15/2023**

*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

ATTACHMENT 6

Operation & Maintenance Plan

GALE

OPERATION AND MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS
HAMILTON, MASSACHUSETTS 01982

NOVEMBER 2023

Hamilton-Wenham Regional School District

Prepared for:

Hamilton-Wenham Regional School District
5 School Street
Wenham, Massachusetts 01984

Prepared by:

Gale Associates, Inc.
300 Ledgewood Place – Suite 300
Rockland, MA 02370
Gale JN 718600

COMMONWEALTH OF MASSACHUSETTS
BREE D. SULLIVAN
CIVIL
No. 48441
REGISTERED PROFESSIONAL ENGINEER

Prepared by: Ryan D. Thackeray, E.I.T.

Reviewed by: Bree D. Sullivan, P.E.

OPERATION AND MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

TABLE OF CONTENTS

OPERATION & MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

Basic Information

Project Address:	775 Bay Road, Hamilton, MA 01982
Owner:	Hamilton-Wenham Regional School District
Town:	Hamilton, MA

SECTION I: CONSTRUCTION ACTIVITIES

1. Contact the Owner in writing at least seven (7) days prior to the start of construction.
2. Place the site sign (with contact numbers) prior to any work on site.
3. Install the erosion control BMPs as shown on the construction documents.
4. The silt fence and silt sock line shall be inspected on a weekly basis; any breaks in the line shall be repaired as soon as possible.
5. All erosion and sedimentation controls shall be in accordance with the DEP's Erosion and Sedimentation Control Guidelines and the USDA SCS Erosion and Sedimentation Control during site development.
6. All stockpile areas are to be protected by silt fence and silt socks, and shall be covered with a tarp to prevent moisture intrusion and dust concerns.
7. All disturbed areas shall be stabilized with mulch or seed immediately upon completion of construction activity. In no case, shall an area be left unstabilized for more than 14 days after the construction activity in that area has ceased.
8. All erosion control measures shall be inspected after any rainfall of 0.5" or greater.
9. All catch basins are to be ringed with silt socks and covered with a sediment filter until all up-gradient disturbed areas are stabilized.
10. Any outlet orifices are to be ringed with silt socks until the detention structure or infiltration area is stabilized, if applicable
11. All slopes greater than 3:1 shall be stabilized with an erosion control blanket.
12. The contractor shall keep additional silt fence and straw bales on site to mitigate any emergency condition.
13. All proposed drainage structures (catch basins, manholes, outlet control structures and detention systems) should be cleaned at the end of construction and at any time the sediment within the structures equals 12" deep.
14. The contractor shall only disturb the minimum area necessary.
15. All illicit discharges are prohibited.
16. The entire project area shall be stabilized with vegetation upon completion of construction and prior to the removal of the erosion control devices.

OPERATION & MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

SECTION II: POST-DEVELOPMENT ACTIVITIES

PART A - GENERAL

- It shall be the responsibility of the owner to implement the procedures outlined herein.
- The closed drainage system shall be inspected every 6 months and any excess sediment within the structures or detention systems shall be properly disposed of.
- Any problems found with the drainage system shall be repaired within one week of discovery.
- The Owner shall employ a qualified professional to perform periodic maintenance, as described herein.
- All maintenance personnel shall be trained annually on the operation and maintenance procedures. A training log shall be maintained for records to document the annual training of employees.
- Inspection logs are included with this O&M Plan. The qualified professional shall provide the Owner with maintenance logs after each inspection or corrective action. The Owner shall keep record of these logs for at least three (3) years and shall provide copies to the Town, if requested.
- In the event that an infiltration BMP (stone/pipe trenches, synthetic turf fields) fails to drain within 72-hours of a storm event, a qualified professional should be consulted to determine what corrective actions may be necessary.
- All illicit discharges are prohibited.

PART B - BMP MANAGEMENT

Each Best Management Practice shall be maintained per the below requirements:

SYNTHETIC TURF FIELDS

- Perform preventative maintenance twice a year.
- Inspect cleanouts and drain manholes after every major storm during the first 3 months of operation and twice a year thereafter.

STONE/PIPE TRENCHES (INFILTRATION SYSTEM OR EQUIVALENT)

- Inspect and remove debris every 6 months and after every major storm.
- Remove all sediment from pre-treatment BMPs.

CATCH BASINS, TRENCH DRAINS, SLOT DRAINS, AND AREA DRAINS

- Inspect and clean at least four times per year (quarterly).
- Sediment shall be removed when the depth is greater than one half the distance from the bottom invert to the manhole floor.
- Use of a vacuum truck is the preferred cleaning method.

SECTION III: LONG TERM POLLUTION PREVENTION PLAN

GOOD HOUSEKEEPING PRACTICES

- Prevent or reduce pollutant runoff by performing periodic landscape maintenance, trash clean up, erosion control measures, and site cleaning.

STORING MATERIALS AND WASTE PRODUCTS

- All materials stored on site shall be stored in a neat and orderly fashion, in their appropriate containers, and under a roof or other secure enclosure. Waste products should be placed in secure receptacles until they are emptied by a licensed solid waste management company.

ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPS

- Follow the guidelines outlined above.

MAINTENANCE OF LAWNS, GARDENS, AND OTHER LANDSCAPED AREAS

- The Owner will be responsible for these activities.

PET WASTE MANAGEMENT

- Pet waste shall be placed in secure receptacles until they are emptied by a licensed solid waste management company.

PROPER MANAGEMENT OF DEICING CHEMICALS AND SNOW

- Snow disposal shall be in accordance with the Department of Environmental Protection, Bureau of Resource Protection, Snow Disposal Guidelines, Guideline No. BRPG01-01. In general, snow will be plowed in accordance with standard operating procedures. Whenever possible, the use of environmentally friendly alternatives (e.g., calcium chloride and sand instead of salt for melting ice) will be considered.

OPERATION & MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

INSPECTION & MAINTENANCE LOG

Inspected By:____________________ Date:________________________________

Days Since Last Rainfall:___________ Amount of Last Rainfall:___________Inches

BMP Being Inspected:

SYNTHETIC TURF FIELD

Opened Inspection Ports or Manhole Covers	YES	NO
Standing Water Observed	YES	NO
Depth of Standing Water (inches)		Not Applicable
Sediment Observed	YES	NO
Depth of Sediment (inches)		Not Applicable

Corrective Actions Taken:

Other Remarks:

OPERATION & MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

INSPECTION & MAINTENANCE LOG

Inspected By:____________________ Date:_________________________________

Days Since Last Rainfall:___________ Amount of Last Rainfall:___________Inches

BMP Being Inspected:

STONE/PIPE TRENCHES

Opened Inspection Ports or Manhole Covers	YES	NO
Standing Water Observed	YES	NO
Depth of Standing Water (inches)		Not Applicable
Sediment Observed	YES	NO
Depth of Sediment (inches)		Not Applicable

Corrective Actions Taken:

Other Remarks:

OPERATION & MAINTENANCE PLAN

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

INSPECTION & MAINTENANCE LOG

Inspected By:____________________ Date:_________________________________

Days Since Last Rainfall:___________ Amount of Last Rainfall:___________ Inches

BMP Being Inspected:

TRENCH DRAINS

Opened Inspection Ports or Manhole Covers	YES	NO
Standing Water Observed	YES	NO
Depth of Standing Water (inches)		Not Applicable
Sediment Observed	YES	NO
Depth of Sediment (inches)		Not Applicable

Corrective Actions Taken:

Other Remarks:

HAMILTON-WENHAM REGIONAL SCHOOL DISTRICT
HAMILTON-WENHAM REGIONAL HIGH SCHOOL ATHLETIC CAMPUS IMPROVEMENTS

SECTION IV: ILLICIT DISCHARGE STATEMENT

Standard 10 of the Massachusetts Stormwater Regulations prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or a municipal separate storm sewer system.

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.

I, ________________________________(print name), certify that I have conducted a proper site investigation and verify that to the best of my knowledge there are no illicit discharges located at HAMILTON-WENHAM REGIONAL HIGH SCHOOL, HAMILTON, MA.

Signature___________________________________

Date_______________________________________

ATTACHMENT 7

PFAS Information
Traffic Summary

Gale Associates, Inc.
163 Libbey Industrial Parkway | Weymouth, MA 02189
P 781.335.6465 F 781.335.6467 www.gainc.com

Traffic Impact Assessment:

The proposed project at Hamilton-Wenham Regional High School is a re-development project, with no change in use. The existing site contains a grass multipurpose stadium field within a 400-meter running track, an existing grass baseball and softball fields and two other grass multipurpose fields. The proposed project will reconstruct the existing track and replace the stadium, baseball/multi-purpose and softball fields with new synthetic turf fields and four new tennis courts. As mentioned in the Permit Pre-Application meeting, since the project will not change in use, a long-term traffic impact is not anticipated. There will be a temporary increase in traffic associated with the construction phase, which is addressed below.

During the construction phase of this project, trucks will need to make product and material deliveries on a regular basis to the site. The approximate number of trucks for each aspect of the project is listed below:

1. Topsoil Removal and Demolition for a single typical turf field will require approximately 90 triaxle truck loads or 60 trailer truck loads during the initial demolition phase of the project. (± 2 weeks per field)
2. Drainage system components, including all drainage structures and piping for a typical turf field will require approximately 2-3 trucks throughout the construction phase of the project and typically arrive within the first month of construction.
3. The 8" drainage stone base for a single typical turf field requires approximately 15 trailers or 25 triaxles over the span of about a week.
4. Turf carpet and shock pad deliveries for a typical field require approximately 2 trucks for turf carpet and 2 trucks for shock pads for each field based on Gale's experience on recent projects of similar size. The deliveries should occur in succession over a few days and the products will be delivered in their entirety and stockpiled on site for future use. Note that the turf carpet and shock pads are delivered wrapped and remain wrapped until installation.

5. Infill material deliveries require approximately 10-12 trucks for each field. The deliveries should occur in succession over a few days and the products will be delivered in their entirety and stockpiled on site for future use. The infill is delivered in sacks where they will remain until placement.
6. Asphalt paving for the track and associated walkways will require approximately 20 trucks for the entirety of the project based on the estimated tons of asphalt required for the project. The project includes reclaiming the existing track pavement and re-using the material for the base. This eliminates truck trips that would have been required to remove the existing pavement and haul in new base material. The paving typically takes two days for the binder course and two days for the top course.
7. Asphalt paving for the nine tennis courts will require approximately 30 trucks for the entirety of the project based on the estimated tons of asphalt required for the tennis courts. The project is includes reclaiming the existing court pavement and re-using the material for the base. This eliminates truck trips that would have been required to remove the existing pavement and haul in new base material. The paving typically takes two days for the binder course and two days for the top course.

Note that truck routes will be developed and confirmed with the selected contractor. All trucks making deliveries or hauling off demolition materials will enter the site via route 1A . The proposed construction traffic will be for a limited time, occurring mostly when school is out of session for the summer.

PFAS INFORMATION & TESTING RESULTS

Gale Associates, Inc.
300 Ledgewood Place | Rockland, MA 02370
P 781.335.6465 F 781.335.6467
www.galeassociates.com

PFAS INFORMATION

Gale appreciates the increased concerns related to potential perfluoroalkyl and polyfluoroalkyl substances (PFAS) presence in synthetic turf field products. Although we are not toxicologists, through our work with the turf suppliers and other Towns, we have compiled pertinent studies, data, and manufacturer's information regarding PFAS, and are submitting this information as part of this application on behalf of Hamilton-Wenham Regional School District.

This attachment includes several studies involving various infill materials including crumb rubber and Brockfill infill materials, as well as results from laboratory testing of synthetic turf backing and synthetic turf fibers. The test results provided by both Act Global and Sprinturf indicate that individual PFAS concentrations are generally below laboratory detectable limits. The documented PFAS levels in turf materials have been reported to be below published background concentrations of PFAS in natural soils, and below risk-based EPA standards related to PFAS. It is our understanding that synthetic turf fibers were manufactured using a polymeric PFAS (PVDF-HFP) as a processing aid. Turf manufacturers are getting away from this process, even though PVDF-HFP is a common component used in medical devices and reported to be biocompatible, inert and insoluble.

In an attempt to address potential PFAS concerns, Gale typically includes the following requirement as part of the bid documents:

- The General Contractor/Turf Supplier is required to conduct 3rd party testing for the currently regulated perfluoroalkyl and polyfluoroalkyl substances (PFAS) for the turf and infill to be installed, and provide written certification that they meet the regulated PFAs limits in the installed materials or that no PFAS are detected in the products.

This requirement has been included in the Bid Documents for Gale's projects over the last few years, and laboratory testing results have been found to be below detectable limits for these projects.

Attachments:
- Act Global PFAS Statement & Lab Results – Synthetic Turf
- Sprinturf PFAS Statement & Lab Results – Synthetic Turf Backing & Fibers
- RTI Laboratories PFAS Statement and Lab Results – Algonquin Regional High School - Synthetic Turf Backing & Fibers
- RTI Laboratories PFAS Statement and Lab Results – Manchester-Essex Regional High School – Brook Street Field & Hyland Field - Synthetic Turf Backing & Fibers, Crumb Rubber and Sand Infill Materials
- Haley Aldrich Crumb Rubber Memorandum
- Laura Green Brock Infill Health Risk Analysis

ACT GLOBAL PFAS STATEMENT & LAB RESULTS – SYNTHETIC TURF

CORPORATE OFFICE | AMERICA
4201 West Parmer Lane
Suite B 175
Austin, Texas 78727 USA
T + 1.512.733.5300

PFA Statement:

Act Global adheres to regulatory or industry environmental guidelines as the public health is of upmost importance to us. In this regard, this letter is to confirm that Act Global does not add any PFAS in its manufacturing process of synthetic turf.

Sincerely,

Bill Lorenz | *Regional Manager*

E blorenz@actglobal.com | T 978-404-1789

O 12 Tower Hill Rd. Bow NH 03304 USA

O 4201 W Parmer Ln Ste B175 | Austin, TX 78727

W www.ActGlobal.com

ANALYTICAL REPORT

Lab Number:	L2010394
Client:	Act Global 410 South River St. Calhoun, GA 30701
ATTN:	Fred Gregg
Phone:	(706) 629-4774
Project Name:	ACT GLOBAL TURF YARN/BACK/PU
Project Number:	EPA 537M
Report Date:	04/02/20

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA030), NH NELAP (2062), CT (PH-0141), DoD (L2474), FL (E87814), IL (200081), LA (85084), ME (MA00030), MD (350), NJ (MA015), NY (11627), NC (685), OH (CL106), PA (68-02089), RI (LAO00299), TX (T104704419), VT (VT-0015), VA (460194), WA (C954), US Army Corps of Engineers, USDA (Permit #P330-17-00150), USFWS (Permit #206964).

320 Forbes Boulevard, Mansfield, MA 02048-1806
508-822-9300 (Fax) 508-822-3288 800-624-9220 - www.alphalab.com

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M

Lab Number: L2010394
Report Date: 04/02/20

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2010394-01	SAMPLE 1	SOLID	Not Specified		03/09/20

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: ACT GLOBAL TURF YARN/BACK/PU **Lab Number:** L2010394
Project Number: EPA 537M **Report Date:** 04/02/20

Case Narrative (continued)

Report Revision

April 2, 2020: A project name and number have been added.

March 27, 2020: The compound list has been revised.

Sample Receipt

The samples were received at the laboratory above the required temperature range and were not on ice.

Perfluorinated Alkyl Acids by Isotope Dilution

L2010394-01: The sample has elevated detection limits due to the limited sample volume utilized during extraction, as required by the sample matrix.

L2010394-01: Extracted Internal Standard recoveries were outside the acceptance criteria for individual analytes. Please refer to the surrogate section of the report for details.

The WG1353986-2 LCS recovery, associated with L2010394-01, is above the acceptance criteria for 1h,1h,2h,2h-perfluorodecanesulfonic acid (8:2fts) (161%); however, the associated sample is non-detect to the RL for this target analyte. The results of the original analysis are reported.

WG1353986-4 and WG1353986-5: Extracted Internal Standard recoveries were outside the acceptance criteria for individual analytes. Please refer to the surrogate section of the report for details.

WG1353986-5: The sample has elevated detection limits due to the limited sample volume utilized during extraction, as required by the sample matrix.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Susan O' Neil

Title: Technical Director/Representative Date: 04/02/20

ORGANICS

SEMIVOLATILES

Project Name: ACT GLOBAL TURF YARN/BACK/PU **Lab Number:** L2010394
Project Number: EPA 537M **Report Date:** 04/02/20

SAMPLE RESULTS

Lab ID: L2010394-01
Client ID: SAMPLE 1
Sample Location: Not Specified

Date Collected:
Date Received: 03/09/20
Field Prep: Not Specified

Sample Depth:
Matrix: Solid
Analytical Method: 134,LCMSMS-ID
Analytical Date: 03/24/20 04:44
Analyst: JW
Percent Solids: Results reported on an 'AS RECEIVED' basis.

Extraction Method: ALPHA 23528
Extraction Date: 03/23/20 09:15

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.67	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.67	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.67	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.67	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.67	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.67	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.67	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.67	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.67	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.67	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.67	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.67	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.67	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.67	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.67	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.67	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.67	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.67	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.67	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.67	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.67	--	1

Project Name: ACT GLOBAL TURF YARN/BACK/PU **Lab Number:** L2010394
Project Number: EPA 537M **Report Date:** 04/02/20

SAMPLE RESULTS

Lab ID: L2010394-01
Client ID: SAMPLE 1
Sample Location: Not Specified
Date Collected:
Date Received: 03/09/20
Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor

Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab

Surrogate (Extracted Internal Standard)	% Recovery	Qualifier	Acceptance Criteria
Perfluoro[13C4]Butanoic Acid (MPFBA)	76		60-153
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	91		65-182
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	70		70-151
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-4:2FTS)	81		56-138
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	75		61-147
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	75		62-149
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	74		63-166
Perfluoro[13C8]Octanoic Acid (M8PFOA)	83		62-152
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS)	124		32-182
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	87		61-154
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	77		65-151
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	84		65-150
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS)	**244**	Q	25-186
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA)	46		45-137
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	69		64-158
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	55		1-125
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	48		42-136
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	68		56-148
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	70		26-160

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M

Lab Number: L2010394
Report Date: 04/02/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 134,LCMSMS-ID
Analytical Date: 03/24/20 04:11
Analyst: JW

Extraction Method: ALPHA 23528
Extraction Date: 03/23/20 09:15

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab for sample(s): 01 Batch: WG1353986-1					
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.00	--
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.00	--
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.00	--
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.00	--
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.00	--
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.00	--
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.00	--
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.00	--
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.00	--
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.00	--
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.00	--
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.00	--
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.00	--
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.00	--
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.00	--
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.00	--
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.00	--
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.00	--
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.00	--
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.00	--

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M

Lab Number: L2010394
Report Date: 04/02/20

Method Blank Analysis
Batch Quality Control

Analytical Method: 134,LCMSMS-ID
Analytical Date: 03/24/20 04:11
Analyst: JW

Extraction Method: ALPHA 23528
Extraction Date: 03/23/20 09:15

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab for sample(s): 01 Batch: WG1353986-1					

Surrogate (Extracted Internal Standard)	%Recovery	Qualifier	Acceptance Criteria
Perfluoro[13C4]Butanoic Acid (MPFBA)	97		60-153
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	106		65-182
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	95		70-151
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-4:2FTS)	72		56-138
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	102		61-147
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	101		62-149
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	105		63-166
Perfluoro[13C8]Octanoic Acid (M8PFOA)	99		62-152
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS)	66		32-182
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	105		61-154
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	103		65-151
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	103		65-150
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS)	88		25-186
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA)	68		45-137
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	101		64-158
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	65		1-125
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	70		42-136
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	91		56-148
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	88		26-160

Lab Control Sample Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M
Lab Number: L2010394
Report Date: 04/02/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 Batch: WG1353986-2 WG1353986-3								
Perfluorobutanoic Acid (PFBA)	104		107		71-135	3		30
Perfluoropentanoic Acid (PFPeA)	111		113		69-132	2		30
Perfluorobutanesulfonic Acid (PFBS)	107		110		72-128	3		30
Perfluorohexanoic Acid (PFHxA)	103		105		70-132	2		30
Perfluoroheptanoic Acid (PFHpA)	106		108		71-131	2		30
Perfluorohexanesulfonic Acid (PFHxS)	114		107		67-130	6		30
Perfluorooctanoic Acid (PFOA)	106		111		69-133	5		30
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	114		130		64-140	13		30
Perfluoroheptanesulfonic Acid (PFHpS)	105		113		70-132	7		30
Perfluorononanoic Acid (PFNA)	106		109		72-129	3		30
Perfluorooctanesulfonic Acid (PFOS)	92		106		68-136	14		30
Perfluorodecanoic Acid (PFDA)	105		108		69-133	3		30
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	**161**	Q	130		65-137	21		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	111		114		63-144	3		30
Perfluoroundecanoic Acid (PFUnA)	109		108		64-136	1		30
Perfluorodecanesulfonic Acid (PFDS)	107		122		59-134	13		30
Perfluorooctanesulfonamide (FOSA)	111		108		67-137	3		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	110		107		61-139	3		30
Perfluorododecanoic Acid (PFDoA)	115		112		69-135	3		30
Perfluorotridecanoic Acid (PFTrDA)	126		129		66-139	2		30
Perfluorotetradecanoic Acid (PFTA)	110		117		69-133	6		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M
Lab Number: L2010394
Report Date: 04/02/20

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 Batch: WG1353986-2 WG1353986-3								

Surrogate (Extracted Internal Standard)	*LCS %Recovery*	*Qual*	*LCSD %Recovery*	*Qual*	*Acceptance Criteria*
Perfluoro[13C4]Butanoic Acid (MPFBA)	103		99		60-153
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	111		106		65-182
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	123		93		70-151
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-4:2FTS)	99		72		56-138
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	112		107		61-147
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	109		104		62-149
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	116		94		63-166
Perfluoro[13C8]Octanoic Acid (M8PFOA)	108		105		62-152
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS)	100		75		32-182
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	112		106		61-154
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	134		96		65-151
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	104		102		65-150
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS)	98		85		25-186
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA)	77		83		45-137
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	112		107		64-158
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	66		70		1-125
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	82		78		42-136
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	102		95		56-148
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	98		92		26-160

Matrix Spike Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU

Project Number: EPA 537M

Lab Number: L2010394

Report Date: 04/02/20

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1353986-4 QC Sample: L2010394-01 Client ID: SAMPLE 1												
Perfluorobutanoic Acid (PFBA)	ND	6.8	7.14	105		-	-		71-135	-		30
Perfluoropentanoic Acid (PFPeA)	ND	6.8	7.54	111		-	-		69-132	-		30
Perfluorobutanesulfonic Acid (PFBS)	ND	6.03	6.24	104		-	-		72-128	-		30
Perfluorohexanoic Acid (PFHxA)	ND	6.8	7.04	103		-	-		70-132	-		30
Perfluoroheptanoic Acid (PFHpA)	ND	6.8	7.15	105		-	-		71-131	-		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	6.2	6.13	99		-	-		67-130	-		30
Perfluorooctanoic Acid (PFOA)	ND	6.8	7.44	109		-	-		69-133	-		30
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND	6.46	7.30	113		-	-		64-140	-		30
Perfluoroheptanesulfonic Acid (PFHpS)	ND	6.46	7.04	109		-	-		70-132	-		30
Perfluorononanoic Acid (PFNA)	ND	6.8	7.45	110		-	-		72-129	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	6.3	5.72	91		-	-		68-136	-		30
Perfluorodecanoic Acid (PFDA)	ND	6.8	7.13	105		-	-		69-133	-		30
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND	6.53	8.29	127		-	-		65-137	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	6.8	8.02	118		-	-		63-144	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	6.8	7.34	108		-	-		64-136	-		30
Perfluorodecanesulfonic Acid (PFDS)	ND	6.57	7.53	115		-	-		59-134	-		30
Perfluorooctanesulfonamide (FOSA)	ND	6.8	7.36	108		-	-		67-137	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	6.8	7.82	115		-	-		61-139	-		30
Perfluorododecanoic Acid (PFDoA)	ND	6.8	7.92	116		-	-		69-135	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	6.8	8.69	128		-	-		66-139	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	6.8	7.83	115		-	-		69-133	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Lab Number: L2010394
Project Number: EPA 537M
Report Date: 04/02/20

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1353986-4 QC Sample: L2010394-01 Client ID: SAMPLE 1												

Surrogate (Extracted Internal Standard)	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS)	**291**	Q			25-186
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-4:2FTS)	109				56-138
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS)	169				32-182
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	59				42-136
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA)	55				45-137
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	81				64-158
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	97				65-150
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	90				61-147
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	89				62-149
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	82				63-166
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	78				56-148
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	86				26-160
Perfluoro[13C4]Butanoic Acid (MPFBA)	88				60-153
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	104				65-182
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	62				1-125
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	90				65-151
Perfluoro[13C8]Octanoic Acid (M8PFOA)	96				62-152
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	101				61-154
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	79				70-151

Lab Duplicate Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M

Lab Number: L2010394
Report Date: 04/02/20

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1353986-5 QC Sample: L2010394-01 Client ID: SAMPLE 1						
Perfluorobutanoic Acid (PFBA)	ND	ND	ng/g	NC		30
Perfluoropentanoic Acid (PFPeA)	ND	ND	ng/g	NC		30
Perfluorobutanesulfonic Acid (PFBS)	ND	ND	ng/g	NC		30
Perfluorohexanoic Acid (PFHxA)	ND	ND	ng/g	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/g	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	ND	ng/g	NC		30
Perfluorooctanoic Acid (PFOA)	ND	ND	ng/g	NC		30
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND	ND	ng/g	NC		30
Perfluoroheptanesulfonic Acid (PFHpS)	ND	ND	ng/g	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/g	NC		30
Perfluorooctanesulfonic Acid (PFOS)	ND	ND	ng/g	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/g	NC		30
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND	ND	ng/g	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/g	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/g	NC		30
Perfluorodecanesulfonic Acid (PFDS)	ND	ND	ng/g	NC		30
Perfluorooctanesulfonamide (FOSA)	ND	ND	ng/g	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/g	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/g	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/g	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: ACT GLOBAL TURF YARN/BACK/PU
Project Number: EPA 537M
Lab Number: L2010394
Report Date: 04/02/20

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG1353986-5 QC Sample: L2010394-01 Client ID: SAMPLE 1						
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/g	NC		30

Surrogate (Extracted Internal Standard)	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro[13C4]Butanoic Acid (MPFBA)	76		75		60-153
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	91		91		65-182
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	70		**68**	Q	70-151
1H,1H,2H,2H-Perfluoro[1,2-13C2]Hexanesulfonic Acid (M2-4:2FTS)	81		95		56-138
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	75		76		61-147
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	75		76		62-149
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	74		77		63-166
Perfluoro[13C8]Octanoic Acid (M8PFOA)	83		83		62-152
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6:2FTS)	124		139		32-182
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	87		90		61-154
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	77		81		65-151
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	84		87		65-150
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8:2FTS)	**244**	Q	**297**	Q	25-186
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (d3-NMeFOSAA)	46		48		45-137
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	69		70		64-158
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	55		62		1-125
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	48		51		42-136
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	68		67		56-148
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	70		75		26-160

Project Name: ACT GLOBAL TURF YARN/BACK/PU **Lab Number:** L2010394
Project Number: EPA 537M **Report Date:** 04/02/20

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	*Custody Seal*
A	Absent

Container Information

Container ID	*Container Type*	*Cooler*	*Initial pH*	*Final pH*	*Temp deg C*	*Pres*	*Seal*	*Frozen Date/Time*	*Analysis(*)*
L2010394-01A	Bag	A	NA		23.1	Y	Absent		A2-537-ISOTOPE(28)

*Values in parentheses indicate holding time in days

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1

Project Name: ACT GLOBAL TURF YARN/BACK/PU **Lab Number:** L2010394
Project Number: EPA 537M **Report Date:** 04/02/20

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: Data Usability Report

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentrations is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less

Data Qualifiers

than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

REFERENCES

134 Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) using Isotope Dilution. Alpha SOP 23528.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
EPA TO-12 Non-methane organics
EPA 3C Fixed gases
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

SPRINTURF PFAS STATEMENT & LAB RESULTS – SYNTHETIC TURF BACKING AND FIBERS

SPRINTURF

P: 877-686-8873
F: 843-410-5712
146 Fairchild Street, Suite 150
Daniel Island, SC 29492

10/24/2019

RE: Recent Article Concerning PFAS and Artificial Turf

To Whom It May Concern:

As some of you may know, the Boston Globe published a sensational article about PFAS they allegedly found in discarded turf. They subsequently extrapolated their unscientific finding to all turf. Please note the following about Sprinturf's products and PFAS:

1. No PFAS chemicals are used in turf manufactured by Sprinturf. We have the advantage of being the only turf company that produces all our turf fibers in house, and in America, giving us full visibility to our supply chain.

2. As an added precaution, we sent our fibers for PFAS testing at an independent, nationally accredited lab. The lab tested for total PFAS (30 compounds) using EPA test method 537.1M. The test found PFAS levels to be non-detectable, as we fully expected.

3. It is important to recognize that PFAS compounds are a manmade additive. It is used in many consumer products such as carpet (stain resistance), surgical gowns (infection resistance), fast food wrappers (non-stick properties) and non-stick cookware. As such, there is room for cross-contamination at some level. The turf tested by PEER was apparently produced in a carpet facility, further increasing the possibility of cross-contamination.

Sprinturf is proud to be the leader in artificial turf technology, safety and responsibility. Every day we focus on delivering cutting edge products at industry leading value. If you have further questions about PFAS, or would like a copy of the test report, please don't hesitate to reach out.

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, October 18, 2019

Kyle Horne
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (843) 936-6009
FAX:

RE: PFAS Analysis of Synthetic Turf Fibers

Work Order #: 1910370

Dear Kyle Horne:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Director of Materials Sciences

RTI Laboratories, Inc. - Case Narrative

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers

Summary,

Total fluorine content was determined at 430mg/kg (ppm) which equates to 0.043% w/w

All extractable PFAS compounds were non-detect at a level of 2-4 ug/kg (ppb). Surrogate value exceedances were qualified due to non-detection of target analyte.

RTI Laboratories, Inc. - Analytical Report

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS Analysis of Synthetic Turf Fibers		
Lab ID:	1910370-001	**Matrix:**	
Client Sample ID:	Synthetic Turf Fibers		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Elemental Analysis by Bomb Combustion and IC	**Method: ASTMD4327**			**SW5050**		**Analyst: LK**
Fluorine	430	33		mg/Kg	1	10/17/2019 7:44 AM
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: EPA 537.1MOD**					**Analyst: DKS**
1H,1H,2H,2H-Perfluorodecanesulfonate	ND	4.0		µg/Kg	1	10/18/2019 2:40 PM
1H,1H,2H,2H-Perfluorohexanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
1H,1H,2H,2H-Perfluorooctanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
HFPO-DA (GEN X)	ND	4.0		µg/Kg	1	10/18/2019 2:40 PM
N-ethyl perfluorooctanesulfonamidoacetic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
N-methyl perfluorooctanesulfonamidoacetic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorobutanesulfonic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorobutanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorodecanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorodecanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorododecanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluoroheptanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluoroheptanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorohexanesulfonic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorohexanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorononanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorononanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorooctanesulfonic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorooctanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorooctansulfonamide	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluoropentanesulfonate	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluoropentanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorotetradecanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluorotridecanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Perfluoroundecanoic acid	ND	2.0		µg/Kg	1	10/18/2019 2:40 PM
Surr: D3-N-MeFOSAA	109	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: D5-N-EtFOSAA	195	50-150	S	%Rec	1	10/18/2019 2:40 PM
Surr: M2PFTeDA	157	50-150	S	%Rec	1	10/18/2019 2:40 PM
Surr: M3 GEN X	140	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M3PFBS	110	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M3PFHxS	112	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M5PFHpA	127	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M5PFHxA	118	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M5PFPeA	118	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M6PFDA	118	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M7PFUdA	139	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M8PFOA	126	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: M8PFOS	106	50-150		%Rec	1	10/18/2019 2:40 PM

RTI Laboratories, Inc. - Analytical Report

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS Analysis of Synthetic Turf Fibers		
Lab ID:	1910370-001	**Matrix:**	
Client Sample ID:	Synthetic Turf Fibers		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M9PFNA	134	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: MFPBA	122	50-150		%Rec	1	10/18/2019 2:40 PM
Surr: MPFDoA	148	50-150		%Rec	1	10/18/2019 2:40 PM

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers **Batch ID:** **50391**

Sample ID: **MB-50391** Samp Type: **MBLK** Test Code: **EPA_537-Mod-S-I** Units: **µg/Kg** Prep Date: **10/16/2019** RunNo: **114332**

Client ID: **PBS** Batch ID: **50391** TestNo: **EPA_537-Mod** Analysis Date: **10/18/2019** SeqNo: **2230600**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	ND	4.0									
1H,1H,2H,2H-Perfluorohexanesulfonate	ND	2.0									
1H,1H,2H,2H-Perfluorooctanesulfonate	ND	2.0									
HFPO-DA (GEN X)	ND	4.0									
N-ethyl perfluorooctanesulfonamidoacetic acid	ND	2.0									
N-methyl perfluorooctanesulfonamidoacetic acid	ND	2.0									
Perfluorobutanesulfonic acid	ND	2.0									
Perfluorobutanoic acid	ND	2.0									
Perfluorodecanesulfonate	ND	2.0									
Perfluorodecanoic acid	ND	2.0									
Perfluorododecanoic acid	ND	2.0									
Perfluoroheptanesulfonate	ND	2.0									
Perfluoroheptanoic acid	ND	2.0									
Perfluorohexanesulfonic acid	ND	2.0									
Perfluorohexanoic acid	ND	2.0									
Perfluorononanesulfonate	ND	2.0									
Perfluorononanoic acid	ND	2.0									
Perfluorooctanesulfonic acid	ND	2.0									
Perfluorooctanoic acid	ND	2.0									
Perfluorooctansulfonamide	ND	2.0									
Perfluoropentanesulfonate	ND	2.0									
Perfluoropentanoic acid	ND	2.0									
Perfluorotetradecanoic acid	ND	2.0									
Perfluorotridecanoic acid	ND	2.0									
Perfluoroundecanoic acid	ND	2.0									
Surr: D3-N-MeFOSAA	13		9.891		130	50	150				
Surr: D5-N-EtFOSAA	13		9.891		133	50	150				
Surr: M2PFTeDA	19		9.891		194	50	150				S
Surr: M3 GEN X	13		9.891		133	50	150				

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers **Batch ID:** **50391**

Sample ID: **MB-50391**	Samp Type: **MBLK**		Test Code: **EPA_537-Mod-S-I**	Units: **µg/Kg**		Prep Date:	**10/16/2019**	RunNo:	**114332**			
Client ID: **PBS**	Batch ID: **50391**		TestNo: **EPA_537-Mod**			Analysis Date:	**10/18/2019**	SeqNo:	**2230600**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual	
Surr: M3PFBS	14		9.891		141	50	150					
Surr: M3PFHxS	13		9.891		130	50	150					
Surr: M5PFHpA	14		9.891		146	50	150					
Surr: M5PFHxA	14		9.891		140	50	150					
Surr: M5PFPeA	14		9.891		144	50	150					
Surr: M6PFDA	16		9.891		162	50	150				S	
Surr: M7PFUdA	17		9.891		174	50	150				S	
Surr: M8PFOA	15		9.891		153	50	150				S	
Surr: M8PFOS	13		9.891		136	50	150					
Surr: M9PFNA	15		9.891		152	50	150				S	
Surr: MFPBA	11		9.891		113	50	150					
Surr: MPFDoA	17		9.891		174	50	150				S	

Sample ID: **LCS-50391**	Samp Type: **LCS**		Test Code: **EPA_537-Mod-S-I**	Units: **µg/Kg**		Prep Date:	**10/16/2019**	RunNo:	**114332**		
Client ID: **LCSS**	Batch ID: **50391**		TestNo: **EPA_537-Mod**			Analysis Date:	**10/18/2019**	SeqNo:	**2230601**		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	9.3	4.0	9.930	0	94.0	70	130				
1H,1H,2H,2H-Perfluorohexanesulfonate	8.2	2.0	9.930	0	83.0	70	130				
1H,1H,2H,2H-Perfluorooctanesulfonate	12	2.0	9.930	0	121	70	130				
HFPO-DA (GEN X)	8.2	4.0	9.930	0	83.0	70	130				
N-ethyl perfluorooctanesulfonamidoacetic acid	7.7	2.0	9.930	0	78.0	70	130				
N-methyl perfluorooctanesulfonamidoacetic acid	12	2.0	9.930	0	117	70	130				
Perfluorobutanesulfonic acid	6.6	2.0	9.930	0	66.0	70	130				S
Perfluorobutanoic acid	6.9	2.0	9.930	0	69.0	70	130				S
Perfluorodecanesulfonate	7.6	2.0	9.930	0	77.0	70	130				
Perfluorodecanoic acid	7.4	2.0	9.930	0	75.0	70	130				
Perfluorododecanoic acid	7.5	2.0	9.930	0	76.0	70	130				
Perfluoroheptanesulfonate	7.2	2.0	9.930	0	73.0	70	130				

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers **Batch ID:** **50391**

Sample ID:	**LCS-50391**	Samp Type:	**LCS**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**10/16/2019**	RunNo:	**114332**
Client ID:	**LCSS**	Batch ID:	**50391**	TestNo:	**EPA_537-Mod**			Analysis Date:	**10/18/2019**	SeqNo:	**2230601**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Perfluoroheptanoic acid	7.2	2.0	9.930	0	73.0	70	130				
Perfluorohexanesulfonic acid	7.9	2.0	9.930	0	80.0	70	130				
Perfluorohexanoic acid	6.6	2.0	9.930	0	66.0	70	130				S
Perfluorononanesulfonate	7.1	2.0	9.930	0	72.0	70	130				
Perfluorononanoic acid	7.2	2.0	9.930	0	73.0	70	130				
Perfluorooctanesulfonic acid	7.1	2.0	9.930	0	71.0	70	130				
Perfluorooctanoic acid	6.9	2.0	9.930	0	69.0	70	130				S
Perfluorooctansulfonamide	9.8	2.0	9.930	0	99.0	70	130				
Perfluoropentanesulfonate	6.8	2.0	9.930	0	68.0	70	130				S
Perfluoropentanoic acid	7.7	2.0	9.930	0	78.0	70	130				
Perfluorotetradecanoic acid	7.2	2.0	9.930	0	73.0	70	130				
Perfluorotridecanoic acid	7.1	2.0	9.930	0	71.0	70	130				
Perfluoroundecanoic acid	7.8	2.0	9.930	0	79.0	70	130				
Surr: D3-N-MeFOSAA	11		9.930		109	50	150				
Surr: D5-N-EtFOSAA	13		9.930		128	50	150				
Surr: M2PFTeDA	18		9.930		186	50	150				S
Surr: M3 GEN X	13		9.930		127	50	150				
Surr: M3PFBS	13		9.930		132	50	150				
Surr: M3PFHxS	13		9.930		126	50	150				
Surr: M5PFHpA	13		9.930		130	50	150				
Surr: M5PFHxA	14		9.930		137	50	150				
Surr: M5PFPeA	14		9.930		138	50	150				
Surr: M6PFDA	15		9.930		152	50	150				S
Surr: M7PFUdA	14		9.930		141	50	150				
Surr: M8PFOA	15		9.930		149	50	150				
Surr: M8PFOS	14		9.930		137	50	150				
Surr: M9PFNA	14		9.930		143	50	150				
Surr: MFPBA	12		9.930		120	50	150				
Surr: MPFDoA	17		9.930		168	50	150				S

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers **Batch ID: 50391**

Sample ID:	**LCSD-50391**	Samp Type:	**LCSD**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**10/16/2019**	RunNo:	**114332**
Client ID:	**LCSS02**	Batch ID:	**50391**	TestNo:	**EPA_537-Mod**			Analysis Date:	**10/18/2019**	SeqNo:	**2230602**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	12	4.0	9.881	0	122	70	130	9.335	25.4	30	
1H,1H,2H,2H-Perfluorohexanesulfonate	7.4	2.0	9.881	0	75.0	70	130	8.242	10.6	30	
1H,1H,2H,2H-Perfluorooctanesulfonate	11	2.0	9.881	0	115	70	130	12.02	5.58	30	
HFPO-DA (GEN X)	8.3	4.0	9.881	0	84.0	70	130	8.242	0.702	30	
N-ethyl perfluorooctanesulfonamidoacetic acid	8.9	2.0	9.881	0	90.0	70	130	7.746	13.8	30	
N-methyl perfluorooctanesulfonamidoacetic acid	9.8	2.0	9.881	0	99.0	70	130	11.62	17.2	30	
Perfluorobutanesulfonic acid	6.7	2.0	9.881	0	68.0	70	130	6.554	2.49	30	S
Perfluorobutanoic acid	7.3	2.0	9.881	0	74.0	70	130	6.852	6.50	30	
Perfluorodecanesulfonate	7.3	2.0	9.881	0	74.0	70	130	7.646	4.47	30	
Perfluorodecanoic acid	7.6	2.0	9.881	0	77.0	70	130	7.448	2.14	30	
Perfluorododecanoic acid	7.4	2.0	9.881	0	75.0	70	130	7.547	1.82	30	
Perfluoroheptanesulfonate	7.7	2.0	9.881	0	78.0	70	130	7.249	6.13	30	
Perfluoroheptanoic acid	7.4	2.0	9.881	0	75.0	70	130	7.249	2.21	30	
Perfluorohexanesulfonic acid	7.9	2.0	9.881	0	80.0	70	130	7.944	0.495	30	
Perfluorohexanoic acid	6.4	2.0	9.881	0	65.0	70	130	6.554	2.02	30	S
Perfluorononanesulfonate	7.5	2.0	9.881	0	76.0	70	130	7.150	4.91	30	
Perfluorononanoic acid	7.6	2.0	9.881	0	77.0	70	130	7.249	4.84	30	
Perfluorooctanesulfonic acid	7.1	2.0	9.881	0	72.0	70	130	7.051	0.903	30	
Perfluorooctanoic acid	7.5	2.0	9.881	0	76.0	70	130	6.852	9.16	30	
Perfluorooctansulfonamide	8.5	2.0	9.881	0	86.0	70	130	9.831	14.5	30	
Perfluoropentanesulfonate	7.1	2.0	9.881	0	72.0	70	130	6.753	5.22	30	
Perfluoropentanoic acid	7.8	2.0	9.881	0	79.0	70	130	7.746	0.779	30	
Perfluorotetradecanoic acid	8.1	2.0	9.881	0	82.0	70	130	7.249	11.1	30	
Perfluorotridecanoic acid	7.3	2.0	9.881	0	74.0	70	130	7.051	3.64	30	
Perfluoroundecanoic acid	6.8	2.0	9.881	0	69.0	70	130	7.845	14.0	30	S
Surr: D3-N-MeFOSAA	13		9.881		136	50	150		0	30	
Surr: D5-N-EtFOSAA	14		9.881		139	50	150		0	30	
Surr: M2PFTeDA	20		9.881		201	50	150		0	30	S
Surr: M3 GEN X	13		9.881		134	50	150		0	30	

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1910370

Date Reported: 10/18/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Fibers **Batch ID:** **50391**

Sample ID:	**LCSD-50391**	Samp Type:	**LCSD**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**10/16/2019**	RunNo:	**114332**
Client ID:	**LCSS02**	Batch ID:	**50391**	TestNo:	**EPA_537-Mod**			Analysis Date:	**10/18/2019**	SeqNo:	**2230602**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: M3PFBS	15		9.881		151	50	150		0	30	S
Surr: M3PFHxS	14		9.881		146	50	150		0	30	
Surr: M5PFHpA	15		9.881		147	50	150		0	30	
Surr: M5PFHxA	15		9.881		149	50	150		0	30	
Surr: M5PFPeA	15		9.881		153	50	150		0	30	S
Surr: M6PFDA	17		9.881		168	50	150		0	30	S
Surr: M7PFUdA	18		9.881		179	50	150		0	30	S
Surr: M8PFOA	16		9.881		163	50	150		0	30	S
Surr: M8PFOS	15		9.881		149	50	150		0	30	
Surr: M9PFNA	16		9.881		159	50	150		0	30	S
Surr: MFPBA	13		9.881		132	50	150		0	30	
Surr: MPFDoA	19		9.881		192	50	150		0	30	S

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a "J" qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H: Holding time for preparation or analysis has been exceeded

J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

M: Manual Integration used to determine area response

ND: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Tuesday, November 12, 2019

Kyle Horne
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (843) 936-6009
FAX:

RE: PFAS Analysis of Synthetic Turf Backing

Work Order #: 1911087

Dear Kyle Horne:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Director of Materials Sciences

RTI Laboratories, Inc. - Case Narrative

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing

Summary,

Total fluorine content was determined at 81mg/kg (ppm) which equates to 0.0081% w/w

All extractable PFAS compounds were non-detect at a level of 2-4 ug/kg (ppb). Surrogate value exceedances were qualified due to non-detection of target analyte.

RTI Laboratories, Inc. - Analytical Report

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS Analysis of Synthetic Turf Backing		
Lab ID:	1911087-001	**Matrix:**	
Client Sample ID:	Urethane Coated Turf Backing		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Elemental Analysis by Bomb Combustion and IC	**Method: ASTMD4327**					**Analyst: LK**
Fluorine	81	32		mg/Kg	1	11/12/2019 8:06 AM
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: EPA 537.1MOD**					**Analyst: DKS**
1H,1H,2H,2H-Perfluorodecanesulfonate	ND	3.9		µg/Kg	1	11/5/2019 3:46 PM
1H,1H,2H,2H-Perfluorohexanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
1H,1H,2H,2H-Perfluorooctanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
HFPO-DA (GEN X)	ND	3.9		µg/Kg	1	11/5/2019 3:46 PM
N-ethyl perfluorooctanesulfonamidoacetic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
N-methyl perfluorooctanesulfonamidoacetic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorobutanesulfonic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorobutanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorodecanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorodecanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorododecanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluoroheptanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluoroheptanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorohexanesulfonic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorohexanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorononanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorononanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorooctanesulfonic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorooctanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorooctansulfonamide	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluoropentanesulfonate	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluoropentanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorotetradecanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluorotridecanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Perfluoroundecanoic acid	ND	2.0		µg/Kg	1	11/5/2019 3:46 PM
Surr: D3-N-MeFOSAA	98.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: D5-N-EtFOSAA	138	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M2PFTeDA	78.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M3 GEN X	84.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M3PFBS	98.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M3PFHxS	100	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M5PFHpA	102	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M5PFHxA	98.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M5PFPeA	104	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M6PFDA	99.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M7PFUdA	99.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M8PFOA	101	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: M8PFOS	91.0	50-150		%Rec	1	11/5/2019 3:46 PM

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS Analysis of Synthetic Turf Backing		
Lab ID:	1911087-001	**Matrix:**	
Client Sample ID:	Urethane Coated Turf Backing		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M9PFNA	94.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: MFPBA	95.0	50-150		%Rec	1	11/5/2019 3:46 PM
Surr: MPFDoA	94.0	50-150		%Rec	1	11/5/2019 3:46 PM

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **50525**

Sample ID:	**MB-50525**	Samp Type:	**MBLK**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**11/5/2019**	RunNo:	**114713**
Client ID:	**PBS**	Batch ID:	**50525**	TestNo:	**EPA_537-Mod**			Analysis Date:	**11/5/2019**	SeqNo:	**2237100**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	ND	4.0									
1H,1H,2H,2H-Perfluorohexanesulfonate	ND	2.0									
1H,1H,2H,2H-Perfluorooctanesulfonate	ND	2.0									
HFPO-DA (GEN X)	ND	4.0									
N-ethyl perfluorooctanesulfonamidoacetic acid	ND	2.0									
N-methyl perfluorooctanesulfonamidoacetic acid	ND	2.0									
Perfluorobutanesulfonic acid	ND	2.0									
Perfluorobutanoic acid	ND	2.0									
Perfluorodecanesulfonate	ND	2.0									
Perfluorodecanoic acid	ND	2.0									
Perfluorododecanoic acid	ND	2.0									
Perfluoroheptanesulfonate	ND	2.0									
Perfluoroheptanoic acid	ND	2.0									
Perfluorohexanesulfonic acid	ND	2.0									
Perfluorohexanoic acid	ND	2.0									
Perfluorononanesulfonate	ND	2.0									
Perfluorononanoic acid	ND	2.0									
Perfluorooctanesulfonic acid	ND	2.0									
Perfluorooctanoic acid	ND	2.0									
Perfluorooctansulfonamide	ND	2.0									
Perfluoropentanesulfonate	ND	2.0									
Perfluoropentanoic acid	ND	2.0									
Perfluorotetradecanoic acid	ND	2.0									
Perfluorotridecanoic acid	ND	2.0									
Perfluoroundecanoic acid	ND	2.0									
Surr: D3-N-MeFOSAA	7.9		9.990		79.0	50	150				
Surr: D5-N-EtFOSAA	8.8		9.990		88.0	50	150				
Surr: M2PFTeDA	10		9.990		102	50	150				
Surr: M3 GEN X	9.1		9.990		91.0	50	150				

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** 50525

Sample ID:	MB-50525	Samp Type:	MBLK	Test Code:	EPA_537-Mod-S-I	Units:	µg/Kg	Prep Date:	11/5/2019	RunNo:	114713
Client ID:	PBS	Batch ID:	50525	TestNo:	EPA_537-Mod			Analysis Date:	11/5/2019	SeqNo:	2237100

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: M3PFBS	8.5		9.990		85.0	50	150				
Surr: M3PFHxS	9.1		9.990		91.0	50	150				
Surr: M5PFHpA	9.7		9.990		97.0	50	150				
Surr: M5PFHxA	8.6		9.990		86.0	50	150				
Surr: M5PFPeA	9.0		9.990		90.0	50	150				
Surr: M6PFDA	9.3		9.990		93.0	50	150				
Surr: M7PFUdA	9.3		9.990		93.0	50	150				
Surr: M8PFOA	9.3		9.990		93.0	50	150				
Surr: M8PFOS	8.9		9.990		89.0	50	150				
Surr: M9PFNA	9.2		9.990		92.0	50	150				
Surr: MFPBA	8.7		9.990		87.0	50	150				
Surr: MPFDoA	9.2		9.990		92.0	50	150				

Sample ID:	LCS-50525	Samp Type:	LCS	Test Code:	EPA_537-Mod-S-I	Units:	µg/Kg	Prep Date:	11/5/2019	RunNo:	114713
Client ID:	LCSS	Batch ID:	50525	TestNo:	EPA_537-Mod			Analysis Date:	11/5/2019	SeqNo:	2237101

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	13	4.0	9.995	0	128	70	130				
1H,1H,2H,2H-Perfluorohexanesulfonate	9.7	2.0	9.995	0	97.0	70	130				
1H,1H,2H,2H-Perfluorooctanesulfonate	12	2.0	9.995	0	123	70	130				
HFPO-DA (GEN X)	11	4.0	9.995	0	112	70	130				
N-ethyl perfluorooctanesulfonamidoacetic acid	11	2.0	9.995	0	109	70	130				
N-methyl perfluorooctanesulfonamidoacetic acid	11	2.0	9.995	0	111	70	130				
Perfluorobutanesulfonic acid	10	2.0	9.995	0	102	70	130				
Perfluorobutanoic acid	11	2.0	9.995	0	109	70	130				
Perfluorodecanesulfonate	11	2.0	9.995	0	107	70	130				
Perfluorodecanoic acid	11	2.0	9.995	0	110	70	130				
Perfluorododecanoic acid	11	2.0	9.995	0	110	70	130				
Perfluoroheptanesulfonate	11	2.0	9.995	0	112	70	130				

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **50525**

Sample ID:	**LCS-50525**	Samp Type:	**LCS**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**11/5/2019**	RunNo:	**114713**
Client ID:	**LCSS**	Batch ID:	**50525**	TestNo:	**EPA_537-Mod**			Analysis Date:	**11/5/2019**	SeqNo:	**2237101**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Perfluoroheptanoic acid	11	2.0	9.995	0	113	70	130				
Perfluorohexanesulfonic acid	11	2.0	9.995	0	109	70	130				
Perfluorohexanoic acid	11	2.0	9.995	0	108	70	130				
Perfluorononanesulfonate	11	2.0	9.995	0	113	70	130				
Perfluorononanoic acid	11	2.0	9.995	0	114	70	130				
Perfluorooctanesulfonic acid	11	2.0	9.995	0	108	70	130				
Perfluorooctanoic acid	12	2.0	9.995	0	117	70	130				
Perfluorooctansulfonamide	11	2.0	9.995	0	110	70	130				
Perfluoropentanesulfonate	9.4	2.0	9.995	0	94.0	70	130				
Perfluoropentanoic acid	10	2.0	9.995	0	104	70	130				
Perfluorotetradecanoic acid	11	2.0	9.995	0	110	70	130				
Perfluorotridecanoic acid	9.6	2.0	9.995	0	96.0	70	130				
Perfluoroundecanoic acid	11	2.0	9.995	0	106	70	130				
Surr: D3-N-MeFOSAA	8.3		9.995		83.0	50	150				
Surr: D5-N-EtFOSAA	9.3		9.995		93.0	50	150				
Surr: M2PFTeDA	9.4		9.995		94.0	50	150				
Surr: M3 GEN X	10		9.995		100	50	150				
Surr: M3PFBS	8.2		9.995		82.0	50	150				
Surr: M3PFHxS	8.1		9.995		81.0	50	150				
Surr: M5PFHpA	9.0		9.995		90.0	50	150				
Surr: M5PFHxA	8.5		9.995		85.0	50	150				
Surr: M5PFPeA	8.2		9.995		82.0	50	150				
Surr: M6PFDA	8.6		9.995		86.0	50	150				
Surr: M7PFUdA	9.3		9.995		93.0	50	150				
Surr: M8PFOA	8.7		9.995		87.0	50	150				
Surr: M8PFOS	8.8		9.995		88.0	50	150				
Surr: M9PFNA	9.0		9.995		90.0	50	150				
Surr: MFPBA	8.2		9.995		82.0	50	150				
Surr: MPFDoA	8.9		9.995		89.0	50	150				

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **50525**

Sample ID: **LCSD-50525** Samp Type: **LCSD** Test Code: **EPA_537-Mod-S-I** Units: **µg/Kg** Prep Date: **11/5/2019** RunNo: **114713**

Client ID: **LCSS02** Batch ID: **50525** TestNo: **EPA_537-Mod** Analysis Date: **11/5/2019** SeqNo: **2237102**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
1H,1H,2H,2H-Perfluorodecanesulfonate	12	4.0	9.916	0	126	70	130	12.79	2.37	30	
1H,1H,2H,2H-Perfluorohexanesulfonate	11	2.0	9.916	0	107	70	130	9.695	9.01	30	
1H,1H,2H,2H-Perfluorooctanesulfonate	12	2.0	9.916	0	120	70	130	12.29	3.27	30	
HFPO-DA (GEN X)	8.6	4.0	9.916	0	87.0	70	130	11.19	25.9	30	
N-ethyl perfluorooctanesulfonamidoacetic acid	12	2.0	9.916	0	118	70	130	10.89	7.13	30	
N-methyl perfluorooctanesulfonamidoacetic acid	11	2.0	9.916	0	112	70	130	11.09	0.100	30	
Perfluorobutanesulfonic acid	10	2.0	9.916	0	103	70	130	10.19	0.179	30	
Perfluorobutanoic acid	10	2.0	9.916	0	104	70	130	10.89	5.49	30	
Perfluorodecanesulfonate	12	2.0	9.916	0	117	70	130	10.69	8.13	30	
Perfluorodecanoic acid	11	2.0	9.916	0	106	70	130	10.99	4.50	30	
Perfluorododecanoic acid	11	2.0	9.916	0	110	70	130	10.99	0.796	30	
Perfluoroheptanesulfonate	12	2.0	9.916	0	116	70	130	11.19	2.71	30	
Perfluoroheptanoic acid	12	2.0	9.916	0	116	70	130	11.29	1.82	30	
Perfluorohexanesulfonic acid	11	2.0	9.916	0	109	70	130	10.89	0.796	30	
Perfluorohexanoic acid	11	2.0	9.916	0	112	70	130	10.79	2.84	30	
Perfluorononanesulfonate	12	2.0	9.916	0	118	70	130	11.29	3.53	30	
Perfluorononanoic acid	12	2.0	9.916	0	122	70	130	11.39	5.98	30	
Perfluorooctanesulfonic acid	11	2.0	9.916	0	110	70	130	10.79	1.04	30	
Perfluorooctanoic acid	10	2.0	9.916	0	101	70	130	11.69	15.5	30	
Perfluorooctansulfonamide	12	2.0	9.916	0	118	70	130	10.99	6.22	30	
Perfluoropentanesulfonate	11	2.0	9.916	0	106	70	130	9.395	11.2	30	
Perfluoropentanoic acid	11	2.0	9.916	0	108	70	130	10.39	2.98	30	
Perfluorotetradecanoic acid	10	2.0	9.916	0	101	70	130	10.99	9.33	30	
Perfluorotridecanoic acid	9.7	2.0	9.916	0	98.0	70	130	9.595	1.27	30	
Perfluoroundecanoic acid	12	2.0	9.916	0	116	70	130	10.59	8.21	30	
Surr: D3-N-MeFOSAA	8.0		9.916		81.0	50	150		0	30	
Surr: D5-N-EtFOSAA	8.3		9.916		84.0	50	150		0	30	
Surr: M2PFTeDA	9.6		9.916		97.0	50	150		0	30	
Surr: M3 GEN X	11		9.916		107	50	150		0	30	

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **50525**

Sample ID:	**LCSD-50525**	Samp Type:	**LCSD**	Test Code:	**EPA_537-Mod-S-I**	Units:	**µg/Kg**	Prep Date:	**11/5/2019**	RunNo:	**114713**
Client ID:	**LCSS02**	Batch ID:	**50525**	TestNo:	**EPA_537-Mod**			Analysis Date:	**11/5/2019**	SeqNo:	**2237102**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: M3PFBS	8.4		9.916		85.0	50	150		0	30	
Surr: M3PFHxS	8.6		9.916		87.0	50	150		0	30	
Surr: M5PFHpA	8.9		9.916		90.0	50	150		0	30	
Surr: M5PFHxA	8.8		9.916		89.0	50	150		0	30	
Surr: M5PFPeA	8.4		9.916		85.0	50	150		0	30	
Surr: M6PFDA	9.1		9.916		92.0	50	150		0	30	
Surr: M7PFUdA	9.0		9.916		91.0	50	150		0	30	
Surr: M8PFOA	9.4		9.916		95.0	50	150		0	30	
Surr: M8PFOS	8.2		9.916		83.0	50	150		0	30	
Surr: M9PFNA	8.7		9.916		88.0	50	150		0	30	
Surr: MFPBA	8.5		9.916		86.0	50	150		0	30	
Surr: MPFDoA	9.1		9.916		92.0	50	150		0	30	

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** R114713

Sample ID:	ICV-110519	Samp Type:	ICV	Test Code:	EPA_537-Mod-S-I	Units:	%Rec	Prep Date:	11/5/2019	RunNo:	114713
Client ID:	ICV	Batch ID:	R114713	TestNo:	EPA_537-Mod			Analysis Date:	11/5/2019	SeqNo:	2237096

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: D3-N-MeFOSAA	9.7		10.00		97.0	50	150				
Surr: D5-N-EtFOSAA	9.7		10.00		97.0	50	150				
Surr: M2PFTeDA	11		10.00		110	50	150				
Surr: M3 GEN X	9.6		10.00		96.0	50	150				
Surr: M3PFBS	10		10.00		100	50	150				
Surr: M3PFHxS	10		10.00		103	50	150				
Surr: M5PFHpA	9.6		10.00		96.0	50	150				
Surr: M5PFHxA	9.7		10.00		97.0	50	150				
Surr: M5PFPeA	9.8		10.00		98.0	50	150				
Surr: M6PFDA	9.8		10.00		98.0	50	150				
Surr: M7PFUdA	10		10.00		105	50	150				
Surr: M8PFOA	10		10.00		100	50	150				
Surr: M8PFOS	10		10.00		105	50	150				
Surr: M9PFNA	9.8		10.00		98.0	50	150				
Surr: MFPBA	9.7		10.00		97.0	50	150				
Surr: MPFDoA	10		10.00		105	50	150				

Sample ID:	ICB-110519	Samp Type:	ICB	Test Code:	EPA_537-Mod-S-I	Units:	%Rec	Prep Date:	11/5/2019	RunNo:	114713
Client ID:	ICB	Batch ID:	R114713	TestNo:	EPA_537-Mod			Analysis Date:	11/5/2019	SeqNo:	2237097

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: D3-N-MeFOSAA	9.5		10.00		95.0	0	0				S
Surr: D5-N-EtFOSAA	7.7		10.00		77.0	0	0				S
Surr: M2PFTeDA	11		10.00		112	0	0				S
Surr: M3 GEN X	11		10.00		107	0	0				S
Surr: M3PFBS	12		10.00		125	0	0				S
Surr: M3PFHxS	13		10.00		133	0	0				S
Surr: M5PFHpA	14		10.00		136	0	0				S
Surr: M5PFHxA	12		10.00		124	0	0				S
Surr: M5PFPeA	13		10.00		130	0	0				S
Surr: M6PFDA	12		10.00		125	0	0				S

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **R114713**

Sample ID: **ICB-110519** Samp Type: **ICB** Test Code: **EPA_537-Mod-S-I** Units: **%Rec** Prep Date: **11/5/2019** RunNo: **114713**

Client ID: **ICB** Batch ID: **R114713** TestNo: **EPA_537-Mod** Analysis Date: **11/5/2019** SeqNo: **2237097**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: M7PFUdA	12		10.00		123	0	0				S
Surr: M8PFOA	13		10.00		134	0	0				S
Surr: M8PFOS	12		10.00		124	0	0				S
Surr: M9PFNA	13		10.00		129	0	0				S
Surr: MFPBA	12		10.00		122	0	0				S
Surr: MPFDoA	12		10.00		121	0	0				S

Sample ID: **CCV-110519** Samp Type: **CCV** Test Code: **EPA_537-Mod-S-I** Units: **%Rec** Prep Date: **11/5/2019** RunNo: **114713**

Client ID: **CCV** Batch ID: **R114713** TestNo: **EPA_537-Mod** Analysis Date: **11/5/2019** SeqNo: **2237104**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: D3-N-MeFOSAA	9.7		10.00		97.0	50	150				
Surr: D5-N-EtFOSAA	10		10.00		104	50	150				
Surr: M2PFTeDA	9.9		10.00		99.0	50	150				
Surr: M3 GEN X	11		10.00		112	50	150				
Surr: M3PFBS	9.6		10.00		96.0	50	150				
Surr: M3PFHxS	10		10.00		104	50	150				
Surr: M5PFHpA	10		10.00		104	50	150				
Surr: M5PFHxA	10		10.00		101	50	150				
Surr: M5PFPeA	10		10.00		104	50	150				
Surr: M6PFDA	11		10.00		107	50	150				
Surr: M7PFUdA	11		10.00		111	50	150				
Surr: M8PFOA	11		10.00		107	50	150				
Surr: M8PFOS	9.7		10.00		97.0	50	150				
Surr: M9PFNA	10		10.00		101	50	150				
Surr: MFPBA	10		10.00		100	50	150				
Surr: MPFDoA	11		10.00		109	50	150				

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1911087

Date Reported: 11/12/2019
Revision v1

Client: Sprinturf

Project: PFAS Analysis of Synthetic Turf Backing **Batch ID:** **R114713**

Sample ID:	**CCB-110519**	Samp Type:	**CCB**	Test Code:	**EPA_537-Mod-S-I**	Units:	**%Rec**	Prep Date:	**11/5/2019**	RunNo: **114713**
Client ID:	**CCB**	Batch ID:	**R114713**	TestNo:	**EPA_537-Mod**			Analysis Date:	**11/5/2019**	SeqNo: **2237105**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Surr: D3-N-MeFOSAA	9.5										
Surr: D5-N-EtFOSAA	9.3										
Surr: M2PFTeDA	13										
Surr: M3 GEN X	12										
Surr: M3PFBS	13										
Surr: M3PFHxS	12										
Surr: M5PFHpA	14										
Surr: M5PFHxA	12										
Surr: M5PFPeA	13										
Surr: M6PFDA	13										
Surr: M7PFUdA	13										
Surr: M8PFOA	15										
Surr: M8PFOS	13										
Surr: M9PFNA	13										
Surr: MFPBA	13										
Surr: MPFDoA	12										

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H: Holding time for preparation or analysis has been exceeded

J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

M: Manual Integration used to determine area response

ND: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

RTI LABORATORIES PFAS STATEMENT AND LAB RESULTS – ALGONQUIN REGIOANAL HIGH SCHOOL – SYNTHETIC TURF BACKING AND FIBERS

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Nicholas Codd
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (908) 528-6332
FAX:

RE: PFAS analysis on two synthetic turf samples

Work Order #: 2308127

Dear Nicholas Codd:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Case Narrative

WO#: 2308127

Date Reported: 8/11/2023
Revision v1

Client: Sprinturf

Project: PFAS analysis on two synthetic turf samples

Concentrations reported with a J flag in the Qual field are values below the reporting limit (RL) but greater than the established method detection limit (MDL). There is greater uncertainty associated with these results and data should be considered as estimated. These analytes are not routinely reviewed nor narrated below as to their potential for being laboratory artifacts.

Concentrations reported with an E flag in the Qual field are values that exceed the upper quantification range. There is greater uncertainty associated with these results and data should be considered as estimated.

All sample analyses included a Method Blank, LCS/LCSD, MS/MSD, Duplicates, post digestion spikes, serial dilutions, and all method specified quality control, as applicable. All QC parameters were within established control limits except where noted on the QC report and/or below. Initial and continuing calibration results were within method specifications, except as noted below.

Pesticide and PCB analysis clarification:
Organochlorine Pesticides: Surrogates were not evaluated for CCV and CRQL samples for Chlordane and Toxaphene. Chlordane and Toxaphene are not present in the LCS, MS and MSD spiking solution.
Polychlorinated Biphenyls (PCB): The spiking solutions only contain the peaks for Aroclors 1016 and 1260.

Any comments or problems with the analytical events associated with this report are noted below.

Surrogate results outside of control limits (high) are qualified due to non-detect of target analyte. Results are unaffected with these excursions.

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-001	**Matrix:**	
Client Sample ID:	Algonquin - 1.75" Pile Height 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	224	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	125	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	138	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	116	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	69.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	99.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	73.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	91.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	67.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	88.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	94.2	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-001	**Matrix:**	
Client Sample ID:	Algonquin - 1.75" Pile Height 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	103	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	97.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	145	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	67.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	127	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	131	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	77.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	94.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	71.0	50-150		%Rec	1	8/11/2023 11:20 AM

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-002	**Matrix:**	
Client Sample ID:	Algonquin - 1.75" Pile Height 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	227	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	155	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	162	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	83.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	80.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	95.1	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	82.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	104	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	82.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	94.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	108	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Revision v1

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-002	**Matrix:**	
Client Sample ID:	Algonquin - 1.75" Pile Height 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	93.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	79.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	143	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	70.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	103	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	79.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	75.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	90.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	78.3	50-150		%Rec	1	8/11/2023 11:20 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES PFAS STATEMENT AND LAB RESULTS – MANCHESTER-ESSEX REGIOANAL HIGH SCHOOL – BROOK STREET FIELD AND HYLAND FIELD – SYNTHETIC TURF BACKING & FIBERS, SHOCK PAD, CRUMB RUBBER AND SAND INFILL MATERIALS

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Nicholas Codd
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (908) 528-6332
FAX:

RE: PFAS analysis on two synthetic turf samples

Work Order #: 2308127

Dear Nicholas Codd:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-001	**Matrix:**	
Client Sample ID:	2" Pile Height FG/Lime Green Blend, 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	224	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	125	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	138	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	116	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	69.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	99.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	73.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	91.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	67.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	88.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	94.2	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-001	**Matrix:**	
Client Sample ID:	2" Pile Height FG/Lime Green Blend, 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	103	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	97.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	145	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	67.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	127	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	131	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	77.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	94.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	71.0	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308127

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-002	**Matrix:**	
Client Sample ID:	2" Pile Height FG/Lime Green Blend, 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	227	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	155	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	162	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	83.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	80.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	95.1	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	82.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	104	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	82.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	94.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	108	50-150		%Rec	1	8/11/2023 11:20 AM

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis on two synthetic turf samples		
Lab ID:	2308127-002	**Matrix:**	
Client Sample ID:	2" Pile Height FG/Lime Green Blend, 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	93.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	79.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	143	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	70.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	103	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	79.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	75.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	90.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	78.3	50-150		%Rec	1	8/11/2023 11:20 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Wednesday, July 12, 2023

Kyle Horne
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL:
FAX:

RE: PFAS on 1 solid

Work Order #: 2306531

Dear Kyle Horne:

Lloyd Kaufman
Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2306531

Date Reported: 7/12/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS on 1 solid		
Lab ID:	2306531-001	**Matrix:**	
Client Sample ID:	Manchester by the Sea, Brooks DFE46		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: LK**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
HFPO-DA (GEN X)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorobutanesulfonic acid (PFBS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorobutanoic acid (PFBA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorodecanesulfonate (PFDS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorodecanoic acid (PFDA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorododecanoic acid (PFDoA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluoroheptanesulfonate (PFHpS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluoroheptanoic acid (PFHpA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorohexanoic acid (PFHxA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorononanesulfonate (PFNS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorononanoic acid (PFNA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorooctanesulfonic acid (PFOS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorooctanoic acid (PFOA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorooctansulfonamide (FOSA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluoropentanesulfonate (PFPeS)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluoropentanoic acid (PFPeA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluorotridecanoic acid (PFTrDA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM
Perfluoroundecanoic acid (PFUdA)	ND	23000		ng/Kg	1	7/12/2023 8:34 AM

RTI Laboratories, Inc. - Definitions and Acronyms

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

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LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

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MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Grayson Anderson
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL:
FAX:

RE: PFAS on 2 solids

Work Order #: 2307542

Dear Grayson Anderson:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2307542

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS on 2 solids		
Lab ID:	2307542-001	**Matrix:**	
Client Sample ID:	Foam, 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	217	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	166	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	115	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	124	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	65.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	52.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	65.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	85.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	52.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	90.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	88.2	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2307542

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS on 2 solids		
Lab ID:	2307542-001	**Matrix:**	
Client Sample ID:	Foam, 1 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	94.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	48.5	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	120	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	52.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	65.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	54.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	62.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	57.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	40.6	50-150	S	%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2307542

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS on 2 solids		
Lab ID:	2307542-002	**Matrix:**	
Client Sample ID:	Foam, 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	40000		ng/Kg	1	8/11/2023 11:20 AM
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Surr: M5PFPeA	146	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	123	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	110	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	68.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	97.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	70.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	88.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	58.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	86.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	76.2	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2307542

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS on 2 solids		
Lab ID:	2307542-002	**Matrix:**	
Client Sample ID:	Foam, 2 of 2		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	85.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	77.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	145	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	60.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	82.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	123	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	70.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	99.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	24.9	50-150	S	%Rec	1	8/11/2023 11:20 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Thursday, September 07, 2023

Grayson Anderson
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (843) 936-6023
FAX:

RE: Manchester BTS - Brooks

Work Order #: 2308550

Dear Grayson Anderson:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2308550

Date Reported: 9/7/2023
Original

Client:	Sprinturf	**Collection Date:**	8/14/2023 12:00:00 AM
Project:	Manchester BTS - Brooks		
Lab ID:	2308550-001	**Matrix:**	Solid
Client Sample ID:	Black Solid		

Perfluorinated Compounds Solid Matrix LC/MS/MS — **Method: EPA-1633** — **Analyst: DKS**

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorobutanoic acid (PFBA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoropentanoic acid (PFPeA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorohexanoic acid (PFHxA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoroheptanoic acid (PFHpA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorooctanoic acid (PFOA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorononanoic acid (PFNA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorodecanoic acid (PFDA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoroundecanoic acid (PFUdA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorododecanoic acid (PFDoA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorotridecanoic acid (PFTrDA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
PFTA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorobutanesulfonic acid (PFBS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoropentanesulfonate (PFPeS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorohexanesulfonic acid (PFHxS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoroheptanesulfonate (PFHpS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluorooctanesulfonic acid (PFOS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
PFNS	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
PFDS	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
PFDoS	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
FOSA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NMeFOSA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NEtFOSA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NMeFOSAA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NEtFOSAA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NMeFOSE	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
NEtFOSE	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
HFPO-DA (GEN X)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
3:3FTCA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
5:3FTCA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
7:3FTCA	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoro-3-methoxypropanoic acid (PFMPA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Perfluoro-4-methoxybutanoic acid (PFMBA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM
Nonafluoro-3,6-dioaheptanoic acid (NFDHA)	ND	4.0		µg/Kg	1	8/31/2023 3:51 PM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308550

Date Reported: 9/7/2023
Original

Client:	Sprinturf	**Collection Date:**	8/14/2023 12:00:00 AM
Project:	Manchester BTS - Brooks		
Lab ID:	2308550-001	**Matrix:**	Solid
Client Sample ID:	Black Solid		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: 13C2-4:2FTS	35.5	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C2-6:2FTS	47.7	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C2-8:2FTS	39.4	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C2-PFTeDA	37.6	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C3-PFBS	39.0	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C3-PFHxS	35.6	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: 13C8-PFOSA	13.9	20-150	S	%Rec	1	8/31/2023 3:51 PM
Surr: D3-NMeFOSA	39.2	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: D3-NMeFOSAA	34.2	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: D5-NEtFOSA	61.1	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: D5-NEtFOSAA	34.2	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: D7-NMeFOSE	37.4	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: D9-NEtFOSE	22.1	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M2PFDoA	37.9	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M3HFPODA	31.3	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M4PFHpA	27.4	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M5PFHxA	59.0	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M5PFPeA	43.8	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M6PFDA	37.0	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M7PFUnA	38.6	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M8PFOA	30.2	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M8PFOS	20.2	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: M9PFNA	44.4	20-150		%Rec	1	8/31/2023 3:51 PM
Surr: MFPBA	48.2	20-150		%Rec	1	8/31/2023 3:51 PM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

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Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

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MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

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Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Grayson Anderson
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (843) 936-6023
FAX:

RE: Sprinturf sample

Work Order #: 2307540

Dear Grayson Anderson:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

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If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2307540

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	7/19/2023 12:00:00 AM
Project:	Sprinturf sample		
Lab ID:	2307540-001	**Matrix:**	Solid
Client Sample ID:	Black Solid		

Perfluorinated Compounds Solid Matrix LC/MS/MS — **Method: DOD QSM5.3 B15** — **Analyst: DKS**

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	35000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	196	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	150	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	127	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	68.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	76.1	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	53.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	72.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	89.7	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	97.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	88.3	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	96.1	50-150		%Rec	1	8/11/2023 11:20 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2307540

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	7/19/2023 12:00:00 AM
Project:	Sprinturf sample		
Lab ID:	2307540-001	**Matrix:**	Solid
Client Sample ID:	Black Solid		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	94.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	173	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	144	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	58.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	124	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	69.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	54.1	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	104	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	62.4	50-150		%Rec	1	8/11/2023 11:20 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

CHAIN OF CUSTODY

RTI LABORATORIES

PAGE: | OF:

Environmental Sciences Division
31628 Glendale Street
Livonia MI, 48150

Materials Testing Division
33080 Industrial Road
Livonia MI 48150

PHONE: (734) 422-8000
FAX: (734) 422-5342
www.rtilab.com

RTI WORK ORDER NO: 2307540

Please Include Email Address of Report Recipient !!!

SUBMITTING COMPANY:	REPORT TO (Name): Seth Fiano	BILL TO:
PROJECT NAME: St Ursula Academy · PROJECT #: · QUOTE #:	COMPANY: Top Choice Turf	COMPANY: SAME
SAMPLING LOCATION (STATE or COUNTRY):	ADDRESS: 3610 W. Crawford Ave.	ADDRESS:
SPECIAL INSTRUCTIONS / COMMENTS:	CITY, STATE, ZIP: Dunbar, PA 15431	CITY, STATE, ZIP:
	PHONE: 724-802-0777 · EMAIL: sfiano@topchoiceturf.com	P.O NUMBER:
SAMPLER'S PRINTED NAME: · SAMPLER'S SIGNATURE:	TESTS REQUESTED	

ITEM NUMBER	SAMPLE I.D.	DATE SAMPLED	TIME SAMPLED (24 hour format)	MATRIX CODE (see codes below)	NBR OF BOTTLES	NONE	HCL	HNO_3	H_2SO_4	NaOH	Methanol	Other	PFAS							pH Acceptable? Y N n/a (Lab only)	COMMENTS Methanol Preserved Weights, VOT Sample Notation, Additional Sample Description, Air Volume, etc.
1	Black Solid	7-19-23		SD	1								X								
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished By	Date	Time	Received By	Date	Time
SETH FIANO	7/20/23	11:20A	[signature]	7-20-23	10:15

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE
ALL REPORTING IS VIA THE RTI "FLASHPOINT" ONLINE SYSTEM UNLESS OTHERWISE SPECIFIED

FOR LAB USE ONLY
Temp of samples: °C On Wet Ice ?
Comments:

TURNAROUND DESIRED: Standard ☐ **RUSH:** Next BD ☐ 2nd BD ☐ 3rd BD ☐
Note: RUSH requests will incur surcharges!

Distribution: White - Lab, Pink - Field

See reverse side for Laboratory Terms and Conditions of Service

MATRIX CODES: A = AIR, SD = SOLID, DW = DRINKING WATER, SL = SLUDGE, GW = GROUNDWATER, SV = SOLVENT WASTE, L = LIQUID, W = WATER, O = OIL, WP = WIPE, WW = WASTE WATER, SW = SURFACE WATER, S = SOIL


From:
To:
ARMANDO FLORES
RTI LABORATORIES, INC
31628 GLENDALE ST
LIVONIA MI 48150
FedEx
THU - 20 JUL 10:30A
PRIORITY OVERNIGHT
TRK# 7813 7131 7269
66 CFAA
48150
MI-US DTW
435

TopChoice Turf

An Artificial Grass Company

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TopChoice Turf LLC

3610 West Crawford Avenue, Dunbar, Pennsylvania 15431

PHONE 724 802 0977

EMAIL sfiano@topchoiceturf.com

GET A QUOTE

Subject: Re: Complete the COC
From: Seth Fiano <sfiano@topchoiceturf.com>
Date: 07/27/2023, 2:24 PM
To: Armando Flores <aflores@rtilab.com>

Please Note. Company name is Sprinturf. If you need anything else please let me know. Thank you

Get Outlook for Android

From: Armando Flores <aflores@rtilab.com>
Sent: Monday, July 24, 2023 1:05:55 PM
To: Seth Fiano <sfiano@topchoiceturf.com>
Subject: Complete the COC

Hello,

Attached is a Chain of Custody (COC) I created with the available info I had. Please complete the COC with sampling date/time, project name and signature. Return the COC to me so we can begin the analysis.

Thank you.

--

Armando Flores
Sample Custodian
RTI Laboratories, Inc.
31628 Glendale Street
Livonia, MI 48150
Email: aflores@rtilab.com
(O) (734) 422-8000 ext. 202
(F) (734) 422-5432
RTI LABORATORIES
Scientific Solutions for Your Success!

Attachments:

TopChoice Turf COC.pdf 751 KB

CHAIN OF CUSTODY

RTI LABORATORIES

PAGE	OF

Environmental Sciences Division
31628 Glendale Street
Livonia MI, 48150

Materials Testing Division
Industrial Road
Livonia MI 48150

PHONE: (734) 422-8000
FAX: (734) 422-5342
www.rtilab.com

RTI WORK ORDER NO: 2307540

Please Include Email Address of Report Recipient !!!

SUBMITTING COMPANY: Sprinturf	REPORT TO (Name): Grayson Anderson	BILL TO:
PROJECT NAME: X / PROJECT #: / QUOTE #:	COMPANY: Sprinturf	COMPANY: SAME
SAMPLING LOCATION (STATE or COUNTRY):	ADDRESS: 146 Fairchild St. ste 150	ADDRESS:
SPECIAL INSTRUCTIONS / COMMENTS:	CITY, STATE, ZIP: Daniel Island SC 29492	CITY, STATE, ZIP:
	PHONE: 610-772-3255 / EMAIL (OR N/A IF NO EMAIL AVAILABLE): ganderson@sprinturf.com	P.O NUMBER:
SAMPLER'S PRINTED NAME:	SAMPLER'S SIGNATURE:	

Field No.	SAMPLE I.D.	DATE SAMPLED	TIME SAMPLED	MATRIX CODE (see codes below)	NBR OF BOTTLES	NONE	HCL	HNO_3	H_2SO_4	NaOH	Methanol	Other	TESTS REQUESTED: PFAS							pH Acceptable? Y N n/a (Lab only)	COMMENTS (Methanol Preserved Weights, HOT Sample Notation, Additional Sample Description, Air Volume, etc.)
1	Black Solid	7-19-23		SD	1	1							X							—	
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished By	Date	Time	Received By	Date	Time
X			[signature]	7-20-23	10:15

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE
ALL REPORTING IS VIA THE RTI "FLASHPOINT" ONLINE SYSTEM UNLESS OTHERWISE SPECIFIED

FOR LAB USE ONLY
Temp of samples: ____ °C On Wet Ice? ____
Comments: ____

TURNAROUND DESIRED: Standard ☐ **RUSH:** Next BD ☐ 2nd BD ☐ ☐
Note: RUSH requests will incur surcharges!

Distribution: White - Lab Pink - Field

See reverse side for Laboratory Terms and Conditions of Service

MATRIX CODES: A = AIR, SD = SOLID, DW = DRINKING WATER, SL = SLUDGE, GW = GROUNDWATER, SV = SOLVENT WASTE, L = LIQUID, W = WATER, O = OIL, WP = WIPE, WW = WASTE WATER, SW = SURFACE WATER, S = SOIL

Subject: RE: Complete the COC
From: Grayson Anderson <ganderson@sprinturf.com>
Date: 07/27/2023, 2:43 PM
To: Armando Flores <aflores@rtilab.com>

See attached additional information filed out

Regards,

Senior Project Manager
Grayson Anderson
(843) 648-0411
146 Fairchild St, Suite 150
Daniel Island, SC 29492
ganderson@sprinturf.com

From: Armando Flores <aflores@rtilab.com>
Sent: Thursday, July 27, 2023 2:34 PM
To: Grayson Anderson <ganderson@sprinturf.com>
Subject: Complete the COC

WARNING: This email originated from the Internet. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello,

Attached is a Chain of Custody (COC) I created with the available info I had. Please complete the COC with sampling date/time, project name and signature. Return the COC to me so we can begin the analysis.

Thank you.

--

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Nicholas Codd
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (908) 528-6332
FAX:

RE: PFAS analysis Sand sample

Work Order #: 2308151

Dear Nicholas Codd:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2308151

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis Sand sample		
Lab ID:	2308151-001	**Matrix:**	
Client Sample ID:	Target Sand		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
HFPO-DA (GEN X)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorobutanesulfonic acid (PFBS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorobutanoic acid (PFBA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorodecanesulfonate (PFDS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorodecanoic acid (PFDA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorododecanoic acid (PFDoA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluoroheptanesulfonate (PFHpS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluoroheptanoic acid (PFHpA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorohexanoic acid (PFHxA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorononanesulfonate (PFNS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorononanoic acid (PFNA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorooctanesulfonic acid (PFOS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorooctanoic acid (PFOA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorooctansulfonamide (FOSA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluoropentanesulfonate (PFPeS)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluoropentanoic acid (PFPeA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluorotridecanoic acid (PFTrDA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Perfluoroundecanoic acid (PFUdA)	ND	3500		ng/Kg	1	8/11/2023 8:42 AM
Surr: MFPBA	229	50-150	S	%Rec	1	8/11/2023 8:42 AM
Surr: M5PFPeA	154	50-150	S	%Rec	1	8/11/2023 8:42 AM
Surr: M3PFBS	110	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M2-4:2FTS	86.8	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M5PFHxA	96.7	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M3 GEN X	106	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M5PFHpA	93.6	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M3PFHxS	93.7	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M2-6:2FTS	86.2	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M8PFOA	96.1	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M9PFNA	100	50-150		%Rec	1	8/11/2023 8:42 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 2308151

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	
Project:	PFAS analysis Sand sample		
Lab ID:	2308151-001	**Matrix:**	
Client Sample ID:	Target Sand		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	109	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M2-8:2FTS	124	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M6PFDA	150	50-150	S	%Rec	1	8/11/2023 8:42 AM
Surr: D3-N-MeFOSAA	62.2	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: D5-N-EtFOSAA	104	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M7PFUdA	76.1	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M8FOSA	84.3	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: MPFDoA	77.2	50-150		%Rec	1	8/11/2023 8:42 AM
Surr: M2PFTeDA	58.3	50-150		%Rec	1	8/11/2023 8:42 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a "J" qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

RTI LABORATORIES, INC.

RTI Laboratories
33080 Industrial Rd.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, August 11, 2023

Grayson Anderson
Sprinturf
146 Fairchild Street, Suite 150
Daniel Island, SC 29492
TEL: (843) 936-6023
FAX:

RE: Manchester by the sea

Work Order #: 2307443

Dear Grayson Anderson:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Lloyd Kaufman

Vice President, Director of Materials Sciences

RTI Laboratories, Inc. - Analytical Report

WO#: 2307443

Date Reported: 8/11/2023
Original

Client:	Sprinturf	**Collection Date:**	7/18/2023 12:00:00 AM
Project:	Manchester by the sea		
Lab ID:	2307443-001	**Matrix:**	Solid
Client Sample ID:	Sand		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Perfluorinated Compounds Solid Matrix LC/MS/MS	**Method: DOD QSM5.3 B15**					**Analyst: DKS**
11-Chloroeicosfluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OYUdS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorodecanesulfonate (8:2 FTS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorohexanesulfonate (4:2 FTS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
1H,1H,2H,2H-Perfluorooctanesulfonate (6:2 FTS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Dodecafluoro-3H-4,8-dioxanonanoate (ADONA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
HFPO-DA (GEN X)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanesulfonic acid (PFBS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorobutanoic acid (PFBA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanesulfonate (PFDS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorodecanoic acid (PFDA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorododecanoic acid (PFDoA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanesulfonate (PFHpS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroheptanoic acid (PFHpA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanesulfonic acid (PFHxS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorohexanoic acid (PFHxA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanesulfonate (PFNS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorononanoic acid (PFNA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanesulfonic acid (PFOS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctanoic acid (PFOA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorooctansulfonamide (FOSA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanesulfonate (PFPeS)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoropentanoic acid (PFPeA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotetradecanoic acid (PFTeDA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluorotridecanoic acid (PFTrDA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Perfluoroundecanoic acid (PFUdA)	ND	32000		ng/Kg	1	8/11/2023 11:20 AM
Surr: MFPBA	183	50-150	S	%Rec	1	8/11/2023 11:20 AM
Surr: M5PFPeA	135	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFBS	143	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-4:2FTS	115	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHxA	52.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3 GEN X	69.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M5PFHpA	87.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M3PFHxS	96.5	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-6:2FTS	76.1	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8PFOA	89.0	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M9PFNA	86.7	50-150		%Rec	1	8/11/2023 11:20 AM

Client:	Sprinturf	**Collection Date:**	7/18/2023 12:00:00 AM
Project:	Manchester by the sea		
Lab ID:	2307443-001	**Matrix:**	Solid
Client Sample ID:	Sand		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Surr: M8PFOS	63.8	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2-8:2FTS	73.6	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M6PFDA	95.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D3-N-MeFOSAA	50.4	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: D5-N-EtFOSAA	72.9	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M7PFUdA	115	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M8FOSA	78.2	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: MPFDoA	119	50-150		%Rec	1	8/11/2023 11:20 AM
Surr: M2PFTeDA	43.5	50-150	S	%Rec	1	8/11/2023 11:20 AM

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

L+: LCS Failed High

L-: LCS Failed Low

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B/v: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H/@: Holding time for preparation or analysis has been exceeded

J/n: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

m/M: Manual Integration used to determine area response

ND/t: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S/Q: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

\: Laboratory Control Sample (LCS) recovery outside of acceptable range

/: Matrix Spike (MS) recovery outside of acceptable range

Y: CCV % REC exceeds control limits

Z: ICV % REC exceeds control limits

CHAIN OF CUSTODY

RTI LABORATORIES

PAGE: OF:

Environmental Sciences Division
31628 Glendale Street
Livonia MI, 48150

Materials Testing Division
33080 Industrial Road
Livonia, MI 48150

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FAX: (734) 422-5342
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Please Include Email Address of Report Recipient !!!

SUBMITTING COMPANY: SprinturF LLC	REPORT TO (Name): Kyle Horne	BILL TO: AP@sprinturF.com
PROJECT NAME: Manchester By the Sea / PROJECT #: / QUOTE #:	COMPANY: Sprinturf	COMPANY: SprinturF LLC
SAMPLING LOCATION (STATE or COUNTRY): New Jersey	ADDRESS:	ADDRESS: 146 Fairchild Suite 150
SPECIAL INSTRUCTIONS / COMMENTS:	CITY, STATE, ZIP:	CITY, STATE, ZIP: Daniel Island
	PHONE: 843-648-0411 / EMAIL (OR FAX IF NO EMAIL AVAILABLE):	P.O NUMBER:
SAMPLER'S PRINTED NAME: Justo Lucena	SAMPLER'S SIGNATURE: [signature]	

TESTS REQUESTED

ITEM NUMBER	SAMPLE I.D.	DATE SAMPLED	TIME SAMPLED (24-hour format)	MATRIX CODE (see codes below)	NBR OF BOTTLES	NONE	HCL	HNO_3	H_2SO_4	NaOH	Methanol	OTHER	PFAS								pH Acceptable? Y N n/a (Lab only)	COMMENTS Methanol Preserved Weights HOT Sample Notation Additional Sample Description, Air Volume, etc
1	Sand	7-18-23		SD	1	1							X								—	
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						

Relinquished By:	Date	Time	Received By:	Date	Time
X			RTI-Industrial	7-19-23	09:33
			[signature]	7-19-23	12:30

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE
ALL REPORTING IS VIA THE RTI "FLASHPOINT" ONLINE SYSTEM UNLESS OTHERWISE SPECIFIED

FOR LAB USE ONLY
Temp of samples 5.6 °C On Wet Ice ? blue ice
Comments:

TURNAROUND DESIRED: Standard ☐ **RUSH:** Next BD ☐ 2nd BD ☐ 3rd BD ☐
Note: RUSH requests will incur surcharges!

Distribution: White - Lab; Pink - Field

See reverse side for Laboratory Terms and Conditions of Service

MATRIX CODES: A = AIR, SD = SOLID, DW = DRINKING WATER, SL = SLUDGE, GW = GROUNDWATER, SV = SOLVENT WASTE, L = LIQUID, W = WATER, O = OIL, WP = WIPE, WW = WASTE WATER, SW = SURFACE WATER, S = SOIL

ORIGIN ID:DYLA (856) 785-0720
EVELYN FULLERTON
U.S.SILICA COMPANY
9035 NOBLE STREET
P.O.BOX 254
MAURICETOWN, NJ 08329
UNITED STATES US

SHIP DATE: 18JUL23
ACTWGT: 11.00 LB
CAD: 100230742/INET4535
DIMS: 13x11x11 IN

BILL THIRD PARTY

TO **ARMANDO**
RTI LABORATORIES
33080 INDUSTRIAL RD.

LIVONIA MI 48150
(734) 422-8000 REF:
INV:
PO: DEPT:

583J4/6AE4/9AE3

FedEx Express

E

J233023071001uv

WED - 19 JUL 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **7727 6529 6198**

48150

NX CFAA

MI-US **DTW**

Campbell/

TB= 5.8°C
C.F.: -0.2°C
5.6°C

blue ice

After printing this label:
CONSIGNEE COPY - PLEASE PLACE IN FRONT OF POUCH
1. Fold the printed page along the horizontal line.
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Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com. FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim. Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental, consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss. Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our Service Guide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

HALEY ALDRICH – CRUMB RUBBER MEMORANDUM

HALEY & ALDRICH, INC.
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Bedford, NH 03110
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2 June 2021
File No. 0200977-000

TO: Dr. Tara Gohlmann
Chief Operating Officer / Chief Financial Officer
Buckingham Browne & Nichols School
80 Gerry's Landing
Cambridge, mA 02138

FROM: Jay Peters
Senior Technical Expert, Risk Assessment
Haley & Aldrich, Inc.

Subject: Evaluation of Health and Environmental Effects: Synthetic Turf

The purpose of this memorandum is to provide a summary of recently published studies and reports that evaluate the safety (health and environmental risks) of using synthetic turf athletic fields, with focus on chemicals contained in or associated with synthetic turf and association of synthetic turf with "Heat Islands".

There are approximately 13,000 synthetic turf athletic fields in the United States and more than 1,200 are being added each year. Similarly, the European Chemicals Agency (ECHA) estimates that there are 13,000 large synthetic turf fields in the European Union. There are no state or federal laws that prohibit installation of synthetic turf fields.

A synthetic turf field consists of three main components, including turf blades (the portion of the system that mimics grass blades), a backing material that holds the turf blades in place (similar in concept to backing material that holds household carpet together), and an infill material. The purpose of the infill material is to keep the grass blades standing "up", provide cushioning for the system, and provide appropriate foot to surface interaction (e.g., traction) as well as feeling underfoot (e.g., soft versus firm). Turf blades and backing material are made from polyethylene / and/or polypropylene (plastic family). There are several materials that are used as infill, but a common infill material and the one that is proposed for use at the Buckingham, Brown & Nichols (BB&N) new athletic facility is a mixture of sand and encapsulated crumb rubber; this is the same infill material that BB&N has installed at their turf field at the Upper School – Franke Field.

Crumb rubber, also referred to as recycled crumb rubber, consists of small rubber fragments (between 0.25 and 4 millimeters in diameter) that are created by recycling tires. There has been a lot of focus on crumb rubber as an infill material, primarily due to allegations in 2014 that exposure to crumb rubber is associated with higher rates of cancer. However, evaluation of those allegations by the Washington

Department of Public Health as well as researchers (e.g., Bleyer et al., 2018) determined that there is no link between use of synthetic turf fields with crumb rubber infill and increased incidence of cancer. ***In addition, over 100 scientific, peer-reviewed, published studies have been performed worldwide evaluating the potential health risks associated with using crumb rubber. We are not aware of any peer-reviewed scientific studies which draw an association between adverse health effects and use of crumb rubber.*** Based on the body of evidence, the following state, national and international agencies, governing bodies, and academic institutions have concluded that the use of crumb rubber in athletic fields does not pose a significant human health risk, including (among others) the following:

- Dutch National Institute for Public Health and Environment
- Norwegian Institute of Public Health
- EU - European Chemical Agency (ECHA)
- Connecticut Department of Public Health
- New York City Department of Health
- New York State Department of Health
- The Washington State Department of Health and researchers from the University of Washington School of Public Health

In addition, in 2015 ***the Massachusetts Department of Public Health (DPH) evaluated health concerns related to the use of crumb rubber infill material for artificial turf fields in Medway, Massachusetts, and concluded that "the scientific literature continues to suggest that exposure opportunities to artificial turf fields are not generally expected to result in health effects".*** A communication documenting the MA DPH evaluation is provided as Attachment 1.

Evaluation of Chemicals in Synthetic Turf

Evaluating health risks of using synthetic turf fields requires resolution of the following questions:

1. Are chemicals present in crumb rubber?
2. What are the concentrations of chemicals present in the crumb rubber?
3. How much of the chemical concentrations can people be exposed to (a term referred to as bioavailability)?
4. How much contact with crumb rubber could occur?
5. Is the combination of bioavailable chemical concentration and contact with crumb rubber at a level that can be considered safe? (Would the possible exposure to chemicals in the crumb rubber pose a health concern?)

Risk assessment is the process of resolving these questions. The US Environmental Protection Agency (USEPA) and the Massachusetts Department of Environmental Protection (MassDEP) have established systematic procedures for evaluating health risks (see for example, USEPA (1989), MassDEP (1995 and 2014)). Those procedures are applied to determine if chemicals present in soil, air, and groundwater are safe (i.e., are associated with insignificant health risks). The same procedures have been applied by various entities, as described below, to evaluate the safety of synthetic turf.

Several recent studies have reported on the chemical composition of crumb rubber (e.g., Perkins, et al. (2019); TURI (2020); Celeiro et al (2018; 2021a; 2021b); Gomes et al (2021)). These studies highlight the presence of chemicals that may be contained in crumb rubber, including substances known or suspected of causing cancer in humans, including certain polyaromatic hydrocarbons (PAHs) such as benzo(a)pyrene and certain volatile organic compounds (VOCs) such as benzene.

Understanding the chemical composition of crumb rubber is an important step in evaluating whether the material could pose a potential health concern (Step 1). To help resolve whether the chemicals in synthetic turf are safe, we have reviewed various studies and reports that have evaluated Steps 2 through 5 above. The following provides a summary of recent studies that address this.

- Pavilonis et al. (2014). This research group collected 8 samples of crumb rubber infill material and 8 samples of synthetic turf fibers from various manufacturers as 'new' (i.e., not yet placed on fields) and 'used' (i.e., in-place in 7 synthetic turf playing fields in New Jersey). Samples were subjected to extractions using simulated gastric fluids and simulated sweat and were analyzed for metals and semi-volatile organic compounds (SVOCs). SVOCs and metals were not detected in the fluid extracts from the 'new' samples, whereas some metals were detected in the fluid extracts from samples collected from playing fields. Health risks were estimated by assuming athletes ages six through adulthood used the fields 3 hours per day, 130 days per year, and were exposed to the metals measured in the fluid extracts by incidentally ingesting crumb rubber, breathing in crumb rubber particles, and having crumb rubber particles stick to their skin. ***The researchers concluded that health risks associated with use of synthetic turf fields with crumb rubber infill were orders of magnitude below regulatory levels used to define safety thresholds.***

- Peterson et al. (2018). This research group applied the systematic procedures for risk assessment as cited above using all available study data as of 2017 that reported chemical concentrations in crumb rubber and in air samples collected near synthetic turf fields (37 crumb rubber studies with 103 samples and 139 chemicals evaluated; 9 air studies with 93 samples and 213 chemicals evaluated). Health risks were evaluated by assuming that athletes (ages 6 to 18 years) and young children and adults as spectators contact crumb rubber by accidentally ingesting it, getting it stuck on their skin, and breathing air above the fields (representing air quality that could be affected by the synthetic turf field), 4 days per week for 8 months of the year (139 days per year). To provide a comparison of health risks between use of synthetic turf fields with crumb rubber infill and natural turf fields, the same exposure assumptions were used to evaluate health risks associated with background concentrations of metals and PAHs in soil.

  The results of the study showed that cancer risks for use of synthetic fields were below USEPA's de minimis risk level of $1x10^{-6}$ and MassDEP's risk threshold of $1x10^{-5}$, and that risks for health effects other than cancer were below the EPA and MassDEP threshold value of 1. ***Furthermore, the evaluation showed that risks estimated for use of synthetic turf fields are lower than risks estimated for natural turf fields which contain ambient background levels of metals and PAHs in the soil.*** The authors concluded that the evaluation demonstrated that use of synthetic turf fields containing recycled crumb rubber infill would not result in unacceptable health risks to children or adults under USEPA's risk assessment guidelines.

- USEPA (2019). USEPA collected crumb rubber from 9 tire recycling facilities, 15 indoor turf fields and 25 outdoor turf fields from throughout United States and analyzed the samples SVOCs, metals, and microbes. The study also measured the bioavailable fraction of metals in the samples and the emissions of VOCs at both 77- and 140-degrees F. Key findings from the study are:
  - Metals and SVOC concentrations were similar to those reported in other studies that examined the chemical content of crumb rubber.
  - Emissions of VOCs were generally not detectable at 77F. Emissions of some VOCs increased slightly for some VOCs at 140F. Nevertheless, even at 140F, emissions were very low.
  - Approximately 3% of the metals concentrations were estimated to be bioavailable if the crumb rubber is ingested, and less than 1% were estimated to be bioavailable if the crumb rubber sticks to skin and the metals transfer from the rubber through the skin.
  - The type and number of bacteria in samples of crumb rubber were similar to those present in environments where synthetic turf is not present. The reported cited literature indicating that crumb rubber infill harbors fewer bacteria than natural turf.

The study completed by EPA helps address Steps 1 through 3 above. EPA has not yet used the results of its investigation to evaluate health risks (Steps 4 and 5 above). However, they conclude that "these findings support the premise that while many chemicals are present in the recycled crumb rubber, exposure may be limited based on what is released into air or biological fluids".

We further evaluated the analytical data for crumb rubber that was reported on by EPA (2019) to help provide context for the results in terms of crumb rubber safety. Specifically, we compared the 90th percentile concentrations of metals and SVOCs, as reported by USEPA in Tables 4-34 and 4-36 of their report, to screening levels published by MassDEP and USEPA. Specifically, the MassDEP screening levels are the Massachusetts Contingency Plan (MCP) S-1/GW-3 soil standards, which would be applicable to evaluation of soil in a natural turf field located where the BB&N field is proposed, and the USEPA Regional Screening Levels (RSLs) for residential soil for substances which are not published in the MCP. The 90th percentile concentration was used because it is a statistic that is consistent with the value that MassDEP recommends for assessing exposures to soil during activities such as recreational uses of a playing field (MassDEP, 2014).

Tire Crumb Rubber Sampling Location	Chemical	90th Percentile (mg/kg)	Screening Level (mg/kg)	
Recycling Plants	Arsenic	0.45	20	a
Recycling Plants	Cadmium	0.73	70	a
Recycling Plants	Chromium	2.4	100	a
Recycling Plants	Cobalt	280	23	b
Recycling Plants	Lead	22	200	a
Recycling Plants	Zinc	21000	1000	a
Synthetic Turf Fields	Arsenic	0.60	20	a
Synthetic Turf Fields	Cadmium	1.7	70	a
Synthetic Turf Fields	Chromium	2.7	100	a
Synthetic Turf Fields	Cobalt	220	23	b
Synthetic Turf Fields	Lead	55	200	a
Synthetic Turf Fields	Zinc	19000	1000	a

a - MassDEP MCP Standard (S-1/GW-3) (310 CMR 40.0975(6)(a)
b - USEPA Regional Screening Level for residential soil (hazard index = 1; cancer risk = 1E-06)
(www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)

Tire Crumb Rubber Sampling Location	Chemical[b]	90th Percentile (mg/kg)	Screening Level (mg/kg)	
Recycling Plants	Phenanthrene	5.8	500	a
Recycling Plants	Fluoranthene	8.6	1000	a
Recycling Plants	Pyrene	22	1000	a
Recycling Plants	Benzo[a]pyrene	1.4	2	a
Recycling Plants	Benzo[ghi]perylene	2.0	1000	a
Recycling Plants	Benzothiazole	100	NA	
Recycling Plants	Dibutyl phthalate	1.5	6300	b
Recycling Plants	Bis(2-ethylhexyl) phthalate	34	90	a
Recycling Plants	Aniline	6.3	95	a
Recycling Plants	4-tert-octylphenol	40	NA	
Recycling Plants	n-Hexadecane	6.5	NA	
Synthetic Turf Fields	Phenanthrene	6.1	500	a
Synthetic Turf Fields	Fluoranthene	8.1	1000	a
Synthetic Turf Fields	Pyrene	21	1000	a
Synthetic Turf Fields	Benzo[a]pyrene	1.4	2	a
Synthetic Turf Fields	Benzo[ghi]perylene	2.0	1000	a
Synthetic Turf Fields	Benzothiazole	31	NA	
Synthetic Turf Fields	Dibutyl phthalate	3.5	6300	b
Synthetic Turf Fields	Bis(2-ethylhexyl) phthalate	100	90	a
Synthetic Turf Fields	Aniline	1.2	95	b
Synthetic Turf Fields	4-tert-octylphenol	27	NA	
Synthetic Turf Fields	n-Hexadecane	2.6	NA	

a - MassDEP MCP Standard (S-1/GW-3) (310 CMR 40.0975(6)(a)
b - USEPA Regional Screening Level for residential soil (hazard index = 1; cancer risk = 1E-06)
(www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
NA - Not Available

As indicated, the concentrations of all chemicals except bis(2-ethylhexyl)phthalate, cobalt and zinc are below their respective screening levels. The screening level for bis(2-ethylhexyl)phthalate is based on a de minimis cancer risk level. The 90^{th} percentile concentration of 100 mg/kg is only 10% higher than the screening level, indicating that the concentration of bis(2-ethylhexyl)phthalate is still within a range this is considered to be safe by MassDEP. The screening levels for cobalt and zinc are based on the assumption that the metals are 100% bioavailable. If the 90^{th} percentile concentrations were adjusted for the bioavailability of the metals in the crumb rubber, as reported by USEPA in Table 102 of their report, the value for cobalt would be 3.4 mg/kg (at 1.2% for maximum bioaccessibility) and zinc would be 475 mg/kg (at 2.5% maximum bioaccessibility), which are both below the screening levels.

Based on this evaluation, the chemicals in crumb rubber as reported by USEPA, would not pose significant health risks and therefore would be considered safe for use as infill in synthetic turf fields.

- Schneider et al. (2020). This paper reports on the outcome of the European Risk Assessment Study on Synthetic Turf Infill. It uses measurements of chemicals detected in crumb rubber infill to estimate health risks to bystanders (young children) and athletes ages 4 to 35 years who were assumed to contact infill material. More specifically, the study assessed substances that were A) detected in rubber infill material, B) could volatilize from the rubber infill material, or C) could be extracted at sufficient quantity into simulated gastric or sweat fluid or simply had particularly hazardous properties. Using the bioavailable chemical concentrations, the evaluation characterized risks for the bystanders and athletes assumed to contact infill material 1.5 to 4 hours per day, 112 to 240 days per year. ***The study concluded that estimated risks for use of synthetic turf fields with crumb rubber infill were below guidelines used by both the European Union and the USEPA.***

- Pronk, eta al. (2020). Similar to testing reported on by Schneider et al. (2020) and USEPA (2019), Pronk et al. collected rubber infill samples from 100 pitches in the Netherlands (6 samples per pitch resulting in 600 total samples of rubber infill material) and analyzed them for SVOCs and metals. Samples were also subjected to extraction by simulated gastric and sweat fluids, and VOC emissions were measured in samples incubated at 140F. Using the bioavailable chemical concentrations, the evaluation characterized risks for study populations similar to those evaluated by Schneider et al. (2020). ***The study concluded that chemical concentrations in crumb rubber infill complied with concentration limits set for mixtures of substances in Europe, and that health risks were below regulatory guidelines.***

- Tetra Tech (2021). Tetra Tech evaluated the chemical composition of a synthetic turf system proposed to be installed as a component of the Martha's Vineyard Regional High School Athletic Fields Project. The evaluation included chemical analyses of each turf system component (turf carpet, shock pad, glue and bonding agents, and infill) for SVOCs, metals, and per-and poly-fluoroalkyl substances (PFAS). Testing was performed to evaluate both total and leachable concentrations. The analytical results were used in a risk assessment to evaluate possible pathways for migration of chemicals to the environment, potential exposure to human and environmental receptors, and possible health and environmental risks. The risk assessment was completed by comparing detected concentrations to standards and screening levels that are protective for exposure to soil in a residential yard setting (i.e., high frequency contact by toddlers, young children, adolescents and adults), and protective for migration to groundwater that is used as drinking water.

Based on the results of the risk assessment Tetra Tech concluded that:

- Concentrations of metals were similar to or less than those that naturally occur in soil and were below standards and screening levels.
- Most SVOCs were not detected, and those that were detected were below standards and screening levels.
- None of the six PFAS compounds regulated by MassDEP were detected. Two PFAS compounds (PFPeA and 6:2FTS) that are not regulated by MassDEP were in synthetic turf system samples detected at low (estimated) concentrations that were also below available standards published for other PFAS compounds.
- None of the compounds analyzed were detected at concentrations that would pose a concern for leaching to groundwater.

The Tetra Tech report also evaluated PFAS using a procedure which evaluates the potential for transformation of a certain class of PFAS compounds (known as precursors) into other PFAS compounds, to mimic conditions that could hypothetically occur under some environmental conditions. The results of the procedure indicate that two additional PFAS compounds (PFHpA) and PFBA could be generated through transformation of PFAS precursor compounds. Although these two PFAS compounds are not regulated by MassDEP, the concentrations yielded by the procedure were less than MassDEP soil standards for regulated PFAS compounds.

A significant aspect of the Tetra Tech study is that it evaluated each of synthetic turf system components for chemicals that have historically been evaluated in crumb rubber infill (e.g., metals and PAHs), as well as PFAS. PFAS is not a chemical that is added to synthetic turf components, nor is it used to manufacture tires which are recycled to create crumb rubber. Therefore, there is no reason to suspect that it would be present in synthetic turf carpeting or crumb rubber infill. However, questions concerning PFAS in synthetic turf were raised in a 2019 article that was published in the Boston Globe and The Intercept. A critical review of the findings cited in those articles is provided in Attachment 2. In summary, the findings reported in the articles indicate that PFAS compounds were detected but at concentrations that are within the range of background concentrations found in soil. Subsequent to the evaluation provided in Attachment 2, MassDEP published PFAS standards for soil. A review of the PFAS concentrations reported in the articles indicates that they are below MassDEP's PFAS standards for soil, indicating that the PFAS reported in the articles would not pose harm to people or the environment.

The testing completed by Tetra Tech, demonstrated that none of the PFAS compounds regulated by the MassDEP were detected in any of the synthetic turf systems components, and that PFAS compounds would not leach from any of the synthetic turf system components at

levels that would be a concern for groundwater or surface water. As with other studies, the Tetra Tech study also documented that metals and PAHs in synthetic turf are not a concern for harm to people or the environment.

We note that the infill material tested by Tetra Tech is not a crumb rubber infill material (i.e., it is a wood fiber material called BrockFill). Therefore, the analytical results and conclusions of the Tetra Tech report as they relate to the infill material are not necessarily applicable to the infill material proposed for the BB&N athletic field project. However, since the results of the Tetra Tech report indicate that the synthetic turf system would not pose any significant risks to human health or the environment, it can be concluded that turf carpeting and bonding agents alone would not pose any significant risks.

In summary, the presence of chemicals in synthetic turf materials have been well documented. However, numerous studies and reports have also demonstrated that the chemicals that are in the synthetic turf cannot come out of the materials at concentrations that would harm people or the environment. Consequently, synthetic turf systems, including turf blades and crumb rubber infill, are safe for contact by people and will not harm groundwater or surface water.

Evaluation of "Heat Island" and Synthetic Turf

A Heat Island is an area where the temperature is higher than in the surrounding area. Heat Islands are caused by reduced natural landscape in urban areas, the properties of urban materials (pavement, roofing, aggregate-based building materials), urban geometry (dimensions and spacing of buildings which can trap heat), heat generated by human activities (e.g., automobiles, air conditioning), and weather and geography. In particular, the combination of urban materials and urban geometry can create large thermal masses that cannot easily release heat. According to the USEPA[1], Heat Islands often build throughout the day and become more pronounced at night due to the slow release of heat from urban materials.

The surfaces of synthetic turf fields get warmer than the surfaces of natural turf fields. However, the differences in temperatures vary depending on weather conditions (e.g., sunny versus cloudy) and time of day. Several studies have examined the differences in heating between synthetic turf fields and natural turf fields. A comprehensive study by Jim et al. (2017) indicates that:

- On sunny days, surface temperatures of synthetic turf fields can be 30 to 40 degrees C higher than surfaces of natural turf fields. On cloudy days (defined as days when cloud cover reduced solar radiation to approximately one-half that of sunny days) surface temperatures of synthetic turf fields may be approximately 20 degrees C higher than natural turf fields, and on overcast days (defined as days when cloud cover reduced solar radiation to approximately one-quarter that of sunny days) there is essentially no difference in field surface temperatures.

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[1] [1] www.epa.gov/heatislands/learn-about-heat-islands

- Despite substantial surface temperature differences between synthetic and natural turf fields on sunny days, there is only a few degrees (centigrade) difference in air temperature between synthetic turf and natural turf fields at 20 inches and 40 inches above the playing field surface, and essentially no difference in air temperature at 60 inches above the field surfaces. This difference becomes smaller as daytime heating increases, with 20- and 40-inch air temperatures above synthetic turf nearly equaling those above natural turf during the afternoon hours. On cloudy and overcast days there is essentially no difference in air temperatures between synthetic turf and natural turf fields at 20- and 40-inches above the playing field surfaces.
- Synthetic turf surfaces and the air above synthetic turf fields heats and cools more rapidly than those associated with natural turf.
- The solar radiation released by natural and synthetic turf fields during nighttime is the same, meaning that that synthetic turf does not 'hold heat' and release it after sunset. This observation reflects that fact that synthetic turf has a poor heat storage capacity, which is reflected in the rapid changes in surface temperature profiles of synthetic turf as compared to natural turf, and the observation that synthetic turf surfaces return to the same temperature as natural turf surfaces when solar radiation is reduced (e.g., late afternoon/evening on sunny days and the duration of the day on overcast days).

The location of the new BB&N athletic facility is presently occupied by a paved (asphalt) parking lot. Unlike synthetic turf, asphalt continues to release heat once daytime heating is discontinued. In fact, a study by Yang et al. (2020) demonstrated that asphalt surfaces that are heated by the sun (i.e., 'sunny day' conditions) continue to release heat for several hours after heating is discontinued (i.e., after sunset). Consequently, replacing the existing asphalt parking lot with synthetic turf fields will improve environmental conditions by <u>decreasing</u> the existing Heat Island effects contributed by the paved parking lot.

Collectively, this information suggests that, while synthetic turf field <u>surfaces</u> get warmer than natural turf field surfaces, air temperatures above synthetic turf surfaces warm only marginally more than those above natural turf field surfaces, and that synthetic field surfaces do not retain heat once day-time heating is discontinued. These differences are substantially minimized on cloudy days and do not exist on overcast days. Moreover, the information suggests that replacing the existing asphalt parking lot with a synthetic turf field will improve environmental conditions by reducing paved surfaces that continue to emit heat after sunset. In that respect, synthetic turf fields are different than urban systems (aggregate buildings, roof tops, and pavement) which are associated with contributing to Heat Island effects which by the nature of those materials continue to release heat well into the nighttime hours. Given that the BB&N athletic field will not be surrounded by buildings made of urban materials, effects associated with urban geometry and lack of air movement will not be a factor. Finally, consider that the athletic field proposed by BB&N is replacing an asphalt parking lot. It is therefore not removing any pre-existing green space and thus not reducing natural landscape that already exists.

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Attachment 1
Massachusetts Department of Public Health Evaluation of Health Concerns Related to Synthetic Turf

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March 23, 2015

Stephanie Bacon, Health Agent
Office of Board of Health
155 Village Street
Medway, MA 02053

Dear Ms. Bacon:

Thank you for your letter of February 24, 2015, in which you requested that the Massachusetts Department of Public Health, Bureau of Environmental Health (MDPH/BEH), evaluate health concerns related to the use of crumb rubber infill material for artificial turf fields in Medway, Massachusetts. As you are likely aware, our office had previously evaluated this issue in a series of letters to the Town of Needham Board of Health in 2008, 2011, and 2013.

In response, MDPH/BEH staff have evaluated more recent information on potential exposure opportunities to artificial turf components, including crumb rubber infill, and evaluated health concerns, including cancer, in relation to exposure to such turf. Recent media reports on soccer players, particularly goalies that have played on artificial turf, and the incidence of some cancers have been expressed. These reports raised concerns about the possible association between playing on crumb rubber fields and the development of cancers, notably, non-Hodgkin's lymphoma, Hodgkin Lymphoma, and osteosarcoma. We also evaluated information you provided on the content of the specific products used in Medway. Our review is summarized below.

<u>Updated Literature Review</u>

Our previous evaluations noted that crumb rubber infill has been found to contain chemicals, including polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and metals. We further stated that although these chemicals are in the material itself, information available at that time did not suggest significant exposure opportunities to the chemicals in the materials such that we would expect health effects. We noted that the most relevant study on this topic at the time was a study conducted by the California Office of Environmental Health Hazard Assessment (CA OEHHA).

Since that time, the CA OEHHA conducted additional evaluations of chemical concentrations in air above crumb rubber turf fields under active use (CA OEHHA 2010). Air samples were taken above fields and analyzed for VOCs and metals. Results suggested that adverse health effects were unlikely to occur from inhalation of VOCs or metals in particulates above these fields. To assess the potential for skin infections due to bacteria or to skin abrasions on these fields, tests for bacterial contamination were performed and the frequency of skin abrasions was assessed. Researchers found fewer bacteria detected on the artificial turf compared to natural turf, suggesting that the risk of infection to athletes using these fields was actually lower. However, more skin abrasions were observed in athletes using artificial turf fields than natural turf fields, and the study authors made various recommendations to help prevent skin abrasions (e.g., protective equipment or clothing) and prompt treatment of skin abrasions.

In another study, the state of Connecticut conducted air sampling at four outdoor artificial turf fields with crumb rubber infills (most relevant to Medway) under summer conditions (Simcox et al. 2011). Air measurements were taken using stationary air sampling monitoring devices as well as personal samplers (placed on people using the fields). They concluded that exposure opportunities to turf contaminants were not associated with elevated health risks and suggested that their findings were consistent with other studies available at the time. A letter prepared by the Connecticut Department of Public Health reiterates these conclusions (CTDPH 2015).

A 2014 study by researchers at the Rutgers Robert Wood Johnson Medical School in New Jersey evaluated opportunities for exposures to PAHs, semivolatile organic compounds (SVOCs), and heavy metals from exposures to artificial turf fibers and crumb rubber infills by measuring these constituents in simulated body fluids (digestive fluids, lung fluids, sweat) that represented different routes of exposure (ingestion, inhalation, dermal). This bioaccessibility study aimed to provide a better measure of the actual amount of these contaminants that might be absorbed into the body after exposure. The researchers found that PAHs were routinely below the limit of detection and SVOCs that have environmental regulatory limits to use for comparison were identified at levels too low to quantify. Some metals were detected but at concentrations at which health risks were low, with the exception of lead from the field sample collected. That sample indicated lead at levels in the simulated digestive fluids that the authors reported could result in blood lead levels above the current U.S. Centers for Disease Control and Prevention (CDC) reference value for blood lead in children (5 ug/dL). It should be noted that the lead concentration of the materials used in this study included a sample of turf fiber with a lead concentration of 4,400 mg/kg. This level contrasts with information on the Medway artificial turf components, which reportedly either contained lead at 39 mg/kg (crumb rubber infill) or had no lead (turf fibers) (see discussion later in this letter). Based on the lead result from this one field sample, the authors suggested that components of artificial turf fields should be certified for low or no lead content prior to use. Overall, however, the authors concluded that opportunities for exposure to constituents in these fluids presented very low risk among all populations that would use artificial turf fields (Pavilonis et al. 2014).

A study conducted in 2010 in the Netherlands assessed the exposure of soccer players to PAHs after playing sports on a rubber crumb field. Urine testing in participants indicated that uptake of PAHs by the participants following exposure to artificial turf with rubber crumb infill was minimal. If there is any exposure, the authors reported, uptake is minimal and within the normal range of uptake of PAHs from environmental sources and/or diet observed in healthy individuals (van Rooij and Jongeneelen 2010).

It is probably worthwhile to also note that MDPH/BEH reviewed testing data for artificial turf for the Town of Needham, as reported in our letters of 2011 and 2013 to the Needham Board of Health. The Town of Needham contracted with an environmental testing firm to conduct environmental tests including, air measurements of volatile organic compounds taken in the laboratory and heavy metals (arsenic, cadmium, chromium, lead, mercury, selenium, zinc) content of crumb rubber materials. Our review and conclusions for that testing, did not indicate exposures of health concern.

Material in Medway

MDPH/BEH reviewed available information provided by the Medway Board of Health regarding the specific materials used in the Medway fields. These included the APT Gridiron turf system and Liberty Tire Recycling 10+20 BM Rubber Crumb Brantford, ON. Among the materials provided for these products were statements or test results for various constituents in these products.

APT submitted a written statement dated October 29, 2014, that reported that the APT Gridiron turf systems (essentially the grass fibers of the artificial turf) are manufactured and installed without the use of any lead or heavy metals. They reported that this included all materials used for the turf fibers and backings. No other documentation about this product, including any testing results, was provided to support this statement.

With respect to the 10+20 BM Crumb Rubber infill product, laboratory testing results were provided for this product, although it is not clear whether the testing was for the materials specifically used in turf applied in Medway. Testing was conducted for metals content as well as emissions of volatile organic compounds (VOCs). It appears that testing included the following: (1) testing for VOCs emitted into a confined air space in the laboratory after heating the product to 73 degrees F; and (2) content testing for eight heavy metals, including lead. The laboratory compared results to criteria established by the Greenguard certification program, part of Underwriters Laboratory, that uses among its criteria for certification health-based levels derived by the CA OEHHA.

Testing results for metals content of the product indicated a lead concentration of 39 mg/kg, which is less than the current Consumer Product Safety Improvement Act (CPSIA) limit of 100 mg/kg for lead in children's products (Ulirsch et al. 2010). No other metals were detected.

Test results measuring emissions off-gassing from heated material were provided in measurements that cannot be compared to any health-based standards or guidelines and thus, MDPH/BEH did not further evaluate this information. Typically, when certain products raise health concerns, health agencies review Material Safety Data Sheets (MSDS). An MSDS provides information on health risks associated with use of the product. An industry group, Synthetic Turf Council, provides a sample template MSDS for crumb rubber infill material (Synthetic Turf Council 2014). Although this sample MSDS is not specific to any particular product, it appears to be applicable to crumb rubber infill in general. In the section under "Hazardous Ingredients," the MSDS notes that the product can contain fine fibers that may cause irritation symptoms (e.g., itching, irritation of mucous membranes, eye irritation). The MSDS notes that the crumb rubber material is generally thought to be a nuisance dust.

Concerns About Cancer Among Soccer Players

As noted earlier in this letter, some recent news reports suggested that the incidence of cancers among soccer players, particularly goaltenders exposed to artificial turf, might be atypical. These reports included many cancer types, but some focused specifically on NHL, Hodgkin Lymphoma, and osteosarcoma in three individuals. We thought it would be helpful to provide additional information on cancers in general and known risk factors for NHL, Hodgkin Lymphoma, and osteosarcoma.

Cancer in General

Understanding that cancer is not one disease, but a group of diseases, is very important. Research has shown that there are more than 100 different types of cancer, each with separate causes, risk factors, characteristics and patterns of survival. A risk factor is anything that increases a person's chance of developing cancer and can include hereditary conditions, medical conditions or treatments, infections, lifestyle factors, or environmental exposures. Although risk factors can influence the development of cancer, most do not directly cause cancer. An individual's risk for developing cancer may change over time due to many factors and it is likely that multiple risk factors influence the development of most cancers. In addition, an individual's risk may depend on a complex interaction between their genetic make-up and exposure to environmental agents, including infectious agents and/or chemicals. This may explain why some individuals have a fairly low risk of developing a particular type of cancer as a result of an environmental exposure, while others are more vulnerable.

Cancers in general have long latency or development periods that can range from 10 to 30 years in adults, particularly for solid tumors. In some cases, the latency period may be more than 40 to 50 years. It is important to note, however, that latency periods for children and adolescents are significantly shorter than for adults.

Hodgkin Lymphoma

Hodgkin Lymphoma is most common in young adults between the ages of 15 and 40, especially in individuals in their 20s. Among adolescents, it is the most common type of cancer.

Hodgkin Lymphoma occurs specifically in a type of B lymphocyte (or white blood cell) called the Reed-Sternberg cell while other lymphomas (non-Hodgkin's types) occur in different cells.

Established risk factors for Hodgkin Lymphoma include: exposure to the Epstein-Barr virus (EBV); a previous diagnosis of mononucleosis (mono is caused by the EBV); family history; and certain hereditary conditions (such as ataxia telangiectasia) associated with a weakened immune system. The Epstein-Barr virus is very prevalent in the general population. Even though most of us have been exposed to the virus (which remains latent in our bodies), most people do not develop mononucleosis or Hodgkin Lymphoma. EBV is thought to account for about 20% or 25% of the diagnoses of classical Hodgkin's in the US.

Higher socioeconomic status is also a possible risk factor. This is thought to be due to delayed infectious exposures in childhood.

Occupational exposures as risk factors have been studied extensively and none have emerged as established risk factors. Likewise, there is very little evidence linking the risk of Hodgkin Lymphoma to an environmental exposure, other than the EBV.

Non-Hodgkin Lymphoma (NHL)

NHL refers to a diverse group of cancers that are characterized by an increase in malignant cells of the immune system. Each subtype of NHL may have different risk factors associated with its development. The specific cause of NHL in most individuals is unknown.

Although some types of NHL are among the more common childhood cancers, more than 95% of diagnoses occur in adults. Incidence generally increases with age, and most diagnoses occur in people in their 60s or older.

Established risk factors for NHL include a weakened immune system, associated with various medical conditions, and exposure to various viruses. An increased risk is faced by individuals taking immunosuppressant drugs following organ transplants; individuals with autoimmune disorders, such as rheumatoid arthritis and lupus; and individuals who have taken certain chemotherapy drugs for other cancers. Several viruses have been shown to play a role in the development of NHL, including the human immunodeficiency virus (HIV), the human T-cell leukemia/lymphoma virus (HTLV-1), and the Epstein-Barr virus.

Exposure to high-dose radiation (for example, by survivors of atomic bombs and nuclear reactor accidents and possibly by patients who have received radiation therapy for a previous cancer) may pose an increased risk. Some studies have also suggested that exposure to chemicals such as benzene and certain herbicides and insecticides may be linked with an increased risk of NHL. Smoking has been associated in some studies with certain types of NHL.

Osteosarcoma

Osteosarcoma is a type of malignant bone cancer which accounts for about 2% of childhood cancers in the United States. It is the most common type of cancer that develops in bone and comprises about 66% of malignant bone tumors in children in Massachusetts. Most osteosarcomas occur in children and young adults between the ages of 10 and 30. Teenagers comprise the most commonly affected age group and are at the highest risk during their growth spurt. However, osteosarcoma can occur in people of any age, with about 10% of all osteosarcomas occurring in people over the age of 60.

Established risk factors for osteosarcoma include certain inherited syndromes (such as retinoblastoma, the Li-Fraumeni syndrome, and others) and certain bone diseases (such as Paget disease of the bone and hereditary multiple osteochondromas). Individuals with these syndromes and bone diseases have an increased risk of developing osteosarcoma. People who have received radiation treatment for a previous cancer may have a higher risk of later developing osteosarcoma in the area that was treated. Being treated at a younger age and with higher doses of radiation both increase the risk. Because the risk of osteosarcoma is highest between the ages of 10 and 30, especially during the teenage growth spurt, experts believe that there may be a link between rapid bone growth and the risk of a bone tumor. Children with osteosarcoma are often tall for their age, which supports the link with rapid bone growth. Other than radiation, there are no known lifestyle or environmental risk factors associated with osteosarcoma. Asides from these risk factors, the causes of most osteosarcomas are unknown.

Summary

In summary, the scientific literature continues to suggest that exposure opportunities to artificial turf fields are not generally expected to result in health effects. Testing results on the crumb rubber infill indicated lead content less than CPSIA statutory limits established for children's products. For the turf fibers, APT provided a statement that this material did not have lead used in its manufacture, but no additional documentation was provided.

With respect to cancer concerns reported in media stories, it is important to note that the reports of cancers were of a wide variety of different types, each with its own set of risk factors. In addition, our staff reviewed cancer incidence data for the Town of Medway. The Massachusetts Cancer Registry (MCR) is a population-based surveillance system that began collecting information in 1982 on Massachusetts residents diagnosed with cancer in the state. All newly diagnosed cancer cases among Massachusetts residents are required by law to be reported to the MCR within six months of the date of diagnosis (MGL, c.111, s.111B). This information is kept in a confidential database and reviewed for accuracy and completeness.

Available information on the occurrence of cancers in children living in Medway indicates no diagnoses of Hodgkin Lymphoma, NHL, or osteosarcoma have been reported to the MCR in a search of their files from 2006 to the present. Although it is possible that a very recent diagnosis may not yet have been reported to the MCR, the fact that there are no reports of such cancers is reassuring.

Although available resources cannot support MDPH conducting environmental testing of this material, we would be happy to assist the Town of Medway in developing a sampling and analysis plan as well as provide technical support in interpreting results, similar to the assistance that we provided to the Town of Needham.

As we stated in our letters to Needham officials, while available information does not indicate exposure opportunities of health concern, MDPH/BEH continues to recommend common sense ways to minimize any potential exposure to chemicals that may be contained in synthetic turf fields made of crumb rubber. MDPH/BEH suggests washing hands after playing on the field and before eating, particularly for younger children with frequent hand-to-mouth activity, and taking off shoes before entering the house to prevent tracking in any crumb rubber particles. Also, there are studies that indicate heat levels on artificial turf fields may rise as outdoor temperatures increase (New York State 2009). Thus, for protection of the players, MDPH/BEH recommends increasing hydration, taking frequent breaks, and watering down the field to cool it on hot days to prevent the potential for burns or heat stress. Finally, based on recent work in California, MDPH/BEH recommends that steps be taken to minimize the potential for skin abrasions (e.g., protective equipment) and that skin abrasions be treated promptly to prevent potential infections.

We hope this information is helpful to you and Medway residents. If you have any questions, please feel free to contact us at 617-624-5757.

Sincerely,

Suzanne K. Condon, Associate Commissioner
Director, Bureau of Environmental Health

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Attachment 2
Evaluation of PFAS in Synthetic Turf as Reported by Boston Globe and The Intercept

TO:	Patrick Maguire; Synthetic Turf Stakeholders
FROM:	Stephen R. Clough, Ph.D., DABT Senior Environmental Toxicologist
DATE:	25 October 2019
SUBJECT:	Low Levels of PFAS Detected in Samples of Discarded Turf

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Recent news articles from both the **Boston Globe** (Toxic chemicals are found in blades of artificial turf) and **The Intercept** (Toxic PFAS chemicals found in artificial turf) have reported analytical laboratory results of synthetic turf sampled for the presence of perfluorinated alkyl substances (PFAS). This information, however, is of a preliminary nature as the results having not been peer-reviewed nor have the concentrations been put into context (e.g. compared to ambient levels reported for soils in unimpacted locations).

In lieu of this information, suppliers of synthetic turf have been contacted to determine if PFAS are utilized in the manufacture of their products (PFAS is not present in recycled tires and therefore crumb rubber). Vendors and manufacturers of turf products have, in the past, stipulated that all of their products meet California Prop 65 and European REACH standards of safety. Moving forward, Activitas Inc. wants to ensure that all products used in the construction of their synthetic turf fields meet the highest levels of quality assurance and safety, which includes minimizing exposure and subsequent risk to any potentially toxic chemicals of concern.

Background. PFAS are a family of highly fluorinated alkyl compounds used in a host of commercial and consumer products to provide durable waterproof coatings. Because of the nonspecific methods used to generate thousands of different types of PFAS, little has been done in terms of understanding their fate and transport. The scientific community is therefore evolving its understanding of PFAS in the environment. PFAS are considered to be contaminants of emerging concern (CECs). CECs are chemicals that have the potential to affect human health or present an environmental risk, and either: (1) do not have regulatory cleanup or health-based standards and/or (2) regulatory standards are evolving due to new science, detection capabilities or exposure pathways. PFAS are "ubiquitous" in the environment because a) they have been used in hundreds of different consumer products (e.g. carpet, waxes, lubricants, nonstick coatings, firefighting foams, leather, etc.) for over 60 years and b) they do not degrade and tend to concentrate in wildlife. Additionally, the carbon-fluorine bond affords detection of most PFAS at infinitesimally low levels, thus allowing observation in all media: air, soil, sediment, groundwater, surface water, animals and humans. Because the amount of peer-reviewed information available on PFAS is voluminous, it is recommended the reader peruse "fact sheets" available in States that are affected by environmental releases (e.g. ITRC PFAS Fact Sheets).

Toxicity research is also evolving, and several large epidemiological studies have "linked" exposure to adverse health effects in humans following long-term drinking water exposure to PFOA and PFOS compounds. The primary exposure route that the USEPA and State regulatory agencies have identified is through consumption of PFAS in contaminated drinking water. Based on research studies and what is known about the chemical composition of PFAS, dermal (skin) exposure to PFAS containing materials is not significant and thus poses a negligible human health risk. Similarly, due to the high water solubility of PFAS and low volatility, these compounds pose a negligible health risk via the inhalation exposure pathway.

Review of Methods. While the preliminary results following the sampling and analysis of discarded turf appears to indicate that PFAS may be present in both the backing and the blades of synthetic turf, a more careful evaluation of the information from the newspaper articles has identified the following issues that may bias an uninformed reader:

- It is well documented at both the State and Federal level that cross-contamination during sampling is a very important issue and, given the ubiquity of PFAS, is a common problem in the field. Technicians need to go through meticulous training to avoid contaminating the sample with materials containing PFAS or fluorine (including gloves, clothing, sampling items, containers, notebooks, makeup, perfumes, etc.). The articles do not mention what precautions were taken in the field, and the results would be suspect if Massachusetts Department of Environmental Protection standard operating procedures were not followed.

- There is no certified method for analyzing PFAS concentrations in materials other than a US EPA method for analyzing PFAS in drinking water. Since the samples were synthetic turf and not drinking water, the methods used for analysis were likely not certified and therefore, the results are questionable. Additionally, the article incorrectly compares apples to oranges, stating "...the swatch of turf from Franklin contained 190 parts per trillion of one of the most common PFAS chemicals, well above federal safety standards for drinking water." The laboratory results from a solid "swatch" would be reported as nanograms per kilogram (ng/kg), but a standard for drinking water would be nanograms per liter (ng/L). Thus the comparison of a PFAS in a bulk sample to a drinking water advisor is misleading.

- The article noted that an additional eight samples were analyzed for total fluorine and assumed that total fluorine is an indication that PFAS is present. Total fluorine, however, is a non-specific method and thus a poor proxy for PFAS. The method can be biased by the presence of many non-PFAS compounds. For example, some anionic surfactants applied to the field drain may contain fluorine. Many consumer products also contain fluorine such as toothpaste, mouthwash and household cleaners. The presence of fluorine, therefore, does not necessarily indicate PFAS compounds are present.

Evaluation of the Analytical Results and Potential Exposure/Risk. If one assumes in good faith that the results are correct, what does a concentration of 190 parts per trillion (0.19 ug/kg) of PFOS in synthetic turf mean? A review paper by Vedagiri and Loso (Remediation Journal, 2019) identified the range of PFOS levels in soil samples taken from "ambient" or "background" locations in 21 States "with no known point source" of PFAS. In other words, samples were taken from rural, uncontaminated areas that were away from urban/suburban impacts. The range of concentrations for PFOS, which was detected in every soil sample taken in North America (N=38), was 0.018 - 2.55 μg/kg (range of PFOA was 0.059 – 1.84 ug/kg). The concentrations in the eastern U.S. are much higher (>0.184 ug/kg). Thus, a concentration of 0.19 ug/kg PFOS in a swatch of used turf falls into this uncontaminated concentration range which would be considered "clean". While synthetic turf is not soil, the fields do receive atmospheric deposition of dust which is recognized as a major PFAS transport mechanism. Moving forward, concentrations in swatches would need to approach 2.5 parts per billion of PFOS (and 1.8 ug/kg PFOA) to raise a concern in terms of categorizing used turf as a potentially hazardous material.

These authors also compared these values to a residential soil Risk Screening Level of 1,260 ug/kg which applies to both PFOS and PFOA. All the background concentrations were well below the safe soil RSL "by two to three orders of magnitude". The concentrations of PFOS in soil cited by ITRC's recent "Fact Sheets" (Table 4-2) that are protective of both human health and underlying groundwater are also much greater than the value of 0.19 ug/kg cited by the recent articles. Based on these comparisons, human health risk is negligible.

Finally, it is noteworthy to mention, based on the conclusions of US EPA's recent Synthetic Turf Research Action Plan, that bioavailability of toxic chemicals (e.g. metals, polycyclic aromatic hydrocarbons) in synthetic turf is very low (≤3%). Thus reporting "total" PFAS that would be bound up in the matrix of the turf backing or plastic blades would overestimate what an athlete would actually be exposed to following contact.

Based on the above information, which addresses analytical uncertainties, concentrations relative to clean background locations, potential exposure, and subsequent human health risk, one may conclude that the discovery and reporting of ultratrace levels of PFAS in used synthetic turf appears to be overstated if not misleading.

Activitas, Inc. will continue to monitor this important issue and strive to keep all synthetic turf products free from any potentially toxic constituents of concern. We will also provide updates on this subject as additional information becomes available.

USGREENTECH PFAS TESTING RESULTS – ENVIROFILL INFILL MATERIAL

USGreentech

September 14, 2021

USGreentech, LLC.
3607 Church Street
Cincinnati, OH 45244
513-371-5520

RE: Supplier PFAS Disclosure Request – Shaw

To Whom It Concerns:

This letter is to disclose any PFAS levels within USGreentech infill products supplied to Shaw. Those products are Envirofill, an acrylic coated, and Safeshell, a natural product made of walnut shells.

PFAS levels in Envirofill are non-detectible as indicated in the attached report.

Safeshell does not use chemical additives in production.

Sincerely,

Ross Vocke

Att.

Envirofill PFAS Testing

Total PFAS (30 compounds) by U.S. Environmental Protection Agency (EPA) Method 537 Modified (537M); and

Leachable PFAS (30 compounds) by EPA Methods 1312 and 537M.

Click Below to go to:

DAVID TETER CONSULTING

December 13, 2019

Mr. Ross Vocke
Operations Manager
USGreentech
5076 Wooster Road
Cincinnati, Ohio 45226

RE: USGreentech Envirofill Synthetic Turf Infill PFAS Testing Results

Dear Mr. Vocke:

David Teter Consulting has prepared this letter report to present the results of testing of USGreentech Envirofill synthetic turf infill for per- and polyfluoroalkyl substances (PFAS).

ENVIROFILL SYNTHETIC TURF INFILL PFAS SAMPLING AND ANALYSIS

USGreentech. shipped a 1-kilogram sample of Envirofill synthetic turf infill to ALS Environmental (Laboratory) of Kelso, Washington under standard chain-of-custody protocols. ALS Environmental analyzed the Envirofill synthetic turf infill for the following:

- Total PFAS (30 compounds) by U.S. Environmental Protection Agency (EPA) Method 537 Modified (537M); and
- Leachable PFAS (30 compounds) by EPA Methods 1312 and 537M.

The following analytical issues were identified by the Laboratory:

- The matrix spike recovery of N-Ethyl perfluorooctane sulfonamidoethanol for sample 12/20 Green Envirofill was outside control criteria. Recovery in the Laboratory Control Sample (LCS) was acceptable, which indicated the analytical batch was in control. The matrix spike outlier suggested a potential high bias in this matrix.
- The control criteria was exceeded for one or more surrogates in Continuing Calibration Verification (CCV) KQ1917081-01. The recoveries of the associated native analytes were within control criteria, which indicated the analysis was in control.

None of these issues significantly affected the quality of the sample data and no further corrective action was deemed appropriate.

ENVIROFILL SYNTHETIC TURF INFILL TOTAL PFAS TESTING RESULTS

As shown in Table 1, total PFAS were not detected in the infill sample above the method reporting limit.

ENVIROFILL SYNTHETIC TURF INFILL LEACHABLE PFAS TESTING RESULTS

As shown in Table 2, leachable PFAS were not detected in the SPLP extraction fluid above the method reporting limit.

CLOSING

I appreciate the opportunity to work with you on this project. Should you have any questions or require additional information, please do not hesitate to contact me at (415) 889-8875 or at david@davidteterconsulting.com.

Sincerely,

David Teter, PhD, PE
Principal Engineer

Enclosures
Table 1 – Total PFAS Testing Results for USGreentech Envirofill Synthetic Turf Infill
Table 2 – Leachable SPLP PFAS Testing Results for USGreentech Envirofill Synthetic Turf Infill
Attachment A – Laboratory Report

1662 CLAY STREET, SAN FRANCISCO, 94109 (415) 889-8875 DAVID@DAVIDTETERCONSULTING.COM

TABLE 1 - Total PFAS Testing Results for USGreentech Envirofill Synthetic Turf Infill. All results are presented in units of nanograms per gram (ng/g).

Analyte Class	Analyte Name	Result	MRL	MDL
Perfluoroalkane Sulfonic Acids	Perfluorobutane sulfonic acid (PFBS)	ND U	0.71	0.22
	Perfluoropentane sulfonic acid (PFPeS)	ND U	0.69	0.17
	Perfluorohexane sulfonic acid (PFHxS)	ND U	0.73	0.30
	Perfluoroheptane sulfonic acid (PFHpS)	ND U	0.69	0.062
	Perfluorooctane sulfonic acid (PFOS)	ND U	0.69	0.13
	Perfluorononane sulfonic acid (PFNS)	ND U	0.69	0.16
	Perfluorodecane sulfonic acid (PFDS)	ND U	0.69	0.17
Perfluoroalkane Carboxylic Acids	Perfluorobutanoic acid (PFBA)	ND U	0.80	0.39
	Perfluoropentanoic acid (PFPeA)	ND U	0.80	0.21
	Perfluorohexanoic acid (PFHxA)	ND U	0.80	0.31
	Perfluoroheptanoic acid (PFHpA)	ND U	0.69	0.19
	Perfluorooctanoic acid (PFOA)	ND U	0.69	0.13
	Perfluorononanoic acid (PFNA)	ND U	0.80	0.33
	Perfluorodecanoic acid (PFDA)	ND U	0.80	0.26
	Perfluoroundecanoic acid (PFUnDA)	ND U	0.69	0.18
	Perfluorododecanoic acid (PFDoDA)	ND U	0.80	0.27
	Perfluorotridecanoic acid (PFTrDA)	ND U	0.80	0.21
	Perfluorotetradecanoic acid (PFTeDA)	ND U	0.69	0.18
Perfluoroalkyl Sulfonamides	Perfluorooctane sulfonamide (FOSA)	ND U	0.69	0.067
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	ND U	0.69	0.073
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	ND U	0.69	0.11
	N-Methyl perfluorooctane sulfonamidoethanol	ND U	0.69	0.054
	N-Ethyl perfluorooctane sulfonamidoethanol	ND U	0.69	0.088
	N-Methyl perfluorooctane sulfonamidoacetic acid	ND U	0.69	0.27
	N-Ethyl perfluorooctane sulfonamidoacetic acid	ND U	0.69	0.20
(n:2) Fluorotelomer Sulfonic Acids	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	ND U	0.69	0.088
	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	ND U	0.69	0.15
	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	ND U	0.69	0.029
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	ND U	0.69	0.036

Notes and Abbreviations

MDL: Method Detection Limit

MRL: Method Reporting Limit

ND: Not Detected

PFAS: Per- and Polyfluoroalkyl Substances

U: Not Detected Above the MDL

TABLE 2 - Leachable SPLP PFAS Testing Results for USGreentech Envirofill Synthetic Turf Infill. All results are presented in unit of nanograms per liter (ng/L).

Analyte Class	Analyte Name	Result	MRL
Perfluoroalkane Sulfonic Acids	Perfluorobutane sulfonic acid (PFBS)	ND U	5.1
	Perfluoropentane sulfonic acid (PFPeS)	ND U	5.1
	Perfluorohexane sulfonic acid (PFHxS)	ND U	5.1
	Perfluoroheptane sulfonic acid (PFHpS)	ND U	5.1
	Perfluorooctane sulfonic acid (PFOS)	ND U	5.1
	Perfluorononane sulfonic acid (PFNS)	ND U	5.1
	Perfluorodecane sulfonic acid (PFDS)	ND U	5.1
Perfluoroalkane Carboxylic Acids	Perfluorobutanoic acid (PFBA)	ND U	5.1
	Perfluoropentanoic acid (PFPeA)	ND U	5.1
	Perfluorohexanoic acid (PFHxA)	ND U	10
	Perfluoroheptanoic acid (PFHpA)	ND U	5.1
	Perfluorooctanoic acid (PFOA)	ND U	2.0
	Perfluorononanoic acid (PFNA)	ND U	5.1
	Perfluorodecanoic acid (PFDA)	ND U	5.1
	Perfluoroundecanoic acid (PFUnDA)	ND U	5.1
	Perfluorododecanoic acid (PFDoDA)	ND U	5.1
	Perfluorotridecanoic acid (PFTrDA)	ND U	5.1
	Perfluorotetradecanoic acid (PFTeDA)	ND U	5.1
Perfluoroalkyl Sulfonamides	Perfluorooctane sulfonamide (FOSA)	ND U	5.1
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	ND U	5.1
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	ND U	5.1
	N-Methyl perfluorooctane sulfonamidoethanol	ND U	5.1
	N-Ethyl perfluorooctane sulfonamidoethanol	ND U	5.1
	N-Methyl perfluorooctane sulfonamidoacetic acid	ND U	5.1
	N-Ethyl perfluorooctane sulfonamidoacetic acid	ND U	5.1
(n:2) Fluorotelomer Sulfonic Acids	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	ND U	5.1
	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	ND U	5.1
	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	ND U	5.1
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	ND U	5.1

Notes and Abbreviations

MRL: Method Reporting Limit

ND: Not Detected

PFAS: Per- and Polyfluoroalkyl Substances

SPLP: Synthetic Precipitation Leachate Procedure

U: Not Detected Above the MDL (the MRL is equivalent to the MDL for this method)

LAURA GREEN - BROCK INFILL HEALTH RISK ANALYSIS

RISKS TO PUBLIC HEALTH FROM CHEMICALS FOUND IN BROCK INFILL AND IN SOIL AT PLAYING FIELDS

Green Toxicology LLC

Laura C. Green, Ph.D., D.A.B.T
Senior Toxicologist

http://www.greentoxicology.com

January 12, 2021

RISKS TO PUBLIC HEALTH FROM PLAYING FIELDS

- All sports-fields contain various chemicals, including traces of various metals, and, potentially, perfluorinated alkyl substances (PFAS).

- This is true of both synthetic turf-fields and of ordinary grass & soil fields.

- Are the chemicals in synthetic turf fields, and/or in grass & soil fields, present at unhealthful concentrations?

- Let’s look first at PFAS … in soil and Brock infill

How much PFAS is in uncontaminated soil?

- Wenyu Zhu *et al.* (2019) evaluated uncontaminated soils in Vermont

- Shallow soil samples obtained from 66 sites
  - State forests, parks, school-yards, and other green areas

- Wide range of various PFAS detected

- Let's look at their results …

PFAS concentrations in uncontaminated soil (Zhu *et al.*, 2019)		
PFAS	**10th percentile**	**95th percentile**
PFPeA	less than 70 ng/kg	360 ng/kg
PFHxA	less than 7.6 ng/kg	920 ng/kg
PFHpA	less than 4.4 ng/kg	650 ng/kg
PFOA	59 ng/kg	1,000 ng/kg
PFNA	62 ng/kg	390 ng/kg
PFDA	40 ng/kg	390 ng/kg
PFUdA	35 ng/kg	180 ng/kg
PFBS	less than 6 ng/kg	500 ng/kg
PFHxS	less than 14 ng/kg	380 ng/kg
PFOS	310 ng/kg	3,000 ng/kg
PFDS	less than 5.3 ng/kg	170 ng/kg

How much PFAS is in Brockfill?

- One "non-regulated" PFAS (perfluoropentanoic acid, PFPeA) detected in the infill (J-qualified, estimated value)
- Two other PFAS (but not PFPeA) detected in "synthetic leachate" generated from infill (tests of leachate were more sensitive than tests of infill)
- These results suggest that infill contains about
  - 455 ng/kg of perfluoropentanoic acid (PFPeA)
  - 58 ng/kg of perfluorohexanoic acid (PFHxA)
  - 100 ng/kg of perfluoroheptanoic acid (PFHpA)
- Recall that uncontaminated soil (per Zhu *et al*., 2019) contains up to (at the 95th percentile)
  - 360 ng/kg of PFPeA
  - 920 ng/kg of PFHxA
  - 650 ng/kg of PFHpA
  - Many other PFAS, at concentrations up to 3,000 ng/kg

ARE PFAS IN SOIL, OR IN INFILL, HARMFUL TO HEALTH?

- Per MA DEP, acceptable daily intake of regulated PFAS (from all sources, including food, drinking water, and incidental ingestion of dust and soil) = 5 nanograms PFAS per kilogram body weight per day (5 ng/kg-day)

- How much incidental ingestion of soil and/or infill would an athlete receive playing on a sports field?

  - And would such ingestion be unhealthful?

- Here's how we addressed this question …

Exposure-scenarios considered

- Consider an athletic girl, aged 5 - 18
- Make conservative assumptions:
  - Plays daily on sports fields, 9 months per year
  - Incidentally ingests 100 mg/day of either infill or soil
  - Absorbs 100% of ingested PFAS, and 50% of ingested metals
  - Acceptable daily intake-values derived by applying ample margins of safety (MA DEP ”reference dose”)
- Assume parallel exposures for
  - Synthetic field with Brockfill infill
  - Natural grass field with ordinary soil

Daily doses of PFAS from incidental ingestion of infill and of soil (based on Zhu *et al.*, 2019), compared with acceptable daily intake of PFAS			
PFAS	**Dose from Brockfill** (picograms/kg-day)	**Dose from Soil** (picograms/kg-day)	**Acceptable Daily Intake** (picograms/kg-day)
PFPeA	0.83	<0.13 – 0.7	**Assume > 5,000**
PFHxA	0.11	<0.01 - 1.7	**5,000**
PFHpA	0.18	<0.01 - 1.2	**5,000**
Five additional, MA DEP-regulated, PFAS	<0.01	<0.03 – 5.5	**5,000**

OTHER POTENTIALLY TOXIC CHEMICALS
IN SOIL AND IN BROCKFILL

- Various metals, present naturally and/or because of contamination

- Three potentially important metals, toxicologically:

  - Arsenic & Cadmium
    - Poses risk of cancer

  - Lead
    - Poses risk of harm to developing brains

Concentrations of two metals in infill and in soil, from Oak Bluffs Elementary School and MVRHS			
Metal	**Brockfill** (mg/kg)	**Elementary school soil** (mg/kg)	**MVRHS soil** (mg/kg)
Arsenic	None detected <0.079	1.6	1.9
Cadmium	0.042	None detected (< 0.1)	None detected (< 0.1)
Lead	None detected <0.102	24.2	16.2

Daily doses of three metals from incidental ingestion of infill and of soil, compared with acceptable daily intakes			
Metal	**Dose from Brockfill** (ng/kg-day)	**Dose from Soil** (ng/kg-day)	**Acceptable Daily Intake** (ng/kg-day)
Arsenic	<0.07	2.0	**300**
Cadmium	0.04	<0.4	**500**
Lead	<0.09	97	**750**

OTHER FIELD COMPONENTS:
GREENFIELD SYNTHETIC TURF, SHOCK PAD, GLUES

❖ Trace, estimated amounts of a few PFAS detected in these other components, all at concentrations smaller than the trace concentrations of PFAS detected in the Brock infill and/or Brockfill "leachate"

❖ Potentially toxic metals detected either at trace, estimated concentrations or not at all

❖ No adverse impact expected on either the environment or the public health

WOULD TESTS FOR TOTAL ORGANIC FLUORINE (TOF) BE INFORMATIVE?

- No.
- Soil would be expected to contain much more organic fluorine than Brockfill or other synthetic field-components.
- Soil can contain bacteria, *Streptomyces cattleya*, that naturally biosynthesize various organofluorine chemicals.
- Several plant-species biosynthesize organofluorine chemicals.
- Countless, non-PFAS, organofluorine compounds will have deposited onto soils from ambient air.
- **The best way to find PFAS is to analyze for PFAS.**

WOULD TESTS FOR TOTAL OXIDIZABLE PRECURSORS TO PFAS (TOP) BE INFORMATIVE?

- No.

- This test is appropriate only for materials that are
  - known to contain organofluorine chemicals that
  - might, *under strongly oxidizing conditions*, degrade into one or more PFAS of toxicologic significance.

- Neither Brockfill nor other synthetic field-components are such materials;

- and nothing about a sports field, whether synthetic or natural, represents strong oxidizing conditions.

Are microplastics at issue here?

- No.
- Brockfill consists only of wood granules.
- Small amounts of microplastic may form, however, from wear-and-tear of synthetic grass surface.
- This "secondary" microplastic would be negligible compared with microplastics ubiquitous in fresh water, seawater, drinking water, food, ambient air, and soil.
- No reliable evidence that exposures to microplastics harm health (see, for example, WHO, 2019, *Microplastics in Drinking Water*).

UNIVERSITY OF VERMONT STUDY & LAB RESULTS – BACKGROUND PFAS IN NATURAL SOILS

PFAS Background in Vermont Shallow Soils

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1.0 INTRODUCTION

This study was conducted by University of Vermont and Sanborn, Head & Associates (Sanborn Head) with partial funding and support provided by Vermont Department of Environmental Conservation (VTDEC). Soil samples were collected from June through August 2018 to determine the background concentrations of a number of per- and polyfluoroalkyl substances (PFAS) in Vermont shallow soils. Shallow soils were collected at a subset of properties sampled in a recent VTDEC Background Study of the levels of polyaromatic hydrocarbons (PAHs), arsenic, and lead in VT soils. The properties sampled in the previous background study were selected by overlaying a 100-square mile grid across the state, identifying the largest municipality in each grid, and then sampling within the town or municipality at state or municipal parks, forests, greens, or building or school lawns.

Proposed properties for sampling were selected using the screening process described in the Quality Assurance Project Plan (QAPP) and Data Quality Objectives Plan (DQO Plan). Based on access issues at some of the proposed properties, some alternative properties were selected. A total of 66 properties were sampled of the 69 properties proposed in the QAPP and DQO Plan. A list of properties, including annotations indicating properties with access issues and those selected as alternatives, is provided in the Appendices. A total of 17 PFAS, summarized in Table 1, were investigated as target analytes in this study. These target analytes belong to either of two groups of PFAS based on their functional groups: perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkyl sulfonates (PFSAs). Additionally, six field duplicate samples were collected and submitted to Alpha Analytical, Inc. (Alpha Analytical) for analysis of 24 PFAS, including the target analyte list for this study.

2.0 FIELD SAMPLING METHODOLOGY

Soil samples were collected from 66 sites across State of Vermont by Sanborn Head. Several municipalities (E1, K6 and L2) provided more than one property for sample collection, which were designated by subsequent lowercase letters, such as E1a. Samples were collected using the methods described in the QAPP and DQO Plan. Soil samples were classified and logged on-site by the field representative using a modified Burmister Soil Classification System. Summarized field sampling forms and Chain-of-Custody forms are provided in the Appendices.

3.0 LABORATORY METHODOLOGY

3.1 Determination of Percent Solid and Total Organic Carbon (TOC)

The percent solids of collected soil samples was determined using ATSM D2216-10 Method, and TOC was measured according to the ASTM 2000 method which is referred as Loss on Ignition (LOI) method.

3.2 Extraction Method

The extraction method used in this project was adapted from the method developed by Rankin *et al.* (2016)[1] where they achieved roughly 100% recovery of PFOA, PFDA and PFDoDA in spike-and-recovery experiments.

3.3 Instrumental Analysis and Quantification

A liquid chromatography-tandem mass spectrometry (LC-MS/MS) system was used to evaluate the existence of PFAS in the soil samples. Typically, a Shimadzu Prominence LC using a Waters Atlantis dC18 column was coupled to an ABI Qtrap 4000 mass spectrometer which was operated in negative electrospray ionization mode. The detailed instrumental parameters and methods were summarized in Appendices. The average recovery of M8PFOA was 80.33% (RSD: 7.62), which was consistent with the laboratory's acceptance limits (70-130%). Accuracy and precision of the method were determined through analysis of LCS/LCSD at four different spiking level as shown in the Appendices. Based on the method used herein, method detection limit (MDL) and reporting limit (RL) of each analyte were summarized in Table 2 and the detailed calculation methods were described in the Appendices. Instead of using PFAS concentrations in dry weight, originally detected values from LC-MS/MS were used to compare with MDL and/or RL. RL was used as the quantified detection threshold of each analyte. Laboratory detections above RL were considered to be quantitative detections, and detections above MDL but below RL were considered qualitative detections and estimated values.

3.4 Quality Assurance Sampling

A total of 22 blank samples (12 trip blanks, three field blanks, three equipment blanks, four method blanks) and two field duplicates samples, were prepared for quality assurance purposes. In addition, six field duplicate samples were collected and submitted for analysis to Alpha Analytical Inc as an overall check on the analytical results.

4.0 SUMMARY OF RESULTS

4.1 Detection Frequency and Concentration of PFAS in Soils

A total of 68 soil samples, including two duplicates, were collected from 66 locations across Vermont. The qualitative and quantitative detection frequency of each PFAS, minimum and maximum concentration of quantitative detections at the 66 locations were provided in Table 2. As estimated values, qualitative detections were not included in further discussions and statistical analyses unless mentioned.

Several PFAS were quantitively detected at relatively high frequencies in the soil samples from Vermont (Table 2). Six PFCAs (PFHxA, PFHpA, PFOA, PFNA, PFDA, and PFUnDA) and two PFSAs (PFBS and PFOS) were quantitively detected at frequencies higher than 50%. PFOS was quantitively detected at the highest frequency and was observed in all soil

---

1 Rankin, K., Mabury, S.A., Jenkins, T.M., and Washington, J.W., A North American and Global Survey of Perfluoroalkyl Substances in Surface Soils: Distribution Patterns and Mode of Occurrence. *Chemosphere*, (2016), 161, 333-341.

samples. In contrast, several other PFAS (i.e., PFBA, PFPeA, PFDoDA, PFTrDA, PFTeDA, PFHxDA, and PFODA) were quantitively detected in less than 10% of the samples.

Total concentration of total PFAS (ΣPFAS) quantitively detected in samples ranged from 540 to 35,000 ng/kg. The highest ΣPFAS concentration, 35,000 ng/kg, was observed at location J6, with the concentrations of total PFCAs (ΣPFCAs) and total PFSAs (ΣPFASs) measured at 23,000 ng/kg and 12,000 ng/kg, respectively. These values are much higher than those obtained from other locations, with the next highest ΣPFAS concentration of 9,400 ng/kg measured at location K6e.

The PFAS concentrations, solids contents, and TOC contents for each soil sample were summarized in Table 3. PFAS detected below the MDL were marked as "<MDL", and PFAS qualitatively detected (less than RL but greater than MDL) were labeled with a "J" qualifier. PFAS not detected by the laboratory method were marked as non-detects ("ND").

Target PFAS were less than the MDLs in all trip blanks, field blanks, and equipment blanks. A trace amount of PFOA (<MDL) was observed in the method blank of the first sample batch. A washing process was added after each injection for the following batches and the trace PFOA was no-longer observed in the method blanks. Of the six duplicate samples analyzed by Alpha Analytical Inc, there were two quantitative detections of PFOS at concentrations similar to those measured using the study methodology; the other 23 PFAS were less than the laboratory RLs, which was 1,030 to 1,300 ng/kg. Because the Alpha Analytical laboratory RLs were higher than the study methodology RLs, the frequency of non-detects is consistent with the study results. The results of PFOS and PFOA, the two most abundant PFAS of the six samples, were summarized in side-by-side comparisons in Table 4.

The two duplicate samples (C1 and I7) were analyzed using relative percent difference (RPD), provided in the Appendices. Of the 16 quantitative detections across the two sets of duplicate samples, two PFAS had RPD values greater than the 50 percent (%) threshold selected for this study (53% for PFBS at C1 and 72% for PFHxA at I7). The corresponding data at locations C1 and I7 were labeled with a "P" qualifier. In the following discussions and statistical analyses, the arithmetic average PFAS concentrations C1 and I7 were applied.

4.2 Composition and Spatial Distribution

A PFAS concentration profile of quantitatively detected PFCAs and PFSAs was provided in Figure 1. Additionally, relative composition profiles were prepared to show the contribution of each target analyte to ΣPFAS, ΣPFCAs, and ΣPFSAs at each location (Figures 2, 3, and 4, respectively). Across the 66 locations, PFCAs were more than 50% of the ΣPFAS at 41 locations, with the highest percentage (85%) at location E5. PFSAs made up the highest percentage of the ΣPFAS (80%) at location D8.

At a majority of locations, PFOA and PFOS were the greatest contributors to ΣPFCAs and ΣPFSAs, respectively. Concentrations of PFOA ranged from 52 to 4,900 ng/kg and concentrations of PFOS ranged from 110 to 9,700 ng/kg, respectively. Overall, PFOS was the predominant compound detected in Vermont soils and accounted for approximately 13% to 80% of ΣPFAS detected in samples.

The spatial distribution of ΣPFAS, ΣPFCAs, and ΣPFSAs was shown in Figures 5.1, 5.2, and 5.3, respectively. The samples with ΣPFAS concentrations higher than 5,000 ng/kg (Figure 5.1) were observed in the northern-third of Vermont and in the Hartford area. The ΣPFCA concentrations were less than 2,000 ng/kg (Figure 5.2), except at several locations in the northern-third of Vermont, in the Hartford area (K5/K6/J6), and at Woodford State Park in Woodford (P2). Similarly, relatively higher ΣPFSAs concentrations of greater than 2,000 ng/kg were observed at several locations in central to north-Vermont, in the Hartford area (J6 and K6), and at the South Stream Boat Launch in Pownal (Q1) (Figure 5.3).

The spatial distribution of select PFAS (i.e., PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFBS, PFHxS, PFOS, and PFDS) were shown in Figures 6-1 through 6-11. The spatial distributions of individual PFAS were largely similar to the spatial trends described above for ΣPFAS, ΣPFCAs, and ΣPFSAs. Particularly, the most evident trend was the relatively higher concentrations in the Hartford area for several PFAS (e.g., PFHxA, PFOA, PFNA, PFDA, PFUnDA, and PFBS).

4.3 Statistical Analyses

4.3.1 Correlations

Potential correlations among TOC, moisture content, and PFAS concentrations were tested and the complete results of the tests were provided in the Appendices. It has been widely reported that concentrations of hydrophobic organic pollutants can be affected by soil characteristics, including TOC.[2] However, in this study, no significant correlation was observed between TOC and individual or ΣPFAS. Moisture content also did not have a significant correlation with any PFAS compounds.

There were strong positive correlations (>0.95) observed among PFNA, PFDA, and PFUnDA, and a less-strong positive correlation (>0.80) with PFHxA and PFNA, PFDA, and PFUnDA. Similar to the study conducted by Bossi *et al.*,[3] notable positive correlations were observed between PFOS and three long chain PFCAs (PFNA, PFDA and PFUnDA). In this study, PFHxA was also positively correlated with PFOS. The underlying cause(s) of these correlations is unknown because PFAS occurrence in soils is potentially affected by multiple factors, including physicochemical characteristics of individual PFAS, soil properties, and local/nearby environmental parameters and sources.

4.3.2 Background Statistics

Preliminary background threshold values (BTVs) were estimated for select PFAS using the ProUCL 5.1 statistical software developed by the United States Environmental Protection Agency (US EPA). BTVs were not calculated for PFAS with quantitative detection frequencies less than 10% (i.e., PFBA, PFPeA, PFDoDA, PFTrDA, PFTeDA, PFHxDA, and PFODA). To

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2 Yan, H., Cousins, I. T., Zhang, C., & Zhou, Q., Perfluoroalkyl acids in municipal landfill leachates from China: Occurrence, fate during leachate treatment and potential impact on groundwater. *Science of the Total Environment*, (2015),524, 23-31.

3 Bossi, R., Dam, M., & Rigét, F. F. Perfluorinated alkyl substances (PFAS) in terrestrial environments in Greenland and Faroe Islands. *Chemosphere*, (2015), 129, 164-169.

estimate the BTVs using ProUCL 5.1, Upper Tolerance Limits (UTLs) were calculated with full dataset, where NDs, concentrations below MDLs, and qualitative detections represented by their RLs.

Because of the relatively high concentrations of numerous PFAS at J6, a summary of statistical analysis before and after removing J6 data as an outlier was provided in Table 5.1 and Table 5.2, respectively. Similarly, the percentiles for each PFAS were also calculated with and without J6 data and summarized in Table 6.1 and 6.2, respectively. Based on the outsized influence the J6 sample had on many of the summary statistics, the J6 data were not included in the data used for UTLs by ProUCL 5.1.

The results of the ProUCL 5.1 analysis were summarized in Table 7. All but three PFAS (PFDA, PFUnDA and PFHxS) fit either a Gamma distribution, Lognormal distribution, or both. UTLs for the PFAS that did not fit a distribution were estimated using their 95% percentile values. Detailed ProUCL outputs for the UTL estimates were provided in the Appendices.

4.4 Data Limitations

Sample collection and laboratory analytical methods were based on the QAPP and DQO Plan prepared specifically for this study. Limitations on the usability of this data should be considered in the context of the procedures described in the QAPP and DQO Plan. We do not recommend application of this data beyond the purpose of this study. Additionally, we provide the following limitations.

- Variations in the types and concentrations of PFAS in soil may occur due to continued or discontinued releases to the environment, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed, and the findings of this study should be updated accordingly;
- Samples were collected at a limited number of publicly owned properties. These data reflect the specific locations and depths at which the samples were collected from and do not necessarily indicate concentrations in soil elsewhere at the property or at other properties;
- Analyses were performed for only 17 PFAS. Beyond those PFAS detected as part of this study, PFAS not searched for during the current study might be present in soil Vermont soils;
- The study was conducted specifically in Vermont and may not reflect conditions in other geographic areas.

5.0 ACKNOWLEDGEMENTS

This study was supported through partial funding from VTDEC, with significant in-kind contributions from University of Vermont, Sanborn Head, and Alpha Analytical. The authors would like to thank the numerous State and municipal officials for their gracious help in coordinating access to the sampling locations.

Table 1. PFAS Analyte List
Basic naming structure and shorthand for target perfluoroalkyl substances (PFAS).

Acronym	**Name (n- linear structure)**	**Molecular Weight (g/mole)**	**Formula**	**CAS No.**
PFBA	Perfluoro-n-butanoic acid	214.03	C_3F_7COOH	375-22-4
PFPeA	Perfluoro-n-pentanoic acid	264.05	C_4F_9COOH	2706-90-3
PFHxA	Perfluoro-n-hexanoic acid	314.05	$C_5F_{11}COOH$	307-24-4
PFHpA	Perfluoro-n-heptanoic acid	364.06	$C_6F_{13}COOH$	375-85-9
PFOA	Perfluoro-n-octanoic acid	414.07	$C_7F_{15}COOH$	335-67-1
PFNA	Perfluoro-n-nonanoic acid	464.08	$C_8F_{17}COOH$	375-95-1
PFDA	Perfluoro-n-decanoic acid	514.09	$C_9F_{19}COOH$	335-76-2
PFUnDA	Perfluoro-n-undecanoic acid	564.09	$C_{10}F_{21}COOH$	2058-94-8
PFDoDA	Perfluoro-n-dodecanoic acid	614.10	$C_{11}F_{23}COOH$	307-203-2
PFTrDA	Perfluoro-n-tridecanoic acid	664.11	$C_{12}F_{25}COOH$	72629-94-8
PFTeDA	Perfluoro-n-tetradecanoic acid	714.12	$C_{13}F_{27}COOH$	376-06-7
PFHxDA	Perfluoro-n-hexadecanoic acid	814.13	$C_{15}F_{31}COOH$	67905-19-5
PFODA	Perfluoro-n-octadecanoic acid	914.15	$C_{17}F_{35}COOH$	240-582-5
PFBS*	Perfluoro-1-butanesulfonic acid	299.95	$C_4F_9SO_3H$	375-73-5
PFHxS*	Perfluoro-1-hexanesulfonic acid	399.94	$C_6F_{13}SO_3H$	355-46-4
PFOS*	Perfluoro-1-octanesulfonic acid	499.94	$C_8F_{17}SO_3H$	1763-23-1
PFDS*	Perfluoro-1-decanesulfonic acid	599.93	$C_{10}F_{21}SO_3H$	335-77-3
M8PFOA*	Perfluoro-n-[$^{13}C_8$]octanoic acid	422.01	$^{13}C_7F_{15}{}^{13}COOH$	335-67-1

* M8PFOA was obtained Wellington Laboratories (Canada) named M8PFOA0717 (isotopic purity>99%); non-isotopic standards were obtained from Wellington Laboratories (Canada) in a mixture named PFCA-MXB (purity > 99%).
* PFBS, PFHxS, PFOS, and PFDS were received in their form of salts, which were Potassium perfluoro-1-butanesulfonate, Sodium perfluoro-1-hexanesulfonate, Sodium perfluoro-1-octanesulfonate, and Sodium perfluoro-1-decanesulfonate, respectively.

Table 2. Laboratory Detection Limits and Detection Frequency Summary
MDL (ng/kg), RL (ng/kg) of each analyte. General Statistics, including: number of observations (Obs), number of qualitative detections (Qual D), number of quantitative detections (Quant D), qualitative frequency of detections (Qual F, %), quantitative frequency of detections (Quant F, %), minimum concentration of quantitative detections (Min, ng/kg), and maximum concentration of quantitative detections (Max, ng/kg) of each analyte**.**

Analyte	**MDL**	**RL**	**Obs**	**Qual D**	**Quant D**	**Qual F**	**Quant F**	**Min**	**Max**
PFBA	100	520	66	0	0	0	0	N/A	N/A
PFPeA	70	350	66	5	5	7.6	7.6	140	1,300
PFHxA	7.6	39	66	33	33	50	50	50	4,400
PFHpA	4.4	22	66	59	59	89	89	44	900
PFOA	7.0	35	66	60	60	91	91	52	4,900
PFNA	9.7	48	66	66	61	100	92	51	5,000
PFDA	8.0	40	66	64	57	97	86	43	7,600
PFUnDA	7.0	35	66	63	48	95	73	38	2,600
PFDoDA	11	54	66	25	3	38	4.6	100	690
PFTrDA	13	65	66	2	1	3.0	1.5	N/A	130
PFTeDA	21	110	66	1	0	1.5	0	N/A	N/A
PFHxDA	23	110	66	3	0	4.5	0	N/A	N/A
PFODA	24	120	66	13	0	20	0	N/A	N/A
PFBS	6.0	30	66	49	42	74	63	33	1,600
PFHxS	14	72	66	46	29	70	44	76	880
PFOS	5.0	25	66	66	66	100	100	106	9,700
PFDS	5.3	26	66	27	23	40	35	32	920

* N/A: not applicable due to limited quantitative detections.
* Statistical analyses were performed on raw data with additional precision, and results have been rounded to two significant digits.

Table 3. Laboratory Analytical Data Summary
Solid percent, total organic carbon (TOC), and analyte concentration (ng/kg, dry weight) for each site.

Analyte	**Soil Sample ID**				
	A1	**A3**	**A5**	**A7**	**A9**
Solid (%)	93	76	86	82	80
TOC (%)	6.8	9.9	8.8	7.8	8.8
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	1,300	ND
PFHxA	ND	ND	1,500	520	ND
PFHpA	ND	150	660	110	510
PFOA	520	240	290	150	140
PFNA	140	82	310	170	220
PFDA	96	38 J	170	95	72
PFUnDA	64	33 J	160	97	44 J
PFDoDA	22 J	ND	27 J	26 J	ND
PFTrDA	<MDL	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	<MDL	<MDL	ND	ND	ND
PFODA	51 J	63 J	ND	ND	ND
PFBS	ND	ND	190	350	81
PFHxS	300	63 J	87	ND	120
PFOS	1,800	330	720	1,600	650
PFDS	110	ND	51	100	ND
ΣPFCA*	820	470	3,100	2,400	940
ΣPFSA*	2,200	330	1,100	2,100	850
ΣPFAS	3,100	800	4,100	4,500	1,800

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID				
	B2	**B4**	**B6**	**B8**	**C1#1†**
Solid (%)	86	94	86	93	75
TOC (%)	11	8.2	9.3	11	10
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	ND	79	680	100	ND
PFHpA	410	260	540	170	150
PFOA	1,600	330	<MDL	390	430
PFNA	1,200	150	150	78	160
PFDA	100	67	160	22 J	89
PFUnDA	75	73	76	14 J	63
PFDoDA	22 J	<MDL	ND	ND	<MDL
PFTrDA	<MDL	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	<MDL	<MDL	ND	ND	ND
PFODA	57 J	51 J	ND	ND	ND
PFBS	ND	ND	1,600	39	240 P
PFHxS	180	83	ND	48 J	230
PFOS	4,400	670	930	380	660
PFDS	150	ND	ND	ND	31
ΣPFCA*	2,400	960	1,600	740	890
ΣPFSA*	4,800	750	2,600	420	1,200
ΣPFAS	7,100	1,700	4,200	1,200	2,100

† C1#1 and C1#2 were duplicate samples collected from C1.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* P: The RPD between the results exceeds the method-specified criteria.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID				
	C1#2†	**C3**	**C5**	**C7**	**C9**
Solid (%)	94	94	98	84	86
TOC (%)	10	6.3	8.6	10	7.5
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	360
PFHxA	ND	ND	680	770	ND
PFHpA	130	110	340	390	120
PFOA	430	140	160	690	190
PFNA	140	78	54	230	110
PFDA	71	45	76	77	51
PFUnDA	50	34 J	73	52	40 J
PFDoDA	ND	ND	17 J	ND	ND
PFTrDA	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	<MDL	ND	ND	ND
PFODA	ND	51 J	ND	ND	ND
PFBS	140 P	ND	150	260	ND
PFHxS	160	89	140	40 J	25 J
PFOS	690	340	590	860	380
PFDS	33	11 J	ND	ND	ND
ΣPFCA*	800	370	1,400	2,200	830
ΣPFSA*	1,000	430	880	1,100	380
ΣPFAS	1,900	800	2,300	3,300	1,200

† C1#1 and C1#2 were duplicate samples collected from C1.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* P: The RPD between the results exceeds the method-specified criteria.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	D1	**D3**	**D4**	**D6†**	**D8**
Solid (%)	92	89	92	35	94
TOC (%)	9.7	5.5	12	2.8	4.2
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	ND	ND	340	ND	17 J
PFHpA	410	120	650	210	46
PFOA	500	140	1,400	270	160
PFNA	260	100	230	33 J	51
PFDA	210	65	330	ND	110
PFUnDA	75	52	84	ND	84
PFDoDA	23 J	ND	33 J	ND	12 J
PFTrDA	ND	ND	ND	ND	<MDL
PFTeDA	ND	ND	<MDL	ND	ND
PFHxDA	ND	<MDL	ND	ND	ND
PFODA	ND	54 J	<MDL	ND	ND
PFBS	100	ND	86	380	ND
PFHxS	440	89	62 J	ND	42 J
PFOS	940	360	1,200	310	1,800
PFDS	230	14 J	170	ND	ND
ΣPFCA*	1,500	480	3,100	480	440
ΣPFSA*	1,700	450	1,400	690	1,800
ΣPFAS	3,200	930	4,500	1,200	2,200

† D6 was collected after a rain.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	E1	**E1a**	**E1c**	**E1d**	**E1e**
Solid (%)	88	95	90	84	91
TOC (%)	8.5	9.6	7.5	9.5	6.7
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	590	610	1,400	150	390
PFHpA	52	160	210	290	ND
PFOA	<MDL	260	430	470	ND
PFNA	120	290	400	190	370
PFDA	87	210	250	430	360
PFUnDA	74	110	100	120	130
PFDoDA	37[J]	ND	ND	100	ND
PFTrDA	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	ND	ND
PFODA	ND	ND	ND	ND	ND
PFBS	120	510	440	160	340
PFHxS	ND	ND	ND	120	ND
PFOS	290	1,400	3,700	3,200	3,800
PFDS	ND	ND	ND	380	190
ΣPFCA*	920	1,600	2,800	1,700	1,200
ΣPFSA*	410	1,900	4,100	3,800	4,300
ΣPFAS	1,300	3,500	6,900	5,600	5,600

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID				
	E1f	**E3**	**E5**	**E7**	**E9**
Solid (%)	93	78	54	87	97
TOC (%)	7.0	11	13	7.7	8.2
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	360	ND	370	63	ND
PFHpA	ND	230	900	87	80
PFOA	82	410	4,900	330	370
PFNA	340	160	330	96	100
PFDA	400	95	66 J	49	53
PFUnDA	83	140	65 J	68	50
PFDoDA	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	<MDL
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	ND	ND
PFODA	ND	ND	ND	ND	ND
PFBS	180	130	80	37	20 J
PFHxS	ND	ND	94	430	96
PFOS	2,000	650	1,000	690	310
PFDS	ND	ND	ND	61	ND
ΣPFCA*	1,300	1,000	6,500	690	650
ΣPFSA*	2,200	780	1,200	1,200	410
ΣPFAS	3,500	1,800	7,700	1,900	1,100

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID				
	F2	**F4**	**F6**	**G1**	**G3**
Solid (%)	95	77	99.6	69	86
TOC (%)	9.2	9.5	7.8	10	7.8
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	100	370	ND	ND	ND
PFHpA	110	280	78	90	130
PFOA	470	690	200	300	200
PFNA	290	300	110	90	44 J
PFDA	81	280	69	56 J	30 J
PFUnDA	60	65	70	38 J	26 J
PFDoDA	ND	43 J	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	ND	ND
PFODA	ND	ND	ND	ND	ND
PFBS	45	300	38	100	43
PFHxS	ND	130	40 J	ND	95
PFOS	540	2,200	310	380	110
PFDS	ND	120	ND	ND	ND
ΣPFCA*	1,100	1,300	530	480	330
ΣPFSA*	590	2,700	350	480	240
ΣPFAS	1,700	4,700	870	960	570

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	G5	**G7**	**H2**	**H4**	**I1**
Solid (%)	80	93	96	80	81
TOC (%)	9.0	8.7	8.1	9.7	10
PFBA	ND	ND	ND	ND	ND
PFPeA	370	140	ND	ND	ND
PFHxA	92	50	210	ND	120
PFHpA	180	89	200	320	190
PFOA	590	450	370	1,000	610
PFNA	180	180	190	150	160
PFDA	75	28 J	43	81	55
PFUnDA	62	21 J	38	33 J	52
PFDoDA	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	30 J	ND
PFODA	ND	ND	ND	65 J	ND
PFBS	55	21 J	44	ND	33
PFHxS	55 J	29 J	22 J	<MDL	35 J
PFOS	1,000	320	330	630	500
PFDS	79	ND	ND	ND	ND
ΣPFCA*	1,600	910	1,100	1,600	1,200
ΣPFSA*	1,200	320	370	630	530
ΣPFAS	2,700	1,200	1,400	2,200	1,700

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	I3	**I5**	**I7#1**	**I7#2**	**J4**
Solid (%)	90	84	84	83	84
TOC (%)	11	7.3	10	13	9.8
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	150	ND	140 J	67 J	28 J
PFHpA	210	410	79	93	200
PFOA	540	550	410	360	490
PFNA	180	210	210	170	150
PFDA	64	110	100	79	44
PFUnDA	36 J	67	52	40	26 J
PFDoDA	ND	27 J	ND	ND	ND
PFTrDA	ND	<MDL	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	28 J	ND	ND	ND
PFODA	ND	72 J	ND	ND	ND
PFBS	130	ND	ND	9.4 J	48
PFHxS	ND	32 J	36 J	68 J	110
PFOS	800	990	540	470	330
PFDS	ND	26 J	14 J	ND	ND
ΣPFCA*	1,100	1,300	1,000	810	890
ΣPFSA*	930	990	540	470	490
ΣPFAS	2,100	2,300	1,500	1,300	1,400

† I7#1 and I7#2 were duplicate samples collected from I7.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* P: The RPD between the results exceeds the method-specified criteria.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID				
	J6	**K1**†	**K3**	**K5**	**K6**
Solid (%)	87	83	71	95	89
TOC (%)	9.0	14	12	6.0	6.7
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	4,400	ND	58	110	200
PFHpA	830	180	150	100	ND
PFOA	2,000	770	590	<MDL	<MDL
PFNA	5,000	170	220	38 J	220
PFDA	7,600	63	97	44	110
PFUnDA	2,600	91	71	34 J	47
PFDoDA	690	26 J	ND	<MDL	ND
PFTrDA	130	ND	ND	ND	ND
PFTeDA	65 J	ND	ND	ND	ND
PFHxDA	94 J	ND	ND	ND	ND
PFODA	ND	ND	ND	<MDL	ND
PFBS	980	200	36 J	79	ND
PFHxS	39 J	100	100	ND	ND
PFOS	9,700	690	470	210	620
PFDS	920	110	ND	ND	ND
ΣPFCA*	23,000	1,300	1,200	250	570
ΣPFSA*	12,000	1,100	570	290	620
ΣPFAS	35,000	2,400	1,800	540	1,200

† K1 was collected after a rain.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	K6b	**K6c**	**K6d**	**K6e**	**L2a**
Solid (%)	94	79	89	91	81
TOC (%)	5.0	9.4	5.0	8.3	8.4
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	250	960	210	1,200	ND
PFHpA	ND	470	ND	500	190
PFOA	ND	420	52	730	500
PFNA	140	390	430	700	170
PFDA	100	310	410	2,800	83
PFUnDA	ND	190	80	520	80
PFDoDA	ND	27 [J]	ND	510	26 [J]
PFTrDA	ND	ND	ND	71 [J]	ND
PFTeDA	ND	ND	ND	<MDL	ND
PFHxDA	ND	ND	ND	<MDL	ND
PFODA	ND	ND	ND	ND	ND
PFBS	130	650	140	890	46
PFHxS	ND	ND	ND	ND	100
PFOS	680	1800	1,900	1,500	780
PFDS	ND	ND	87	ND	29 [J]
ΣPFCA*	500	2,700	1,200	7,000	1,000
ΣPFSA*	810	2,500	2,100	2,400	900
ΣPFAS	1,300	5,200	3,300	9,400	1,900

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	L2b	**L4**	**M1**†	**M3**	**M5**
Solid (%)	79	73	86	78	88
TOC (%)	8.3	8.0	5.6	7.0	8.1
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND
PFHxA	ND	ND	ND	ND	ND
PFHpA	250	200	700	230	190
PFOA	470	560	70	440	210
PFNA	130	150	120	73	120
PFDA	47	97	110	38 J	120
PFUnDA	88	49	140	37 J	52
PFDoDA	ND	16 J	30 J	<MDL	25 J
PFTrDA	ND	<MDL	ND	ND	<MDL
PFTeDA	ND	ND	ND	ND	<MDL
PFHxDA	<MDL	<MDL	ND	<MDL	<MDL
PFODA	62 J	69 J	ND	62 J	57 J
PFBS	ND	ND	87	ND	ND
PFHxS	880	76	390	83	48 J
PFOS	570	790	640	300	1,200
PFDS	35	ND	ND	40	56
ΣPFCA*	990	1,100	1,100	740	690
ΣPFSA*	1,500	860	1,000	420	1,200
ΣPFAS	2,500	1,900	2,200	1,200	1,900

† M1 was collected after a rain.

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	**Soil Sample ID**				
	N2	**O1**	**O3**	**O5**	**P2**
Solid (%)	91	76	71	86	78
TOC (%)	8.9	8.8	9.2	7.2	9.3
PFBA	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	620
PFHxA	30 J	ND	ND	ND	ND
PFHpA	44	150	110	ND	870
PFOA	120	660	150	120	350
PFNA	160	160	140	80	120
PFDA	65	97	70	150	54
PFUnDA	40	71	32 J	70.0	75
PFDoDA	ND	24 J	ND	38 J	42 J
PFTrDA	ND	ND	ND	<MDL	ND
PFTeDA	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	<MDL	ND
PFODA	ND	ND	ND	56 J	ND
PFBS	27 J	50	31 J	ND	160
PFHxS	140	ND	15 J	290	89 J
PFOS	230	800	350	720	1,200
PFDS	ND	50	ND	97	48
ΣPFCA*	430	1,100	460	420	2,100
ΣPFSA*	370	900	350	1,100	1,400
ΣPFAS	800	2,000	810	1,500	3,500

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Analyte	Soil Sample ID		
	Q1	**Q3**	**Q5**
Solid (%)	65	74	71
TOC (%)	9.0	9.7	9.5
PFBA	ND	ND	ND
PFPeA	ND	ND	ND
PFHxA	76	ND	ND
PFHpA	160	76	130
PFOA	990	88	110
PFNA	220	56 J	66 J
PFDA	140	ND	110
PFUnDA	190	ND	180
PFDoDA	45 J	ND	55 J
PFTrDA	ND	ND	ND
PFTeDA	ND	ND	ND
PFHxDA	ND	ND	ND
PFODA	ND	ND	ND
PFBS	41 J	29 J	45
PFHxS	320	280	360
PFOS	2,100	160	330
PFDS	100	ND	50
ΣPFCA*	1,800	160	540
ΣPFSA*	2,500	440	790
ΣPFAS	4,300	600	1,300

* PFCA: perfluoroalkyl carboxylic acids; PFSA: perfluoroalkyl sulfonates.
* J: Estimated value (qualitative detection), this value is less than RL but greater than MDL.
* Analytes below RLs were not included in calculating the total amount of PFCA (ΣPFCA), PFSA (ΣPFSA), and PFAS (ΣPFAS).
* Data were rounded to two significant digits.

Table 4. Comparison of Laboratory Analytical Data from Alpha Analytical Inc and UVM
PFOS and PFOA concentrations detected by Alpha Analytical Inc and UVM, RPD for PFOS.

Analyte / **Sample ID**	**PFOS (ng/kg)**		**Precision**	**PFOA (ng/kg)**	
	Alpha	**UVM**	**RPD (%)**	**Alpha**	**UVM**
A1	1,650	1,800	10	<1,090	520
A3	<1,200	330	N/A	<1,200	240
B2	3,740	4,400	17	<1,300	1,600
B4	<1,100	670	N/A	<1,100	330
C3	<1,200	340	N/A	<1,200	140
D3	<1,030	360	N/A	<1,030	140

* Statistical analyses were performed on raw data with additional precision, and all results have been rounded to two significant digits.
* Reporting limit (RL) was listed when the detected concentration was lower than RL.
* For each sample, Alpha Analytical Inc applied the same RL value for all 24 PFAS analyzed, and except PFOS detected in A1 and B2 samples, all the other PFAS were reported below RL.

Table 5.1. Statistical Summary for Select PFAS (all samples)
General Statistics on quantitative detections, including: number of observations (Obs), number of quantitative detections (Quant D), quantitative frequency of detections (Quant F, %), minimum concentration (Min, ng/kg), and maximum concentration (Max, ng/kg) of each analyte**,** mean concentration (Mean, ng/kg), median concentration (Median, ng/kg) and KM mean (ng/kg) of each analyte.

Analyte	**Obs**	**Quant D**	**Quant F**	**Min**	**Max**	**Mean**	**Median**	**KM Mean**
PFHxA	66	33	50	50	4,400	520	260	280
PFHpA	66	59	89	44	900	260	190	240
PFOA	66	60	91	52	4,900	520	400	480
PFNA	66	61	92	51	5,000	270	160	250
PFDA	66	57	86	43	7,600	310	95	270
PFUnDA	66	48	73	38	2,600	150	75	120
PFBS	66	42	64	33	1,600	230	130	160
PFHxS	66	29	44	76	880	200	120	130
PFOS	66	66	100	106	9,700	1,100	680	1,100
PFDS	66	23	35	32	920	140	97	67

* Minimum, maximum, mean, and median were calculated based on quantitative detections.
* Kaplan Meier method was used to calculate KM mean based on the full data; NDs, concentration below MDLs, and qualitative detections were represented by RLs.
* Statistical analyses were performed on raw data with additional precision, results have been rounded to two significant digits.

Table 5.2. Statistical Summary for Select PFAS (outlier removed)
General Statistics on quantitative detections, including: number of observations (Obs), number of quantitative detections (Quant D), quantitative frequency of detections (Quant F, %), minimum concentration (Min, ng/kg), and maximum concentration (Max, ng/kg) of each analyte**,** mean concentration (Mean, ng/kg), median concentration (Median, ng/kg) and KM mean (ng/kg) of each analyte.

Analyte	Obs	Quant D	Quant F	Min	Max	Mean	Median	KM Mean
PFHxA	65	32	49	50	1,500	400	230	220
PFHpA	65	58	89	44	900	250	190	230
PFOA	65	59	91	52	4,900	500	390	450
PFNA	65	60	92	51	700	190	160	180
PFDA	65	56	86	43	2,800	180	95	160
PFUnDA	65	47	72	38	520	93	74	77
PFBS	65	41	63	33	1,600	210	130	150
PFHxS	65	28	43	76	880	200	120	130
PFOS	65	65	100	110	4,400	970	680	970
PFDS	65	22	34	32	380	110	92	53

* Minimum, maximum, mean, and median were calculated based on quantitative detections.
* Kaplan Meier method was used to calculate KM mean based on the full data; NDs, concentration below MDLs, and qualitative detections were represented by RLs.
* Statistical analyses were performed on raw data with additional precision, all results have been rounded to two significant digits.

Table 6.1. Percentiles for Select PFAS (all samples)

Variable	10%ile	20%ile	25%ile	50%ile	75%ile	80%ile	90%ile	95%ile	99%ile
PFHxA	39	39	39	44	240	370	680	1,200	2,500
PFHpA	33	86	92	170	290	390	520	690	880
PFOA	60	140	145	370	530	590	750	1,300	3,000
PFNA	64	96	110	160	220	230	340	400	2,200
PFDA	40	47	53	82	120	160	320	410	4,500
PFUdA	35	35	35	66	83	91	140	190	1,300
PFBS	30	30	30	47	160	190	370	620	1,200
PFHxS	72	72	72	72	110	130	300	380	600
PFOS	310	330	360	680	1,200	1,500	2,100	3,500	6,300
PFDS	26	26	26	26	51	79	120	180	570

* Percentiles were calculated with full dataset; NDs, concentrations below MDLs, and qualitative detections were represented by their RLs.
* Statistical analyses were performed on raw data with additional precision, and all results have been rounded to two significant digits.

Table 6.2. Percentiles for Select PFAS (outlier removed)

Variable	10%ile	20%ile	25%ile	50%ile	75%ile	80%ile	90%ile	95%ile	99%ile
PFHxA	39	39	39	39	210	360	650	920	1,400
PFHpA	31	85	89	170	280	350	500	650	880
PFOA	59	140	150	370	520	560	720	1,000	2,800
PFNA	62	95	110	160	220	230	320	390	530
PFDA	40	46	53	81	110	160	300	390	1,300
PFUdA	35	35	35	65	82	89	130	180	310
PFBS	30	30	30	46	150	180	340	500	1,200
PFHxS	72	72	72	72	110	130	300	380	600
PFOS	310	330	360	680	1,200	1,400	2,000	3,000	4,000
PFDS	26	26	26	26	50	64	110	170	280

* Percentiles were calculated with full dataset; NDs, concentrations below MDLs, and qualitative detections were represented by their RLs; J6 was removed as outlier.
* Statistical analyses were performed on raw data with additional precision, and all results have been rounded to two significant digits.

Table 7. Proposed UTLs for Select PFAS
Proposed Upper Tolerance Limits (UTLs) for each PFAS compound.

Analyst	**Method**	**Proposed UTL (ng/kg)**
PFHxA	95% Approx. Gamma UTL with 95% Coverage (WH)-KM*	870
PFHpA	95% BCA UTL95% Coverage (Lognormal)	840
PFOA	95% BCA UTL95% Coverage (Lognormal)	1,600
PFNA	95% Approx. Gamma UTL with 95% Coverage (WH)-KM*	440
PFDA	95% percentile	390
PFUnDA	95% percentile	180
PFBS	95% KM UTL (Lognormal) 95% Coverage	590
PFHxS	95% percentile	380
PFOS	95% UTL95% Coverage (Lognormal)	3,400
PFDS	95% Approx. Gamma UTL with 95% Coverage (WH)-KM*	150

* Statistical analyses were performed on raw data with additional precision, and all results have been rounded to two significant digits.

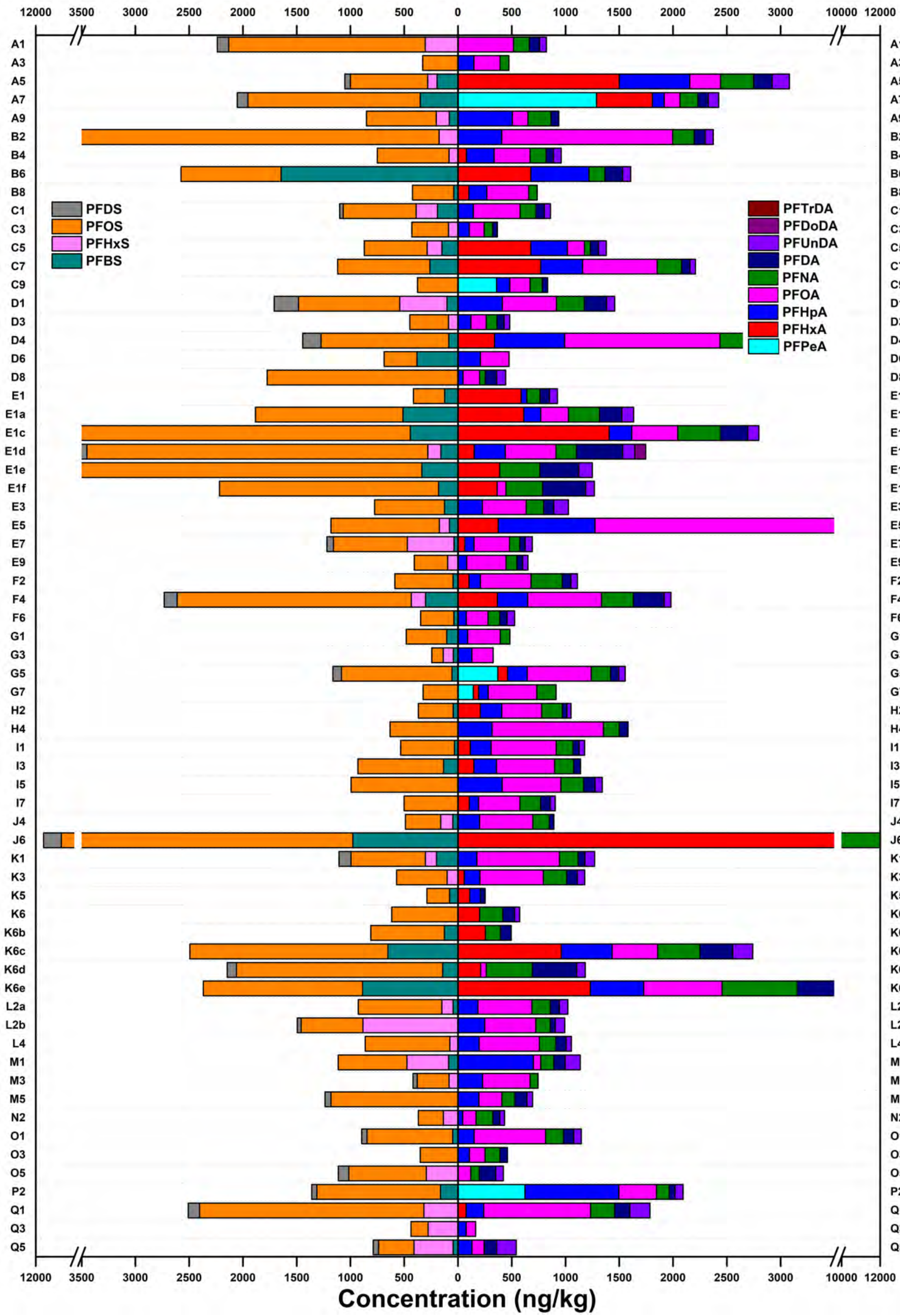

Figure 1. PFAS concentration profile. An Overview of PFCAs and PFSAs (quantitative detections) concentrations in each soil sample of Vermont.

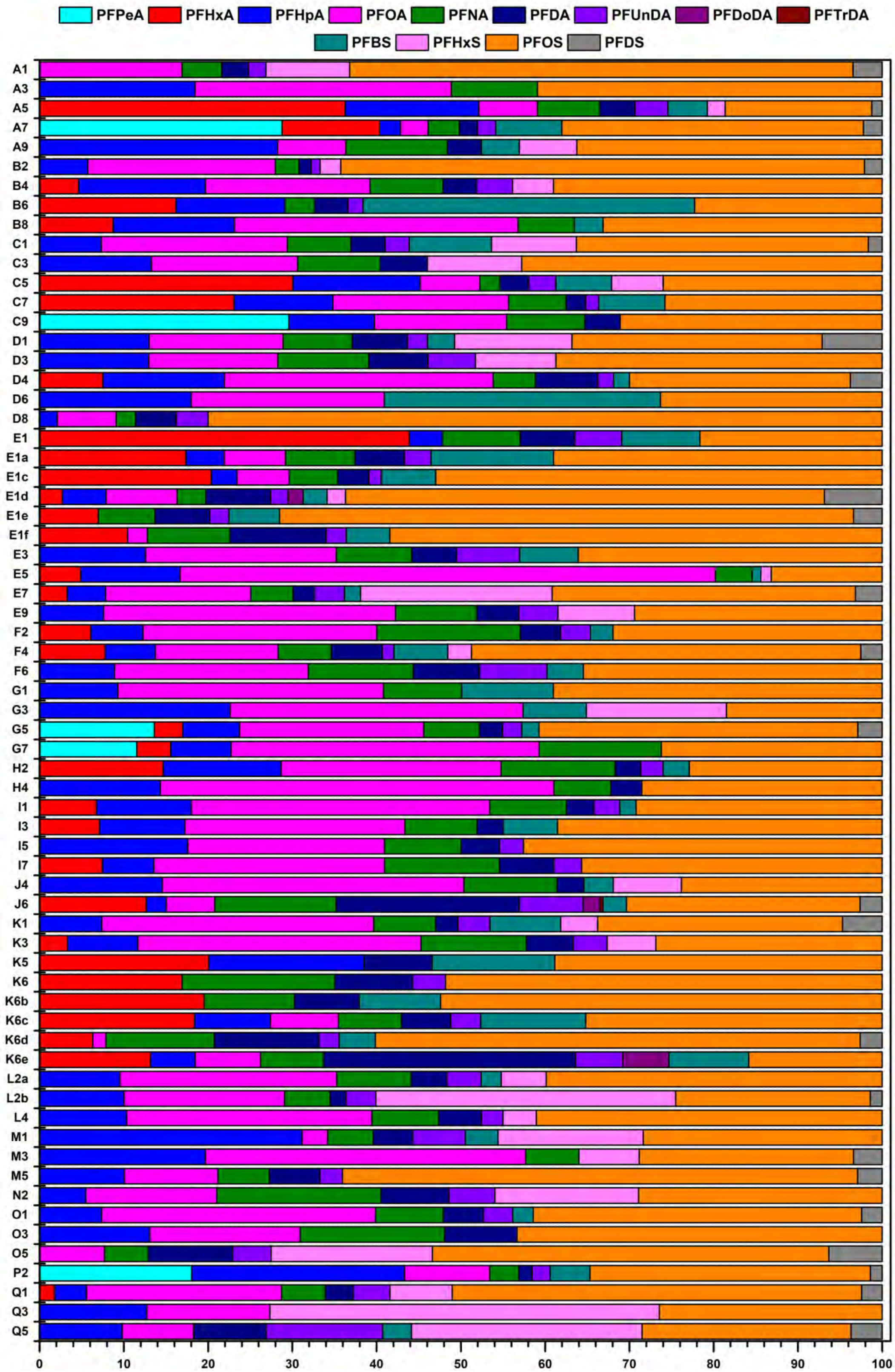

Figure 2. PFAS relative concentration profiles. Relative composition profile (%) of individual PFAS (quantitative detections) in each soil sample of Vermont.

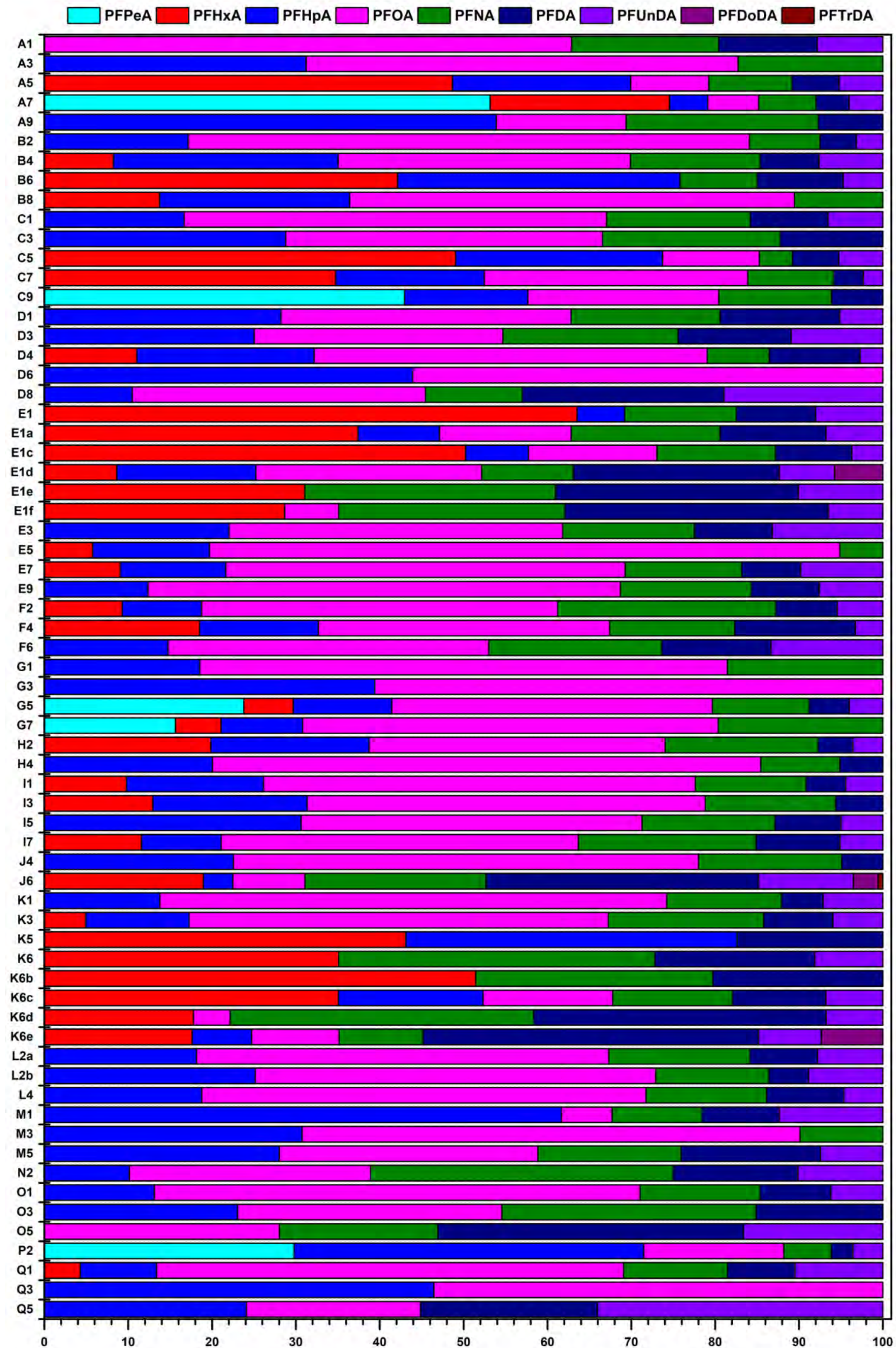

Figure 3. PFCAs relative concentration profiles. Relative composition profile (%) of individual PFCA (quantitative detections) in each soil sample of Vermont.

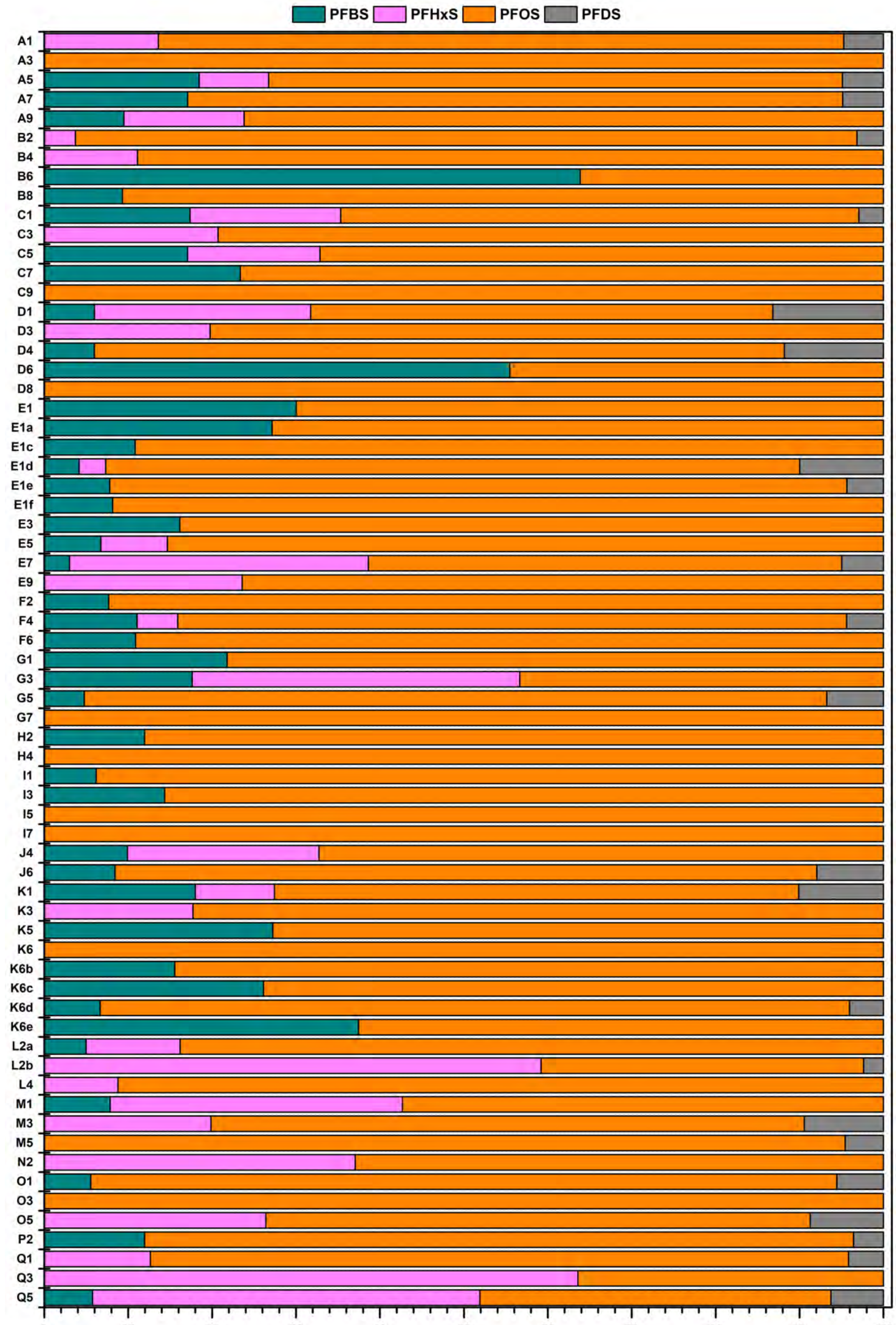

Figure 4. PFSAs relative concentration profiles. Relative composition profile (%) of individual PFSAs (quantitative detections) in each soil sample of Vermont.

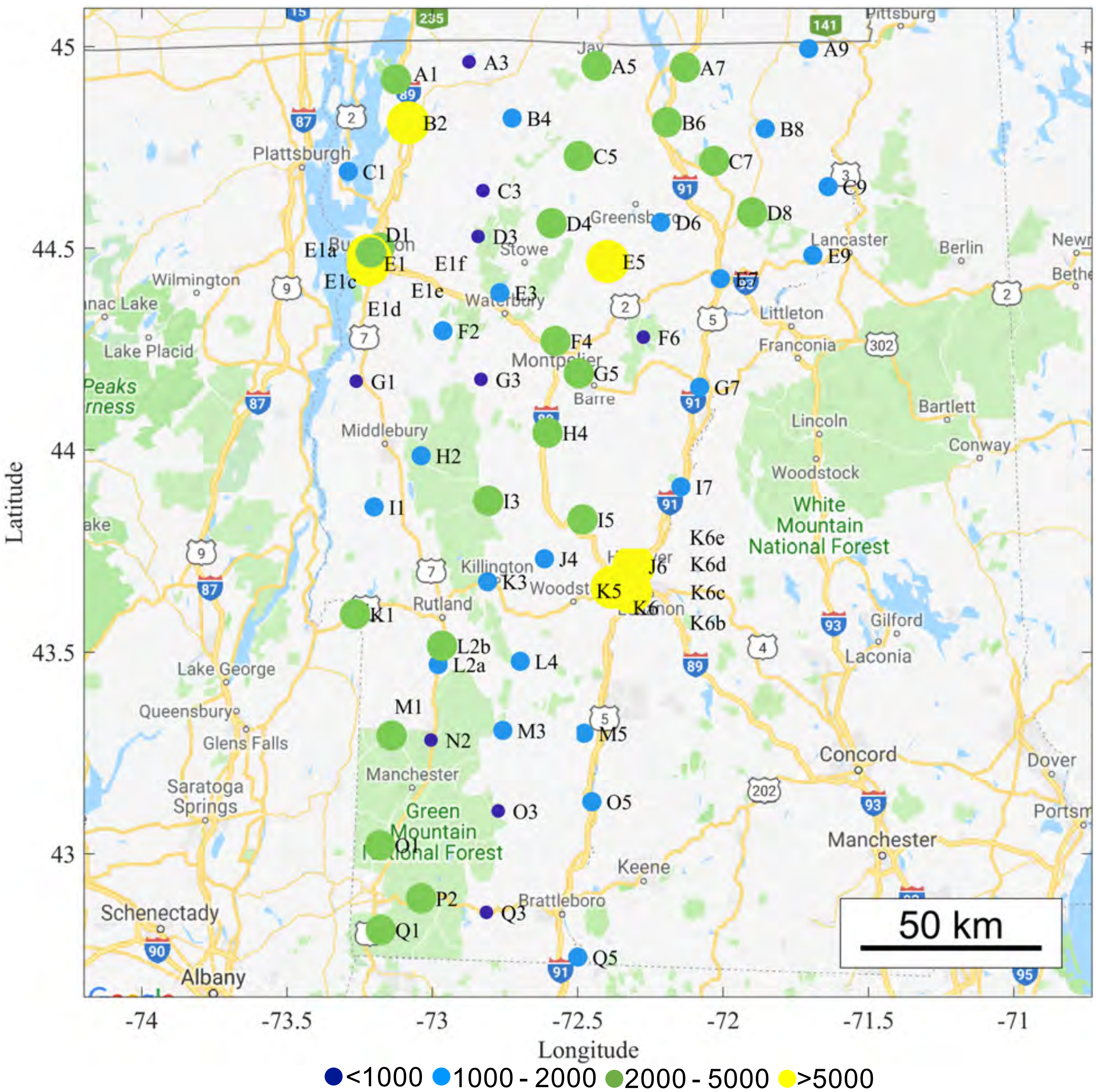

Figure 5.1. Spatial distribution of ΣPFAS.

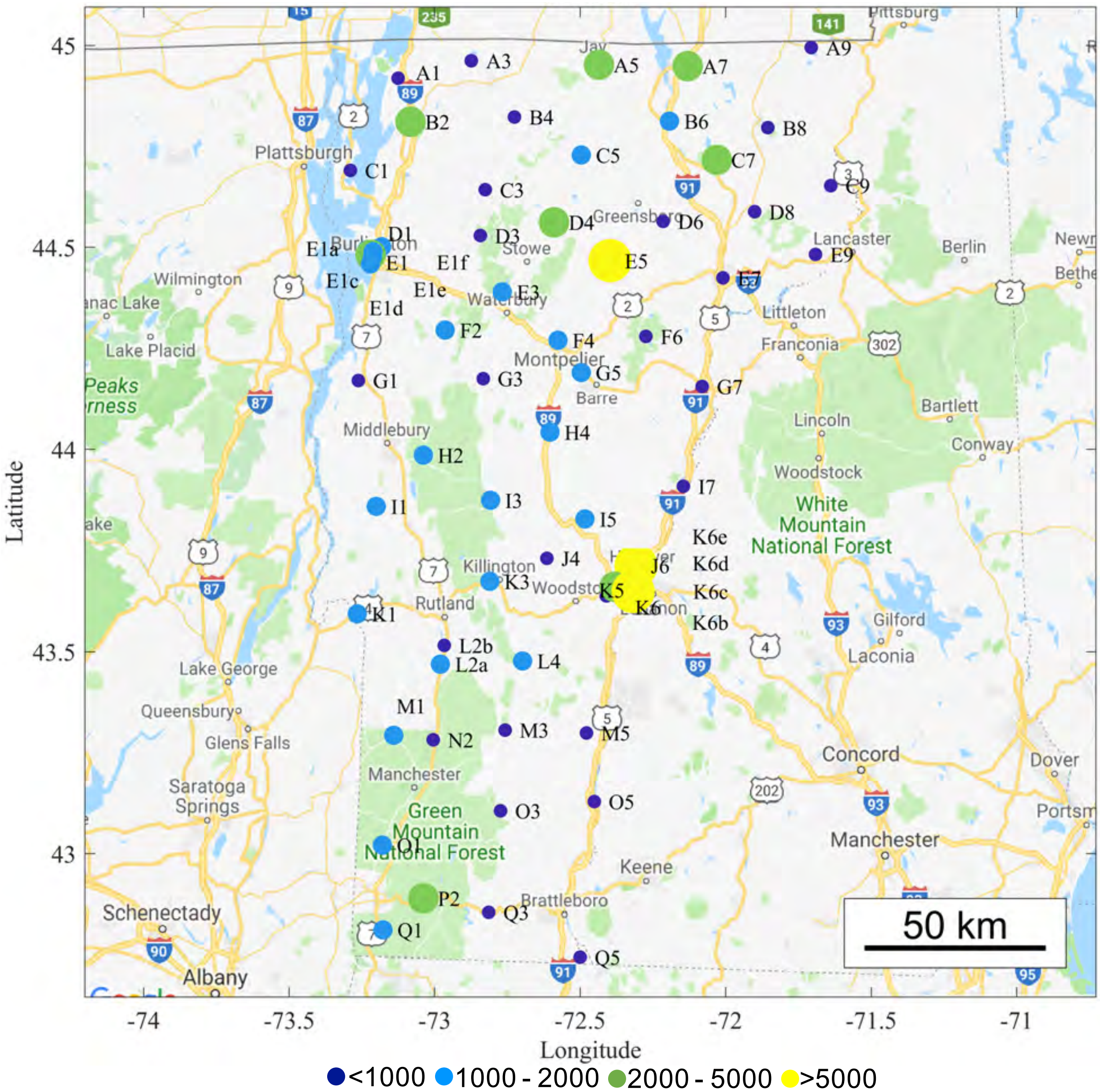

Figure 5.2. Spatial distribution of ΣPFCAs.

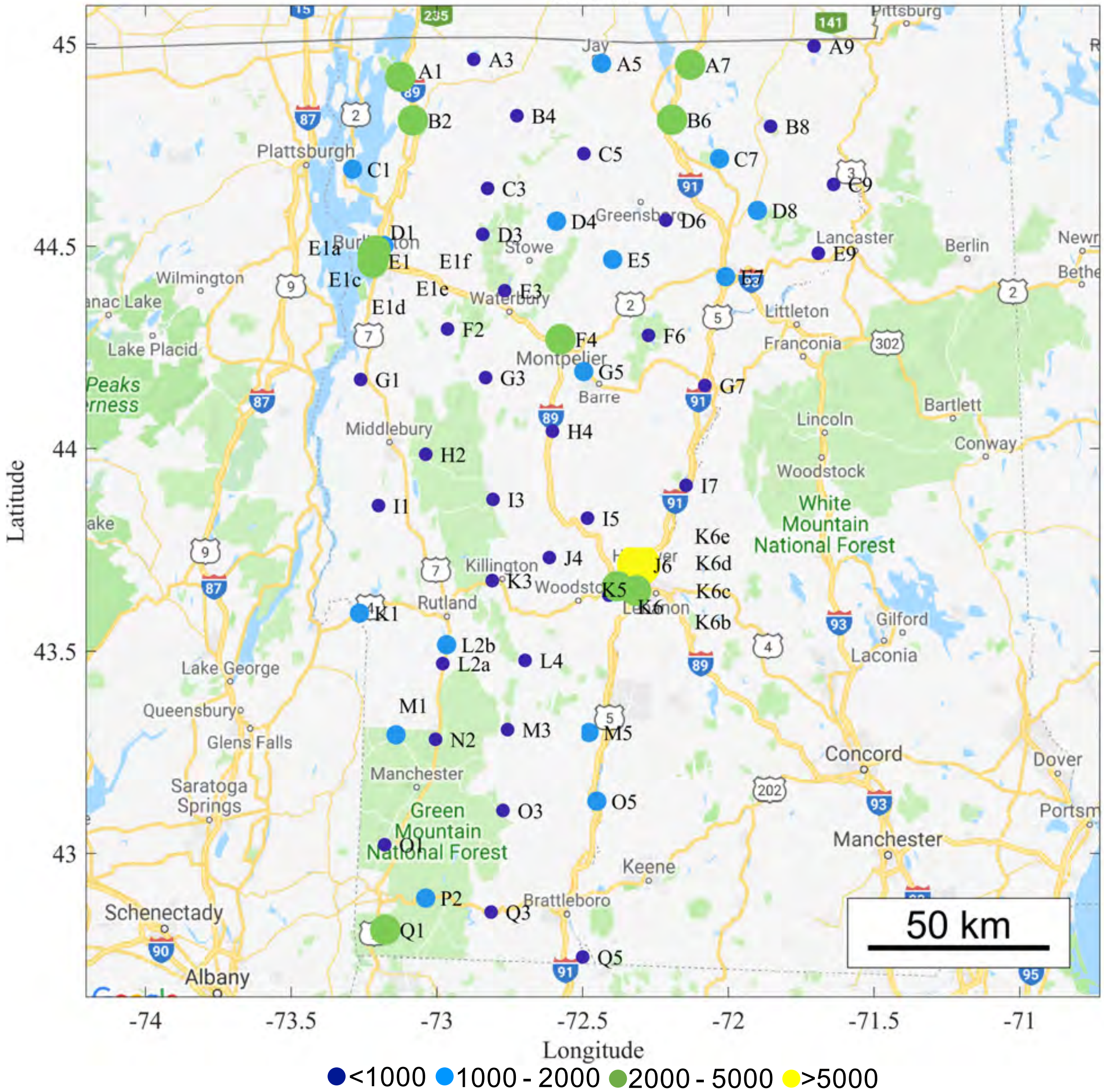

Figure 5.3. Spatial distribution of ΣPFSAs.

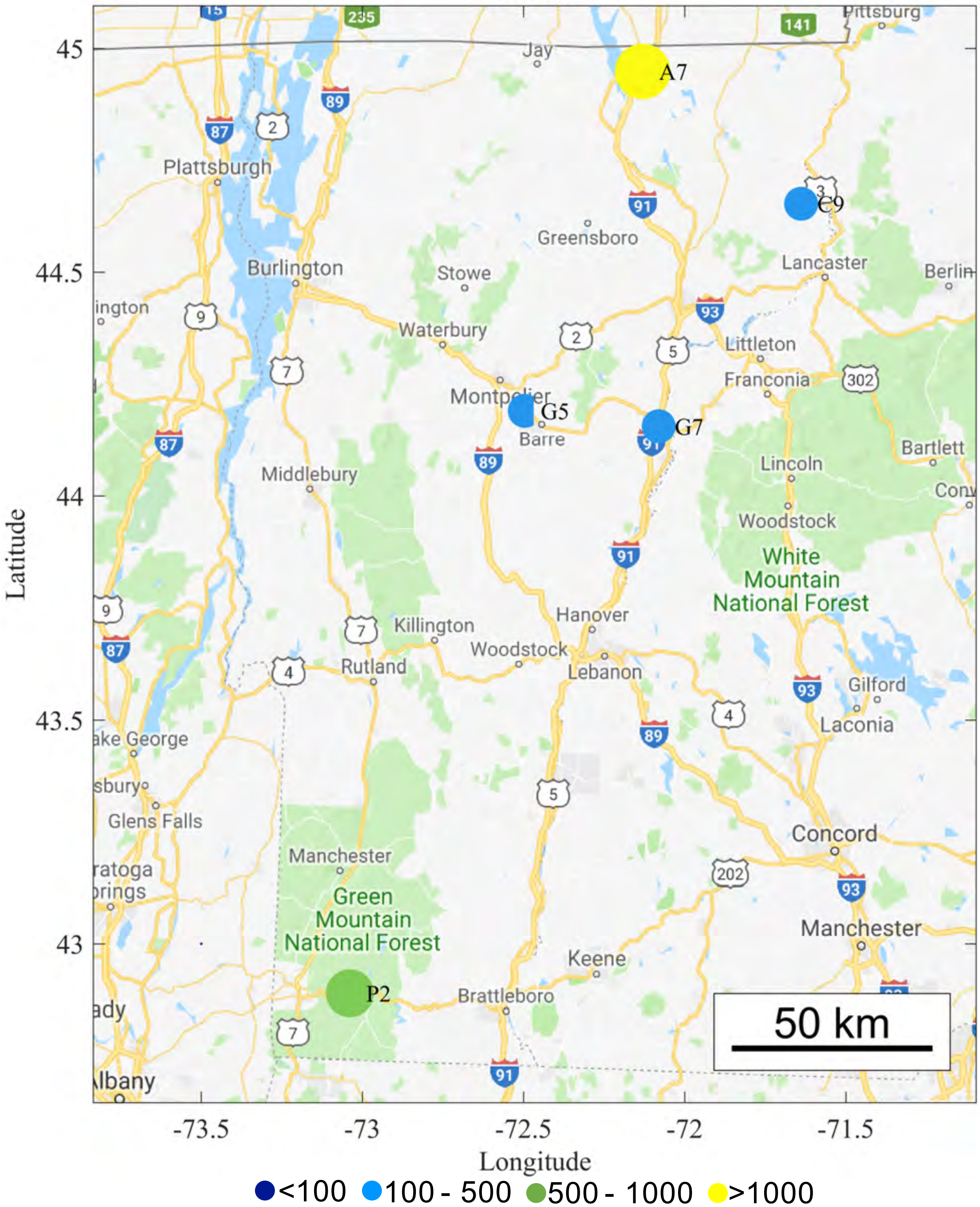

Figure 6.1. Spatial distribution of PFPeA.

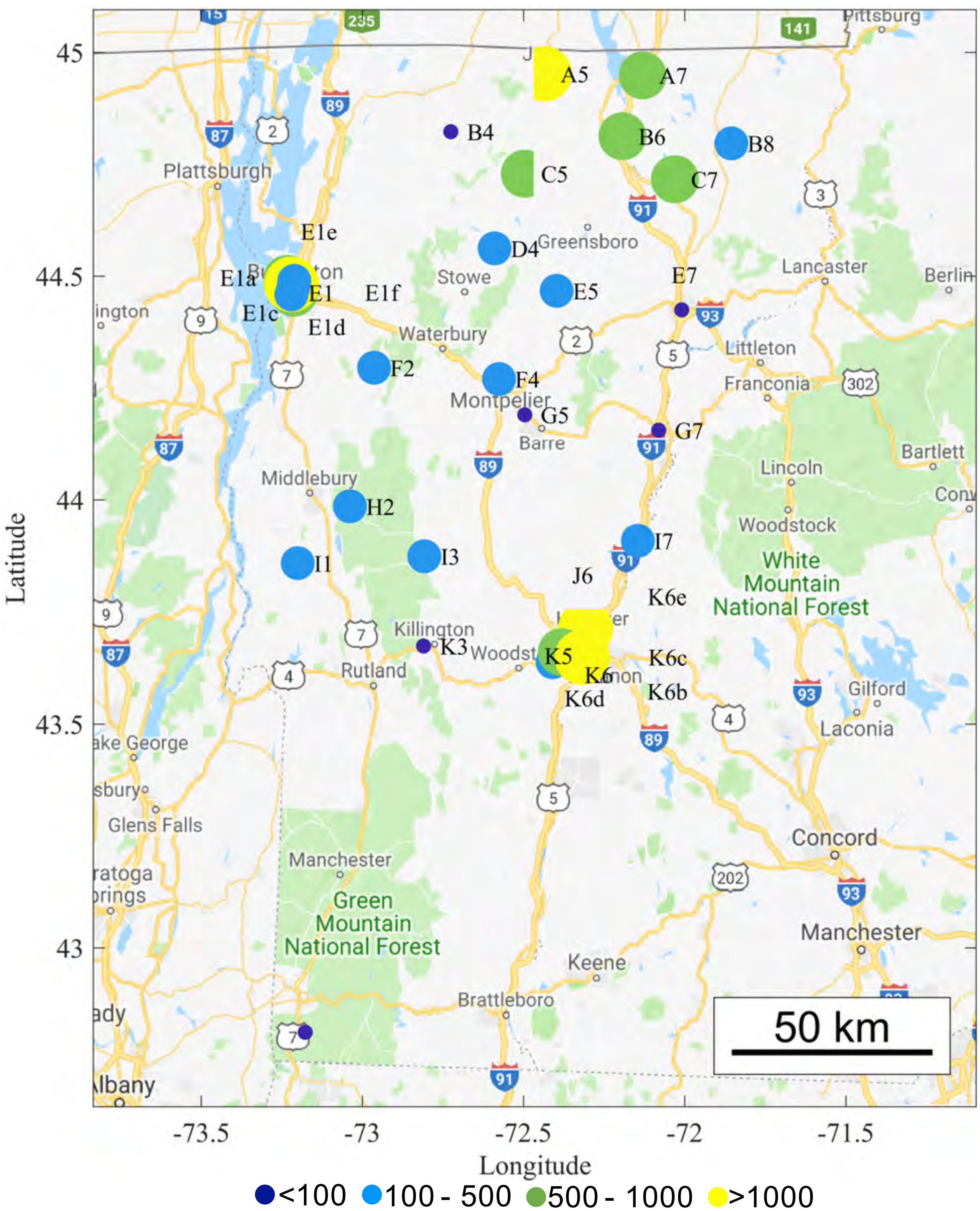

Figure 6.2. Spatial distribution of PFHxA.

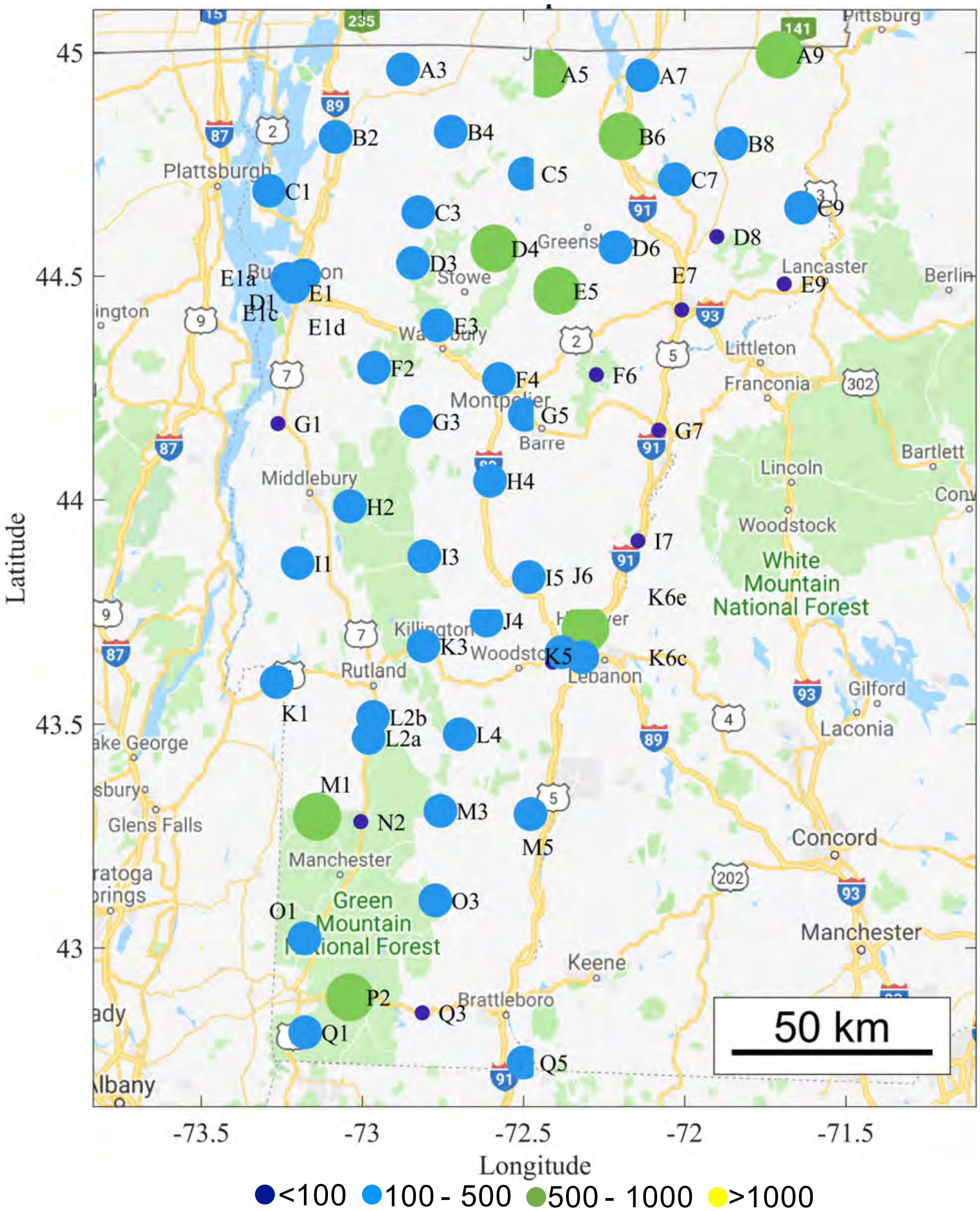

Figure 6.3. Spatial distribution of PFHpA.

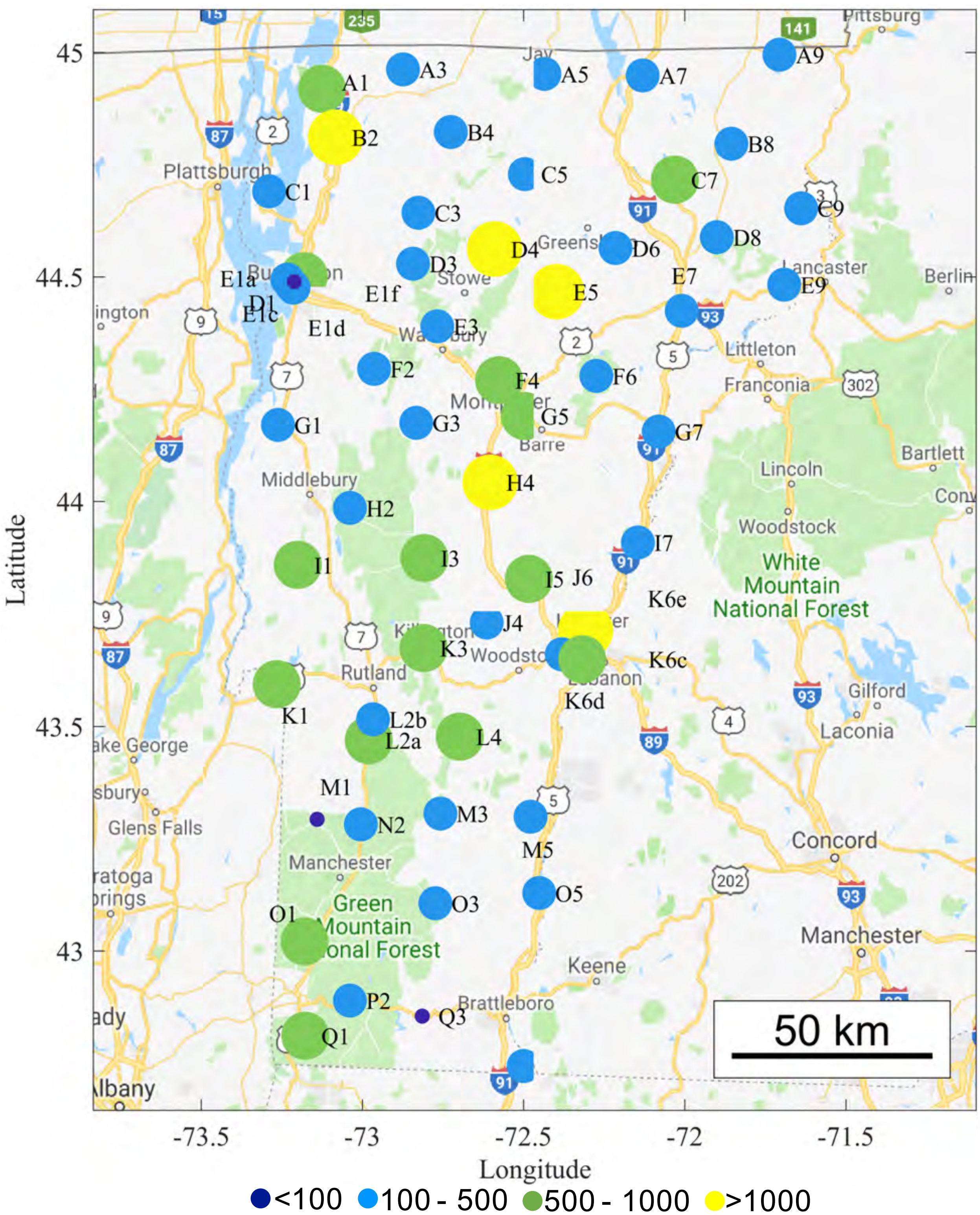

Figure 6.4. Spatial distribution of PFOA.

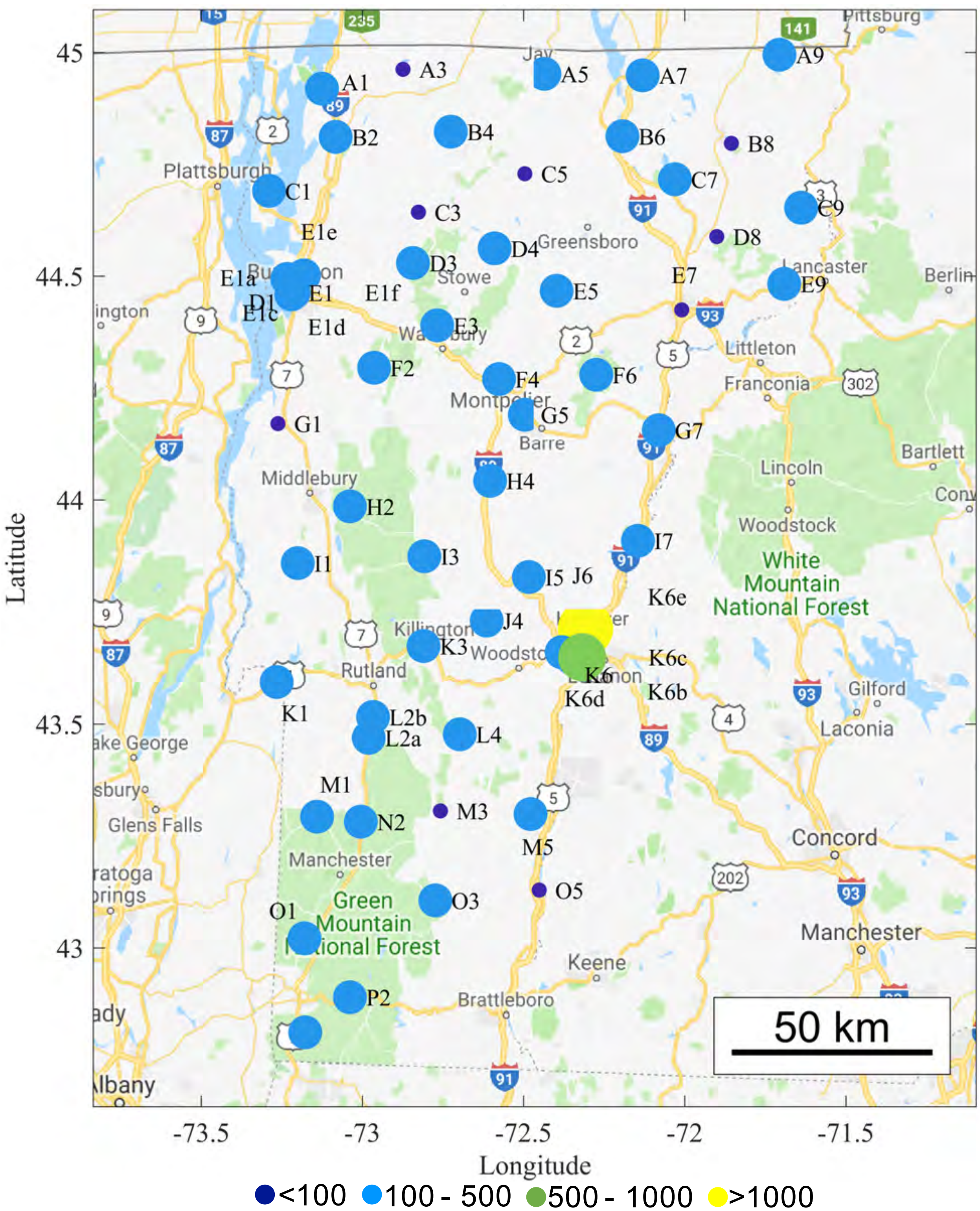

Figure 6.5. Spatial distribution of PFNA.

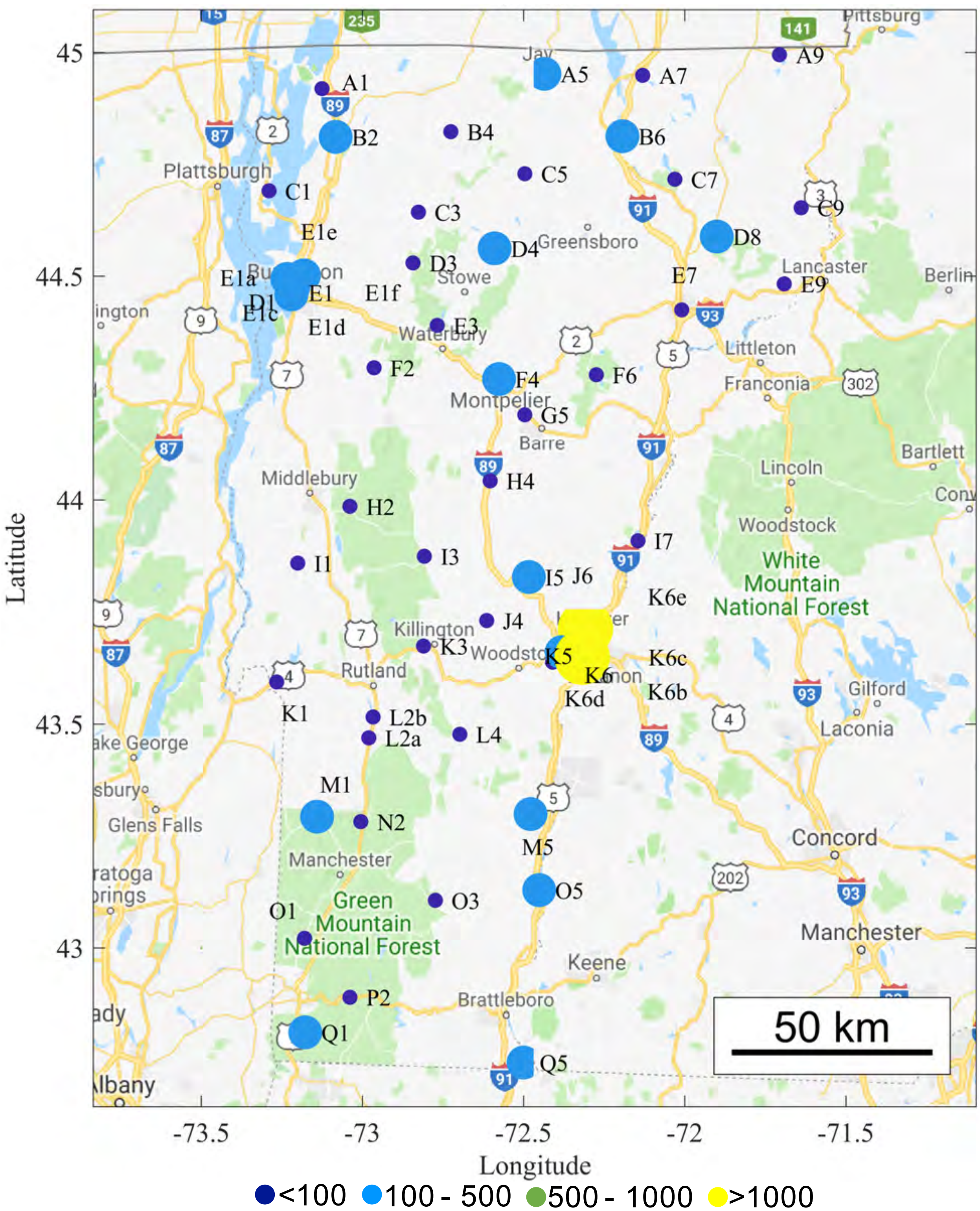

Figure 6.6. Spatial distribution of PFDA.

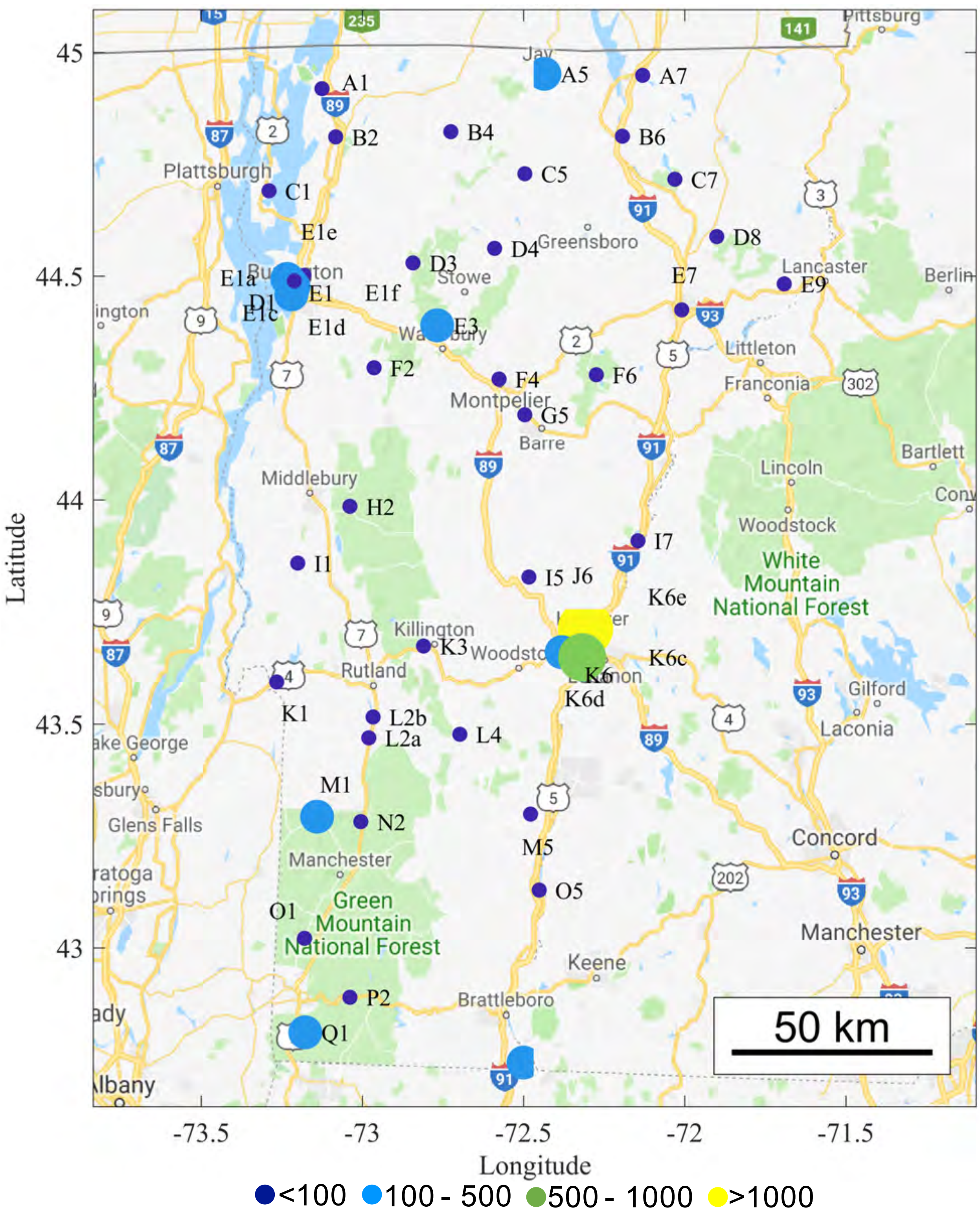

Figure 6.7. Spatial distribution of PFUnDA.

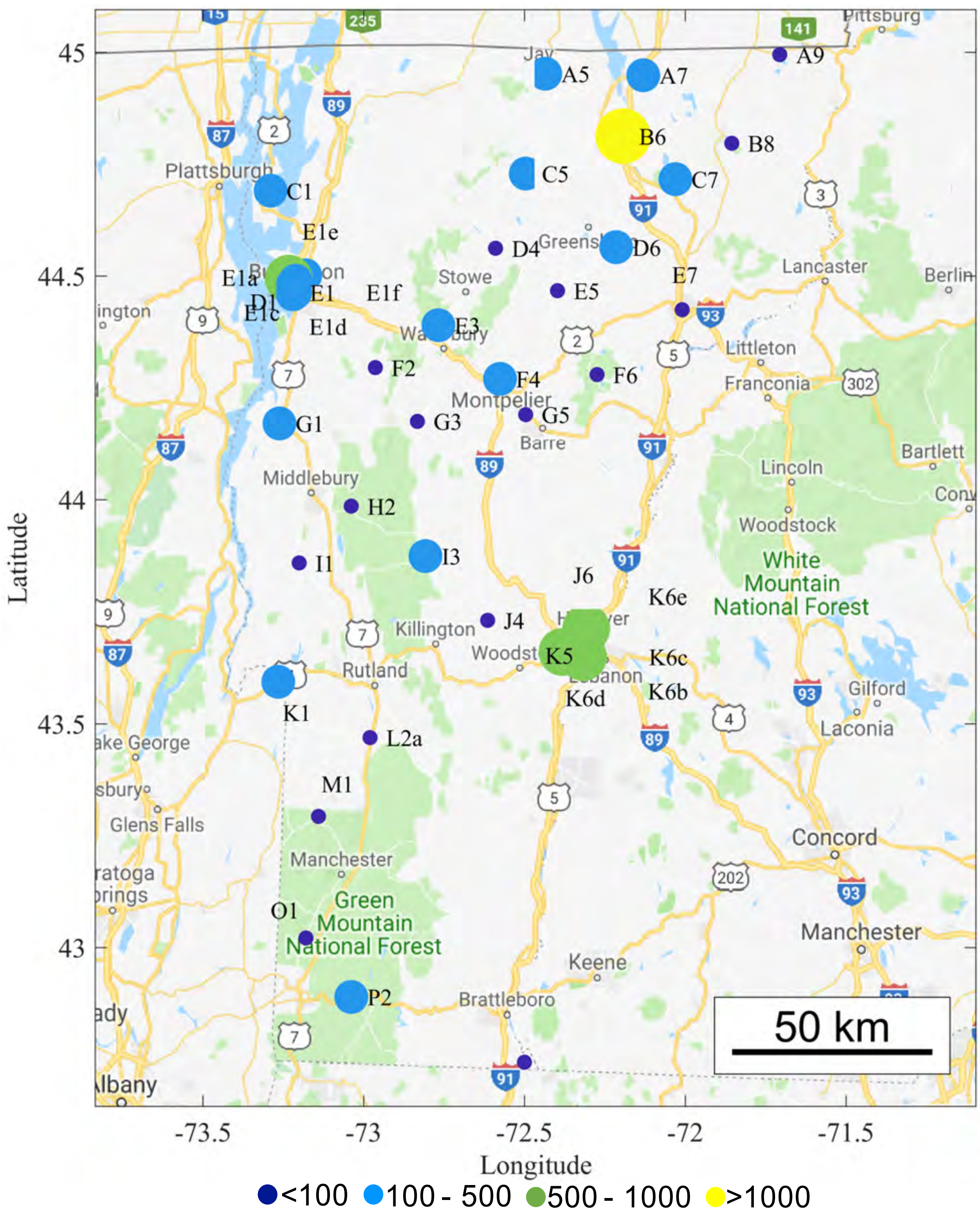

Figure 6.8. Spatial distribution of PFBS.

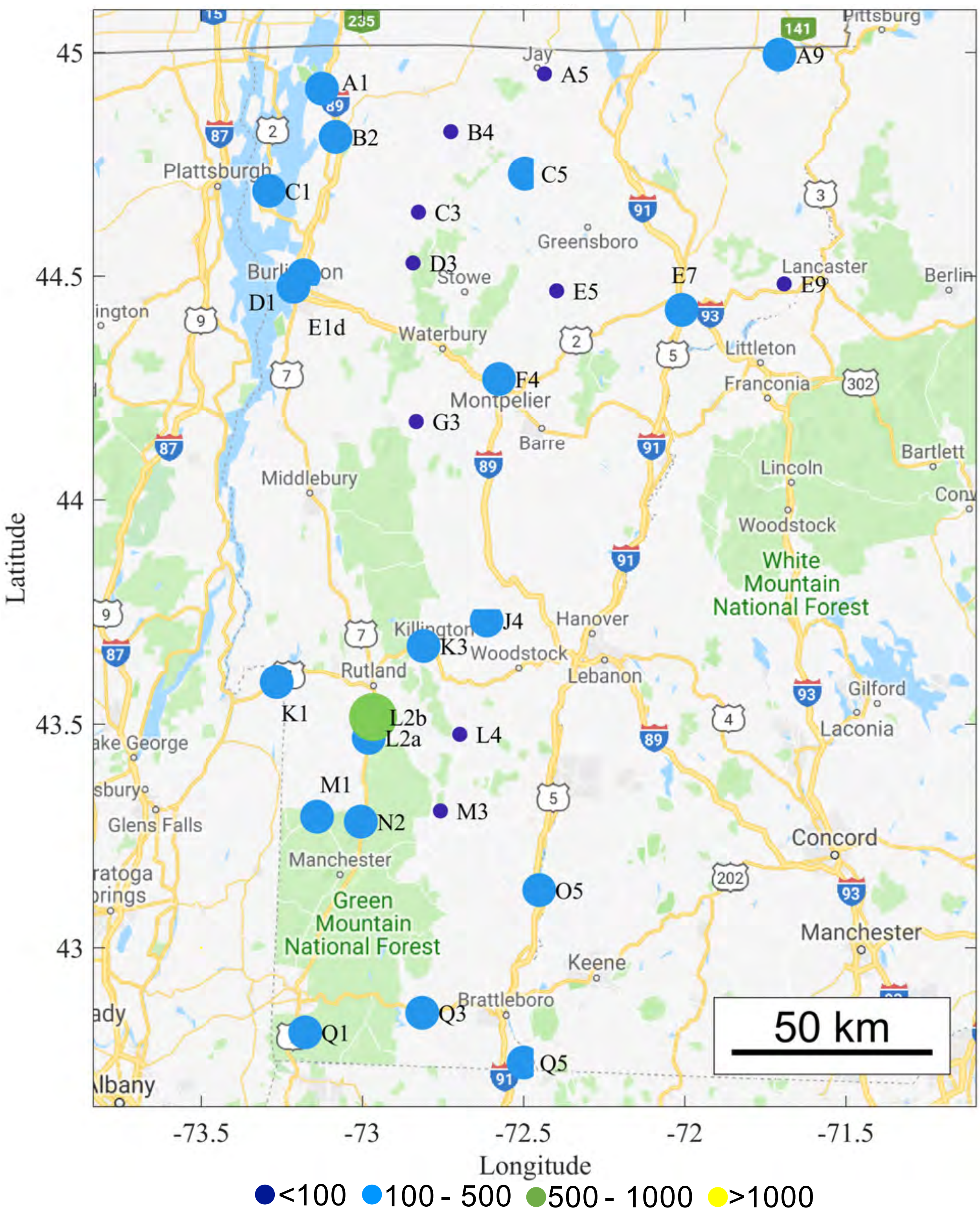

Figure 6.9. Spatial distribution of PFHxS.

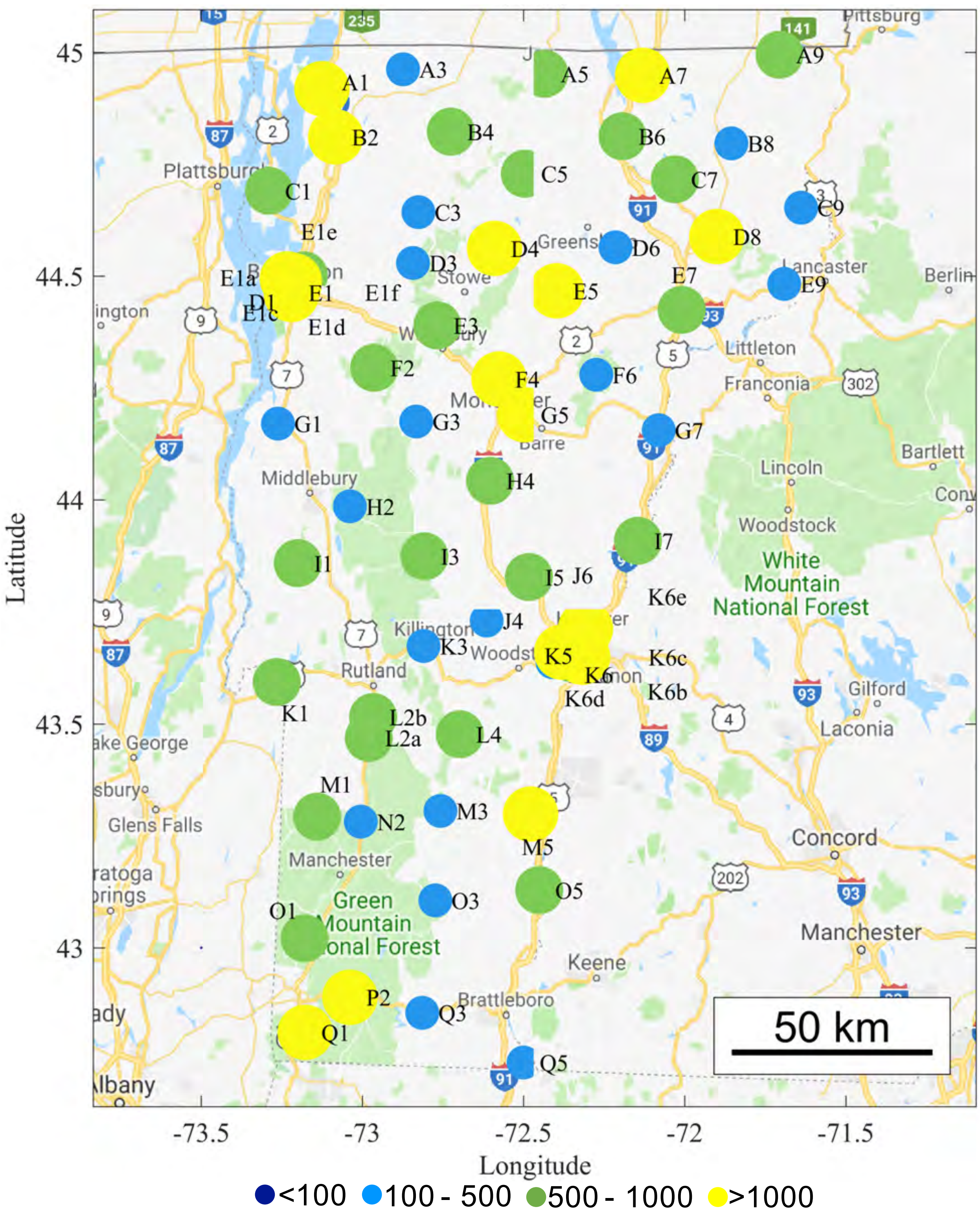

Figure 6.10. Spatial distribution of PFOS.

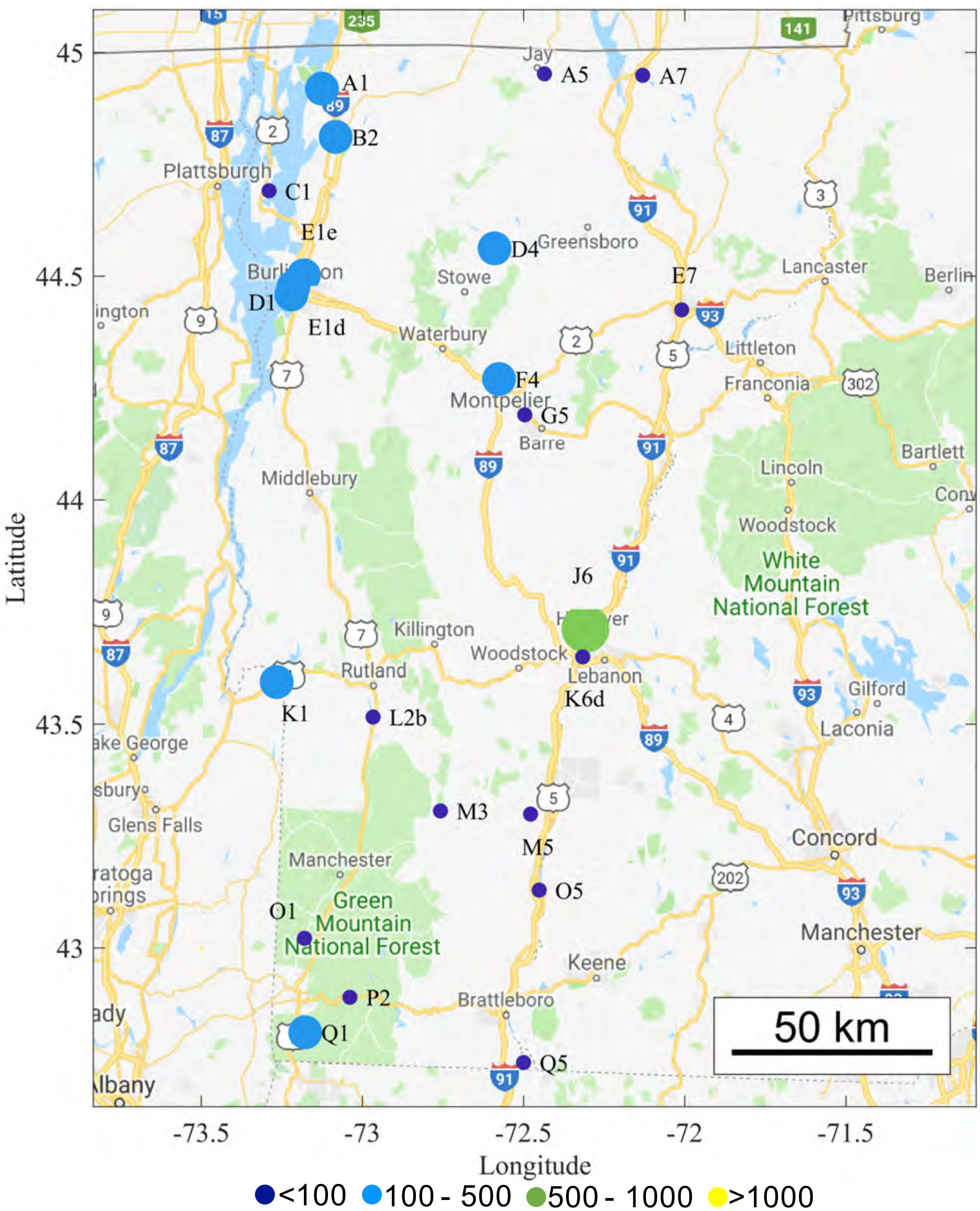

Figure 6.11. Spatial distribution of PFDS.

Appendices

Contents of Appendices

LABORATORY ANALYTICAL METHODS

Percent Solids Determination using ATSM D2216-10 Method

The soil sample was sieved through a methanol-washed, stainless-steel, 2 mm sieve to remove rocks, solid particles and other solid contaminants. The sample was grinded if necessary. A representative quantity of soil in a clean aluminum weighing dish (42 mm) was placed in the oven and dried at constant temperature of between 102 °C and 105 °C. Following drying the dish was placed in a desiccator to cool before recoding the dry weight. The percent moisture content is calculated on a dry basis to ensure consistency. The moisture content of the soil is described as the ratio of the mass of water held in the soil to the dry soil.

Moisture content (%) = $\left(\frac{W_2 - W_3}{W_3 - W_1} \times 100\right)$ where,

W_1 = weight of empty dish, g

W_2 = weight of dish containing a representative quantity of soil, g

W_3 = weight of dish containing a representative quantity of soil after drying, g

Solid content (%) = 100 – Moisture content (%)

Total Organic Carbon (TOC) Determination

TOC was measured according to the ASTM 2000 method which is referred as Loss on Ignition (LOI) method. Briefly, the soil sample was sieved and grinded, if necessary, to create a homogeneous sample. A certain amount (5-20 g, depending on the soil condition) of soil was dried in the oven for 12 h at 65 °C to remove moisture from the sample. Following drying, the sample was cooled in a desiccator to room temperature and grinded for further homogenization if necessary. Using a 4-decimal point balance, 1.0000 (±0.0099) gram of soil was carefully taken from the dried and homogenized sample and transferred into ceramic crucible for ashing process, which was carried out in a muffle furnace for 12 h at 440 °C. Temperature control is critical in this process since heating above 440 °C is associated with the risk of losing inorganic carbon that might generate biased result. After ashing, the samples were cooled to room temperature in the desiccator and were weighed to measure the loss of organic compounds due to ashing process following Equation 1 (E1). Finally, the calculated weight loss of organic compounds was converted to percent loss of organic matter (E2) and multiplied by "Van Bemmelen" factor of 0.58 to calculate the TOC (E3).

Loss of Organic Matter, $M = M_{initial} - (M_{final} - M_{crucible})$ E1

Percent of Organic Matter loss, $M_1 = (M/M_{initial}) \times 100$ E2

TOC = $M_1 \times 0.58$ E3

Extraction Method

The extraction method used in this project was adapted from the method developed by Rankin et al (2016) where they reported that roughly 100% recovery of PFOA, PFDA and PFDoDA in spike-and-recovery experiments was achieved.

To avoid possible contamination from the solvents during sample preparation and exaction, high-purity 18.2 MΩ-cm water (HW) and high-purity tetrabutyl ammonium hydrogen sulfate (TBAHS) ion-pairing agent were prepared as follows: High-purity waters was made by passing 18.2 MΩ-cm water through an Oasis 35 cc HLB cartridge, after that HW was collected by a specific 2 L Erlenmeyer flask washed by high-purity methanol before usage. To make sure that HW was of good quality, the HLB cartridge was changed when the total volume of 6 L was filtered. Similarly, TBAHS ion pairing agent was first prepared by slowly mixing 0.25 M Na_2CO_3 solution with 0.50 M TBAHS solution (2:1, v/v) to avoid spillage due to the generation of CO_2. The mixture was purified by passing through the Oasis 35 cc HLB cartridge.

Soil samples were 2mm-sieved the same way as described earlier. Briefly, for each soil sample, 5 g (wet weight) was prepared and transferred into methanol-washed PPCO centrifuge tubes and sealed with PPCO caps. Here, $^{13}C8$ mass-labeled PFOA (M8PFOA) was used as a recovery standard, and 2000 pg was spiked into each 5 g-soil sample. Subsequently, 400 μL of 2M sodium hydroxide and 8.5 mL of 90:10 acetonitrile (ACN):HW solution were mixed into the soil sample by vortexing for 15 to 30 s, and then was sonicated in an ice bath for 1 h. After that, the samples were loaded onto a LabQuake rotisserie mixer and rotated for around 15 h at 8 rpm before they were centrifuged at 17,500 rpm and 20 °C for 15 min. After carefully decanted the supernatants into glass vials, a second round of extraction using 90:10 ACN:HW solution were conducted on the soil samples and the supernatant was combined together with the one from the first round. A solid-phase extraction (SPE) manifold was employed to blow the obtained supernatants to near dryness under filtered air. The extract matrices were reconstituted into 4 mL TBAHS ion-paring solution and extracted by 5 mL of methyl-tert-butyl ether (MTBE) through vortexing. After stored the mixture overnight in a freezer, MTBE fractions were decanted into glass vials while the TBAHS solutions were extracted by MTBE for a second round. The collected MTBE fractions from the two rounds of extraction were then blown to dryness in the SPE. Finally, 1 mL of ACN was used to reconstitute the dried extracts and filtered by 0.2 μm Nylon filters.

MDL and RL

MDL of each analyst was calculated using Equation 4 (E4) below, where SD is the standard deviation of the lab fortified blank replicates, t is the student's t value at 99% confidence interval and n is the number of replicates. Reporting limit (RL) of each analyte was defined as MDL times a safety factor (five in this report) as illustrated in Equation 2 (E5). MDL and RL of each compound are summarized in Table 2.

$MDL=SD(t_{(n-1)})$ E4

$RL=MDL \times 5$ E5

Table A1. Instrumental method parameters for analysis of PFAS by LC-MS/MS.

<table>
<tr><td>Instrument</td><td>Shimadzu Prominence LC system interfaced with an ABI 4000Qtrap mass spectrometer. Operated in the negative ion multiple reaction monitoring mode.</td></tr>
<tr><td>Analytical Column</td><td>Waters Atlantis dC18 (100Å, 5µm, 1.0x150mm)</td></tr>
<tr><td>Mobile Phases</td><td>A: 0.15% acetic acid in water
B: 0.15% acetic acid in acetonitrile</td></tr>
<tr><td>Gradient Profile</td><td>
<table>
<tr><td>Time (min)</td><td>Percentage B</td><td>Flow rate (mL/min)</td></tr>
<tr><td>0.00</td><td>25</td><td>0.10</td></tr>
<tr><td>1.00</td><td>25</td><td>0.10</td></tr>
<tr><td>10.99</td><td>98</td><td>0.10</td></tr>
<tr><td>11.00</td><td>98</td><td>0.15</td></tr>
<tr><td>12.00</td><td>98</td><td>0.15</td></tr>
<tr><td>12.01</td><td>25</td><td>0.15</td></tr>
<tr><td>16.00</td><td>25</td><td>0.15</td></tr>
<tr><td>16.01</td><td>25</td><td>0.10</td></tr>
<tr><td>20.00</td><td>25</td><td>0.10</td></tr>
</table>
</td></tr>
<tr><td>Injection Volume</td><td>10 µL</td></tr>
<tr><td>Monitored Ion Transitions</td><td>
<table>
<tr><td>Analytes</td><td>Ion Transitions</td><td>DP</td><td>CE</td><td>CXP</td><td>EP</td><td>RT</td></tr>
<tr><td>PFBA</td><td>213.1 > 169.0</td><td>-42</td><td>-13</td><td>-6</td><td>-10</td><td>2.4</td></tr>
<tr><td>PFPeA</td><td>263.1 > 219.0</td><td>-33</td><td>-13</td><td>-6</td><td>-10</td><td>4.4</td></tr>
<tr><td>PFHxA</td><td>313.1 > 269.0</td><td>-40</td><td>-14</td><td>-6</td><td>-10</td><td>6.6</td></tr>
<tr><td>PFHpA</td><td>363.1 > 319.0</td><td>-40</td><td>-15</td><td>-6</td><td>-10</td><td>7.2</td></tr>
<tr><td>PFOA</td><td>413.2 > 369.0</td><td>-40</td><td>-16</td><td>-11</td><td>-10</td><td>7.5</td></tr>
<tr><td>PFNA</td><td>463.0 > 419.0</td><td>-45</td><td>-16</td><td>-12</td><td>-10</td><td>7.9</td></tr>
<tr><td>PFDA</td><td>513.2 > 469.0</td><td>-45</td><td>-17</td><td>-12</td><td>-10</td><td>8.2</td></tr>
<tr><td>PFUnDA</td><td>563.2 > 519.0</td><td>-45</td><td>-18</td><td>-15</td><td>-10</td><td>8.5</td></tr>
<tr><td>PFDoDA</td><td>613.2 > 569.0</td><td>-55</td><td>-19</td><td>-17</td><td>-10</td><td>8.8</td></tr>
<tr><td>PFTrDA</td><td>663.3 > 619.0</td><td>-55</td><td>-19</td><td>-19</td><td>-3</td><td>9.1</td></tr>
<tr><td>PFTeDA</td><td>713.3 > 669.0</td><td>-60</td><td>-20</td><td>-23</td><td>-3</td><td>9.5</td></tr>
<tr><td>PFHxDA</td><td>813.2 > 769.0</td><td>-60</td><td>-22</td><td>-27</td><td>-10</td><td>10.3</td></tr>
<tr><td>PFODA</td><td>913.2 > 869.0</td><td>-70</td><td>-25</td><td>-28</td><td>-10</td><td>11.5</td></tr>
<tr><td>PFBS</td><td>299.1 > 80.0</td><td>-80</td><td>-58</td><td>-6</td><td>-10</td><td>6.6</td></tr>
<tr><td>PFHxS</td><td>399.1 > 80.0</td><td>-90</td><td>-80</td><td>-6</td><td>-10</td><td>7.6</td></tr>
<tr><td>PFOS</td><td>499.2 > 80.0</td><td>-100</td><td>-90</td><td>-6</td><td>-10</td><td>8.1</td></tr>
<tr><td>PFDS</td><td>599.2 > 80.0</td><td>-100</td><td>-100</td><td>-6</td><td>-10</td><td>8.5</td></tr>
<tr><td>M8PFOA</td><td>421.2 > 376.0</td><td>-45</td><td>-16</td><td>-11</td><td>-10</td><td>7.5</td></tr>
</table>
</td></tr>
<tr><td>Calibration</td><td>Quantitation was achieved with an 9-point linear regressed calibration curve spanning 0.05 to 20 ng/mL.</td></tr>
</table>

* RT : Retention time (min).

SAMPLING INFORMATION

Table A2. List of Sampled Properties, locations, sampling date.

Sample ID	Property			Sampling Date	Sampling Time
	Name	Latitude	Longitude		
A1	Swanton Village Green	44.91884	-73.12551	8/15/18	13:50
A3	Lake Carmi State Park	44.96210	-72.87404	8/15/18	12:43
A5	Jay Elementary	44.95206	-72.43537	7/13/18	11:58
A7	N. Country Union Jr. High School	44.94861	-72.13055	7/13/18	13:21
A9	Great Averill Pond Boat Launch	44.99474	-71.70613	7/20/18	13:23
B2	St. Albans Taylor Park	44.81101	-73.08299	8/15/18	11:39
B4	Avery's Gore Wildlife Management Area	44.82265	-72.72577	8/15/18	16:35
B6	Willoughby Falls Fishing Access Area	44.81250	-72.19334	7/13/18	14:17
B8	Brighton State Park	44.79647	-71.85522	7/20/18	12:51
C1	Grand Isle State Park	44.69054	-73.28962	8/23/18	10:55
C3	Cambridge Elementary School	44.64285	-72.82619	8/15/18	17:27
C5	Eden Boat Launch - field repositioned	44.72878	-72.49607	7/13/18	10:34
C7	Willoughby State Forest	44.71641	-72.03065	7/13/18	15:58
C9	Maidstone State Forest	44.65277	-71.63894	7/20/18	14:40
D1	Winooski High School	44.50167	-73.18167	8/23/18	12:07
D3	Underhill State Park	44.52931	-72.84304	8/15/18	18:08
D4	Peoples Academy-Morrisville	44.56194	-72.59000	7/18/18	10:21
D6	Flagg Pond	44.56431	-72.21493	7/13/18	17:00
D8	Darling State Forest	44.58833	-71.90055	7/20/18	11:36
E1	Callahan Park-Burlington	44.46285	-73.21300	6/13/18	11:40
E1a	Lakeview Cementery	44.49370	-73.23308	6/13/18	14:20

E1c	Battery Park	44.48148	-73.21988	6/13/18	12:45
E1d	City Hall Park	44.47603	-73.21377	8/23/18	11:28
E1e	Lakeside Park	44.45895	-73.22038	6/13/18	10:50
E1f	Roosevelt Park	44.48931	-73.21127	6/13/18	13:25
E3	Little River State Park	44.38988	-72.76780	7/18/18	16:42
E5	Buck Lake WMA	44.46704	-72.39734	7/18/18	11:36
E7	St. J. Municipal Forest	44.42448	-72.00947	7/20/18	17:03
E9	Neal Pond Launch	44.48254	-71.69150	7/20/18	15:51
F2	Huntington Schools (Brewster-Pierce Memorial School)	44.29513	-72.96381	7/16/18	17:08
F4	Hubbard Park - Montpelier*	44.26994	-72.57617	8/23/18	12:56
F6	Groton State Forest @ Stillwater	44.27953	-72.27425	7/18/18	13:06
G1	Former Week's School	44.17027	-73.26197	7/16/18	10:22
G3	Waitsfield Lareau Park	44.17493	-72.83302	7/16/18	16:18
G5	Barre Spaulding High	44.19005	-72.49625	7/18/18	15:42
G7	Blue Mtn. Union School-Wells River	44.15551	-72.08078	7/18/18	14:15
H2	Ripton Elementary	43.98555	-73.03879	7/16/18	12:02
H4	Brookfield Floating Bridge	44.04244	-72.60382	7/31/18	18:25
I1	Whiting Elementary	43.85859	-73.20070	7/16/18	13:22
I3	Rochester Town Green	43.87382	-72.80785	7/16/18	15:52
I5	McIntosh Pond	43.82744	-72.48354	7/31/18	17:31
I7	Samuel Morey Elementary-Fairlee	43.90844	-72.14525	7/31/18	13:22
J4	Silver Lake State Park	43.73137	-72.61446	7/31/18	16:43
J6	Norwich Green	43.71329	-72.30790	6/27/18	14:29
K1	Fair Haven Village Green	43.59402	-73.26590	8/17/18	10:13
K3	Gifford Woods State Park	43.67444	-72.81028	7/31/18	15:39

K5	Quechee State Park	43.63834	-72.41001	6/27/18	12:28
K6	Ratcliffe Park-WRJ	43.64378	-72.31537	6/27/18	11:08
K6b	Hurricane Wildlife Refuge	43.64706	-72.34908	6/27/18	11:48
K6c	Meeting House Common	43.66070	-72.38163	6/27/18	13:50
K6d	Lyman's Point Park	43.65006	-72.31670	6/27/18	10:39
K6e	Veterans Memorial Park - Hartford*	43.64944	-72.31809	6/27/18	13:16
L2a	Wallingford Recreation Fields	43.46922	-72.98030	8/17/18	14:49
L2b	Lower Clarendon Gorge State Forest*	43.51583	-72.96694	8/6/18	11:52
L4	Camp Plymouth State Park	43.47719	-72.69784	8/6/18	13:05
M1	Mettawee River Boat Launch	43.29309	-73.14064	8/17/18	11:28
M3	Okemo State Forest	43.30595	-72.75792	8/6/18	13:51
M5	The Commons Park-Springfield	43.29889	-72.47835	8/6/18	16:288
N2	Emerald Lake State Park	43.28198	-73.00499	8/17/18	12:08
O1	Shaftsbury State Park	43.02127	-73.17963	8/22/18	12:21
O3	Jamaica State Park	43.10612	-72.77359	8/17/18	13:08
O5	Rockingham Recreation Fields-Bellows Falls	43.12904	-72.45146	8/6/18	15:40
P2	Woodford State Park	42.88945	-73.03882	8/22/18	14:24
Q1	South Stream Boat Launch	42.81119	-73.17750	8/22/18	13:32
Q3	Molly Stark State Park	42.85478	-72.81434	8/22/18	15:06
Q5	Vernon Hatchery Pond	42.74374	-72.50004	-8/22/18	16:21

Notes:
(1) Sample and property names generally correspond with those designated in the DEC Background study. Sample names correspond with the grid pattern indicated in the figure also include in the Appendix A. Sample locations at the properties were selected and documented in the field by sampling personnel. Access to the proposed properties has not been confirmed and alternative sampling locations or properties may be selected if access issues are encountered.
(2) Proposed properties for sampling were selected using the screening process described in the QAPP and DQO plan. Based on access issues at some of the proposed properties, some alternative properties were selected (indicated by *). A total of 66 properties were sampled compared to 69 properties proposed in the QAPP and DQO plan.

Table A3. Summarized field sampling forms.

Sample Location	**A1**	**A3**	**A5**	**A7**	**A9**
Sample ID	A1_20180815	A3_20180815	A5_20180713	A7_20180713	A9_20180720
Property Name	Swanton Village Green	Lake Carmi State Park	Jay Elementary	N. Country Union Jr. High School	Great Averill Pond Boat Launch
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/15/18	8/15/18	7/13/18	7/13/18	7/20/18
Sampling Time	13:50	12:43	11:58	13:21	13:23
Latitude	44.91884	44.96210	44.95206	44.94861	44.99474
Longitude	-73.12551	-72.87404	-72.43537	-72.13055	-71.70613
Weather	Mostly cloudy	Cloudy	Sunny	Sunny with some clouds	Clear skies
Location Description	Grass area behind metal bench at northwest corner of park, approximately 10 ft from the sidewalk and 15-20 ft from the street.	Grass area behind nature trail sign, visible from end of one-way loop closest to the woods.	Grass area under trees, approximately 10 ft from a power box and stone/metal in-ground boxes.	Grass area near the southeast corner of paved bus drop-off zone.	Grass area on edge of lake within fishing access lot.
Surroundings Description	Residential/Commercial. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Residential/Agricultural Fields. No potential PFAS source was observed.	Residential. No potential PFAS source was observed.	Residential/Wooded. No potential PFAS source was observed.
Burmister Soil Description	Light-medium brown, SILT, little Sand, few root fragments, topsoil and subsoil. Moist.	Brown, SILT, and Sand, few root fragments, topsoil and subsoil. Moist.	Brown, SILT & CLAY, some Sand, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark brown, CLAY & SILT, some Sand, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	**B2**	**B4**	**B6**	**B8**	**C1**
Sample ID	B2_20180815	B4_20180815	B6_20180713	B8_20180720	C1 _20180823
Property Name	St. Albans Taylor Park	Avery's Gore Wildlife Management Area	Willoughby Falls Fishing Access Area	Brighton State Park	Grand Isle State Park
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/15/18	8/15/18	7/13/18	7/20/18	8/23/18
Sampling Time	11:39	16:35	14:17	12:51	10:55
Latitude	44.81101	44.82265	44.81250	44.79647	44.69054
Longitude	-73.08299	-72.72577	-72.19334	-71.85522	-73.28962
Weather	Cloudy with sun	Partly cloudy	Sunny with some clouds	Clear skies	Mostly cloudy
Location Description	Grass area approximately 50-75 feet from side walk, between two trees in the southwest quadrant of the park.	Grass area accessed from roadway.	Gravel trail area along the river falls, near the information hut at the beginning of path.	Grass backyard of check-in cabin/park managers home.	Grass area behind large center tree at beach front.
Surroundings Description	Residential/Commercial. No potential PFAS source was observed.	Wooded/Fields. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Light-medium brown, fine to coarse SAND, some Clayey Silt, few root fragments, topsoil and subsoil. Moist.	Light brown, fine to coarse SAND, some Silt, little Gravel, few root fragments, topsoil and subsoil	Dark brown, fine to coarse SAND, and Silt, subsoil, some root fragments. Moist.	Brown, fine to coarse SAND, trace Silt, little root fragments, topsoil and subsoil. Moist.	Brown, fine to coarse SAND, little Gravel, little Silt, few root fragments, topsoil and subsoil. Moist.

Sample Location	**C3**	**C5**	**C7**	**C9**
Sample ID	C3_20180815	C5_20180713	C7_20180713	C9_20180720
Property Name	Cambridge Elementary School	Eden Boat Launch - field repositioned	Willoughby State Forest	Maidstone State Forest
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/15/18	7/13/18	7/13/18	7/20/18
Sampling Time	17:27	10:34	15:58	14:40
Latitude	44.64285	44.72878	44.71641	44.65277
Longitude	-72.82619	-72.49607	-72.03065	-71.63894
Weather	Partly cloudy	Sun	Sunny, partly cloudy	Clear skies
Location Description	Grass area east of the home plate for the baseball field farthest from school bus parking lot.	Grass area to the far west of launch road, close to bordering greenery.	Wooded area approximately 15-20 feet south from parking area.	Brass area between "Maidstone State Park" sign and the nearest tree.
Surroundings Description	Residential/Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Wooded/Camping Area. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Light Brown, SILT & CLAY, and Sand, few root fragments, topsoil and subsoil. Moist.	Light Brown, GRAVEL, and Sand, trace Silt, topsoil and subsoil, few/no root fragments. Moist.	Very dark brown, fine to coarse SAND, some Silt, little Gravel, very few root fragments, subsoil. Moist.	Dark brown, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	**D1**	**D3**	**D4**	**D6**	**D8**
Sample ID	D1_20180823	D3_20180815	D4_20180718	D6_20180713	D8_20180720
Property Name	Winooski High School	Underhill State Park	Peoples Academy-Morrisville	Flagg Pond	Darling State Forest
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/23/18	8/15/18	7/18/18	7/13/18	7/20/18
Sampling Time	12:07	18:08	10:21	17:00	11:36
Latitude	44.50167	44.52931	44.56194	44.56431	44.58833
Longitude	-73.18167	-72.84304	-72.59000	-72.21493	-71.90055
Weather	Mostly clear skies, few clouds	Cloudy	Mostly sunny	After a shower. Sunny with few clouds	Clear skies
Location Description	Grass area near the soccer field bleachers and circular playground feature, northwest of the school.	Grass area next to picnic table located near of parking lot.	Grass area near custodial parking lot, south of the main school building.	Wooded area bordering pond, approximately 10-15 ft from gravel road pull-off parking.	Grass area at camping ground "Lot 1", near parking lot of Burke Mountain campground check-in cabin.
Surroundings Description	Residential/Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Residential/Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Dark brown and gray, fine to coarse SAND, little Silt, trace Gravel, topsoil and subsoil. Moist.	Very dark brown, GRAVEL, and Sand, some Clay & Silt, few root fragments, topsoil and subsoil. Moist.	Olive-brown, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Very dark brown, Silty CLAY, little Sand, subsoil, some root fragments. Moist, wet at approximately 4-inches deep.	Brown, fine to coarse SAND, and Gravel, trace Silt, few root fragments, topsoil and subsoil. Moist.

Sample Location	**E1**	**E1a**	**E1c**	**E1d**	**E1e**
Sample ID	E1_20180613	E1a_20180613	E1c_20180613	E1d_20180823	E1e_20180613
Property Name	Callahan Park-Burlington	Lakeview Cementery	Battery Park	City Hall Park	Lakeside Park
Collector(s)	Harrison Roakes & Ryan Weinstein	Harrison Roakes & Ryan Weinstein	Harrison Roakes & Ryan Weinstein	Ryan Weinstein	Harrison Roakes & Ryan Weinstein
Sampling Date	6/13/18	6/13/18	6/13/18	8/23/18	6/13/18
Sampling Time	11:40	14:00	12:45	11:28	10:50
Latitude	44.46285	44.49370	44.48148	44.47603	44.45895
Longitude	-73.21300	-73.23308	-73.21988	-73.21377	-73.22038
Weather	Mostly cloudy	Mostly cloudy	Mostly cloudy	Mostly clear skies, few clouds	Mostly cloudy
Location Description	North edge of park, approximately 20 ft from the park athletic fields.	Grass area in cemetery, approximately 10 feet from gravel access road.	Grass area north of the center of the park.	Grass area at the southwest corner of city hall park beside a flower bed.	Grass area under trees at the southwest corner of park, approximately 25 ft from roadway.
Surroundings Description	Residential/ Athletic Fields. No potential PFAS source was observed.	Cemetery/Athletic fields/Wooded. No potential PFAS source was observed.	Residential/Commercial. No potential PFAS source was observed.	Residential/Commercial. No potential PFAS source was observed.	Residential. No potential PFAS source was observed.
Burmister Soil Description	Light brown, Clayey SILT, some Sand, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Light brown, fine to coarse SAND, some Silt, few root fragments, topsoil and subsoil. Moist.	Dark brown, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, Clayey SILT, little Sand, few root fragments, topsoil and subsoil. Moist.	Brown, fine to coarse SAND, some Silt, some Gravel, topsoil and subsoil, few root fragments. Moist.

Sample Location	E1f	E3	E5	E7	E9
Sample ID	E1f_20180613	E3_20180718	E5_20180718	E7_20180720	E9_20180720
Property Name	Roosevelt Park	Little River State Park	Buck Lake WMA	St. J. Municipal Forest	Neal Pond Launch
Collector(s)	Harrison Roakes & Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	6/13/18	7/18/18	7/18/18	7/20/18	7/20/18
Sampling Time	13:25	16:42	11:36	17:03	15:51
Latitude	44.48931	44.38988	44.46704	44.42448	44.48254
Longitude	-73.21127	-72.76780	-72.39734	-72.00947	-71.69150
Weather	Cloudy	Clear skies	Clear skies	Clear skies	Clear skies
Location Description	Mulched area between the basketball and tennis courts.	Picnic area near campsite check-in parking lot.	Wooded area approximately 200 ft up a trail, opposite an informational sign.	Behind the backstop fence of the western baseball field.	grass area between the parking area and the lake.
Surroundings Description	Residential/ Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Commercial/Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Olive-brown, fine to coarse SAND, little Silt, few root fragments, subsoil. Moist.	Dark brown, fine to coarse SAND, little Silt, some root fragments, subsoil. Moist. Synthetic material (suspected fiberglass) found in the soil and removed prior to sample collection.	Dark brown, Clayey SILT, and Sand, some root fragments, topsoil and subsoil. Moist.	Dark brown, fine to coarse SAND, and Silt, few root fragments, topsoil and subsoil. Moist.	Dark-light brown, fine to coarse SAND, little Silt, little Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	F2	F4	F6	G1	G3
Sample ID	F2_20180716	F4_20180823	F6_20180718	G1_20180716	G3_20180716
Property Name	Huntington Schools (Brewster-Pierce Memorial School)	Hubbard Park - Montpelier	Groton State Forest at Stillwater	Former Week's School	Waitsfield Lareau Park
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	7/16/18	8/23/18	7/18/18	7/16/18	7/16/18
Sampling Time	17:08	12:56	13:06	10:22	16:18
Latitude	44.29513	44.26994	44.27953	44.17027	44.17493
Longitude	-72.96381	-72.57617	-72.27425	-73.26197	-72.83302
Weather	Sunny	Mostly cloudy	Clear skies	Mostly sunny	Sunny with slight clouds
Location Description	Beneath tree near the basketball court.	Grass area near gravel parking lot.	Grass area behind basketball hoop at the parking lot.	South of the tree in the horse-shoe driveway island of Vermont Job Corps parking lot.	Grass area near the southern end of the parking lot.
Surroundings Description	Residential/Commercial. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Agricultural Fields/Commercial/Residential. No potential PFAS source was observed.	Agricultural Fields. No potential PFAS source was observed.
Burmister Soil Description	Dark-light brown, SILT, and Sand, few root fragments, topsoil and subsoil. Moist.	Light brown, CLAY & SILT, little Sand, trace Gravel, few root fragments, topsoil and subsoil. Moist. .	Light brown and gray, fine to coarse SAND, and Gravel, little root fragments, topsoil and subsoil. Moist.	Very light brown, fine SAND, little Silt, topsoil and subsoil, some root fragments. Moist.	Brown, fine to coarse SAND, little Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	**G5**	**G7**	**H2**	**H4**	**I1**
Sample ID	G5-20180718	G7_20180718	H2_20180716	H4_20180731	I1_20180716
Property Name	Barre Spaulding High	Blue Mtn. Union School-Wells River	Ripton Elementary	Brookfield Floating Bridge	Whiting Elementary
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	7/18/18	7/18/18	7/16/18	7/31/18	7/16/18
Sampling Time	15:42	14:15	12:02	18:25	13:22
Latitude	44.19005	44.15551	43.98555	44.04244	43.85859
Longitude	-72.49625	-72.08078	-73.03879	-72.60382	-73.20070
Weather	Clear skies	Clear skies	Sunny	Partly cloudy	Sunny, light clouds
Location Description	Grass area approximately 15 ft behind the Homeplate of eastern baseball field.	Behind the backstop of northern baseball field, approximately 10 ft from the batting cage.	Grass area near the woods, north of the basketball court.	Grass area at the center of the park.	Grass area near the second base in the baseball field.
Surroundings Description	Residential/Athletic Fields. No potential PFAS source was observed.	Wooded/Athletic Fields. No potential PFAS source was observed.	Wooded/Fields. No potential PFAS source was observed.	Residential. No potential PFAS source was observed.	Agricultural Fields/Commercial/Residential. No potential PFAS source was observed.
Burmister Soil Description	Brown, fine to coarse SAND, and Silt, few root fragments, topsoil and subsoil. Moist.	Light brown, SILT, and Sand, few root fragments, topsoil and subsoil. Moist.	Very light brown, fine to coarse SAND, little Gravel, trace Silt, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, fine to coarse SAND, and Silt & Clay, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, CLAY & SILT, trace Sand, topsoil and subsoil, few root fragments. Moist.

Sample Location	**I3**	**I5**	**I7**	**J4**
Sample ID	I3_20180716	I5_20180731	I7_20180731	J4_20180731
Property Name	Rochester Town Green	McIntosh Pond	Samuel Morey Elementary-Fairlee	Silver Lake State Park
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	7/16/18	7/31/18	7/31/18	7/31/18
Sampling Time	14:52	17:31	13:22	16:42
Latitude	43.87382	43.82744	43.90844	43.73137
Longitude	-72.80785	-72.48354	-72.14525	-72.61446
Weather	Sunny with some clouds	Mostly cloudy	Mostly sunny, some clouds	Cloudy
Location Description	Southwest of the monument and west of the gazebo steps, approximately 50 to 100 ft from sidewalk.	Grass area between the parking area and the pond.	Grass outfield approximately 100 ft from gravel path at the northeast end of the school.	Grass area northwest of the basketball court.
Surroundings Description	Residential/Commercial. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Residential/Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Light-medium brown, fine to coarse SAND, some Gravel, trace Silt, few root fragments, topsoil and subsoil. Moist.	Light brown and gray, fine to coarse SAND, and Gravel, some Clay & Silt, few root fragments, topsoil and subsoil. Moist.	Dark brown, Clayey SILT, some Sand, few root fragments, topsoil and subsoil. Moist.	Light-medium brown, fine to coarse SAND, some Silt, little root fragments, topsoil and subsoil. Moist.

Sample Location	**J6**	**K1**	**K3**	**K5**	**K6**
Sample ID	J6_20180627	K1_20180817	K3_20180731	K5_20180627	K6_20180627
Property Name	Norwich Green	Fair Haven Village Green	Gifford Woods State Park	Quechee State Park	Ratcliffe Park-WRJ
Collector(s)	Abigail Ames & Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Abigail Ames & Ryan Weinstein	Abigail Ames & Ryan Weinstein
Sampling Date	6/27/18	8/17/18	7/31/18	6/27/18	6/27/18
Sampling Time	14:29	10:13	15:39	12:28	11:08
Latitude	43.71329	43.59402	43.67444	43.63834	43.64378
Longitude	-72.30790	-73.26590	-72.81028	-72.41001	-72.31537
Weather	Cloudy	Cloudy, light rain	Cloudy	Cloudy	Cloudy
Location Description	North of the gazebo, approximately 20 ft from garden area and path off Main Street.	Near large tree in the northeast quadrant of the park.	Behind the "Gifford Woods State Park off season access" sign.	Grass area accessed from gravel parking, northeast of the signs and trees.	At the end of left outfield fence.
Surroundings Description	Athletic Fields/Residential/Commercial. No potential PFAS source was observed.	Residential/Commercial. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.	Residential/ Athletic Fields. No potential PFAS source was observed.
Burmister Soil Description	Brown, fine to coarse SAND, some Silt, few root fragments, topsoil and subsoil. Moist.	Dark brown and gray, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark brown, fine to coarse SAND, some Gravel, little Silt, some root fragments, topsoil and subsoil. Moist.	Brown, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Brown, Clayey SILT, and Sand, few root fragments, topsoil and subsoil. Moist.

Sample Location	**K6b**	**K6c**	**K6d**	**K6e**	**L2A**
Sample ID	K6B_20180627	K6C_20180627	K6D_20180627	K6E_20180627	L2A_20180817
Property Name	Hurricane Wildlife Refuge	Meeting House Common	Lyman's Point Park	Veterans Memorial Park - Hartford	Wallingford Recreation Fields
Collector(s)	Abigail Ames & Ryan Weinstein	Abigail Ames & Ryan Weinstein	Abigail Ames & Ryan Weinstein	Abigail Ames & Ryan Weinstein	Ryan Weinstein
Sampling Date	6/27/18	6/27/18	6/27/18	6/27/18	8/17/18
Sampling Time	11:48	13:50	10:39	13:16	14:49
Latitude	43.64706	43.66070	43.65006	43.64944	43.46922
Longitude	-72.34908	-72.38163	-72.31670	-72.31809	-72.98030
Weather	Cloudy	Cloudy	Cloudy	Cloudy	Partly cloudy with sun
Location Description	On grass walkway near the picnic table.	Grass area on the north end of the park.	Southwest corner of park, approximately 100 ft southwest from stage and near the top of the stairs that go under the railroad.	Grass area near a park bench, approximately 30 feet west of the memorial and bird statues.	Grass area in front of the third-base line dugout of the most southern baseball field.
Surroundings Description	Wooded/Fields. No potential PFAS source was observed.	Residential/Fields/Wooded. No potential PFAS source was observed.	Commercial. No potential PFAS source was observed.	Commercial. No potential PFAS source was observed.	Residential/Athletic Fields. No potential PFAS source was observed.
Burmister Soil Description	Light brown, fine to coarse SAND, and Gravel, few root fragments, topsoil and subsoil. Moist.	Dark brown, CLAY & SILT, trace Sand, few root fragments, topsoil and subsoil. Moist.	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Light brown, fine to coarse SAND, trace Silt, some Gravel, few root fragments, topsoil and subsoil. Moist.	Light-medium brown, CLAY & SILT, little Sand, few root fragments, topsoil and subsoil. Moist.

Sample Location	L2B	L4	M1	M3	M5
Sample ID	L2B_20180806	L4_20180806	M1_20180817	M3_20180806	M5_20180806
Property Name	Lower Clarendon Gorge State Forest	Camp Plymouth State Park	Mettawee River Boat Launch	Okemo State Forest	The Commons Park-Springfield
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/6/18	8/6/18	8/17/18	8/6/18	8/6/18
Sampling Time	11:52	13:05	11:28	13:51	16:28
Latitude	43.51583	43.47719	43.29309	43.30595	43.29889
Longitude	-72.96694	-72.69784	-73.14064	-72.75792	-72.47835
Weather	Sunny	Sunny	Very cloudy, light rain	Sunny	Sunny
Location Description	Grass area to the west side of the state forest path, approximately 5 ft south of the rocks lining the entrance.	Grass area between two horseshoe pits, approximately 20 ft from picnic table area.	Grass area approximately 5 ft southeast of the "Stone Byway" sign.	Grass area on the western side of the access road.	Grass area in the outfield along the first-base line.
Surroundings Description	Wooded/Residential. No potential PFAS source was observed.	Wooded/Residential/Fields. No potential PFAS source was observed.	Wooded/Agricultural Fields. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.	Residential/Athletic Fields/Cemetery. No potential PFAS source was observed.
Burmister Soil Description	Dark brown, CLAY & SILT, little Sand, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, Silty CLAY, trace Sand, few root fragments, topsoil and subsoil. Moist.	Light-medium brown, fine to coarse SAND, and Gravel, little Silt, few root fragments, topsoil and subsoil. Moist.	Dark-light brown, fine to coarse SAND, trace Silt, few root fragments, topsoil and subsoil. Moist.	Dark-light brown, fine to coarse SAND, some Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	**N2**	**O1**	**O3**	**O5**	**P2**
Sample ID	N2_20180817	O1_20180822	O3_20180817	O5_20180806	P2_20180822
Property Name	Emerald Lake State Park	Shaftsbury State Park	Jamaica State Park	Rockingham Recreation Fields-Bellows Falls	Woodford State Park
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/17/18	8/22/18	8/17/18	8/6/18	8/22/18
Sampling Time	12:08	12:21	13:08	15:40	14:24
Latitude	43.28198	43.02127	43.10612	43.12904	42.88945
Longitude	-73.00499	-73.17963	-72.77359	-72.45146	-73.03882
Weather	Cloudy, little sun	Cloudy with sun	Partly cloudy, some sun	Sunny	Few clouds, mostly clear skies
Location Description	Grass area north of the gravel entrance road.	Grass area approximately 15 ft south of the mulch area around the playground structure.	Grass area west of the park entrance road.	Grass area approximately 15 ft north of the parking lot.	Along grass path accessed from the loop road.
Surroundings Description	Wooded/Fields. No potential PFAS source was observed.	Wooded/Fields. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.	Residential/Athletic Fields. No potential PFAS source was observed.	Wooded. No potential PFAS source was observed.
Burmister Soil Description	Light gray, fine to coarse SAND, little Gravel, trace Silt, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, fine to coarse SAND, Silt & Clay, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Light brown, Clayey SILT, little fine Sand, few root fragments, topsoil and subsoil. Moist.	Dark-medium brown, fine to coarse SAND, some Silt, little root fragments, topsoil and subsoil. Moist.	Brown and gray, fine to coarse SAND, little Silt, trace Gravel, few root fragments, topsoil and subsoil. Moist.

Sample Location	Q1	Q3	Q5
Sample ID	Q1_20180822	Q3_20180822	Q5_20180822
Property Name	South Stream Boat Launch	Molly Stark State Park	Vernon Hatchery Pond
Collector(s)	Ryan Weinstein	Ryan Weinstein	Ryan Weinstein
Sampling Date	8/22/18	8/22/18	8/22/18
Sampling Time	13:32	15:06	16:21
Latitude	42.81119	42.85478	42.74374
Longitude	-73.17750	-72.81434	-72.50004
Weather	Dark clouds	Partly cloudy	Partly cloudy
Location Description	Grass area near the boat launch.	Grass shoulder of the entrance road, approximately 15 ft southeast of the entrance at Vermont Route 9.	Leaf-litter covered area approximately 5 ft east of the pond billboard sign.
Surroundings Description	Wooded/Residential. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.	Wooded/Residential. No potential PFAS source was observed.
Burmister Soil Description	Dark brown, Clayey SILT, some Sand, few root fragments, topsoil and subsoil. Moist.	Dark brown, CLAY & SILT, little Sand, trace Gravel, few root fragments, topsoil and subsoil. Moist.	Dark brown and gray, fine to coarse SAND, little Silt, little Gravel, few root fragments, topsoil and subsoil. Moist.

QA/QC

Table A4. PFAS Analyst list analyzed by Alpha Analytical Inc.

Acronym	Name (n- linear structure)	Acronym	Name (n- linear structure)
PFBA	Perfluoro-n-butanoic acid	PFHxS	Perfluoro-1-hexanesulfonic acid
PFPeA	Perfluoro-n-pentanoic acid	PFOS	Perfluoro-1-octanesulfonic acid
PFHxA	Perfluoro-n-hexanoic acid	PFDS	Perfluoro-1-decanesulfonic acid
PFHpA	Perfluoro-n-heptanoic acid	PFNS*	Perfluoro-1-nonanesulfonic acid
PFOA	Perfluoro-n-octanoic acid	PFPeS*	Perfluoro-1-pentanesulfonic acid
PFNA	Perfluoro-n-nonanoic acid	PFHpS*	Perfluoro-1-heptanesulfonic acid
PFDA	Perfluoro-n-decanoic acid	4:2FTSA*	1H,1H,2H,2H-Perfluorahexanesulonic acid
PFUnDA	Perfluoro-n-undecanoic acid	6:2FTSA*	1H, 1H, 2H, 2H-Perfluorooactanesulfonic acid
PFDoDA	Perfluoro-n-dodecanoic acid	8:2FTSA*	1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid
PFTrDA	Perfluoro-n-tridecanoic acid	N-MeFOSAA*	N-Methyl Perfluoro-1-octanesulfonamidoacetic acid
PFTeDA	Perfluoro-n-tetradecanoic acid	N-EtFOSAA*	N-Ethyl Perfluoro-1-octanesulfonamidoacetic acid
PFBS	Perfluoro-1-butanesulfonic acid	FOSA*	Perfluoro-1-octanesulfonamide

* PFNS, PFPeS, PFHpS, 4:2FTSA, 6:2FTSA, 8:2FTSA, N-MeFOSAA, N-EtFOSAA and FOSA were not analyzed in UVM method.
* PFHxDA and PFODA were not analyzed in AlphaLab method.

Table A5. RLs of 24 PFAS analyzed by Alpha Analytical Inc.

Sample ID	RL (ng/kg)
A1	<1,090
A3	<1,200
B2	<1,300
B4	<1,100
C3	<1,200
D3	<1,030

Table A6. Trip Blank Data Summary

Analyte	TB 1	TB 2	TB 3	TB 4	TB 5	TB 6	TB 7	TB 8	TB 9	TB 10	TB 11	TB 12
PFBA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHpA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFOA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFUnDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDoDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFODA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFBS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFOS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table A7. Field Blanks, Equipment Blanks and Method Blanks Data Summary.

Analyte	**FB 1**	**FB 2**	**FB 3**	**EB 1**	**EB 2**	**EB 3**	**MB 1**	**MB 2**	**MB 3**	**MB 1**
PFBA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFPeA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHpA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFOA	ND	ND	ND	ND	ND	ND	<MDL	ND	ND	ND
PFNA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFUnDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDoDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFTrDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFTeDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxDA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFODA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFBS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFHxS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFOS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table A8. Precision and accuracy of LCS/LCSDs.

Spiking level (ng/mL)	0.3		1.2		2.4		9.6	
Analyst	**Recovery (%)**	**RPD (%)**	**Recovery (%)**	**RPD (%)**	**Recovery (%)**	**RPD (%)**	**Recovery (%)**	**RPD (%)**
PFBA	104	2.5	47	5.3	36	28	43	14
PFPeA	99	6.4	97	16	74	1.0	76	5.8
PFHxA	142	24	132	2.6	111	16	91	27
PFHpA	142	11	122	7.9	107	10	104	0.72
PFOA	98	12	107	3.9	115	15	129	23
PFNA	126	11	112	4.5	106	10	120	5.9
PFDA	127	6.6	122	8.6	104	10	92	6.7
PFUnDA	66	18	73	3.4	95	12	87	2.9
PFDoDA	N/A	N/A	68	20	55	23	65	9.4
PFTrDA	N/A	N/A	62	24	47	4.2	50	36
PFTeDA	N/A	N/A	65	32	57	1.5	48	24
PFHxDA	N/A	N/A	106	27	99	24	109	17
PFODA	N/A	N/A	71	29	73	13	125	21
PFBS	152	6.7	121	12	106	21	86	25
PFHxS	109	16	114	19	105	11	102	8.3
PFOS	133	8.9	103	2.9	110	12	93	0.19
PFDS	128	6.0	119	0.55	111	15	92	6.9

* LCS: laboratory control samples; LCDs: laboratory control sample duplicates.
* LCS/LCDs of four spiking levels, including low (0.3 ng/mL), moderate (1.2 ng/mL and 2.4 ng/mL), and high (9.6 ng/mL), were applied to evaluate the accuracy and precision of the analytical method.
* PFUnDA, PFDoDA, PFTrDA, PFTeDA, PFHxDA, PFODA showed recoveries lower than 50% at spiking level of 0.3 ng/mL, and were labeled as N/A.
*RPD results have been rounded to two significant digits.

Table A9. RPD analysis for duplicate samples.

	C1#1	**C1#2**	**RPD (%)**
TOC (%)	10	10	0.10
PFHpA	150	130	15
PFOA	430	430	0.076
PFNA	160	140	11
PFDA	89	71	23
PFUnDA	63	50	24
PFBS	240	140	53
PFHxS	230	160	33
PFOS	660	690	4.3
PFDS	31	33	6.4
	I7#1	**I7#2**	**RPD (%)**
TOC (%)	10	13	22
PFHxA	140	67	72
PFHpA	79	93	17
PFOA	410	360	14
PFNA	210	170	19
PFDA	100	79	25
PFUnDA	52	40	26
PFOS	540	470	13

* Qualitative detections were not included.
* Statistical analyses were performed on raw data with additional precision, and all results have been rounded to two significant digits.
* If RPD≤50, results were accepted as reported; if RPD>50, the resulted were taken as estimated values and marked by P.

STATISTICAL ANALYSES

Table A10.1. Pearson Correlations (α<0.05) between TOC, percent solid and individual PFAS and ΣPFCA, ΣPFSA and ΣPFAS.

		PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFBS	PFOS	ΣPFCA	ΣPFSA	ΣPFAS
TOC	r	0.0227	0.277	0.4541	0.042	-0.0016	0.0167	0.0145	-0.0157	0.1342	-0.0054	0.0883
Solid%	r	0.1098	-0.195	-0.3433	0.0527	0.0769	0.0495	0.0062	0.077	-0.0264	0.0611	0.0049

* r: Pearson's correlation coefficient; calculated based on quantitative detections.

Table A10.2. Correlations between individual PFAS and ΣPFCA, ΣPFSA and ΣPFAS by Pearson Correlation (α<0.05).

		PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFBS	PFOS	ΣPFCA	ΣPFSA	ΣPFAS
PFHxA	r	0.4502	0.2678	0.8862	0.8739	0.8801	0.6254	0.7631	0.9043	0.7923	0.9022
	p	0.00012	0.2773	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
PFHpA	r		0.5649	0.3831	0.3765	0.3846	0.3918	0.3229	0.5588	0.3686	0.5127
	p		<0.00001	0.0013	0.0016	0.0012	0.0095	0.0072	<0.00001	0.0020	<0.00001
PFOA	r			0.3339	0.2811	0.2805	0.0464	0.3259	0.5205	0.3098	0.4651
	p			0.0054	0.0202	0.0205	0.7071	0.0067	<0.00001	0.0102	0.00007
PFNA	r				0.9656	0.9832	0.4469	0.8205	0.9560	0.8310	0.9514
	p				<0.00001	<0.00001	0.0001	<0.00001	<0.00001	<0.00001	<0.00001
PFDA	r					0.9780	0.5024	0.7821	0.9479	0.8055	0.9364
	p					<0.00001	0.000013	<0.00001	<0.00001	<0.00001	<0.00001
PFUnDA	r						0.4646	0.8020	0.9474	0.8239	0.9429
	p						0.0001	<0.00001	<0.00001	<0.00001	<0.00001
PFBS	r							0.4387	0.5034	0.5455	0.5410
	p							0.0002	0.000012	<0.00001	<0.00001
PFOS	r								0.8022	0.9860	0.9054
	p								<0.00001	<0.00001	<0.00001
ΣPFCA	r									0.8213	0.9774
	p									<0.00001	<0.00001
ΣPFSA	r										0.9234
	p										<0.00001

* r: Pearson's correlation coefficient; calculated based on quantitative detections.
* p: p-value for Pearson r score.

Table A11. Estimated UTLs of each PFAS compound by ProUCL 5.1.

Analyst	PFHxA		PFHpA		PFOA		PFNA		PFDA		PFUnDA	
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution												
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Normal (5%)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
95% UTL95% Coverage	1501	879.7	659.9	628.6	1,786	1,717	1,462	404.1	2,210	844.6	757.2	212.4
Gamma ROS Statistics using Imputed Non-Detects												
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Gamma (5%)	N & Y	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
k star	<1	<1	<1	<1	<1	<1	<1	>1	<1	<1	<1	<1
95% Approx. Gamma UTL with 95% Coverage (WH)	1,497	1,200	1,003	964.9	2,011	1,905	959.6	518.7	1,114	678.5	536.3	349.9
95% Approx. Gamma UTL with 95% Coverage (HW)	1,880	1,549	1,940	1,261	2,519	2,399	1,118	583.7	1,232	841.6	690.3	478
Gamma and KM, Upper Limits using WH and HW Methods												
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Gamma (5%)	N & Y	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
95% Approx. Gamma UTL with 95% Coverage (WH)	1146	868.2	767.9	731	1,642	1,539	772.2	435.5	940.9	502.3	361.1	189.6
95% Approx. Gamma UTL with 95% Coverage (HW)	1143	884.8	811.4	772.3	1,710	1,602	731.9	446.1	844	481.6	332.9	189.2
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects												
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Lognormal (5%)	YES	YES	YES	YES	YES	YES	NO	YES	NO	NO	NO	NO
95% UTL95% Coverage	2,592	1,895	970.1	913.9	2,122	1,958	717	500.3	834.6	546.4	352.4	222.8
95% Bootstrap (%) UTL95% Coverage	1,476	1,371	860.8	860	2,015	1,589	698.6	422.3	2,797	428.8	522.1	187.3
95% BCA UTL95% Coverage	1,476	1,371	860.8	838.4	1,909	1,589	698.6	428.7	2,205	425.7	522.1	187.1
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution												

	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Lognormal (5%)	YES	YES	YES	YES	YES	YES	NO	YES	NO	NO	NO	NO
95% KM UTL (Lognormal)95% Coverage	1,224	1,001	1,092	1,037	2,290	2,139	684.7	497.2	664.4	451.7	279.7	192.2
Nonparametric Distribution Free Background Statistics												
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Discernible (5%)	YES	YES	YES	YES	YES	YES	NO	YES	NO	NO	NO	NO
95% UTL with95% Coverage	1,500	1,406	872.8	872.8	2,015	1,589	698.6	428.7	2,797	428.8	522.1	187.3
Analyst	**PFBS**		**PFHxS**		**PFDS**						**PFOS**	
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution							**Background Statistics Assuming Normal Distribution**					
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6						
Normal (5%)	NO	NO	NO	NO	NO	NO					RL-O	RL-J6
95% UTL95% Coverage	686.7	638.1	393.3	396.3	309	172.7	Normal (5%)				NO	NO
Gamma ROS Statistics using Imputed Non-Detects							95% UTL with 95% Coverage				3,886	2,761
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6	**Background Statistics Assuming Gamma Distribution**					
Gamma (5%)	NO	NO	NO	NO	NO	YES						
k star	<1	<1	<1	<1	<1	<1					RL-O	RL-J6
95% Approx. Gamma UTL with 95% Coverage (WH)	853.6	784.7	550.7	562.5	269.9	211.2	Gamma				NO	NO
95% Approx. Gamma UTL with 95% Coverage (HW)	1126	1040	705.2	724.3	310.2	250.5	95% WH Approx. Gamma UTL with 95% Coverage				3,527	2,904
Gamma and KM, Upper Limits using WH and HW Methods							95% HW Approx. Gamma UTL with 95% Coverage				3,571	2,979
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6						
Gamma (5%)	NO	NO	NO	NO	NO	YES	**Background Statistics assuming Lognormal Distribution**					
95% Approx. Gamma UTL with 95% Coverage (WH)	599.8	541.3	345.9	349.6	214.3	154.1						
95% Approx. Gamma UTL with 95% Coverage (HW)	603.2	543.2	341.5	345.3	207	152.8					RL-O	RL-J6

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects						
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Lognormal (5%)	N & Y	YES	NO	NO	YES	YES
95% UTL95% Coverage	1,131	994.2	582.7	588.3	408.6	276
95% Bootstrap (%) UTL95% Coverage	977.5	887	439	440.5	382.8	225.4
95% BCA UTL95% Coverage	954.9	840	439	439.3	382.8	218
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution						
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Lognormal (5%)	N & Y	YES	NO	NO	YES	YES
95% KM UTL (Lognormal)95% Coverage	657.3	586.4	330.5	334.8	191.5	150.3
Nonparametric Distribution Free Background Statistics						
	RL-O	RL-J6	RL-O	RL-J6	RL-O	RL-J6
Discernible (5%)	YES	YES	NO	NO	YES	YES
95% UTL with95% Coverage	977.5	887	440.5	440.5	382.8	225.4

Lognormal	YES	YES
95% UTL with 95% Coverage	3,971	3,407
Nonparametric Upper Limits for Background Threshold Values		
	RL-O	RL-J6
Discernible	YES	YES
	Lognormal	
95% Percentile Bootstrap UTL with 95% Coverage	4,431	3,790
95% UTL with 95% Coverage	4,431	3,790
95% BCA Bootstrap UTL with 95% Coverage	4,271	3,763

* RL-O represents that the results were achieved based on full data set without removing J6 data, and these ULTs were listed here for purpose of comparison.
* RL-J6 represents that the results were obtained after removing J6 data from the data set.
* YES means that the data set passed the both GOF tests given in ProUCL5.1.
* NO means that the data set failed the GOF tests given in ProUCL5.1.
* N&Y means that the data set only passed one of the two GOF tests given in ProUCL 5.1.

PFAS ANALYTICAL RESULTS FROM ALAPHA ANALYTICAL INC

Serial_No:09051810:07

Project Name: UNIVERSITY OF VT, PFAS BSS **Lab Number:** L1832167

Project Number: 4357.00 **Report Date:** 09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-01	Date Collected:	08/15/18 10:28
Client ID:	TRIP BLANK_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Water	Extraction Method:	EPA 537
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	09/01/18 10:35		
Analyst:	AJ		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/l	1.86	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/l	1.86	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	1.86	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/l	1.86	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	1.86	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/l	1.86	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	1.86	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	1.86	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	1.86	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/l	1.86	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/l	1.86	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	1.86	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	1.86	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	1.86	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/l	1.86	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/l	1.86	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	1.86	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	1.86	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/l	1.86	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/l	1.86	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	1.86	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	1.86	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	1.86	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	1.86	--	1

Serial_No:09051810:07

Project Name:	UNIVERSITY OF VT, PFAS BSS	**Lab Number:**	L1832167
Project Number:	4357.00	**Report Date:**	09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-04	Date Collected:	08/15/18 13:50
Client ID:	A1_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 537(M)
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	08/26/18 16:04		
Analyst:	PB		
Percent Solids:	90%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.09	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.09	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.09	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.09	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.09	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.09	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.09	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.09	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.09	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.09	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.09	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.09	--	1
Perfluorooctanesulfonic Acid (PFOS)	1.65		ng/g	1.09	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.09	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.09	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.09	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.09	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.09	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.09	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.09	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.09	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.09	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.09	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.09	--	1

Serial_No:09051810:07

Project Name:	UNIVERSITY OF VT, PFAS BSS	**Lab Number:**	L1832167
Project Number:	4357.00	**Report Date:**	09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-03	Date Collected:	08/15/18 12:43
Client ID:	A3_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 537(M)
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	08/26/18 15:47		
Analyst:	PB		
Percent Solids:	78%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.20	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.20	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.20	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.20	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.20	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.20	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.20	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.20	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.20	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.20	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.20	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.20	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.20	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.20	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.20	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.20	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.20	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.20	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.20	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.20	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.20	--	1

Serial_No:09051810:07

Project Name: UNIVERSITY OF VT, PFAS BSS **Lab Number:** L1832167
Project Number: 4357.00 **Report Date:** 09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-02	Date Collected:	08/15/18 11:39
Client ID:	B2_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 537(M)
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	08/26/18 15:31		
Analyst:	PB		
Percent Solids:	72%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.30	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.30	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.30	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.30	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.30	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.30	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.30	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.30	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.30	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.30	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.30	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.30	--	1
Perfluorooctanesulfonic Acid (PFOS)	3.74		ng/g	1.30	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.30	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.30	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.30	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.30	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.30	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.30	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.30	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.30	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.30	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.30	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.30	--	1

Serial_No:09051810:07

Project Name:	UNIVERSITY OF VT, PFAS BSS	**Lab Number:**	L1832167
Project Number:	4357.00	**Report Date:**	09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-05	Date Collected:	08/15/18 16:35
Client ID:	B4_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 537(M)
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	08/26/18 16:21		
Analyst:	PB		
Percent Solids:	89%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.10	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.10	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.10	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.10	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.10	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.10	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.10	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.10	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.10	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.10	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.10	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.10	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.10	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.10	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.10	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.10	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.10	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.10	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.10	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.10	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.10	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.10	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.10	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.10	--	1

Serial_No:09051810:07

Project Name:	UNIVERSITY OF VT, PFAS BSS	**Lab Number:**	L1832167
Project Number:	4357.00	**Report Date:**	09/05/18

SAMPLE RESULTS

Lab ID:	L1832167-06	Date Collected:	08/15/18 17:27
Client ID:	C3_20180815	Date Received:	08/16/18
Sample Location:	STATEWIDE	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 537(M)
Analytical Method:	122,537(M)	Extraction Date:	08/22/18 18:10
Analytical Date:	08/26/18 16:37		
Analyst:	PB		
Percent Solids:	82%		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.20	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.20	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.20	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.20	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.20	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.20	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.20	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.20	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.20	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.20	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.20	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.20	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.20	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.20	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.20	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.20	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.20	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.20	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.20	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.20	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.20	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.20	--	1

Serial_No:09051810:07

Project Name: UNIVERSITY OF VT, PFAS BSS **Lab Number:** L1832167

Project Number: 4357.00 **Report Date:** 09/05/18

SAMPLE RESULTS

Lab ID: L1832167-07
Client ID: D3_20180815
Sample Location: STATEWIDE

Date Collected: 08/15/18 18:08
Date Received: 08/16/18
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 122,537(M)
Analytical Date: 08/26/18 16:54
Analyst: PB
Percent Solids: 85%

Extraction Method: EPA 537(M)
Extraction Date: 08/22/18 18:10

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by Isotope Dilution - Mansfield Lab						
Perfluorobutanoic Acid (PFBA)	ND		ng/g	1.03	--	1
Perfluoropentanoic Acid (PFPeA)	ND		ng/g	1.03	--	1
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/g	1.03	--	1
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	ND		ng/g	1.03	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/g	1.03	--	1
Perfluoropentanesulfonic Acid (PFPeS)	ND		ng/g	1.03	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/g	1.03	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/g	1.03	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/g	1.03	--	1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND		ng/g	1.03	--	1
Perfluoroheptanesulfonic Acid (PFHpS)	ND		ng/g	1.03	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/g	1.03	--	1
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/g	1.03	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/g	1.03	--	1
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND		ng/g	1.03	--	1
Perfluorononanesulfonic Acid (PFNS)	ND		ng/g	1.03	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/g	1.03	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/g	1.03	--	1
Perfluorodecanesulfonic Acid (PFDS)	ND		ng/g	1.03	--	1
Perfluorooctanesulfonamide (FOSA)	ND		ng/g	1.03	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/g	1.03	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/g	1.03	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/g	1.03	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/g	1.03	--	1

CHAIN-OF-CUSTODY RECORD

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	PFAS (See QAPP for UVM Analytical List)	TOC (Total Organic Carbon)	# of Containers	NOTES
Ele — 20180613	6/13/18, 10:50	S	G	X	X	1	
E1 — 20180613	6/13/18, 11:40	↓	↓	↓	↓	1	
E1c — 20180613	6/13/18, 12:45	↓	↓	↓	↓	1	
E1f — 20180613	6/13/18, 13:25	↓	↓	↓	↓	1	
E1a — 20180613	6/13/18, 14:00	↓	↓	↓	↓	1	
EquipBlank — 20180613	6/13/18, 14:20	Lab	↓	↓		1	
FieldBlank — 20180613	6/13/18, 13:55	Lab	↓	↓		1	
Trip Blank — 20180612	6/12/18, 14:50	Lab	↓	↓		1	

Analyses Requested

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Harrison Roakes & Ryan Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan Weinstein	6/14/18	10:03	Elliot Maker
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

Sanborn, Head & Associates

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	PFAS (See QAPP for IBVM Analytical List)	TOC (Total Organic Carbon)	# of Containers	NOTES
K6D – 20180627	6/27/18 ,	S	G	X	X	1	
K6 – 20180627	,					1	
K6B – 20180627	,					1	
K5 – 20180627	,					1	
K6E – 20180627	,					1	
K6C – 20180627	,					1	
J6 – 20180627	,	↓			↓	1	
Trip Blank – 20180627	↓ ,	Lab	↓	↓		1	

Analyses Requested

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HN03; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S203

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Weinstein & Abigail Ames

Relinquished By:	Date:	Time:	Received By:
			Elliot Mead 6/28/18 1:37
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Sanborn, Head & Associates,

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
C5_20180713	7/13/18, 10:34	S	G		1	
A5_20180713	7/13/18, 11:58				1	
A7_20180713	7/13/18, 13:21				1	
B6_20180713	7/13/18, 14:17				1	
C7_20180713	7/13/18, 15:58				1	
D6_20180713	7/13/18, 17:00	↓			1	
Trip Blank_20180713	7/13/18, 7:53	Lab	↓		1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan Weinstein	7/14/18	2:37	[illegible]

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	PFAS (See QAPP for UVM Analytical List)	TOC (Total Organic Carbon)	# of Containers	NOTES
GI – 20180716	7/16/18, 10:22	S	G	X	X	1	
H2 – 20180716	↓ , 12:02	↓	↓	↓	↓	1	
I1 – 20180716	, 13:22					1	
I3 – 20180716	, 14:52					1	
G3 – 20180716	, 16:18					1	
F2 – 20180716	, 17:08	↓				1	
Trip Blank – 20180716	↓ , 9:03	Lab	↓	↓	↓	1	

Analyses Requested

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Stratton Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan S Weinstein	7/17/18	2:39	Elliot Maker

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Sanborn, Head & Associates, In

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
TripBlank — 20180720	7/20/18, 9:21	Lab	G		1	
D8 — 20180720	↓ , 11:36	S	↓		1	
B8 — 20180720	, 12:51				1	
A9 — 20180720	, 13:23				1	
C9 — 20180720	, 14:40				1	
E9 — 20180720	, 15:51				1	
E7 — 20180720	↓ , 17:03	↓	↓		1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan Weinstein	7/23/18	12:37	[signature]
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

Sanborn, Head & Associates

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
TripBlank_20180731	7/31/18, 10:51	Lab	G			
FieldBlank_20180731	↓ , 13:47	Lab	↓		1	
EquipBlank_20180731	, 13:55	Lab			1	
I7_20180731	, 13:22	S			1	
K3_20180731	, 15:39	↓			2	
J4_20180731	, 16:42				1	
I5_20180731	, 17:31				1	
H4_20180731	↓ , 18:25	↓	↓		1	
					1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____°C; Ice? (Yes) No

Sampler(s): Ryan Stratton Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan S. Weinstein	8/1/18	2:30	Elliot Maker

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
Trip Blank — 20180806	8/6/18, 9:05	Lab	G		1	
L2B — 20180806	, 11:52	S			1	
L4 — 20180806	, 13:05				1	
M3 — 20180806	, 13:51				1	
N4 — 20180806	, 14:32				1	
O5 — 20180806	, 15:40				1	
M5 — 20180806	, 16:28				1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous

Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice: (Yes) No

Sampler(s): Ryan Stratton Weinstein

Relinquished By:	Date:	Time:	Received By:
[signature]	8/7/18		Elliot Omek

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
Trip Blank_20180815	8/15/18, 10:28	Lab	G			
B2_20180815	↓ , 11:39	S	↓		1	
A1_20180815	, 12:43	↓	↓		1	
A3_20180815	, 13:50	↓	↓		1	
B4_20180815	, 16:35	↓	↓		1	
C3_20180815	, 17:27	↓	↓		1	
D3_20180815	↓ , 18:08	↓	↓		1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager:	Harrison Roakes
Company:	Sanborn, Head & Associates, Inc.
Address:	187 Saint Paul Street, Suite 4-C
City:	Burlington State: VT Zip: 05401
Phone:	(603) 415-6156 Ext.:
Fax:	(603) 229-1919
E-Mail:	hroakes@sanbornhead.com
Site Name:	PFAS BACKGROUND IN VERMONT SOILS
Project #:	4357.00
State:	Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Stratton Wehstein

Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Sanborn, Head & Ass

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
TripBlank _ 20180817	8/17/18, 8:32	Lab	G			
K1 — 20180817	, 10:13	S			1	
M1 — 20180817	, 11:28				1	
N2 — 20180817	, 12:08				1	
O3 — 20180817	, 13:08				1	
L2A — 20180817	, 14:49	↓	↓		1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Stratton Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan S. Weinstein	8/17/18		Elliot [illegible]
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

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Sanborn, Head & Associates, Inc.

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Chain-of-Custody Record

Laboratory Batch ID:

Sample ID	Sampling Date/Time *If Composite, Indicate Both Start & Finish Date/Time	Matrix (see below)	Grab/*Composite	Analyses Requested	# of Containers	NOTES
Trip Blank – 20180822	8/22/18, 9:36	Lab	G			
O1 – 20180822	12:21	S			1	
Q1 – 20180822	13:32				1	
P2 – 20180822	14:24				1	
Q3 – 20180822	15:06				1	
Q5 – 20180822	16:21				1	
Trip Blank – 20180823	8/23/18, 9:41	Lab			1	
Field Blank – 20180823	10:34				1	
Equip Blank – 20180823	10:41				1	
C1 – 20180823	10:55	S			1	
E1d – 20180823	11:28				2	
D1 – 20180823	12:07				1	
F4 – 20180823	12:56				1	

Matrix: A-Air; S-Soil; GW-Ground Water; SW-Surface Water; DW-Drining Water; WW-Waste Water; AQ-Aqueous
Preservative: H-HCl; N-HNO3; S-H2SO4; Na-NaOH; M-MeOH; NSO-Na2S2O3

Project Manager: Harrison Roakes
Company: Sanborn, Head & Associates, Inc.
Address: 187 Saint Paul Street, Suite 4-C
City: Burlington State: VT Zip: 05401
Phone: (603) 415-6156 Ext.:
Fax: (603) 229-1919
E-Mail: hroakes@sanbornhead.com
Site Name: PFAS BACKGROUND IN VERMONT SOILS
Project #: 4357.00
State: Vermont

Temp. ____ °C; Ice? (Yes) No

Sampler(s): Ryan Stratton Weinstein

Relinquished By:	Date:	Time:	Received By:
Ryan S. Weinstein	8/24/18		
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

Notes: (e.g., Special Detection Limits, Sample Abnormalities)

Page 1 of 1

Sanborn, Head & Associates, Inc.

ATTACHMENT 8

Notification to Abutters
Certified Abutters List

Notification to Abutters

By Hand Delivery, Certified Mail (return receipt requested), or Certificates of Mailing

In accordance with the Site Plan Regulations, you are hereby notified of the following:

A. A Site Plan Review Application was filed with the Hamilton Planning Board seeking permission for the installation of a new synthetic turf softball field, football field and baseball field with associated drainage system, four bituminous concrete tennis courts with associated drainage system, bituminous concrete track reconstruction, grandstand installation, amenities building construction, relocation of track & field events, and associated site improvements.

B. The name of the applicant is:

   Hamilton-Wenham Regional School District

C. The address of the land where the activity is proposed is:

   775 Bay Road, Hamilton, MA
   Parcel ID: 40-11

D. Copies of the Site Plan Review Application may be examined at the office of the Hamilton Planning Board, located at the Town of Hamilton Town Hall at 577 Bay Road, Hamilton, MA. The regular business hours of the Planning Board are Monday, Wednesday and Thursday from 8:00 AM – 4:30 PM, and Tuesdays from 8:00 AM – 6:30 PM. The Planning Board may be reached at (978) 626-5250.

E. Copies of the Site Plan Review Application may be obtained from the applicant or their representative, Gale Associates, Inc. by calling Kathy Hervol, Gale Associates, Inc at (781) 335-6465. An administrative fee may be applied for providing copies of the application and plans.

F. Information regarding the date, time, and location of the public hearing regarding the Site Plan Review Application may be obtained from the Hamilton Planning Board. Notice of the public hearing will be published at least five business days in advance, in the Salem News.

October 24, 2023 **MAP 40 LOT 11**

TOWN OF HAMILTON
Planning Board
CERTIFICATE OF PARTIES IN INTEREST

Pursuant to Massachusetts General Laws, Chapter 40A, Section 11, the undersigned Assessor of the Town of Hamilton, hereby certifies that the names and addresses appearing on the list appended hereto are those of the:

(a) abutters 100’

(b) owners of land directly opposite on any public or private street or way

X **(c)** owners of land within 300’ of the property line of the property at:

775 Bay Road

So. Hamilton

Dated ***October 24, 2023***

Prepared by Assessor's Office of the Town of Hamilton.

Jane Dooley

Assistant Assessor

300 feet Abutters List Report

Hamilton, MA
October 24, 2023

Subject Property:

Parcel Number:	40-0011	Mailing Address:	HAMILTON-WENHAM REGIONAL HIGH SCHOOL 775 BAY RD HAMILTON, MA 01936
CAMA Number:	40-000-0011		
Property Address:	775 BAY RD		

Abutters:

Parcel Number:	31-0001	Mailing Address:	MURRAY CORNELIUS J 3RD JANE PO BOX 207 HAMILTON, MA 01936
CAMA Number:	31-000-0001		
Property Address:	799 BAY RD		
Parcel Number:	31-0017	Mailing Address:	TOSH MATTHEW F & AUBREY 792 BAY RD SOUTH HAMILTON, MA 01982
CAMA Number:	31-000-0017		
Property Address:	792 BAY RD		
Parcel Number:	31-0032	Mailing Address:	CASSIDY MICHAEL TRAIN ELIZABETH 786 BAY RD SOUTH HAMILTON, MA 01982
CAMA Number:	31-000-0032		
Property Address:	786 BAY RD		
Parcel Number:	31-0034	Mailing Address:	COLLINS JOHN J 810 BAY RD SOUTH HAMILTON, MA 01982
CAMA Number:	31-000-0034		
Property Address:	810 BAY RD		
Parcel Number:	31-0050	Mailing Address:	OSHEA CHRISTINE ETAL 780 BAY RD SOUTH HAMILTON, MA 01982
CAMA Number:	31-000-0050		
Property Address:	780 BAY RD		
Parcel Number:	31-0054	Mailing Address:	CASS DONALD J & REBECCA L 776 BAY RD SOUTH HAMILTON, MA 01982
CAMA Number:	31-000-0054		
Property Address:	776 BAY RD		
Parcel Number:	32-0016	Mailing Address:	CLARK MARGUERITE T S/O CLARK MARGUERITE T TRUSTEE PO BOX 149 HAMILTON, MA 01936
CAMA Number:	32-000-0016		
Property Address:	823 BAY RD		
Parcel Number:	32-0020	Mailing Address:	CLARK MARGUERITE T TRUSTEE MARGUERITE T CLARK 1990 REVOCA 823 BAY ROAD SOUTH HAMILTON, MA 01982
CAMA Number:	32-000-0020		
Property Address:	0 BAY RD (OFF)		
Parcel Number:	32-0021	Mailing Address:	GERO ANNE L. 821 BAY RD HAMILTON, MA 01982
CAMA Number:	32-000-0021		
Property Address:	821 BAY RD		
Parcel Number:	32-0022	Mailing Address:	CLARK MARGUERITE T S/O CLARK MARGUERITE T TRUSTEE PO BOX 149 HAMILTON, MA 01936
CAMA Number:	32-000-0022		
Property Address:	0 BAY RD (OFF)		

Data shown on this report is for informational purposes only. The Town of Hamilton and CAI Technologies are not responsible for any use for other purposes or misuse or misrepresentation of this report. The Town of Hamilton makes no warranties with regard to the report's accuracy or completeness and assumes no liability associated with use of the data.

300 feet Abutters List Report

Hamilton, MA
October 24, 2023

Parcel Number:	40-0008	Mailing Address:	PAPPAS JOHN C & LESLIE F
CAMA Number:	40-000-0008		728 BAY RD
Property Address:	728 BAY RD		SOUTH HAMILTON, MA 01982
Parcel Number:	40-0009	Mailing Address:	WOLCOTT JEAN S TR JEAN S
CAMA Number:	40-000-0009		WOLCOTT TRUST
Property Address:	746 BAY RD		PO BOX 476
			HAMILTON, MA 01936
Parcel Number:	40-0010	Mailing Address:	TRUJILLO LEDA
CAMA Number:	40-000-0010		756 BAY RD
Property Address:	756 BAY RD		SOUTH HAMILTON, MA 01982
Parcel Number:	40-0012	Mailing Address:	743 BAY ROAD REALTY TRUST ST.
CAMA Number:	40-000-0012		PIERRE ANDREW F.
Property Address:	743 BAY RD		743 BAY RD
			SOUTH HAMILTON, MA 01982
Parcel Number:	40-0013	Mailing Address:	SHIELDS WILLIAM M HARRIET H
CAMA Number:	40-000-0013		PO BOX 480
Property Address:	721 BAY RD		HAMILTON, MA 01936
Parcel Number:	40-0054	Mailing Address:	KROHG OLAF
CAMA Number:	40-000-0054		1 LONGMEADOW WAY
Property Address:	1 LONGMEADOW WAY		SOUTH HAMILTON, MA 01982
Parcel Number:	40-0055	Mailing Address:	MILLER J KURT PO BOX 313
CAMA Number:	40-000-0055		5 LONGMEADOW WY
Property Address:	0 LONGMEADOW WAY		HAMILTON, MA 01936
Parcel Number:	41-0001	Mailing Address:	HAMILTON WENHAM REGIONAL HIGH
CAMA Number:	41-000-0001		775 BAY RD
Property Address:	775 BAY RD		HAMILTON, MA 01936
Parcel Number:	41-0007	Mailing Address:	BELLOFATTO RALPH & LINDA
CAMA Number:	41-000-0007		100 ORTINS RD
Property Address:	100 ORTINS RD		SOUTH HAMILTON, MA 01982
Parcel Number:	41-0008	Mailing Address:	SCOTT JOHN R JR TRUSTEE SCOTT
CAMA Number:	41-000-0008		CHRISTINE V TRUSTEE
Property Address:	92 ORTINS RD		PO BOX 152
			HAMILTON, MA 01936
Parcel Number:	41-0009	Mailing Address:	WALKER KATHERINE
CAMA Number:	41-000-0009		82 ORTINS RD
Property Address:	82 ORTINS RD		S HAMILTON, MA 01982
Parcel Number:	41-0010	Mailing Address:	COHEN ALEX & ANNA DIDIO
CAMA Number:	41-000-0010		72 ORTINS RD
Property Address:	72 ORTINS RD		SOUTH HAMILTON, MA 01982

300 feet Abutters List Report

Hamilton, MA
October 24, 2023

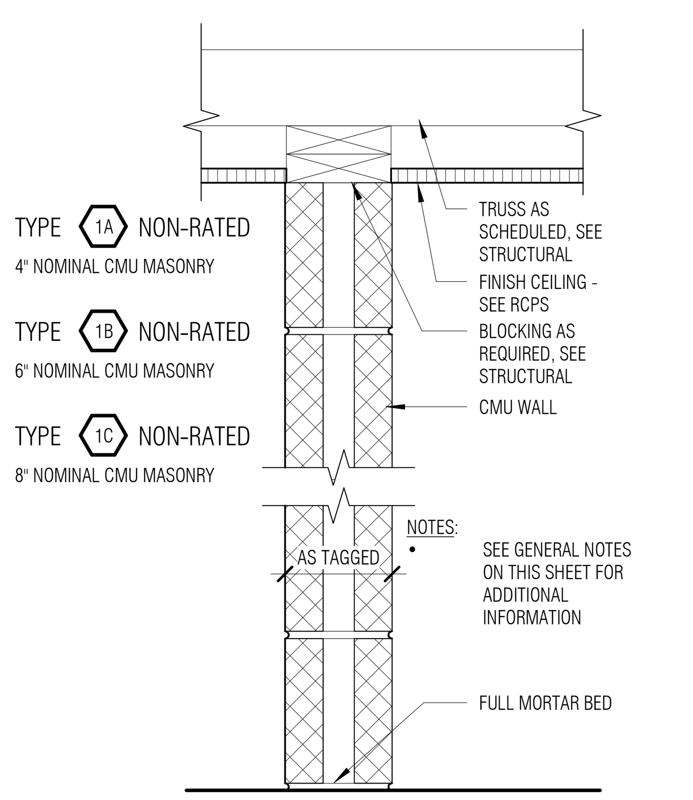
Parcel Number:	41-0012	Mailing Address:	RODIO CAROLYN
CAMA Number:	41-000-0012		10 GAP HEAD ROAD
Property Address:	3 LONGMEADOW WAY		ROCKPORT, MA 01966
Parcel Number:	41-0013	Mailing Address:	MILLER J KURT
CAMA Number:	41-000-0013		PO BOX 313
Property Address:	5 LONGMEADOW WAY		HAMILTON, MA 01936
Parcel Number:	41-0014	Mailing Address:	195 MOULTON STREET LLC
CAMA Number:	41-000-0014		197 MOULTON ST
Property Address:	195 MOULTON ST		SOUTH HAMILTON, MA 01982
Parcel Number:	41-0017	Mailing Address:	ESSEX COUNTY GREENBELT ASSOC
CAMA Number:	41-000-0017		82 EASTERN AVE
Property Address:	675 REAR BAY RD		ESSEX, MA 01929

ATTACHMENT 9

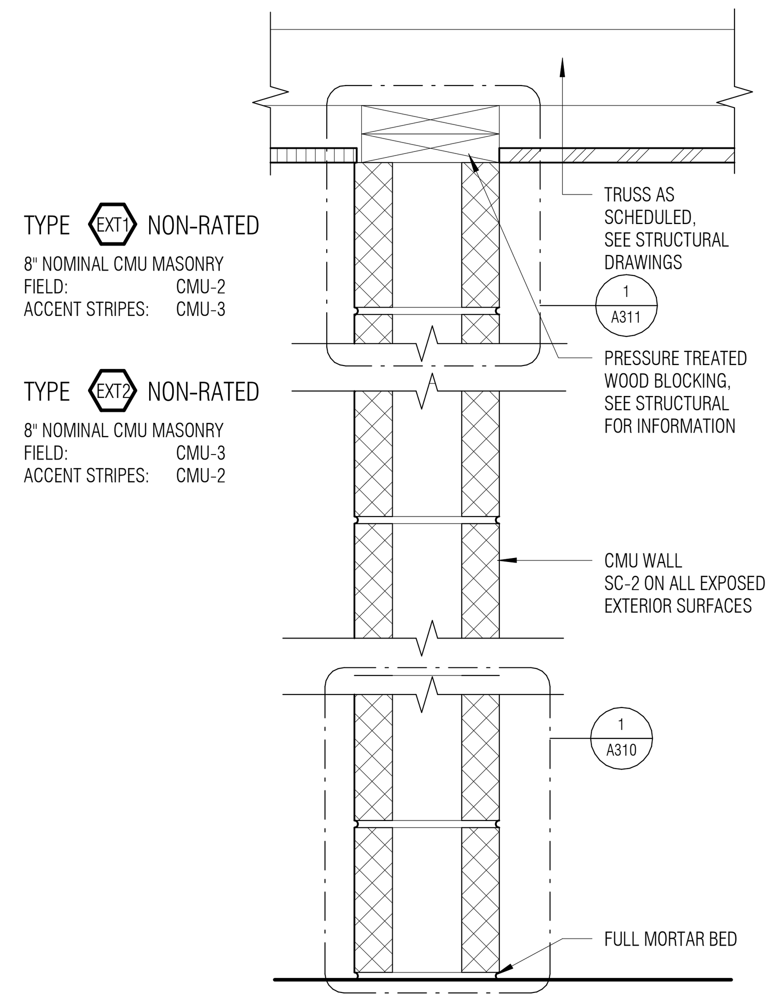
Permit Plan Set – HWRHS Athletic Campus Improvements (11/16/2023)

ATTACHMENT 10

Architectural Plan Set – Schematic Elevations and Renderings (11/7/2023)



3 PARTITION TYPE 1
SCALE: 1 1/2" = 1'-0"



2 PARTITION TYPE EXT
SCALE: 1 1/2" = 1'-0"

PLAN LEGEND:

NEW CMU PARTITION

NEW PARTITION

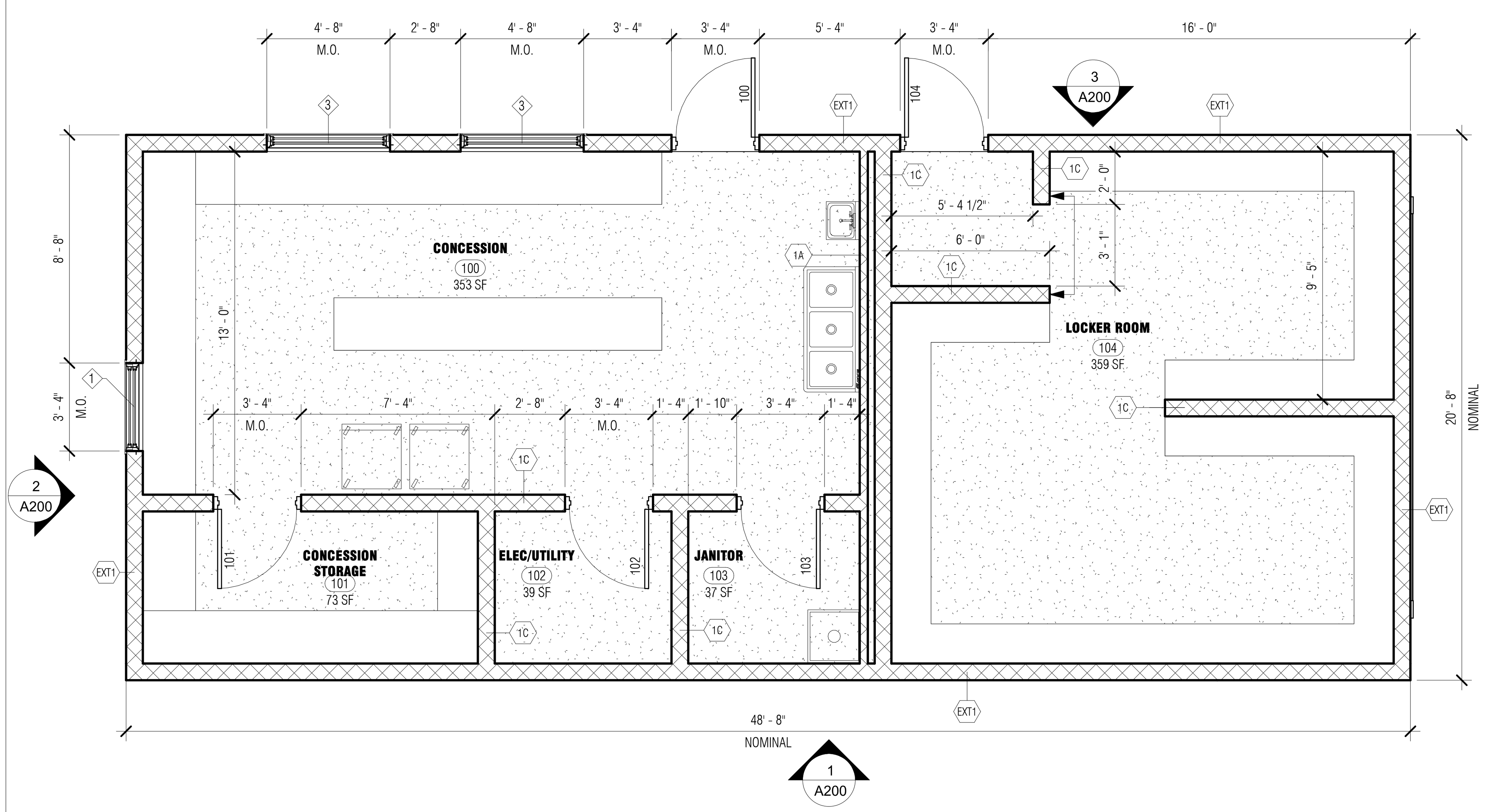
KEYED FLOOR PLAN NOTES:

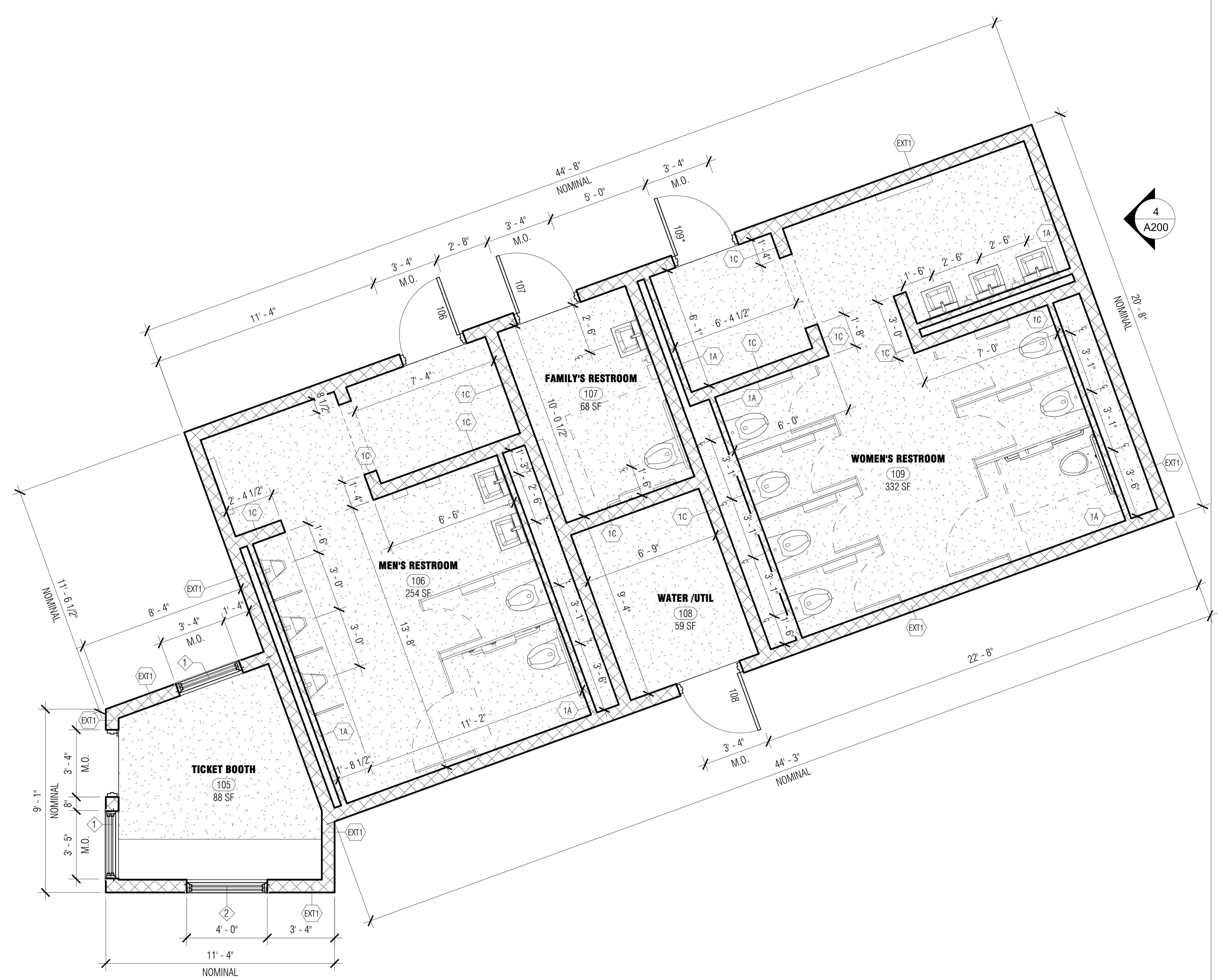
1. ADD KEYED FLOOR PLAN NOTES HERE
2. ADD KEYED FLOOR PLAN NOTES HERE
3. ADD KEYED FLOOR PLAN NOTES HERE
4. ADD KEYED FLOOR PLAN NOTES HERE
5. ADD KEYED FLOOR PLAN NOTES HERE

GENERAL PLAN NOTES:

A. REFER TO PROJECT GENERAL NOTES FOR GENERAL REQUIREMENTS, WORKMANSHIP, MATERIALS, AND SHOP DRAWING REQUIREMENTS INCLUDED IN THIS CONTRACT.
B. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL EXISTING CONDITIONS FOR COORDINATION WITH WORK TO BE EXECUTED. PRIOR TO COMMENCING CONSTRUCTION, ARCHITECT AND OWNER MUST BE NOTIFIED OF DISCREPANCIES IMMEDIATELY.
C. FLOOR TO BE LEVEL, MAINTAINING A TOP SURFACE LEVEL OF 1/8 INCH SLOPE IN TEN FEET. THE CONTRACTOR SHALL PROVIDE SELF LEVELING UNDERLAYMENT WHERE REQUIRED AND INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, SEE SPECIFICATIONS.
D. THE ARCHITECT SHALL REVIEW AND APPROVE PARTITION LAYOUT PRIOR TO PROCEEDING.
E. ALL CUTS AND PENETRATIONS SHALL BE FINISHED AND FIRESTOPPED WHERE REQUIRED. ALL FIRE RATED SYSTEMS TO BE MAINTAINED.
F. THE CONTRACTOR SHALL PROVIDE FIRE-RETARDANT TREATED WOOD BLOCKING FOR ATTACHMENT OF ALL DRAPERY TRACK, MILLWORK, EQUIPMENT, MIRRORS, WOOD BASE, ACCESSORIES, ETC., AS REQUIRED. COORDINATE QUANTITY AND LOCATION WITH ARCHITECT IF THERE IS A DISCREPANCY.
G. ALL EXISTING WALLS, SURFACES, AND MATERIALS TO REMAIN ARE TO BE PROTECTED DURING CONSTRUCTION. THE CONTRACTOR SHALL PATCH AND REPAIR ALL EXISTING WORK DAMAGED OR AFFECTED BY WORK IN THE SCOPE. ALL WORK TO BE IN "AS NEW" CONDITION AT THE END OF CONSTRUCTION.
H. G.C. TO CORE AND COORDINATE ALL FLOOR PENETRATIONS FOR WATER RISERS, GAS RISERS, NETWORK CLOSET, ETC.
I. COORDINATE WITH ARCHITECT THE LOCATION OF ALL ACCESS PANELS PRIOR TO INSTALLATION
J. HINGE SIDE OF DOOR FRAME SHALL BE OFFSET FROM ADJACENT WALL 4" U.O.N.
K. SEE STRUCTURAL, MEP/FP, LIGHTING, AND ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
L. PATCH AND REPAIR AS REQUIRED ALL FLOOR SURFACES PRIOR TO INSTALLATION OF SCHEDULED FLOORING MATERIALS.
M. SEE SHEET A602 FOR DOOR AND HARDWARE SCHEDULE.
N. ALL WORK TO BE NEW UNLESS OTHERWISE NOTED.
O. AT NEW SHAFT PENETRATIONS MAINTAIN FIRE RATING CONSISTENT WITH BASE BUILDING.
P. SEE SHEET A601 FOR FINISH SCHEDULE.
Q. ALL WALL TO BE TYPE 0A3 UNLESS OTHERWISE NOTED
R. METAL FRAMING TO BE ENGINEERED BY G.C. ADD KICKERS AS NECESSARY FOR WALLS TO MEET L/240 AT 5LBS PER SQ FT.
S. ALL REVEALS TO BE 1/4" ALUMINUM, UNLESS OTHERWISE NOTED.
T. ALL WALLS TO BE PAINTED PT-2, UNLESS OTHERWISE NOTED.
U. ALL PAINTED WALLS ARE TO BE PAINTED WITH 100% ACRYLIC INTERIOR ENAMEL IN EGGSHELL FINISH.
V. ALL PAINTED DOORS AND FRAMES ARE TO BE PAINTED WITH 100% ACRYLIC INTERIOR ENAMEL IN SEMI-GLOSS FINISH.
W. ALL PAINTED SOFFITS AND CEILINGS TO BE PAINTED WITH 100% ACRYLIC INTERIOR ENAMEL IN FLAT FINISH.
X. ALL WALL COVERINGS ARE TO BE INSTALLED FROM TOP OF NEW BASE TO BOTTOM OF CEILING U.O.N.
Y. ALL JOINTS AND PENETRATIONS OF FIRE RATED ASSEMBLIES TO BE SEALED WITH APPROVED U.L. LISTED "P" AND "T" SYSTEMS, SUBMIT PRODUCT DATA AND INSTALLATION INFORMATION PRIOR TO INSTALLATION FOR ARCHITECT'S APPROVAL.
Z. DIMENSIONS ARE TAKEN FROM FACE OF MASONRY WALLS, COLUMN CENTERLINES, FINISH FACE OR EXISTING WALLS, AND FINISH FACE OF NEW WALLS UNLESS OTHERWISE INDICATED. NOTIFY ARCHITECT OF ANY DISCREPANCIES.
AA. VERIFY ALL CRITICAL DIMENSIONS WITHIN AND/ OR RELATED TP THE EXISTING BUILDING, DIMENSIONS AND CONDITIONS INDICATED WERE DETERMINED BY VISUAL SURVEY AND/OR INFORMATION FROM EXISTING DRAWINGS.
BB. +/- DIMENSIONS IS EQUAL TO VERIFY IN FIELD
CC. ALL EXISTING WALLS, FLOORS, AND CEILINGS SHALL BE FINISHED/ REPAIRED SMOOTH TO BE SUITABLE TO RECEIVE NEW FINISHES AS DESCRIBED ON ROOM SCHEDULE/ LEGEND.
DD. ALL EXISTING AND NEW SURFACES TO BE PREPARED FOR FINISHED PER MANUFACTURERS RECOMMENDED INSTRUCTIONS.
EE. PLANS ARE NOT TO BE SCALED FOR FINISH OR WALL INFORMATION.
FF. WALL BEHIND AND DIRECTLY ADJACENT TO ALL TOILET ROOM FIXTURES (LAVATORIES, TOILETS, AND URINALS) SHALL HAVE A SMOOTH, HARD NON ABSORBENT SURFACE. TOILET ROOM ACCESSORIES (GRAB BARS, TOILET PAPER DISPENSERS, ETC.) IN THESE AREAS SHALL BE INSTALLED AND SEALED TO PREVENT MOISTURE PENETRATION.

PROJECT NOTES	
KEY VALUE	KEYNOTE TEXT





1 GROUND LEVEL FLOOR PLAN
SCALE: 1/4" = 1'-0"

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150 Wood Road, Suite 1000
Braintree, Massachusetts 02184
781.848.8804
www.s3design-inc.com
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Project Status

Revision Schedule

Revision Number	Revision Description	Revision Date

Consultants:

Stamp & Signature:

Printed Name: Salvatore J. Canciello
Reg. No.: FL Reg. No. 96288

Project Title:

HAMILTON-WENHAM REGIONAL HIGH SCHOOL

775 Bay Road S.
Hamilton, MA 01982

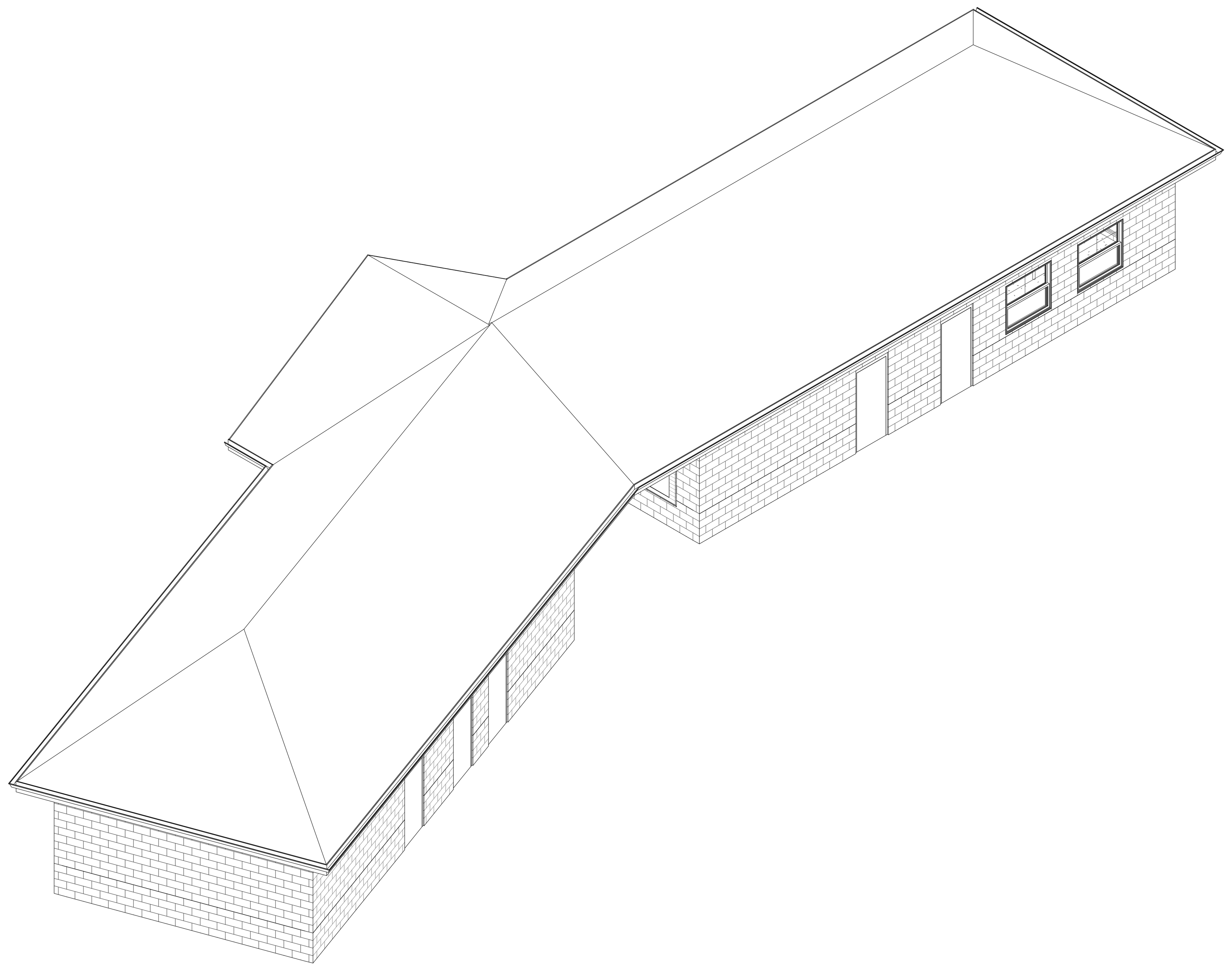
Drawing Title:

GROUND FLOOR PLAN

Project No:	Project Number	Scale:	As indicated
Drawn By:	Author		
Checked By:	Checker		
Approved By:	Approver		
Date:	11/07/2023		

Drawing No:

A101



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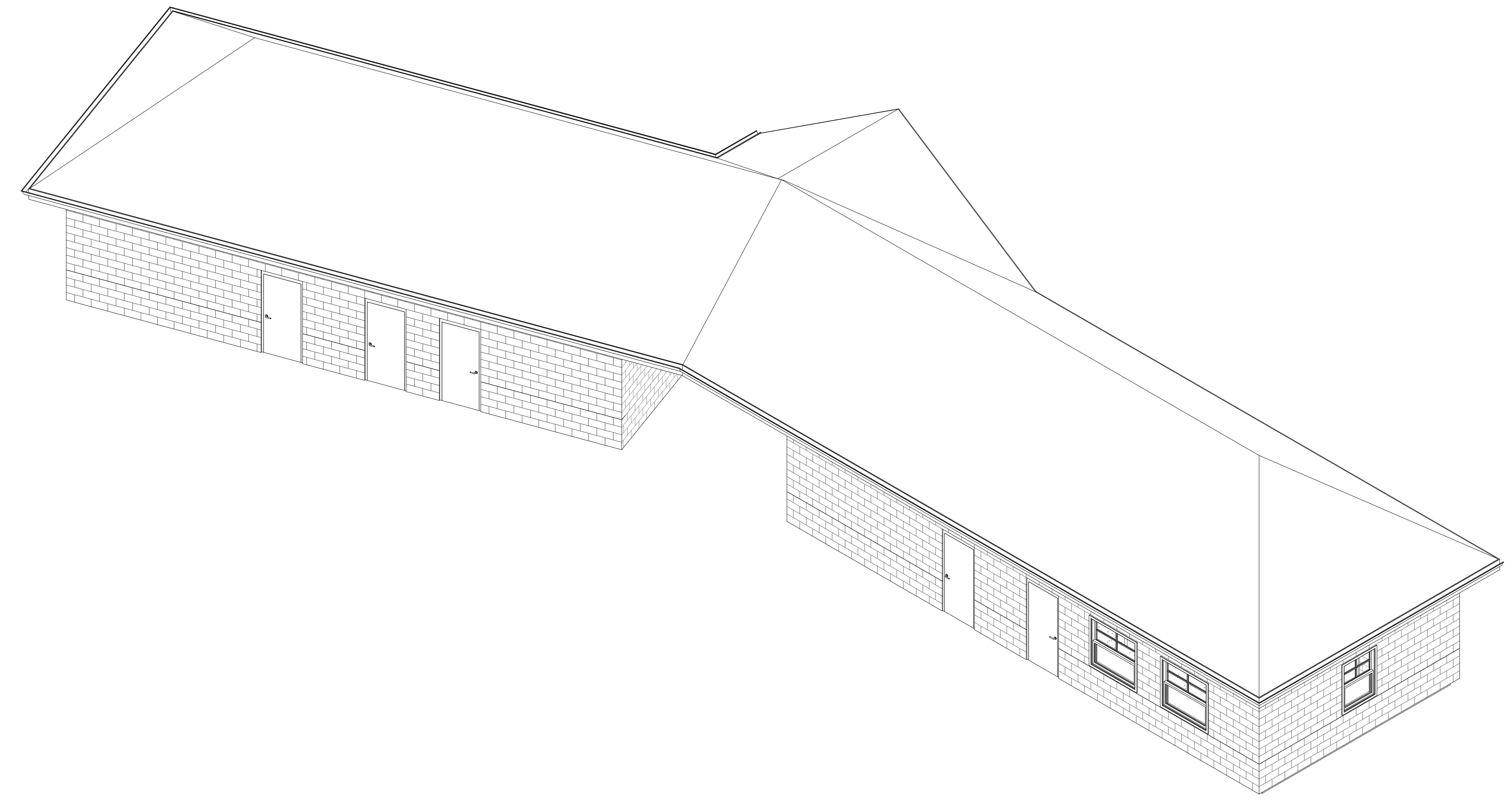

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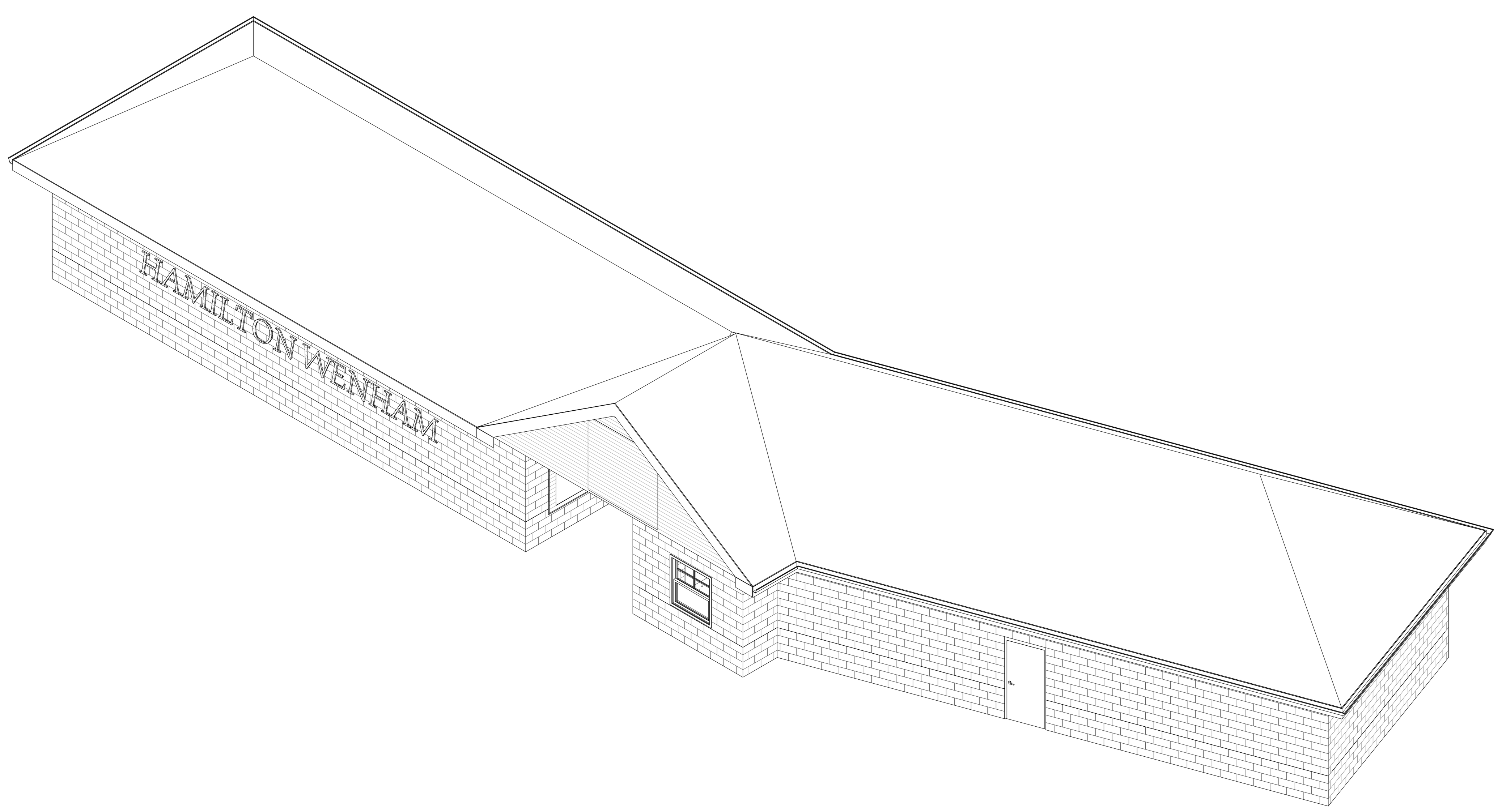

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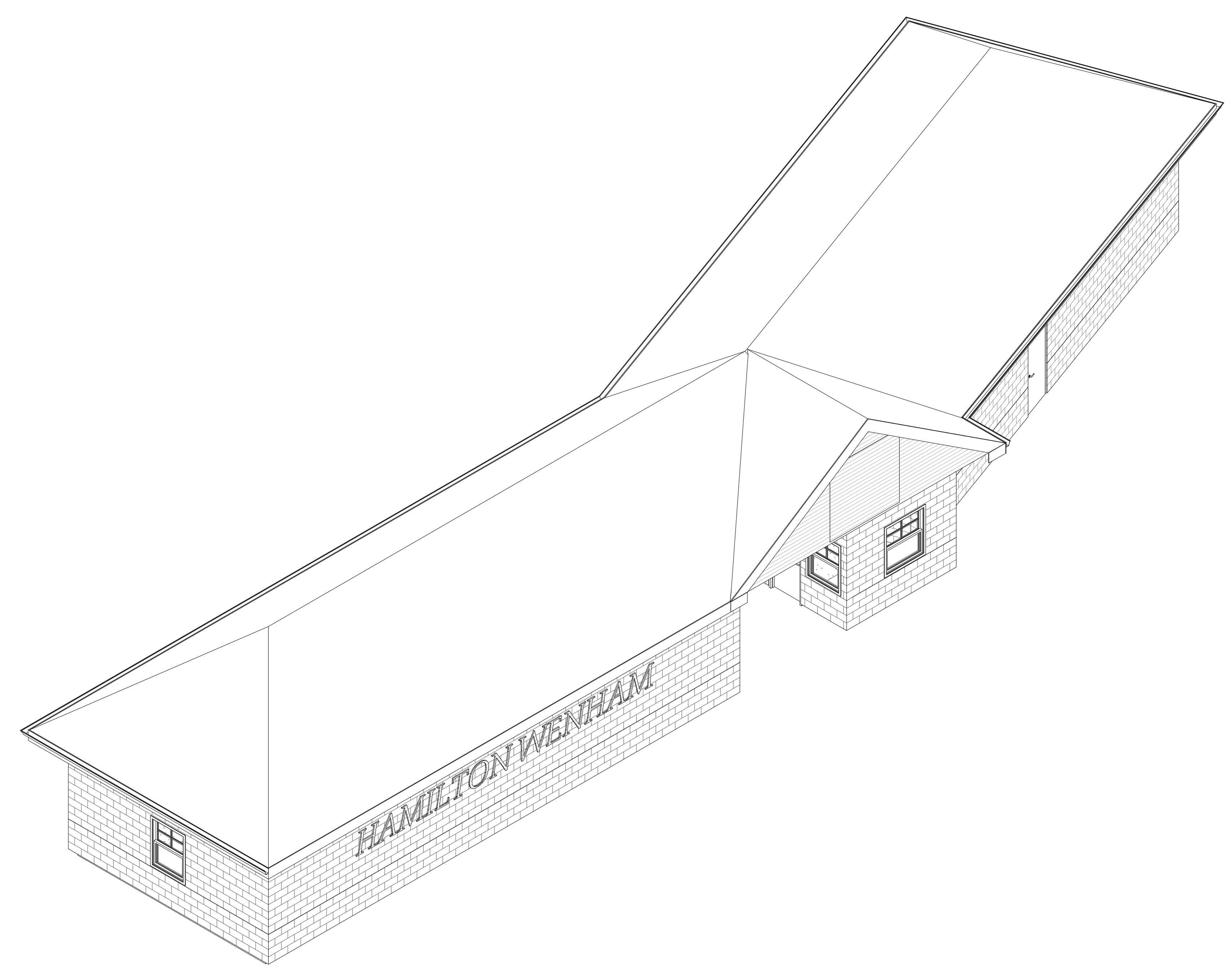

1 SOUTHWEST

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Project Status

Revision Schedule

Revision Number	Revision Description	Revision Date

Consultants:

Stamp & Signature:

Printed Name Salvatore J. Canciello
Reg. No. FL Reg. No. 96288

Project Title:

HAMILTON-WENHAM
REGIONAL HIGH SCHOOL

775 Bay Road S.
Hamilton, MA 01982

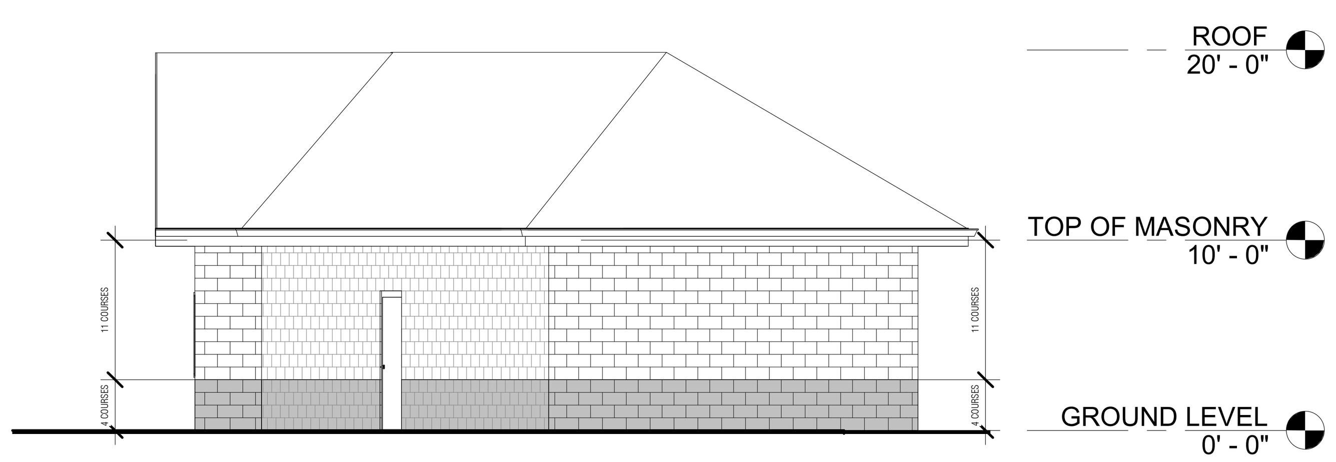
Drawing Title:

AXON VIEWS

Project No: Project Number Scale:
Drawn By: Author
Checked By: Checker
Approved By: Approver
Date: 11/07/2023

Drawing No:

A103



4 EAST ELEVATION
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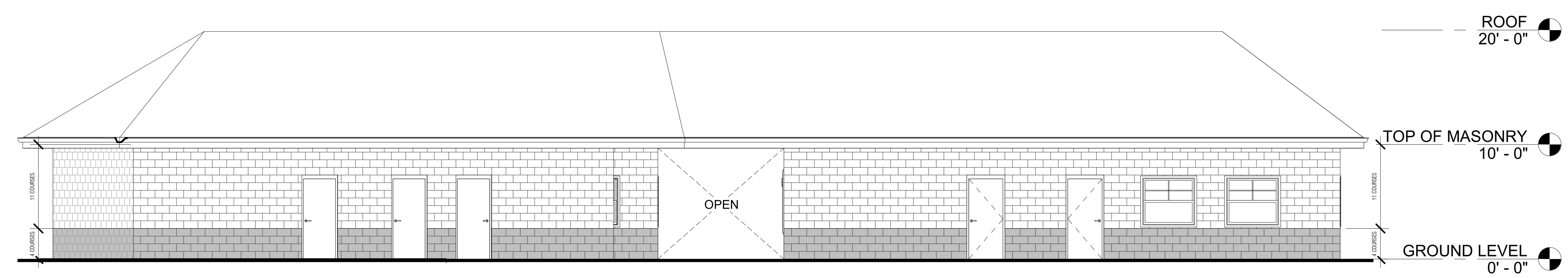

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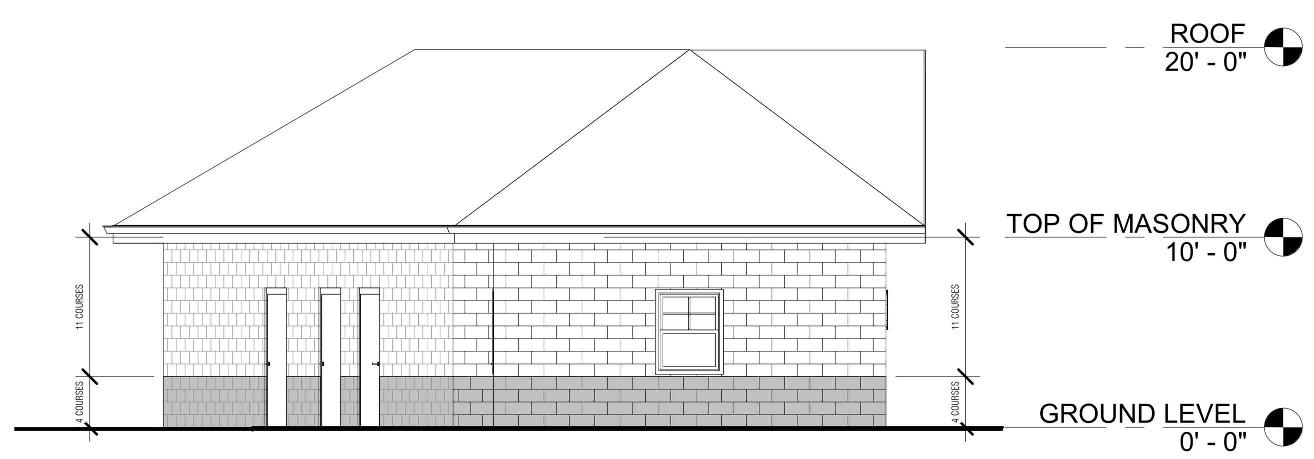

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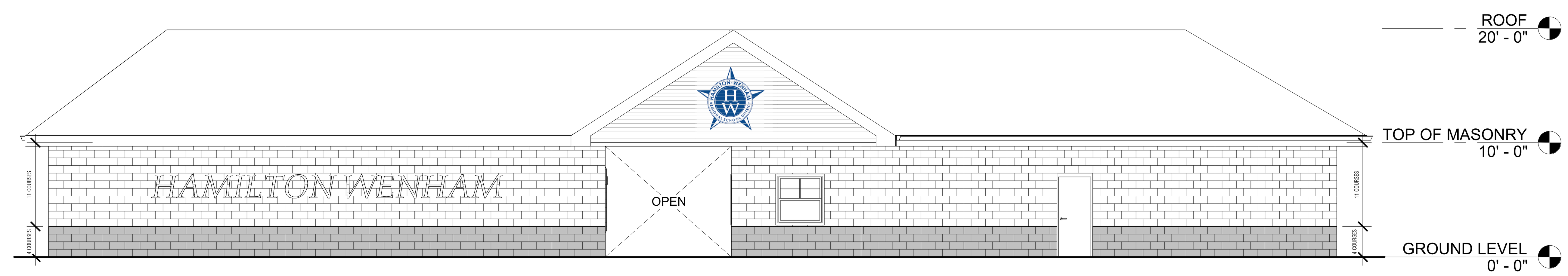

1 NORTH ELEVATION
SCALE: 1/8" = 1'-0"

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Project Status

Revision Schedule

Revision Number	Revision Description	Revision Date

Consultants:

Stamp & Signature:

Printed Name Salvatore J. Canciello
Reg. No. FL Reg. No. 96288

Project Title:

HAMILTON-WENHAM REGIONAL HIGH SCHOOL

775 Bay Road S.
Hamilton, MA 01982

Drawing Title:

EXTERIOR ELEVATIONS

Project No: Project Number
Scale: 1/8" = 1'-0"
Drawn By: Author
Checked By: Checker
Approved By: Approver
Date: 11/07/2023

Drawing No:

A200

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