

February 17, 2022

Boston Conservation Commission
c/o Nicholas Moreno, Executive Director
1 City Hall Square, Room 709
Boston, Massachusetts 02201

Via: FedEx and Email to cc@boston.gov

Reference: Supplemental Information and Response to Comments
DEP File No. 006-1846
Suffolk Downs Redevelopment:
Outdoor Entertainment Venue
William F. McClellan Highway
Boston, Massachusetts
B+T Project No. 2854.18

Dear Commissioners:

On behalf of the Applicant, The McClellan Highway Development Company, LLC (“Applicant”), Beals and Thomas, Inc (B+T) respectfully submits this supplemental information regarding the creation of an interim outdoor entertainment venue, associated infrastructure, and other related site improvements, to be located in the future Central Common of the Suffolk Downs Redevelopment Project. Additionally, a response to comments provided by the Executive Director via email on February 7, 2022, as well as verbal comments made by the Commission at the February 2, 2022 hearing, is provided below.

Design Updates

The enclosed plans and stormwater management report have been revised based upon comments provided by the Commission at the February 2, 2022 hearing. The design revisions include the following:

- The proposed outdoor entertainment venue has been reduced in size and relocated entirely outside of the Area of Critical Environmental Concern (ACEC) and 100-foot buffer zone to Sales Creek as depicted on Sheets C3.0 – C3.1.
- The bioretention area has been redesigned to treat runoff from the 100-year storm event (the 8.78-inch storm event) as documented in Attachment 2.
- A stone diaphragm is proposed along the northern edge of the gravel access drive to encourage sheet flow across the vegetated area prior to entering Sales Creek as depicted on Sheet 5.0.

- A detail depicting a cross-section of the proposed soil profile has been added to Sheet C7.0 and the soil specification is provided as Attachment 3.
- The limits of work for both the Venue Project and the Central Common Project are depicted separately on Sheets C3.0 – C3.1 and Sheets C8.0 – C8.1.

As requested by the Commission, the impacts associated with the revised Venue Project and the previously-approved Central Common Project are as follows:

| | LSCSF | RFA | Waterfront Area | ACEC |
|-------------------------------------|-------------|---------|-----------------|------------|
| Central Common Project ¹ | 173,400± sf | 361± sf | 14,298± sf | 71,942± sf |
| Venue Project ² | 214,784± sf | 0 sf | 0 sf | 0 sf |

¹ Previously approved through Order of Conditions, MassDEP File No. 006-1721

² Portions of the impacts associated with the Venue Project are located within the footprint of the Central Common Project and are not additive

Response to Comments

For clarity of the Administrative Record, comments are provided in *italics* below, followed by our current response in **bold** detailing how the comment has been addressed.

Executive Director provided Comments

Comment: Distance of closest proximity that work will be to Inland Bank and BVW

Response: The Venue Project limit of work is located approximately 42± lf from Inland Bank associated with the Horseshoe Pond and 100± lf from BVW associated with Sales Creek at its closest point.

Comment: Distance of erosion control barrier and limit of work that was previously approved

Response: The previously-approved Central Common Project limit of work is located approximately 5± lf from Inland Bank proximate to existing culverts associated with Sales Creek at its closest point, with a typical distance of 26± lf parallel to Sales Creek. The limit of work is located approximately 3± lf from BVW associated with Sales Creek at its closest point. Refer to Sheets C8.0 – C8.1.

Comment: More details on the amount and type of fertilizer use anticipated (formal O&M Plan may be needed)

Response: Please refer to the Landscape Maintenance Specification enclosed as Attachment 4.

Comment: More details on event operations (set up, break down) and how that will affect the proximate area (formal O&M Plan may be needed)

Response: Please refer to the Operation and Maintenance Plan enclosed as Attachment 5.

Comment: More details on the venue decommissioning and resumption of the regrading work

The intent of the Venue Project is to serve as an interim use of the Central Common associated with the Master Plan as approved by the Boston Planning and Development Agency. This interim use will bring people back to Suffolk Downs and make the interior of the site's open space more accessible to the community. The Master Plan of the Suffolk Downs Redevelopment Project is to transform the Master Plan Property from a previously disturbed and underutilized property, isolated from surrounding neighborhoods, into a dynamic mixed-use neighborhood with associated infrastructure and improvements, including a network of publicly accessible open spaces.

Upon reestablishment of connections to the community and as the redevelopment of the Suffolk Downs Master Plan project moves forward, the Applicant will transition the site from an outdoor entertainment venue to the previously approved Central Common open space, as contemplated in the Master Plan. This transition includes removal of the gravel and impervious areas that supported the Venue and replacement with loam and seed, the removal of the installed Venue infrastructure, and regrading the limited portions of the Venue area where the grade was adjusted for this interim use.

Comment: Plans that show a revised limit of work for the temporary venue and separate plans that show the limit of work for the subsequent grading

Response: The limits of work for both the Venue Project and the Central Common Project are depicted separately on Sheets C3.0 – C3.1 and Sheets C8.0 – C8.1.

Comments from February 2, 2022 Public Hearing

In addition to the written comments provided by the Executive Director, the Commission provided the following general comments at the hearing on February 2, 2022:

Comment: Work within the ACEC associated with the outdoor entertainment venue is a more impactful use than what was previously approved through the Central Common Project.

Response: The design has been revised to relocate the proposed outdoor entertainment venue and associated access drive outside of the ACEC as shown on Sheets C3.0 – C3.1.

Comment: Confirm the design storm for the proposed stormwater management system

Response: The bioretention area has been redesigned to treat runoff from the 100-year storm (the 8.78-inch storm event) as documented in Attachment 2.

As required, enclosed are two copies of revised materials. Submission package. A digital copy of this filing has been forwarded to your office via e-mail as required.

Should you have any questions regarding this matter or require additional information, please do not hesitate to contact us at (508) 366-0560. We thank you for your consideration of this NOI and look forward to meeting again with the Commission at the March 2, 2022 public hearing.

Very truly yours,

BEALS AND THOMAS, INC.



Jeffrey A. Heidelberg, PE
Manager, Urban Development


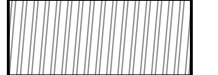

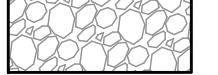

Enclosures: Attachment 1: Plans
Attachment 2: Stormwater Management Report
Attachment 3: Soil Specification
Attachment 4: Landscape Maintenance Outline
Attachment 5: Operations and Maintenance Plan

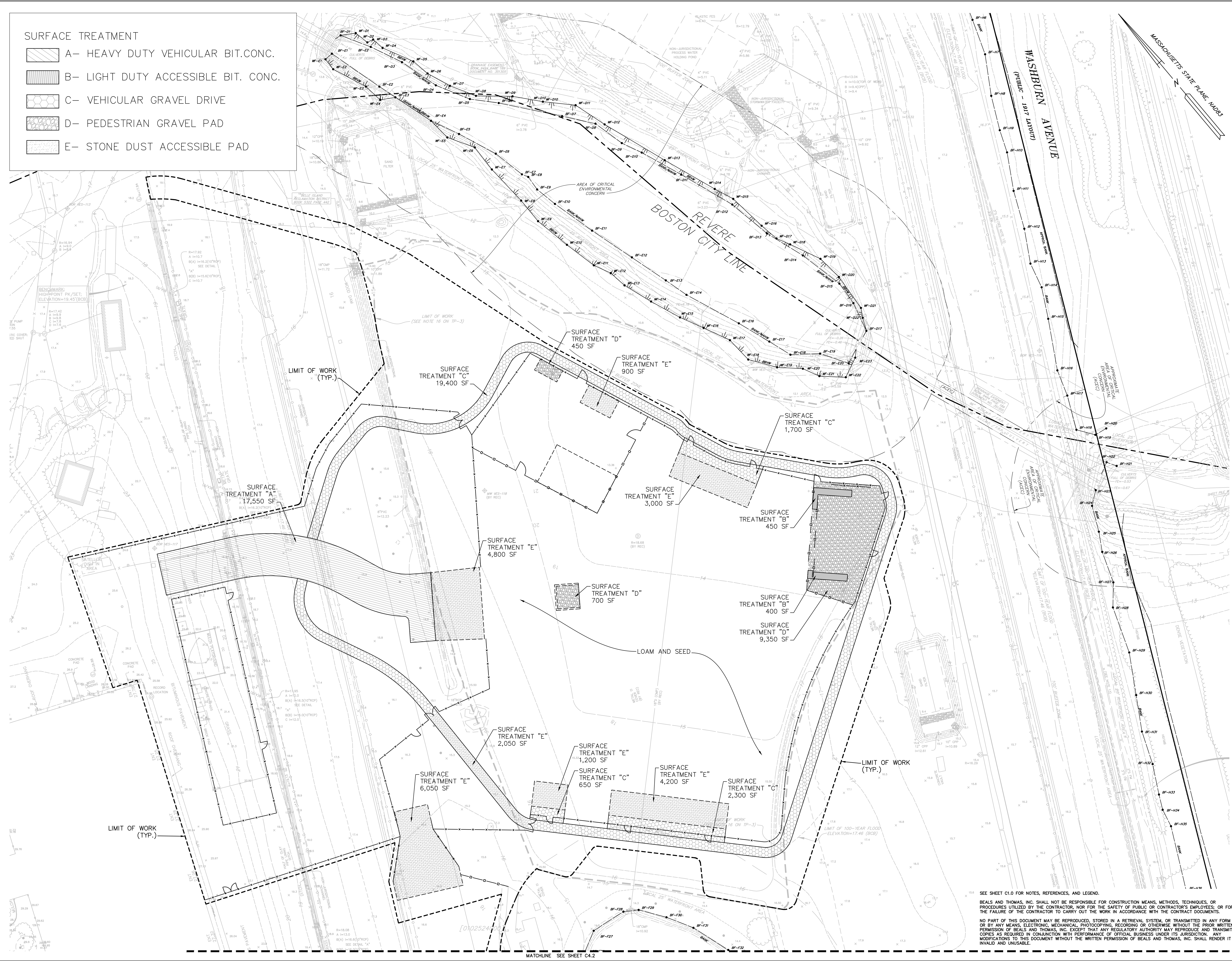
Boston Conservation Commission
c/o Nicholas Moreno, Executive Director
February 17, 2022
Page 5

cc: MassDEP Northeast Regional Office (1 copy via Certified Mail and Email)
Revere Conservation Commission (1 copy via Certified Mail)
Douglas Manz, The McClellan Highway Development Company, LLC, c/o the HYM
Investment Group, LLC (via Email)
Michael Barowsky, The McClellan Highway Development Company, LLC, c/o the HYM
Investment Group, LLC (via Email)
Leo Rusk, The McClellan Highway Development Company, LLC, c/o The HYM Investment
Group, LLC (via Email)

MKS/JAH/mac/285418LT002

SURFACE TREATMENT

-  A- HEAVY DUTY VEHICULAR BIT.CONC.
-  B- LIGHT DUTY ACCESSIBLE BIT. CONC.
-  C- VEHICULAR GRAVEL DRIVE
-  D- PEDESTRIAN GRAVEL PAD
-  E- STONE DUST ACCESSIBLE PAD



PREPARED FOR:

The McClellan Highway Department Company, LLC
 c/o the HYM Investment Group, LLC

ONE CONGRESS STREET
 BOSTON, MASSACHUSETTS

LOCUS MAP
 NOT TO SCALE

NOT ISSUED FOR CONSTRUCTION

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PROJECT:

SUFFOLK DOWNS OUTDOOR ENTERTAINMENT VENUE

BOSTON, MASSACHUSETTS

SCALE: 1" = 40' DATE: JANUARY 19, 2021

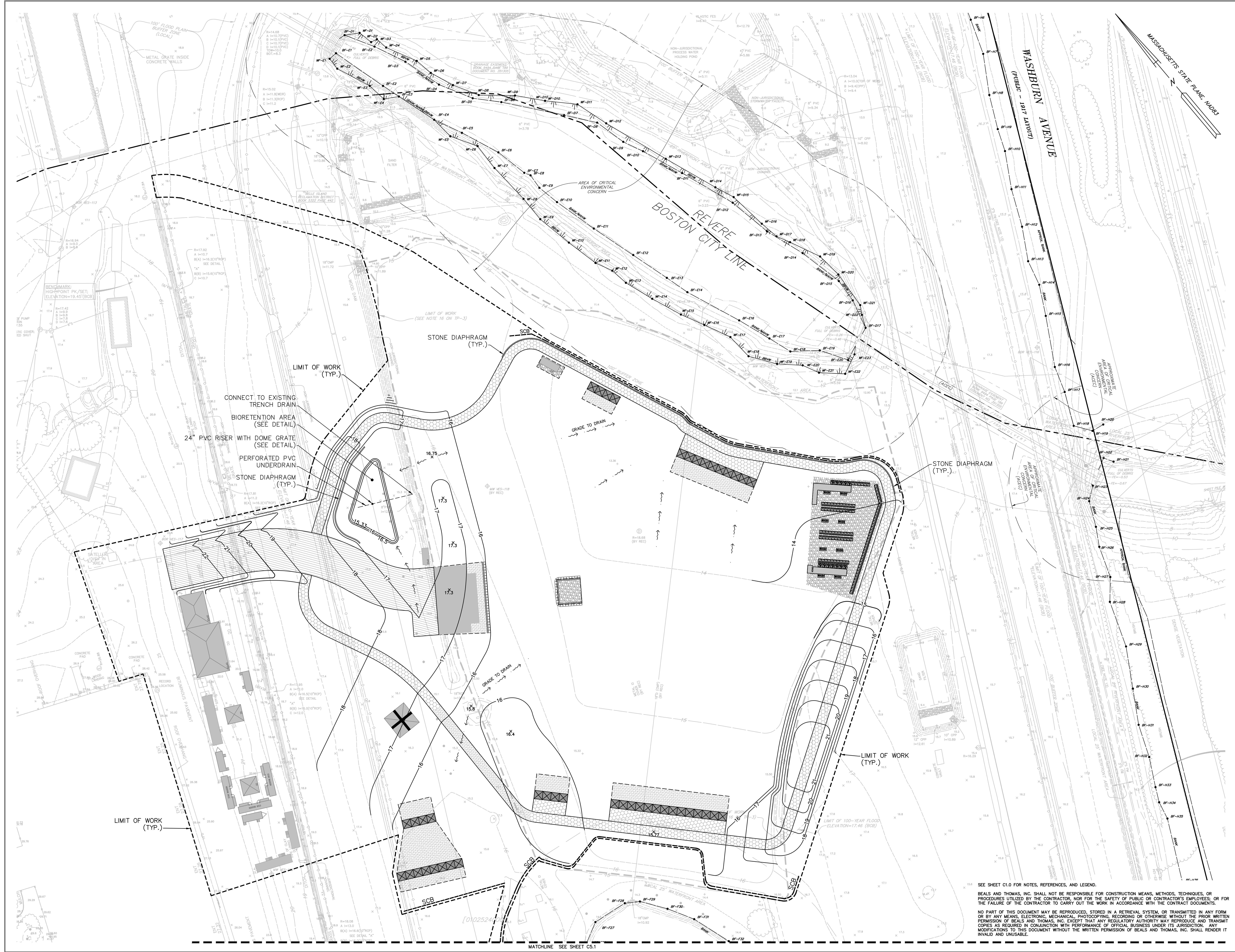
LAYOUT AND MATERIALS PLAN

| | |
|--------------|-----------------|
| B+T JOB NO. | 2854-18 |
| B+T PLAN NO. | 285418P439B-004 |
| | C4.1 |

SEE SHEET C1.0 FOR NOTES, REFERENCES, AND LEGEND.

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ONE CONGRESS STREET
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BOSTON, MASSACHUSETTS

SCALE: 1" = 40' DATE: JANUARY 19, 2021

GRADING AND DRAINAGE PLAN

B+T JOB NO. 2854.18

B+T PLAN NO. 285418P439B-006

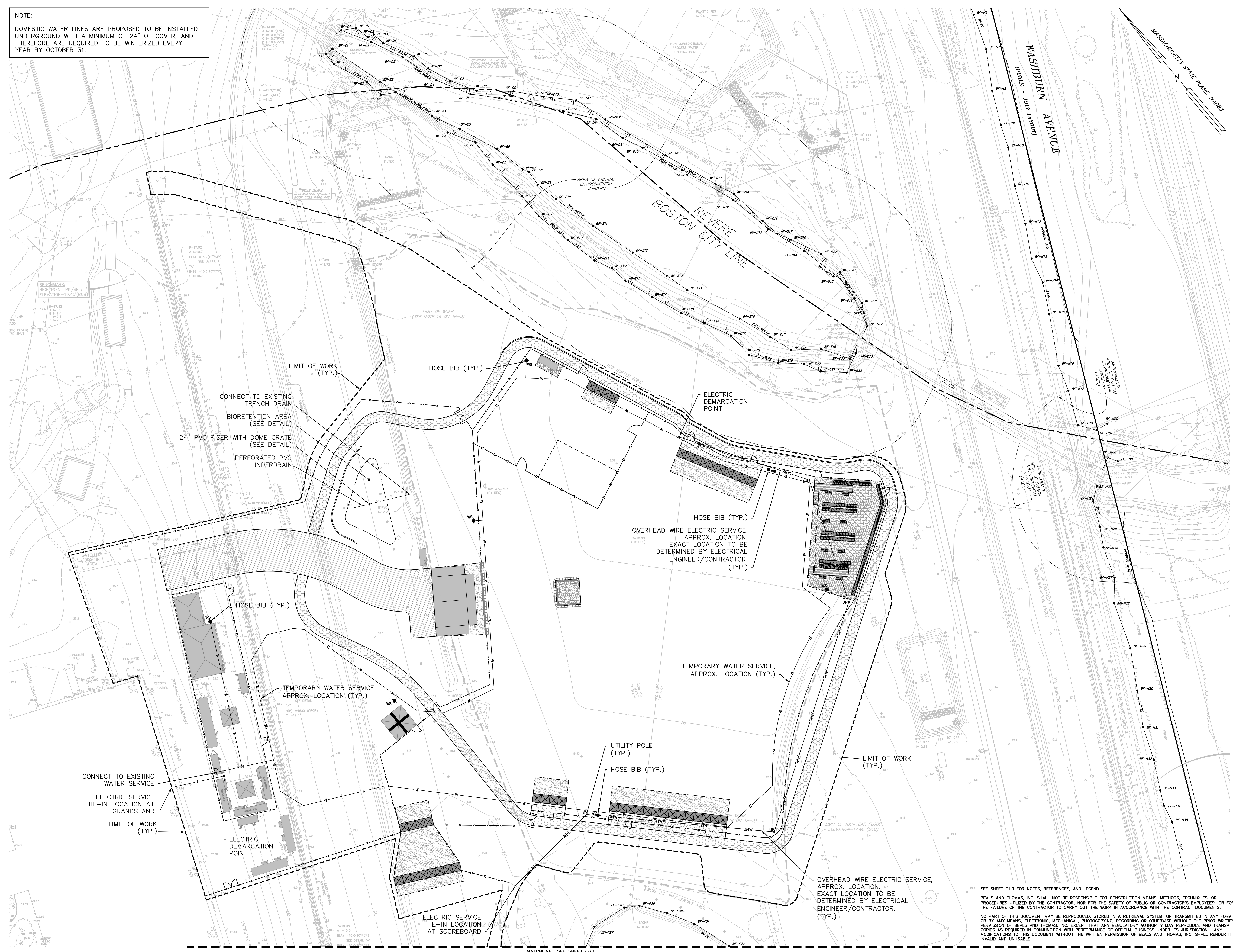
C5.0

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NOTE:
DOMESTIC WATER LINES ARE PROPOSED TO BE INSTALLED UNDERGROUND WITH A MINIMUM OF 24" OF COVER, AND THEREFORE ARE REQUIRED TO BE WINTERIZED EVERY YEAR BY OCTOBER 31.



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ONE CONGRESS STREET
BOSTON, MASSACHUSETTS

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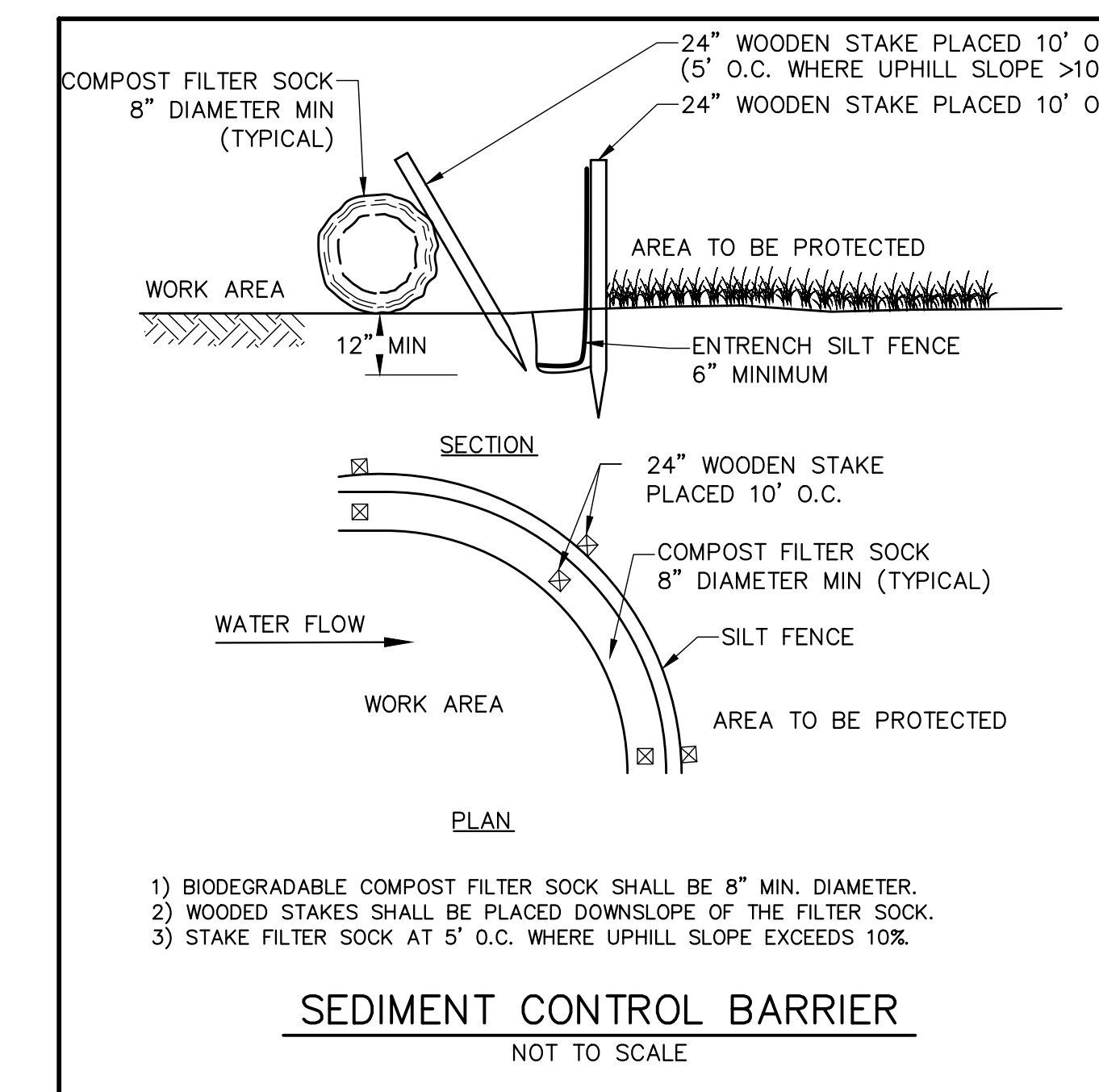
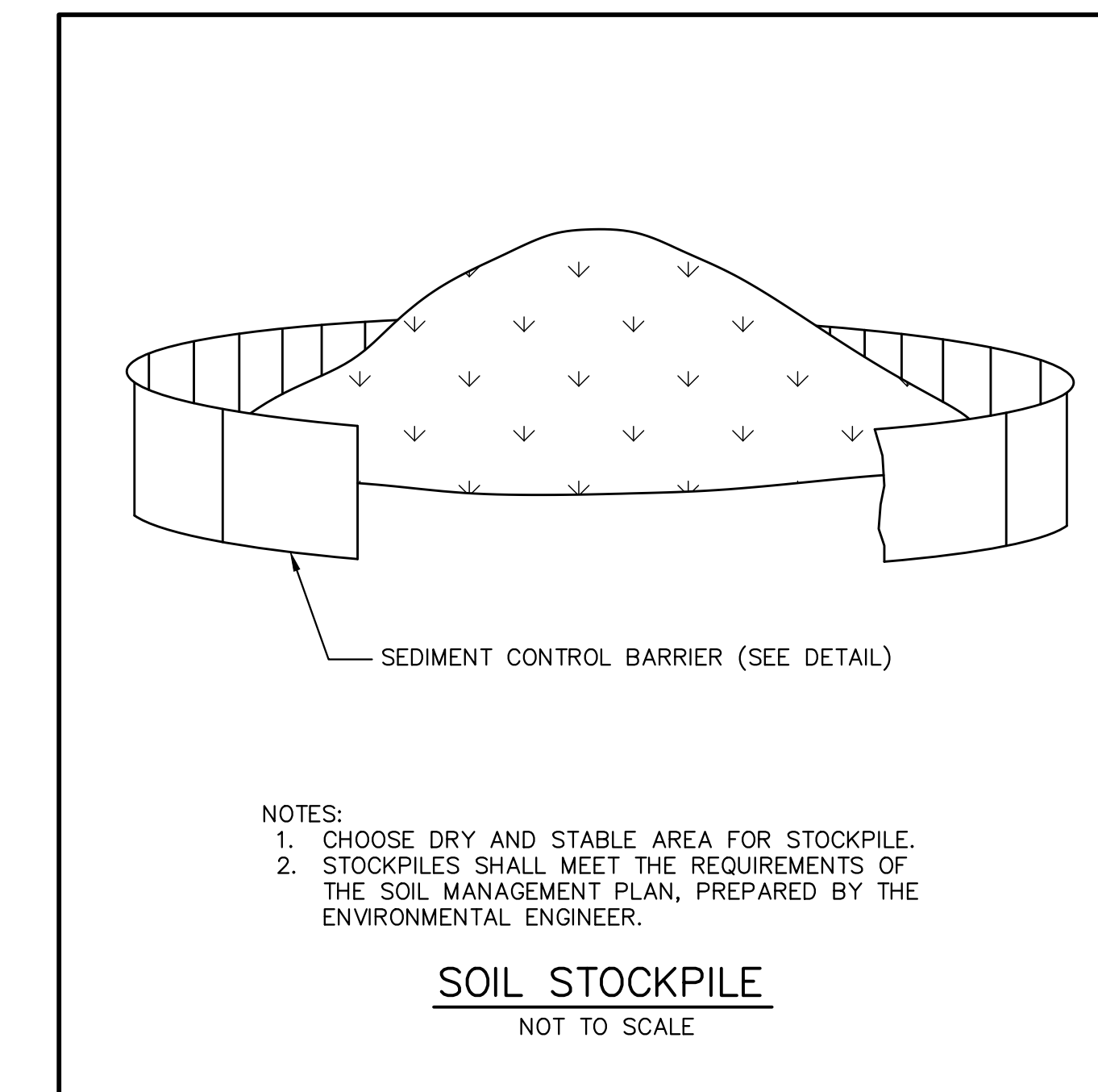
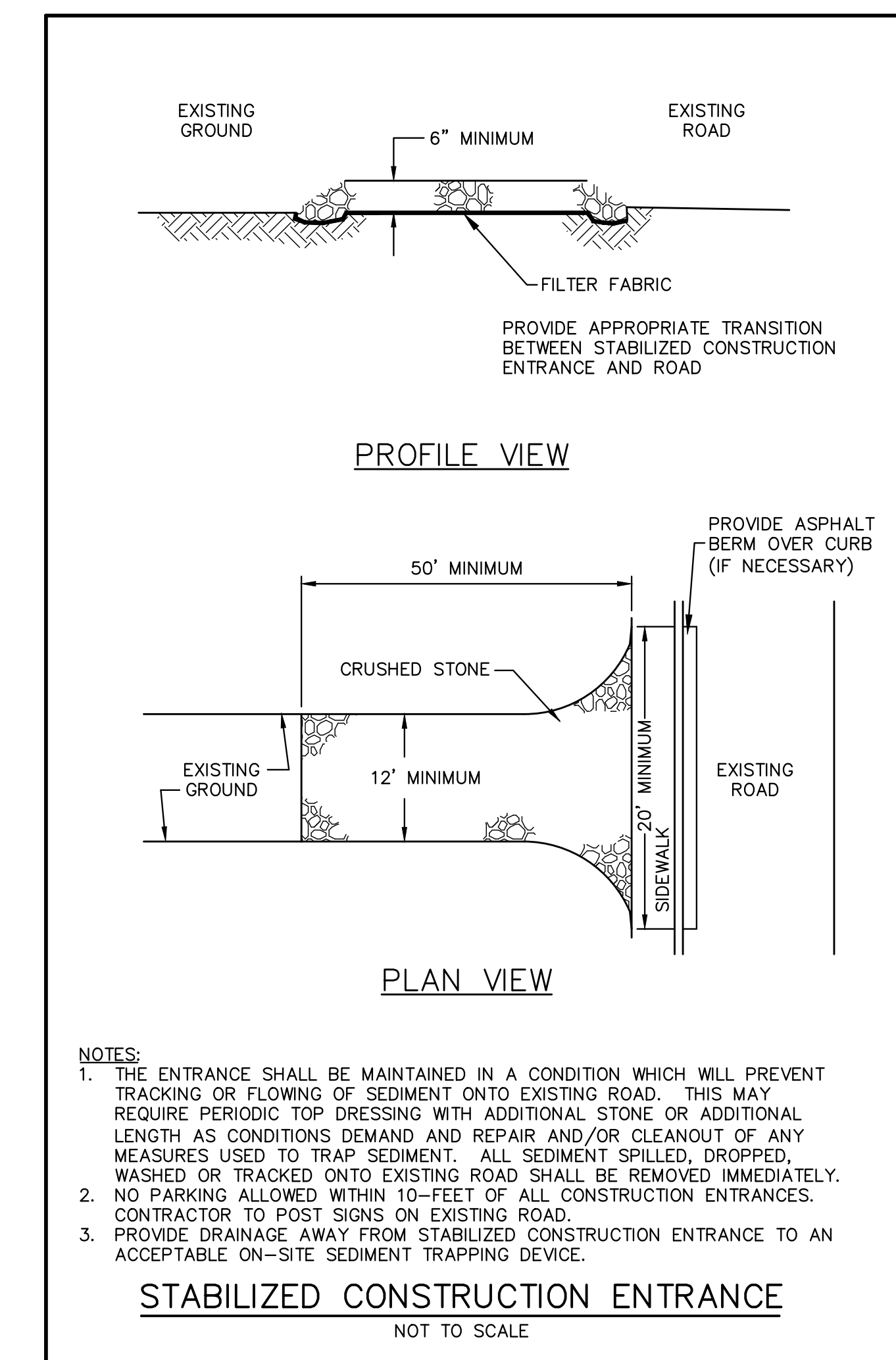
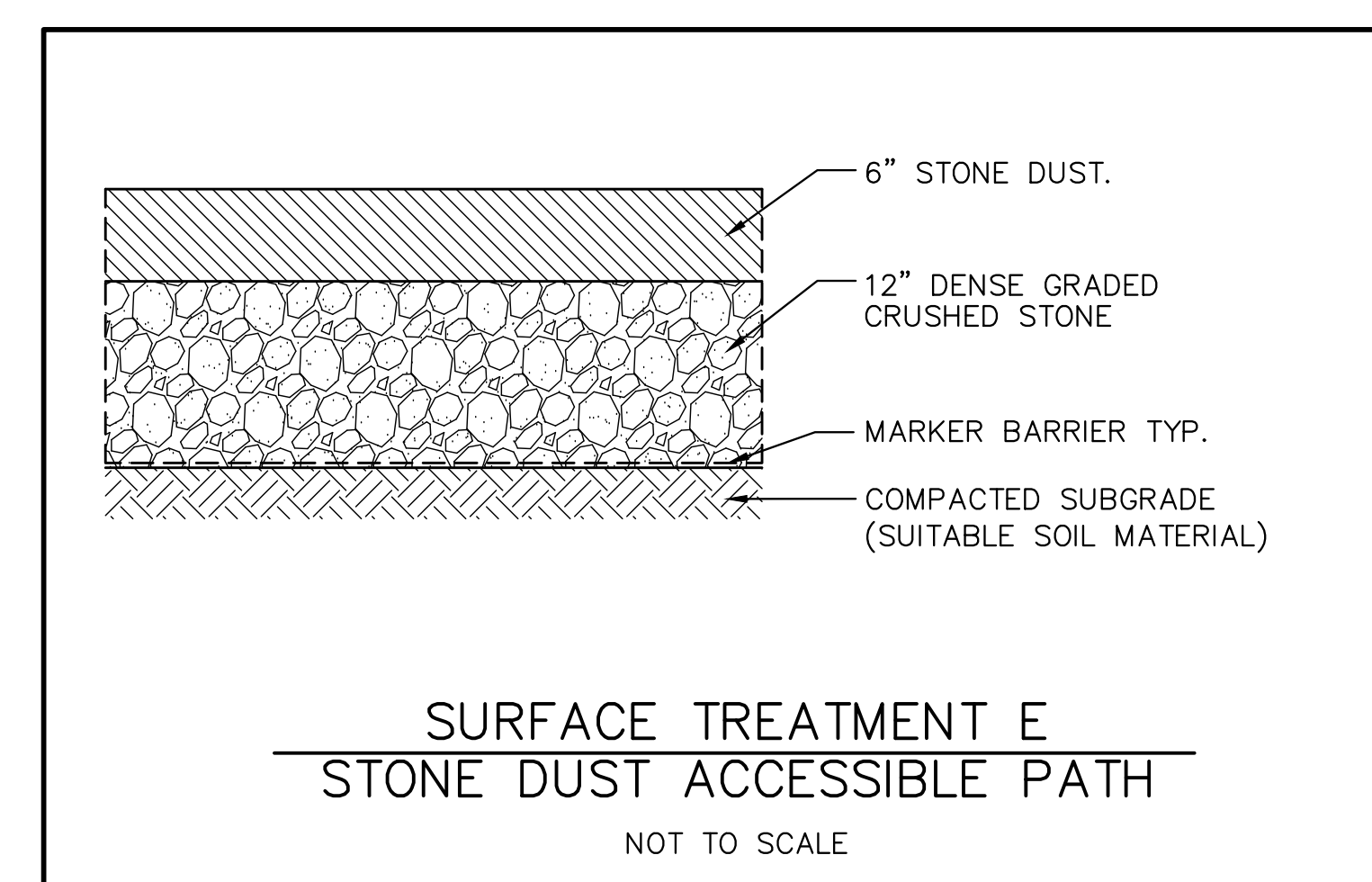
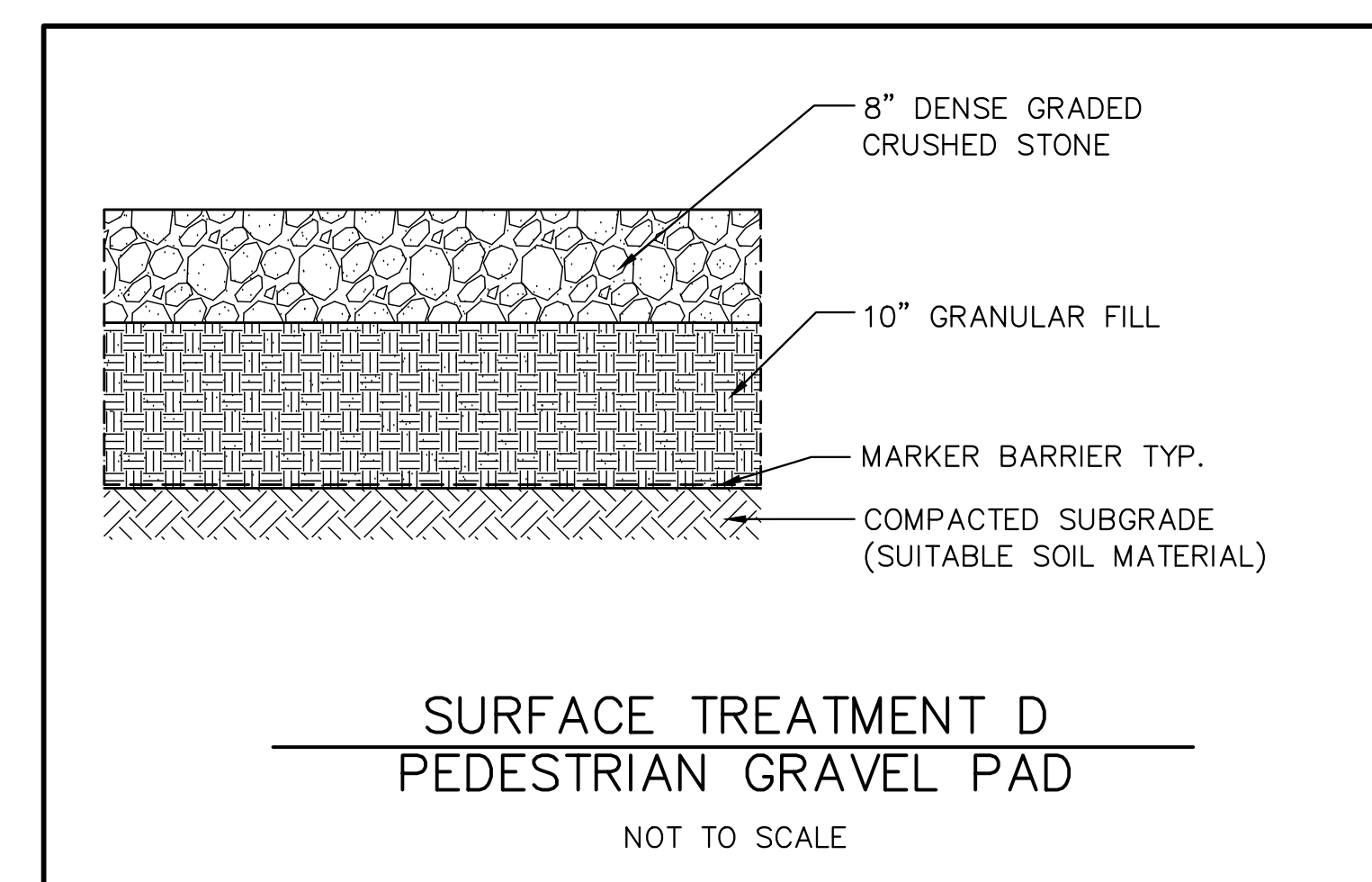
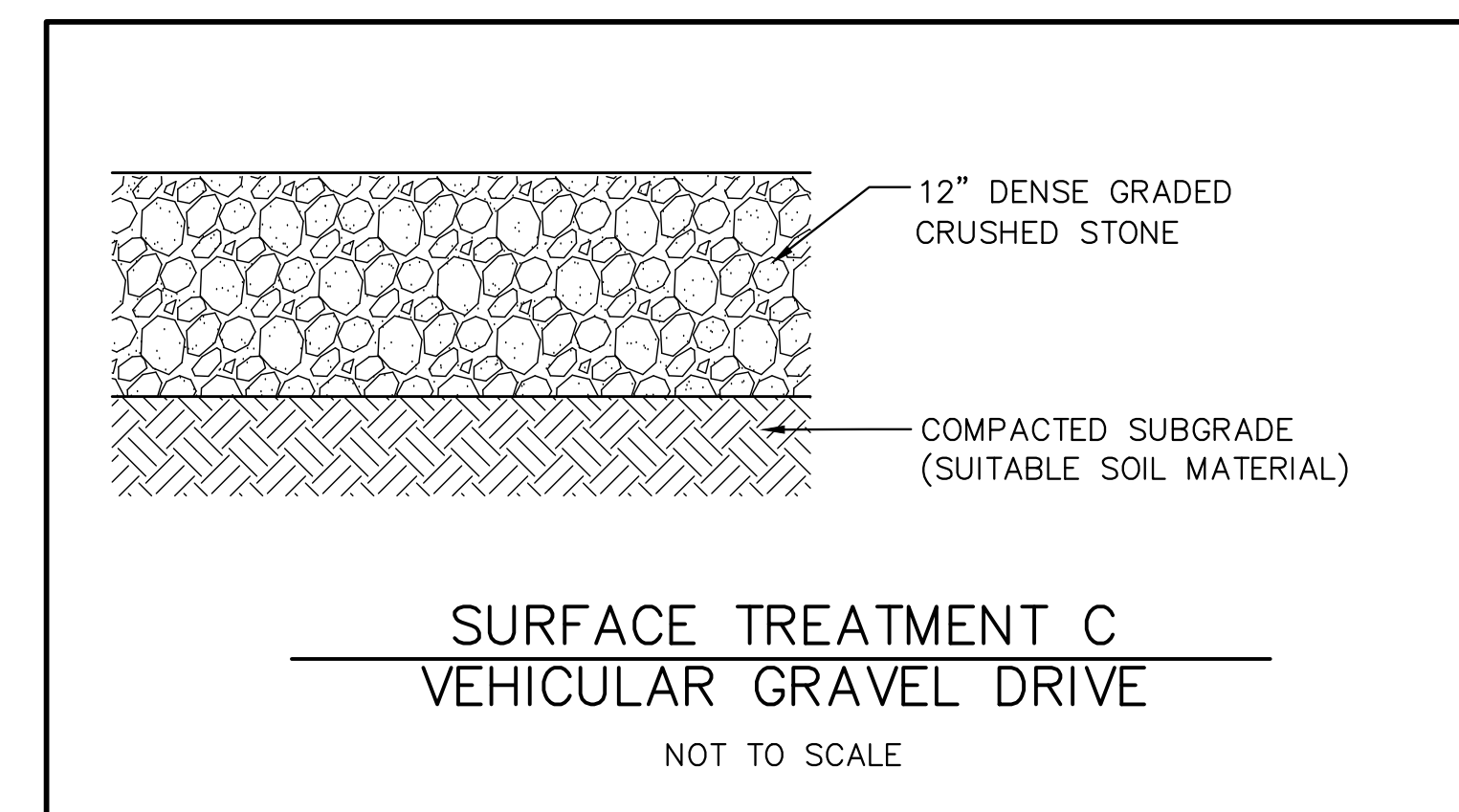
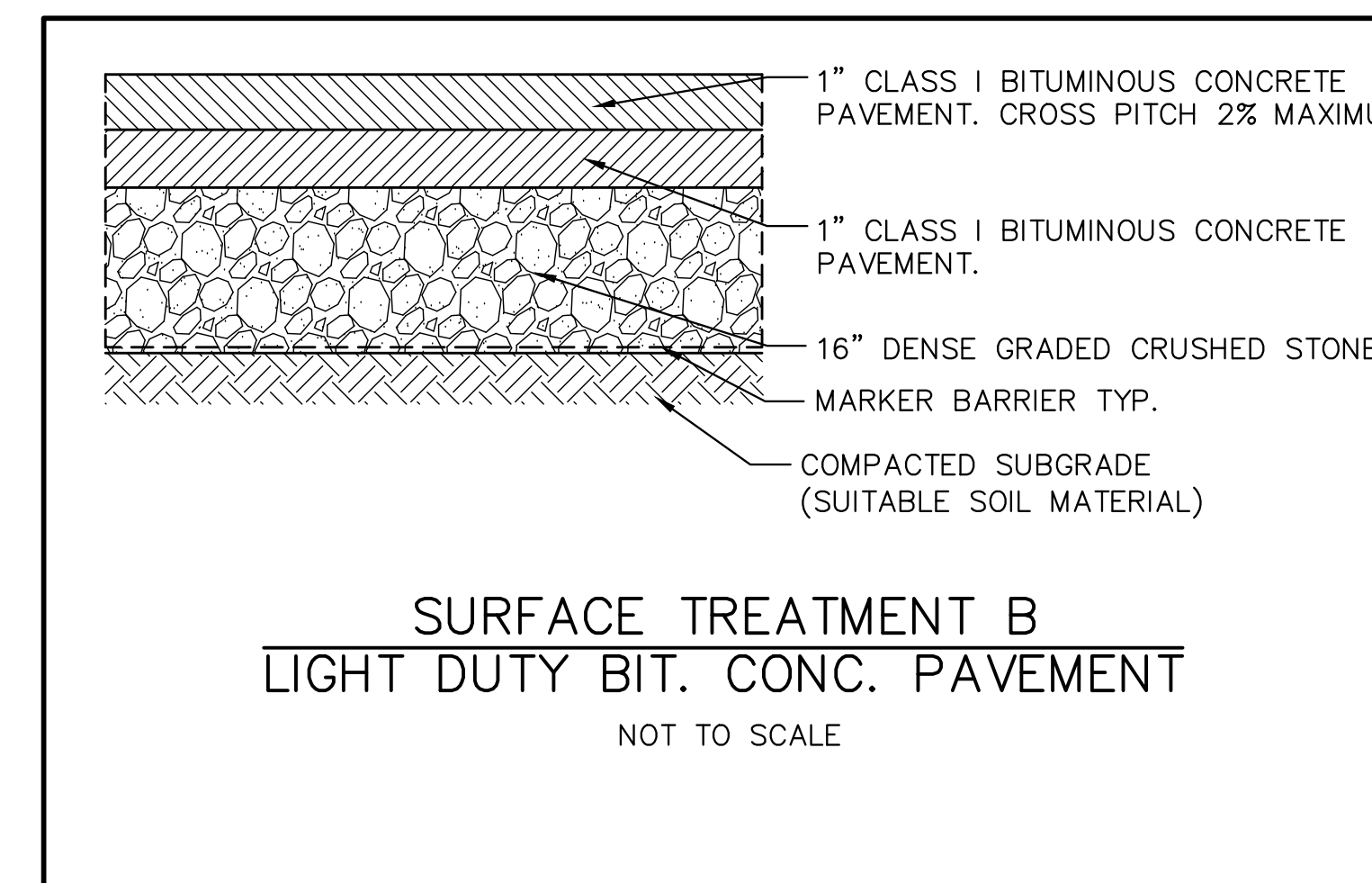
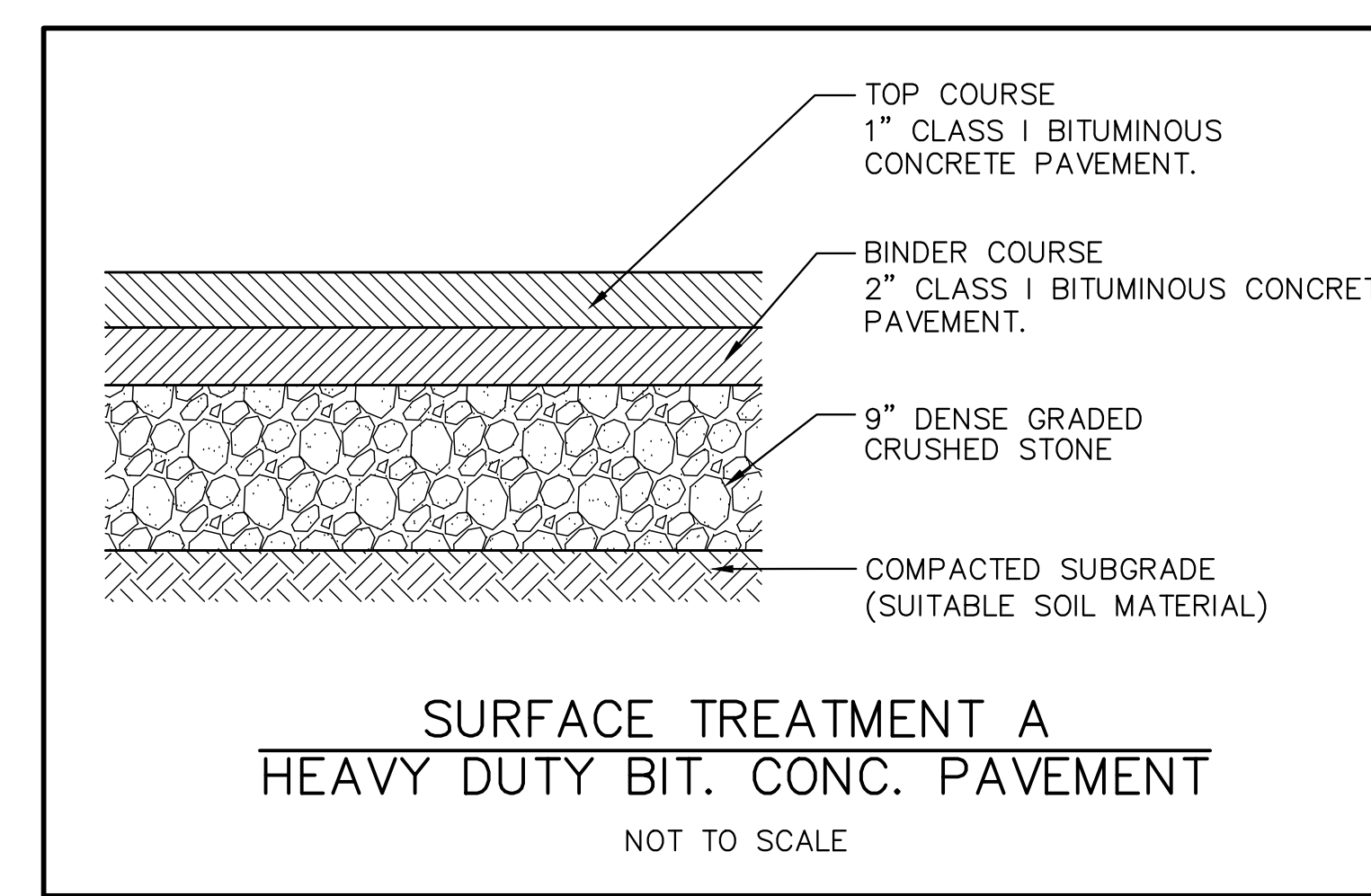
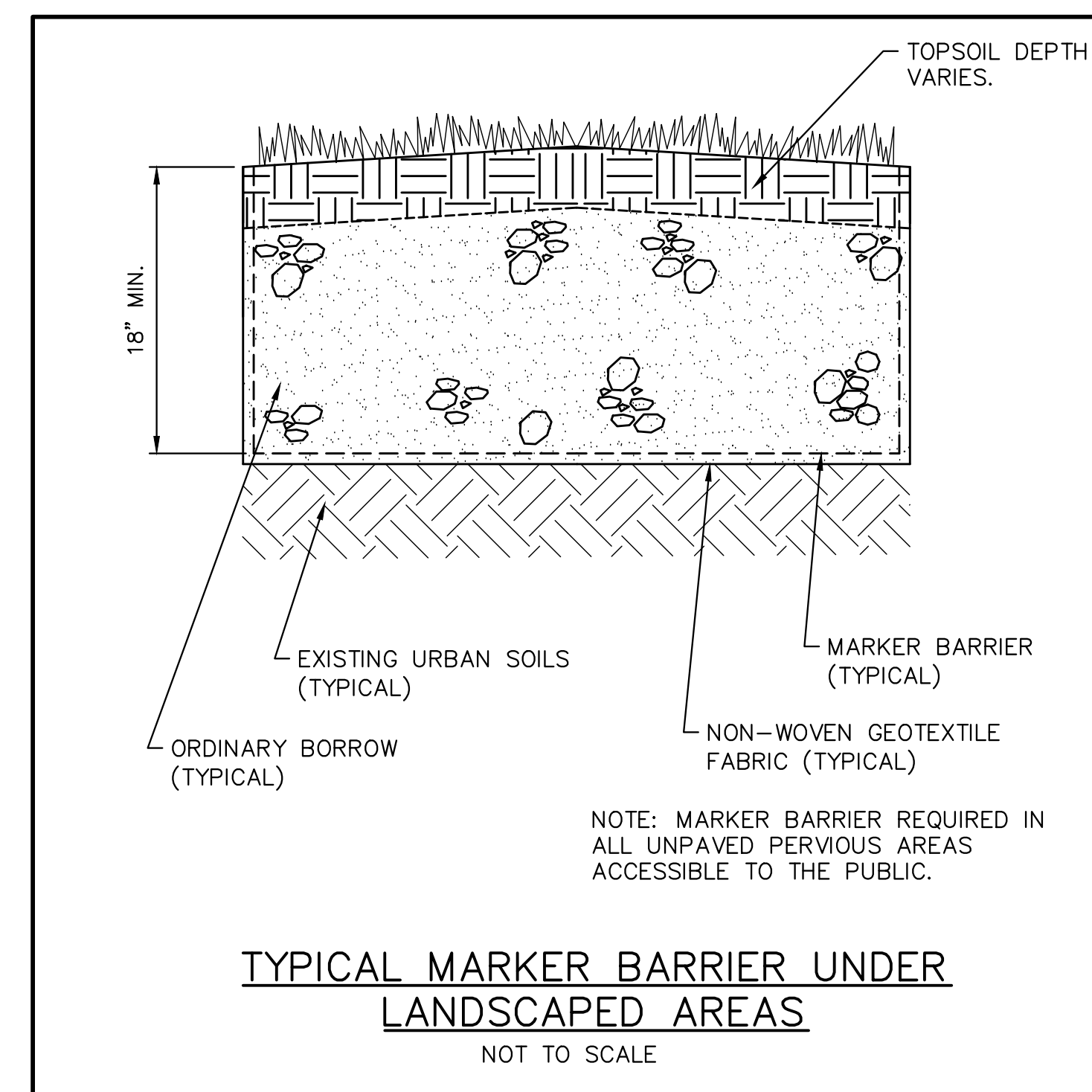
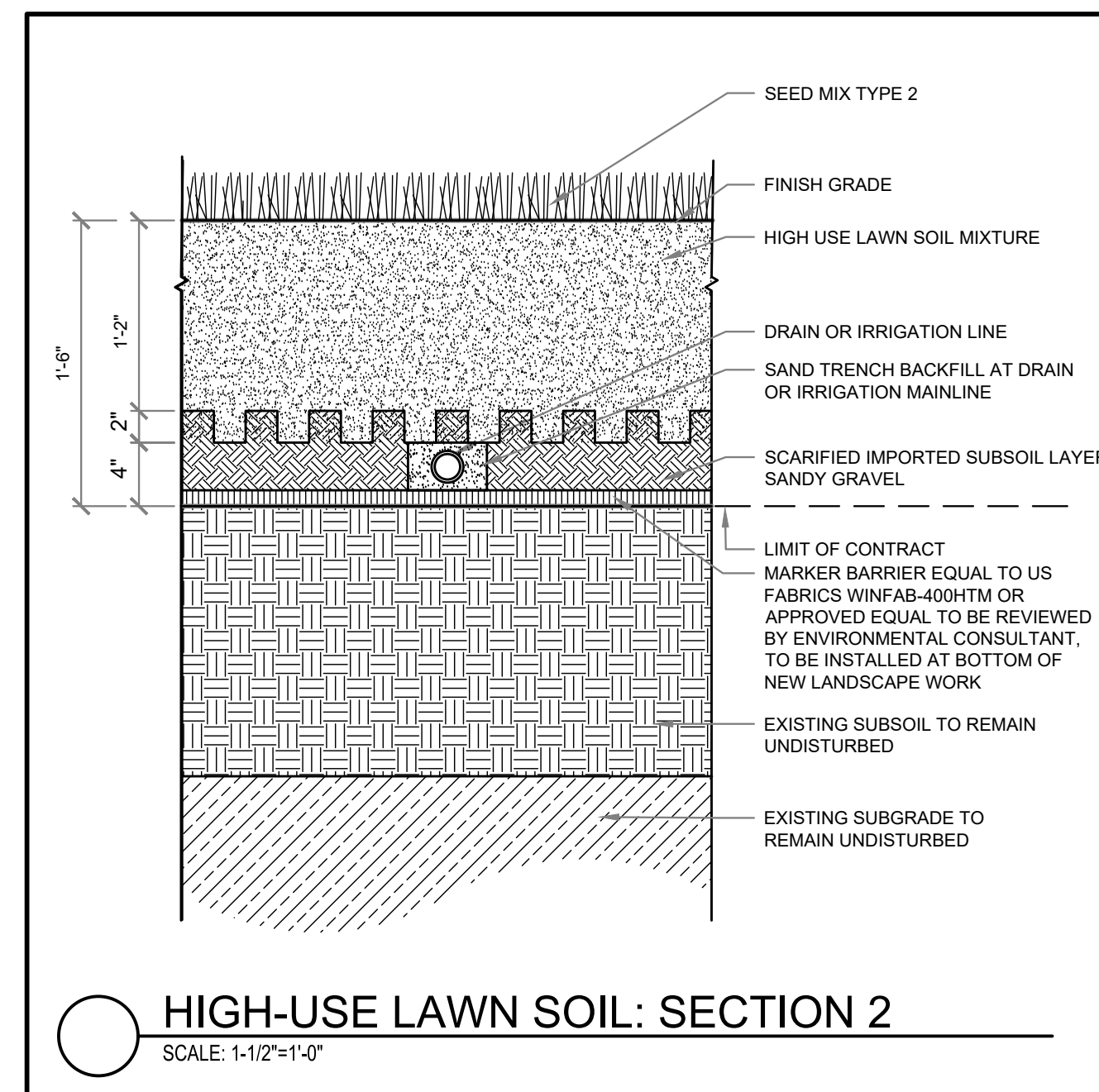
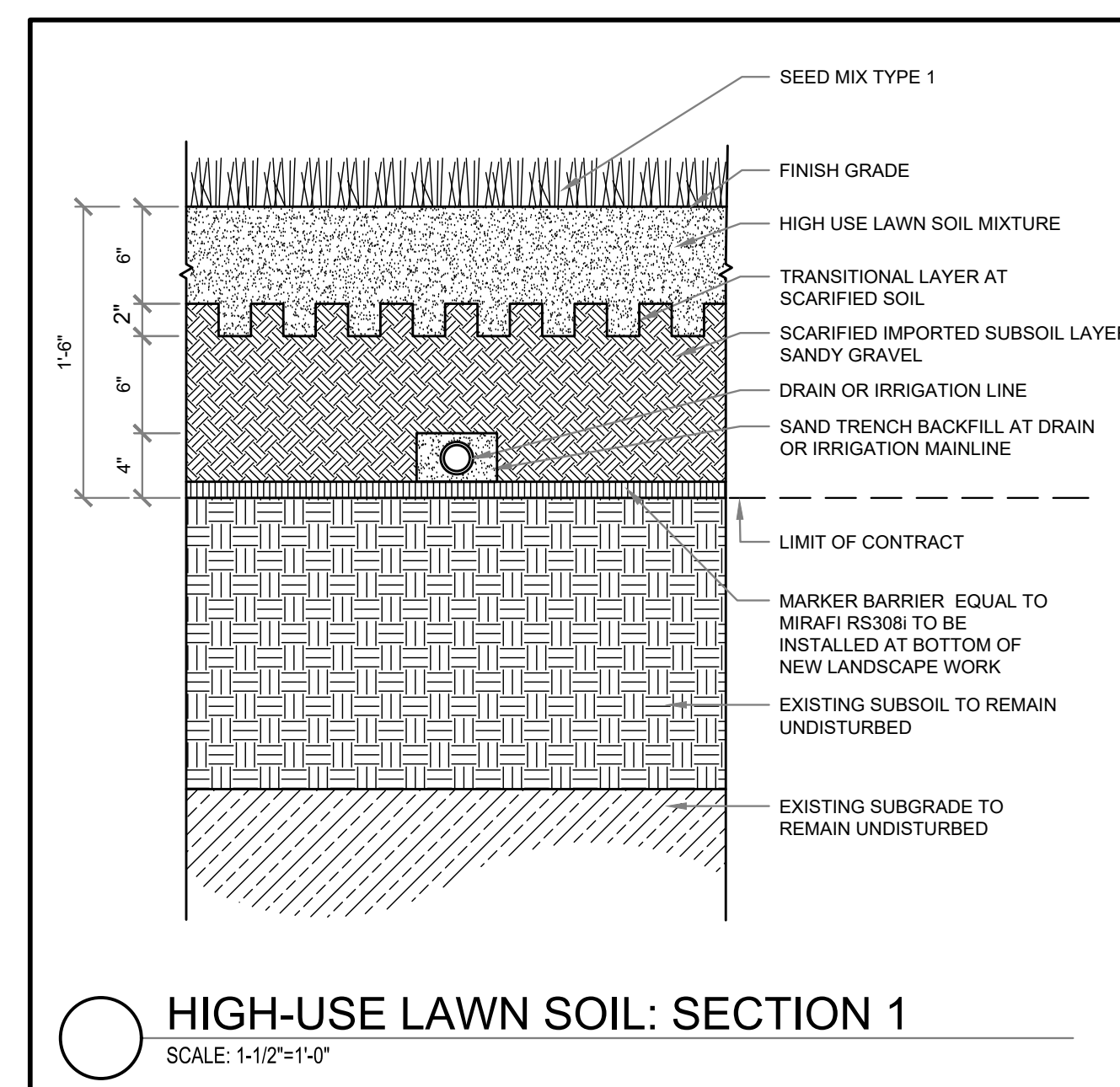
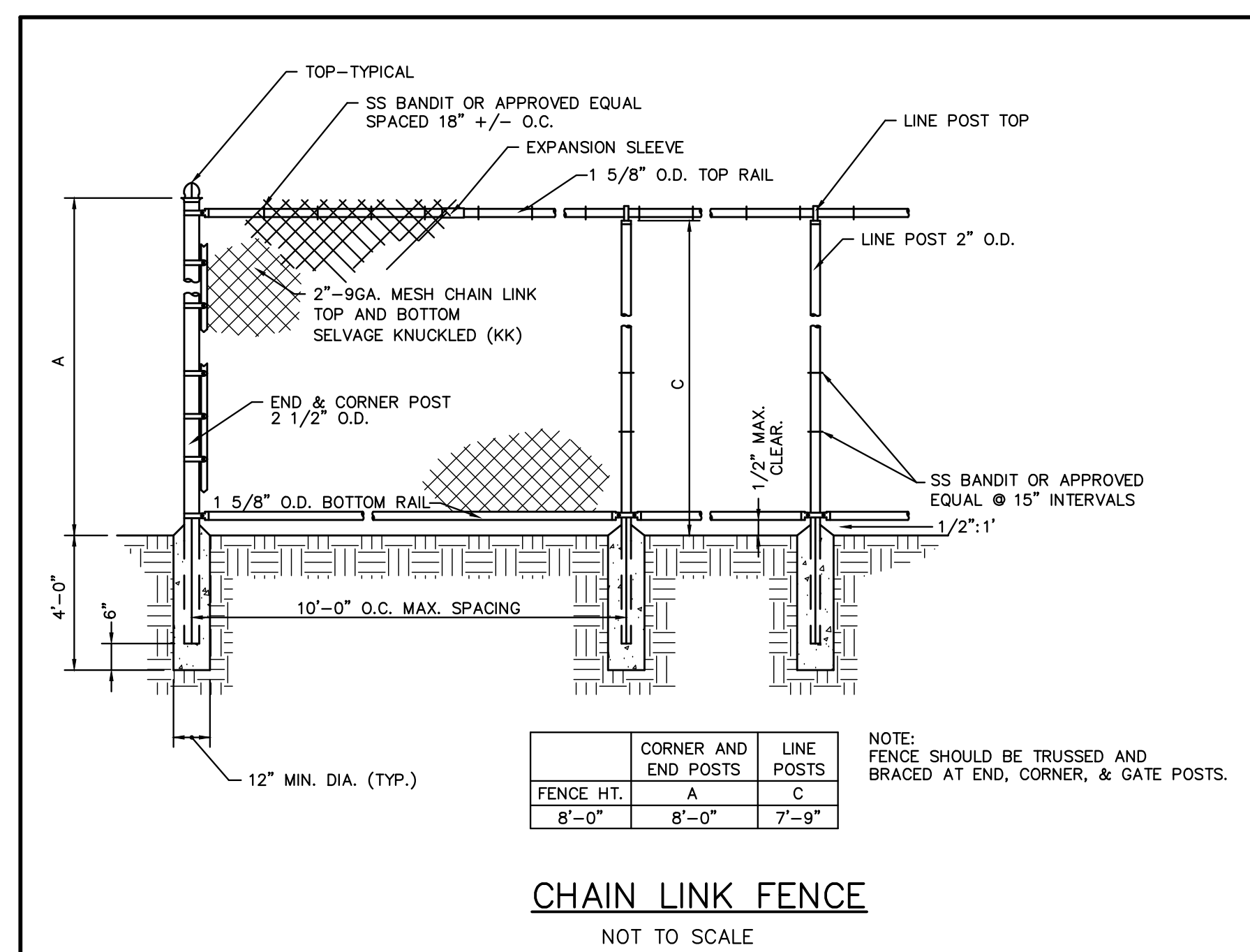
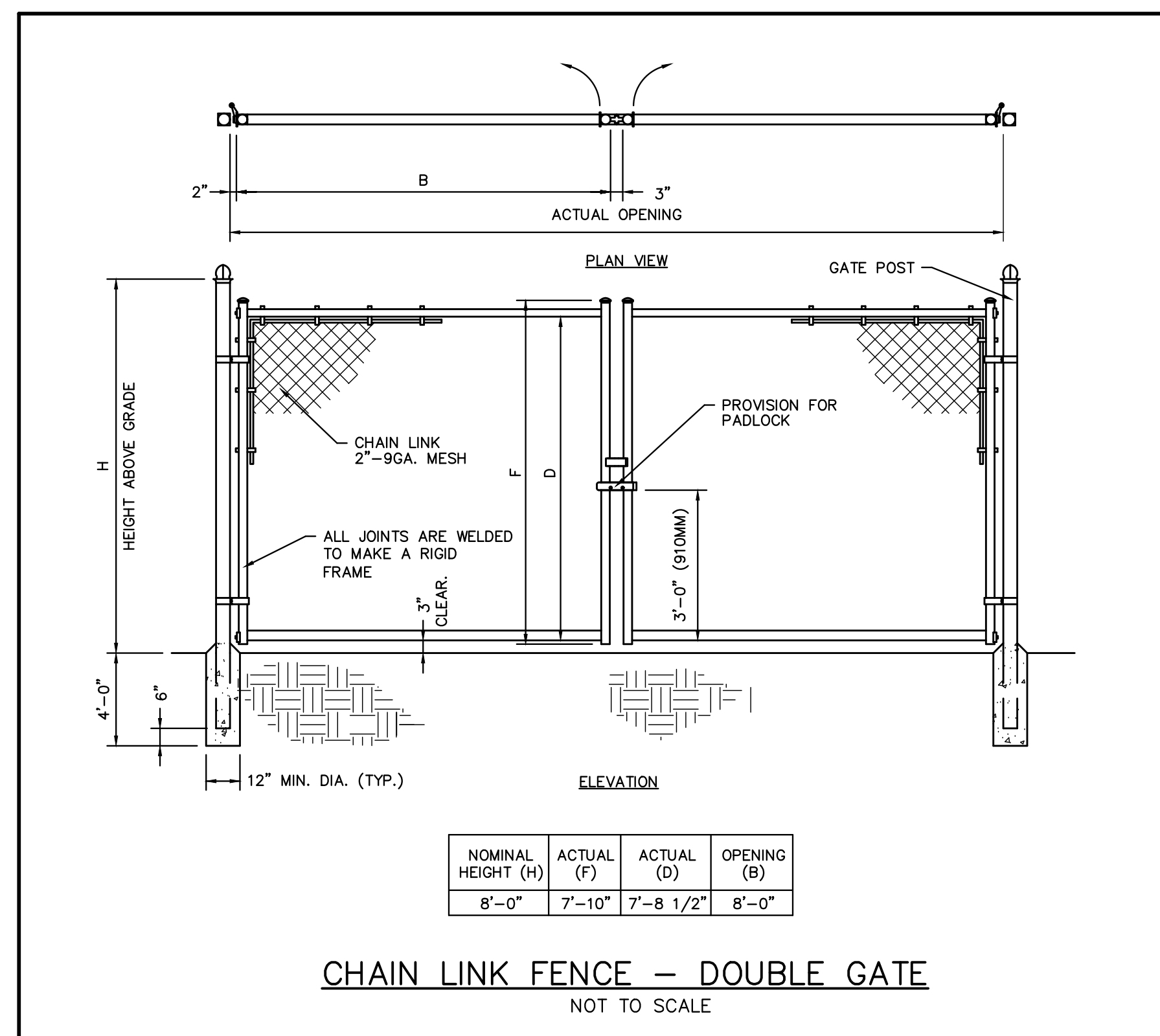
PROJECT:
SUFFOLK DOWNS OUTDOOR ENTERTAINMENT VENUE
BOSTON, MASSACHUSETTS

SCALE: 1" = 40' DATE: JANUARY 19, 2021

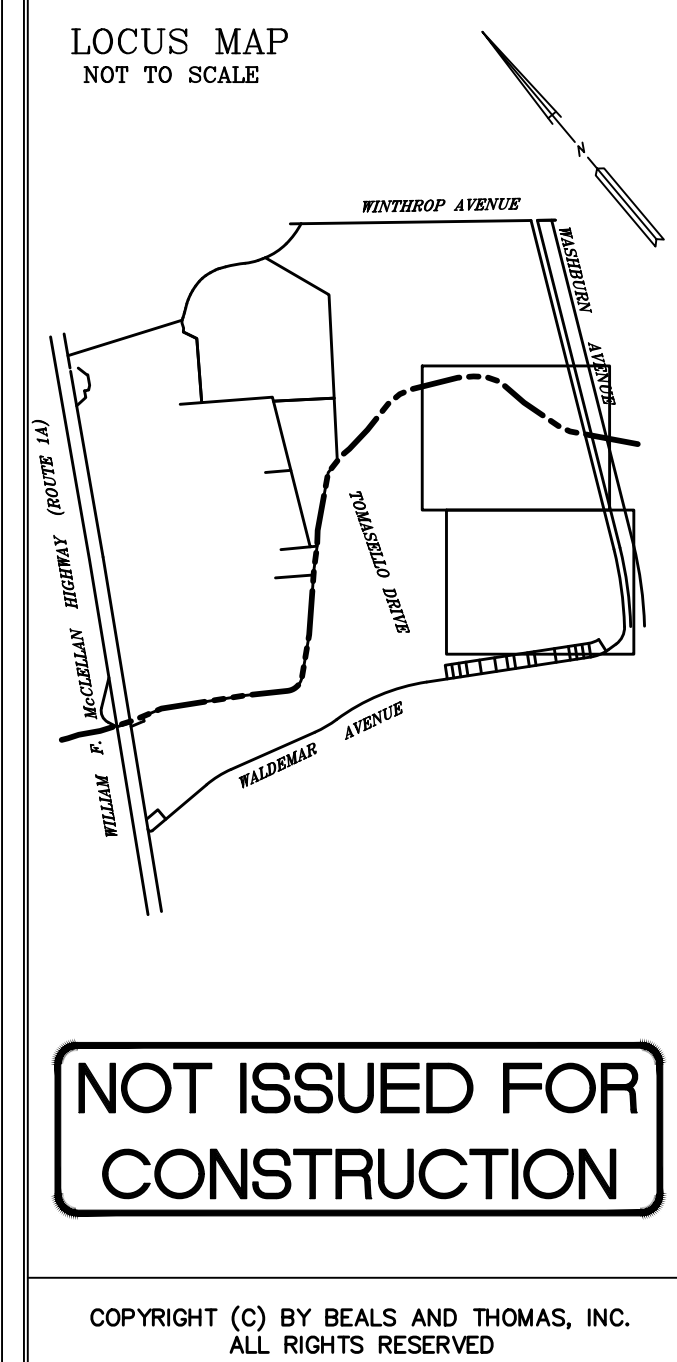
UTILITY PLAN

B+T JOB NO. 2854.18
B+T PLAN NO. 285418P439B-008 **C6.0**

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PROJECT:
SUFFOLK DOWNS OUTDOOR ENTERTAINMENT VENUE
BOSTON, MASSACHUSETTS

SCALE: AS SHOWN DATE: JANUARY 19, 2021

SITE DETAILS

B+T JOB NO. 285418
B+T PLAN NO. 285418P437B-003
C7.0

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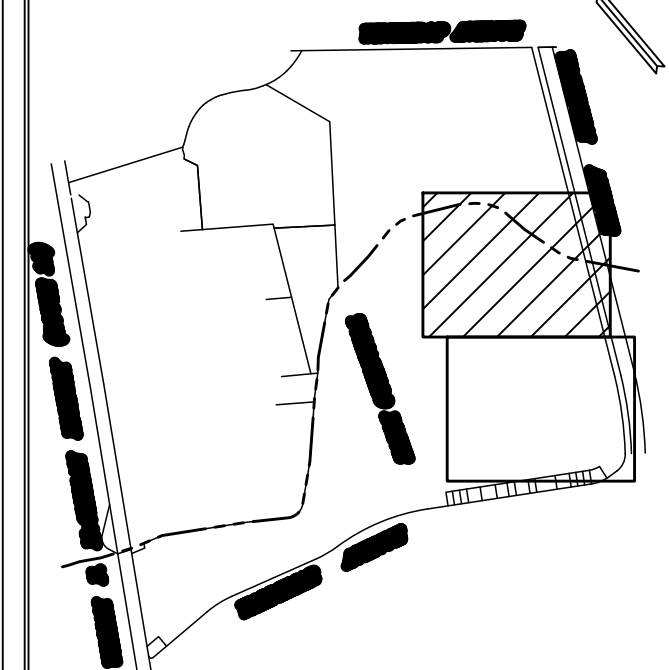
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LOCUS MAP
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 BOSTON, MASSACHUSETTS

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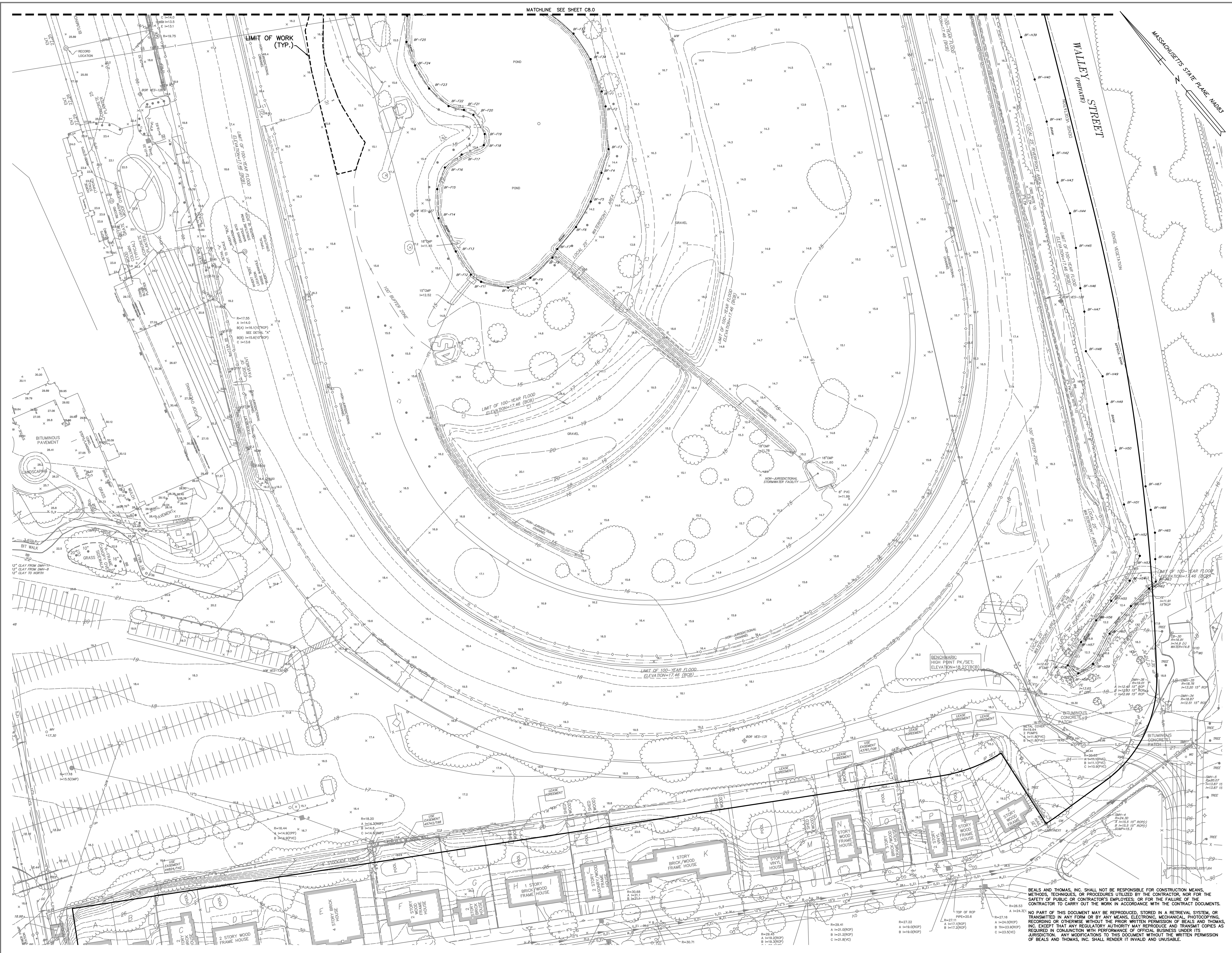
FINAL CONDITION PLAN

B+T JOB NO. 2854.18
 B+T PLAN NO. 285418P451A-001 **C8.0**

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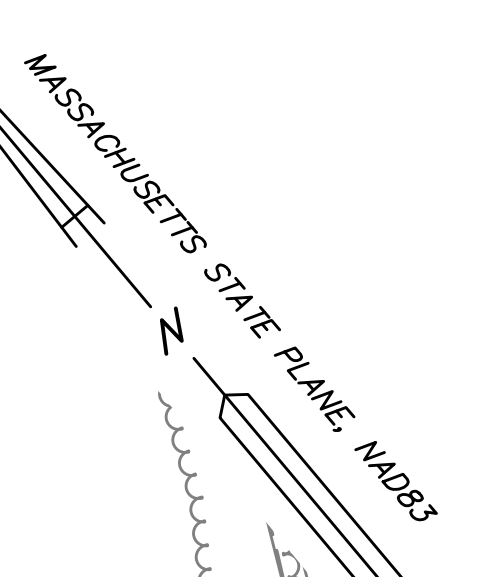
MATCHLINE SEE SHEET C8.1



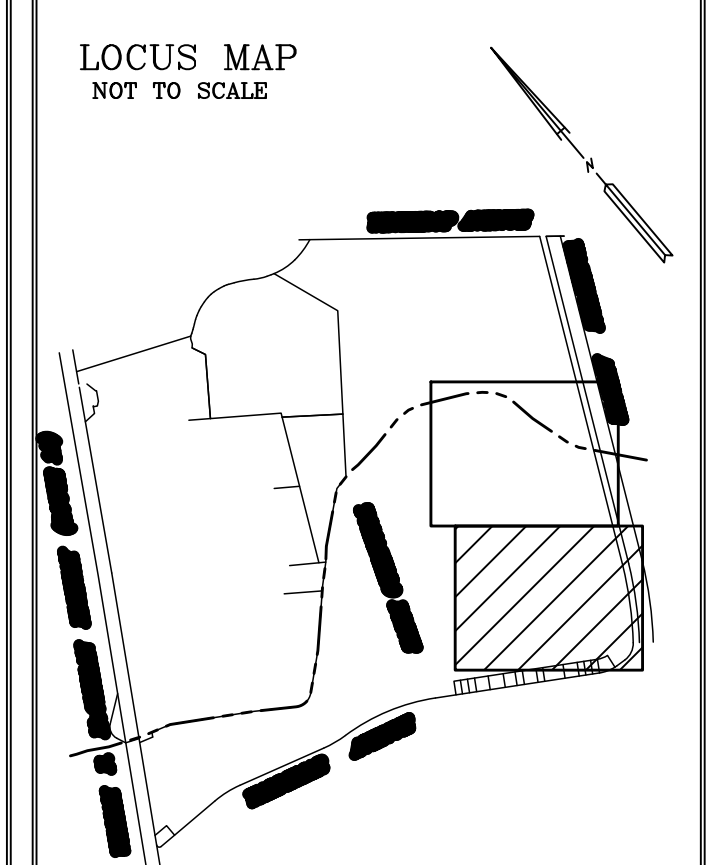
MATCHLINE SEE SHEET C8.0

LIMIT OF WORK (TYP.)

VALLEY STREET (PRIVATE)



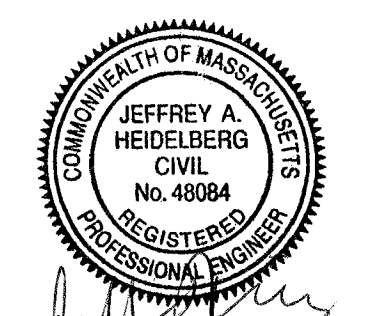
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BOSTON, MASSACHUSETTS

SCALE: 1" = 40' DATE: JANUARY 19, 2021
METERS 0 5 10 25
FEET 0 20 40 80 120

FINAL CONDITION PLAN

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B+T JOB NO. 2854.18
B+T PLAN NO. 285418P451A-002 **C8.1**



TO: Boston Conservation Commission
c/o Nicholas Moreno, Executive Director
1 City Hall Square, Room 709
Boston, Massachusetts 02201

FROM: Beals and Thomas, Inc.

DATE: February 17, 2022

REFERENCE: Stormwater Management Summary
Suffolk Downs Redevelopment
Outdoor Entertainment Venue - Notice of Intent
Boston, Massachusetts
B+T Project No. 2854.18

The proposed project (the “Project”) entails site improvements and infrastructure to support the creation of an interim outdoor entertainment venue to be located in a portion of the existing infield area. The venue will serve as an interim site use prior to the construction of the final condition of this area proposed in the Master Plan, which is anticipated to commence no sooner than late 2025. The improvements associated with the venue are generally temporary in nature and will be removed upon commencement of future work.

Construction of the proposed venue will result in an increase of impervious area. Specifically, various surface treatments, consisting of bituminous concrete, gravel, and stone dust will be placed as indicated on the enclosed plans to accommodate various temporary structures, as well as pedestrian and vehicular access to the venue. Jersey barriers will also be placed along the southern property boundary, including in the 100-foot buffer zone to the H-series intermittent stream, as an additional security measure. These temporary barriers are not anticipated to alter flood flow paths or velocity.

Upon completion of grading, all other areas within the Project Site will be loamed and seeded with a native grass mix or sod. During the design phase of the site layout, consideration was given to conserving environmentally sensitive features and minimizing impact on the existing hydrology. To mitigate increased stormwater flow rates associated with the proposed impervious area, a bioretention area has been proposed. The bioretention area is intended to capture runoff from the newly created impervious area and overflow into an existing trench drain, consistent with the existing hydrology of the Site.

Civil Engineering ▪ Land Surveying ▪ Landscape Architecture ▪ Land Use Permitting ▪ Environmental Planning ▪ Wetland Science

In the future phase(s) of the development, a new stormwater management system will be constructed to provide treatment and peak runoff rate attenuation for later development phases that include the finalization of the roadways and building construction. A subsequent Notice of Intent(s) will be filed for these phase(s) and will detail the proposed stormwater management system.

LIST OF ATTACHMENTS

- ATTACHMENT 1: SOIL DATA
- ATTACHMENT 2: PRE- AND POST-DEVELOPMENT HYDROLOGIC ANALYSES
- ATTACHMENT 3: GROUNDWATER RECHARGE, WATER QUALITY VOLUME, AND TSS
REMOVAL CALCULATIONS
- ATTACHMENT 4: SITE OWNER'S MANUAL

The following summary details how this Project complies with the Massachusetts Department of Environmental Protection (MassDEP) ten Stormwater Standards.

STANDARD 1: **No new stormwater conveyance (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.**

Most of the impervious areas of the Site are existing, and runoff from these areas will follow the same conveyance under proposed conditions. Some new impervious areas will sheet stormwater to nearby wetlands and waters of the Commonwealth; however, these areas will not be subject to sanding or salting due to the seasonal usage of the Site and therefore will not have an adverse impact.

STANDARD 2: **Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.**

The stormwater management design will control post-development peak discharge rates for the 2-, 10-, and 100-year, 24-hour storms so as to maintain pre-development peak discharge rates.

The following table summarizes the peak runoff rates for the pre- and post-development conditions at the main design points.

| | 2 Year | | 10 Year | | 100 Year | |
|---|------------|-------|------------|-------|------------|-------|
| | <i>Pre</i> | Post | <i>Pre</i> | Post | <i>Pre</i> | Post |
| Design Point 1: Sales Creek (cfs) | 14.29 | 12.84 | 42.35 | 35.41 | 72.32 | 59.89 |
| Design Point 2: Horseshoe Pond (cfs) | 1.34 | 0.54 | 4.38 | 1.69 | 7.72 | 2.94 |

Pre- and Post-Development Hydrologic Analyses to support these peak runoff rates are included in Attachment 2.

STANDARD 3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater management practices and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil types. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The stormwater management system includes a bioretention area that will effectively recharge groundwater on-site. Infiltration BMPs were sized using the static method based on the DEP infiltration requirement for the post-development site. Additionally, the recharge volume was increased to meet requirements of the Boston Planning & Development Agency (BPDA) and the Boston Water and Sewer Commission (BWSC). As a result, annual recharge from the post-development site will approximate the annual recharge from the site under pre-development conditions. See Attachment 4 for the groundwater recharge calculation.

STANDARD 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The proposed project will meet the water quality requirements of Standard 4 using on-site treatment trains that achieve 80% TSS removal. Stormwater BMPs designed for water quality treatment, including the bioretention area, were sized to capture and treat the flow rate associated with the first 1.0 of runoff from tributary impervious surfaces. Refer to Attachment 4 for the water quality volume calculation and TSS removal worksheet. All proposed stormwater management BMPs will be operated and maintained to ensure continued water quality treatment of runoff. The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards. The Manual outlines source control and pollution prevention measures and maintenance requirements of stormwater best management practices (BMPs) associated with the proposed development.

It is also important to note that due to the seasonal usage of the proposed Site, roadways and other impervious areas will not be subject to sanding or salting. For this reason, the overall TSS loading for the Project will be negligible. Furthermore, during the months when the proposed Site is in use, trash and debris will be cleared from the Site after each use.

STANDARD 5: For land uses with higher potential pollutant loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed Project is not associated with stormwater discharges from land uses with higher potential pollutant loads.

STANDARD 6: Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shellfish beds, swimming beaches, coldwater fisheries and recharge areas for public water supplies.

The proposed BMPs are consistent with the Stormwater Management Handbook for use within critical areas. The stormwater management system has been designed to capture and treat the first 1.0-inch of runoff as stipulated in the Stormwater Management Handbook. A bioretention area is proposed to remove pollutants from the first 1.0-inch of runoff from tributary impervious areas. Adequate pretreatment will be provided before discharge.

The Massachusetts Surface Water Quality Standards (314 CMR 4.00) indicates that both Sales Creek and the H-series intermittent stream are Class SA Outstanding Resource Waters (ORW). Pursuant to the Surface Water Quality Standards, these waters are designated as an excellent habitat for fish, other aquatic life, wildlife, and shall have an excellent aesthetic value.

Belle Isle Marsh consists of approximately 241-acres and is part of the larger Rumney Marsh Area of Critical Environmental Concern (ACEC). Belle Isle Marsh is designated as a shellfish growing area by the Division of Marine Fisheries but is currently listed as an area where shellfish growing is prohibited.

Both ORWs and shellfish growing areas are classified as critical areas.

In compliance with the NPDES Construction General Permit requirements for a critical area, soil stabilization measures must be implemented immediately whenever earth-disturbing activities are temporarily or permanently ceased on any portion of the Site. Earth-disturbing activities are temporarily ceased when clearing, grading, and excavation within any area of a site that will not

include a permanent structure will not resume for a period of seven (7) or more calendar days, but such activities will resume in the future. Additionally, the inspection of the erosion and sediment controls will occur once every seven (7) days and within 24 hours of the end of a storm event of 0.25-inch or greater.

STANDARD 7: **Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.**

The Project is a mix of new development and redevelopment. All new impervious area complies with all standards of the Stormwater Management Handbook.

STANDARD 8: **A plan to control construction-related impacts during erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.**

A Stormwater Pollution Prevention Plan (SWPPP) will be developed to comply with Section 3 of the NPDES Construction General Permit for Stormwater Discharges prior to construction; thus fulfilling the requirements of Standard 8.

STANDARD 9: **A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.**

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards. The Manual outlines source control and pollution prevention measures and maintenance requirements of the stormwater best management practices (BMPs) associated with the proposed development.

STANDARD 10: All illicit discharges to the stormwater management system are prohibited.

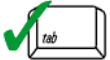
There will be no illicit discharges to the proposed stormwater management system associated with the proposed Project.



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 8²
- 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.



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



Jeffrey A. Heidelberg 2/17/22
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): _____

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

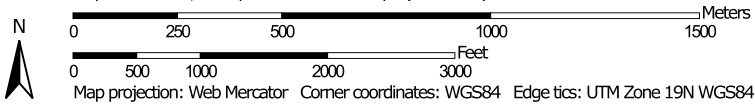
Attachment 1

Soil Data

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(Suffolk Downs Redevelopment Hydrologic Soil Group)




Map Scale: 1:18,100 if printed on A landscape (11" x 8.5") sheet.



Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(Suffolk Downs Redevelopment Hydrologic Soil Group)


MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points






-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available


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 1:25,000.

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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 12, Sep 15, 2016

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

Date(s) aerial images were photographed: Mar 30, 2011—Aug 25, 2014

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.

Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Norfolk and Suffolk Counties, Massachusetts (MA616) | | | | |
|--|--|--------|--------------|----------------|
| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
| 1 | Water | | 9.0 | 1.4% |
| 65 | Ipswich mucky peat, 0 to 2 percent slopes, very frequently flooded | A/D | 40.2 | 6.1% |
| 325D | Newport silt loam, 15 to 25 percent slopes | B | 64.9 | 9.9% |
| 603 | Urban land, wet substratum, 0 to 3 percent slopes | | 298.6 | 45.4% |
| 610 | Beaches | | 1.3 | 0.2% |
| 627C | Newport-Urban land complex, 3 to 15 percent slopes | B | 85.2 | 13.0% |
| 653 | Udorthents, sandy | A | 2.0 | 0.3% |
| 655 | Udorthents, wet substratum | | 156.3 | 23.8% |
| Totals for Area of Interest | | | 657.6 | 100.0% |

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Attachment 2

Pre-Development Hydrologic Analysis
Post-Development Hydrologic Analysis

PRE-DEVELOPMENT HYDROLOGIC ANALYSIS

OBJECTIVE

To determine the pre-development peak rates of runoff from the site for the 2-, 10-, and 100-year storm events.

CONCLUSION(S)

Peak Runoff Rates

The following numbers represent the peak rates of runoff from the site under pre-development conditions:

| Storm Event | Design Point 1: Sales Creek (cfs) | Design Point 2: Horseshoe Pond (cfs) |
|----------------------|-----------------------------------|--------------------------------------|
| 2-year | 14.29 | 1.34 |
| BWSC 10-year | 42.35 | 4.38 |
| BWSC 100-year | 72.32 | 7.72 |

CALCULATION METHODS

1. CN and T_c determined based on TR-55 methodology.
2. Runoff rates computed using HydroCAD version 10.10-5a.
3. Area take-offs performed using Civil 3D.

ASSUMPTIONS

1. Pre-development conditions are site conditions prior to all site work (demolition, surcharge).
2. Surface cover types and boundaries have been estimated based upon MassGIS, USGS Color Ortho Imagery 2016, aerial photography viewed on Google Earth, and AutoCAD file 285402B004N.dwg.
3. Urban Land, Udorthents, and Ipswich Mucky Peat modeled as Hydrologic soil class “C” soils.
4. Rainfall depth for 10-year storm event and 100-year storm event based on “BWSC Climate Change Risk Assessment, Findings and Mitigation/Adaptation Strategies for Wastewater and Storm Drainage” dated 01/28/2015.

SOURCES OF DATA/ EQUATIONS

1. Pre-Development Conditions Watershed Map, dated 12/30/2021, prepared by Beals and Thomas, Inc. (285418P444A-001).
2. TR-55 Urban Hydrology for Small Watersheds, SCS, 1986.
3. NRCS Soil Survey for Norfolk and Suffolk Counties, downloaded from Web Soil Survey 2.0 on 05/04/2017.
4. Existing catchment EDA-2 is the same as catchment EDA-1 in the approved calculation “Existing Conditions Hydrology” for Suffolk Downs Redevelopment – Central Common Regrading, dated 1/15/2020 (285402CS056.pdf).

| REV | CALC. BY | DATE | CHECKED BY | DATE | APPROVED BY | DATE |
|-----|----------|------------|------------|------------|-------------|------------|
| 0 | RFK | 12/30/2021 | KJP | 01/03/2022 | JAH | 01/18/2022 |
| | | | | | | |
| | | | | | | |

285418CS002A.docx

LIST OF ATTACHMENTS

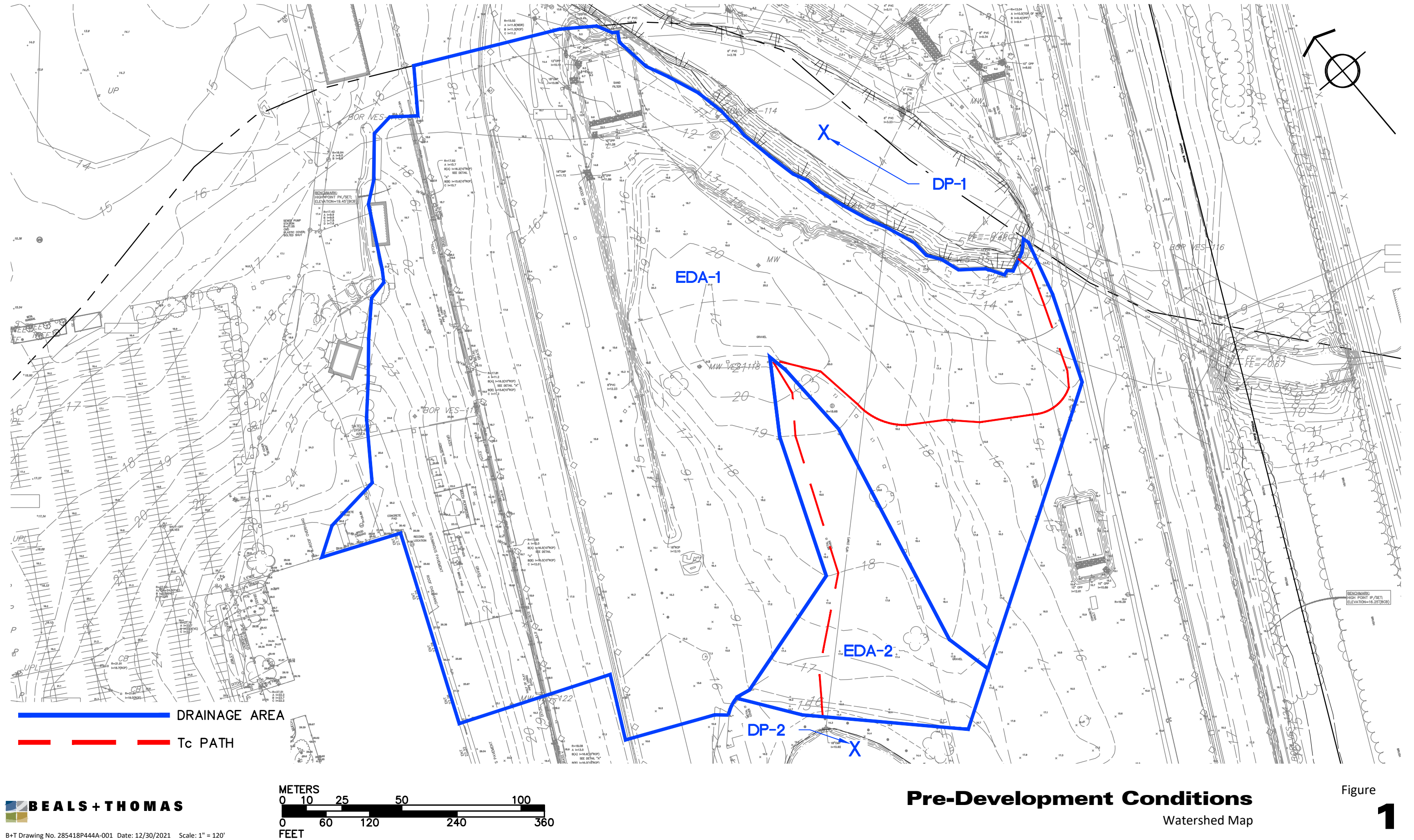
1. Pre-Development Conditions Watershed Map, dated 12/30/2021, prepared by Beals and Thomas, Inc.
2. Pre-Development Conditions Hydrology Report from HydroCAD file 285418HC001A, dated 12/30/2021.

| REV | CALC. BY | DATE | CHECKED BY | DATE | APPROVED BY | DATE |
|-----|----------|------------|------------|------------|-------------|------------|
| 0 | RFK | 12/30/2021 | KJP | 01/03/2022 | JAH | 01/18/2022 |
| | | | | | | |
| | | | | | | |

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Suffolk Downs Redevelopment - Outdoor Entertainment Venue

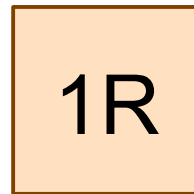
Boston, Massachusetts





EDA-1

EDA-1



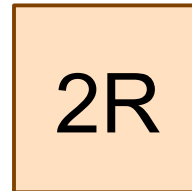
1R

Design Point 1: Sales Creek



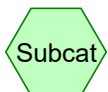
EDA-2

EDA-2



2R

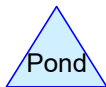
Design Point 2: Horseshoe Pond



Subcat



Reach



Pond



Link

Routing Diagram for 285418HC001A

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Rainfall Events Listing (selected events)

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|--------|------------|----------------|-------|---------|------------------|-----|----------------|-----|
| 1 | BWSC-002yr | Type III 24-hr | | Default | 24.00 | 1 | 3.20 | 2 |
| 2 | BWSC-010yr | Type III 24-hr | | Default | 24.00 | 1 | 6.00 | 2 |
| 3 | BWSC-100yr | Type III 24-hr | | Default | 24.00 | 1 | 8.78 | 2 |

285418HC001A

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Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|--|
| 12.547 | 74 | >75% Grass cover, Good, HSG C (EDA-1, EDA-2) |
| 1.815 | 87 | Dirt roads, HSG C (EDA-1) |
| 0.054 | 89 | Gravel roads, HSG C (EDA-1) |
| 1.881 | 98 | Unconnected pavement, HSG C (EDA-1) |
| 0.020 | 98 | Water Surface, HSG C (EDA-1) |
| 16.317 | 78 | 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 EDA-1: EDA-1 Runoff Area=14.640 ac 12.98% Impervious Runoff Depth>1.21"
Flow Length=635' Tc=17.5 min UI Adjusted CN=77 Runoff=14.29 cfs 1.472 af

Subcatchment EDA-2: EDA-2 Runoff Area=1.677 ac 0.00% Impervious Runoff Depth>1.03"
Flow Length=507' Tc=18.1 min CN=74 Runoff=1.34 cfs 0.144 af

Reach 1R: Design Point 1: Sales Creek Inflow=14.29 cfs 1.472 af
Outflow=14.29 cfs 1.472 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=1.34 cfs 0.144 af
Outflow=1.34 cfs 0.144 af

Total Runoff Area = 16.317 ac Runoff Volume = 1.617 af Average Runoff Depth = 1.19"
88.35% Pervious = 14.416 ac 11.65% Impervious = 1.901 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 14.29 cfs @ 12.26 hrs, Volume= 1.472 af, Depth> 1.21"
 Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 10.870 | 74 | | >75% Grass cover, Good, HSG C |
| 1.815 | 87 | | Dirt roads, HSG C |
| 0.054 | 89 | | Gravel roads, HSG C |
| 1.881 | 98 | | Unconnected pavement, HSG C |
| 0.020 | 98 | | Water Surface, HSG C |
| 14.640 | 79 | 77 | Weighted Average, UI Adjusted |
| 12.739 | | | 87.02% Pervious Area |
| 1.901 | | | 12.98% Impervious Area |
| 1.881 | | | 98.95% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 6.0 | 50 | 0.0172 | 0.14 | | Sheet Flow, Grass |
| | | | | | Grass: Short n= 0.150 P2= 3.20" |
| 0.1 | 8 | 0.0172 | 0.92 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 68 | 0.0147 | 0.85 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 74 | 0.0135 | 0.81 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.0 | 55 | 0.0182 | 0.94 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 46 | 0.0217 | 1.03 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 75 | 0.0133 | 0.81 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 65 | 0.0153 | 0.87 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 3.0 | 118 | 0.0085 | 0.65 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.9 | 52 | 0.0192 | 0.97 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 24 | 0.1250 | 2.47 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 17.5 | 635 | Total | | | |

Summary for Subcatchment EDA-2: EDA-2

Runoff = 1.34 cfs @ 12.27 hrs, Volume= 0.144 af, Depth> 1.03"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.677 | 74 | >75% Grass cover, Good, HSG C |
| 1.677 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 5.6 | 50 | 0.0200 | 0.15 | | Sheet Flow, grass Grass: Short n= 0.150 P2= 3.20" |
| 1.1 | 59 | 0.0169 | 0.91 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 6.7 | 198 | 0.0050 | 0.49 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 136 | 0.0074 | 0.60 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 44 | 0.0227 | 1.05 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.0 | 7 | 0.1429 | 2.65 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 13 | 0.0333 | 1.28 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 18.1 | 507 | Total | | | |

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 14.640 ac, 12.98% Impervious, Inflow Depth > 1.21" for BWSC-002yr event
Inflow = 14.29 cfs @ 12.26 hrs, Volume= 1.472 af
Outflow = 14.29 cfs @ 12.26 hrs, Volume= 1.472 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 1.677 ac, 0.00% Impervious, Inflow Depth > 1.03" for BWSC-002yr event
Inflow = 1.34 cfs @ 12.27 hrs, Volume= 0.144 af
Outflow = 1.34 cfs @ 12.27 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

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

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 EDA-1: EDA-1 Runoff Area=14.640 ac 12.98% Impervious Runoff Depth>3.47"
Flow Length=635' Tc=17.5 min UI Adjusted CN=77 Runoff=42.35 cfs 4.231 af

Subcatchment EDA-2: EDA-2 Runoff Area=1.677 ac 0.00% Impervious Runoff Depth>3.17"
Flow Length=507' Tc=18.1 min CN=74 Runoff=4.38 cfs 0.443 af

Reach 1R: Design Point 1: Sales Creek Inflow=42.35 cfs 4.231 af
Outflow=42.35 cfs 4.231 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=4.38 cfs 0.443 af
Outflow=4.38 cfs 0.443 af

Total Runoff Area = 16.317 ac Runoff Volume = 4.674 af Average Runoff Depth = 3.44"
88.35% Pervious = 14.416 ac 11.65% Impervious = 1.901 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 42.35 cfs @ 12.24 hrs, Volume= 4.231 af, Depth> 3.47"
 Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 10.870 | 74 | | >75% Grass cover, Good, HSG C |
| 1.815 | 87 | | Dirt roads, HSG C |
| 0.054 | 89 | | Gravel roads, HSG C |
| 1.881 | 98 | | Unconnected pavement, HSG C |
| 0.020 | 98 | | Water Surface, HSG C |
| 14.640 | 79 | 77 | Weighted Average, UI Adjusted |
| 12.739 | | | 87.02% Pervious Area |
| 1.901 | | | 12.98% Impervious Area |
| 1.881 | | | 98.95% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 6.0 | 50 | 0.0172 | 0.14 | | Sheet Flow, Grass |
| | | | | | Grass: Short n= 0.150 P2= 3.20" |
| 0.1 | 8 | 0.0172 | 0.92 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 68 | 0.0147 | 0.85 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 74 | 0.0135 | 0.81 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.0 | 55 | 0.0182 | 0.94 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 46 | 0.0217 | 1.03 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 75 | 0.0133 | 0.81 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 65 | 0.0153 | 0.87 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 3.0 | 118 | 0.0085 | 0.65 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.9 | 52 | 0.0192 | 0.97 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 24 | 0.1250 | 2.47 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 17.5 | 635 | Total | | | |

Summary for Subcatchment EDA-2: EDA-2

Runoff = 4.38 cfs @ 12.25 hrs, Volume= 0.443 af, Depth> 3.17"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.677 | 74 | >75% Grass cover, Good, HSG C |
| 1.677 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 5.6 | 50 | 0.0200 | 0.15 | | Sheet Flow, grass Grass: Short n= 0.150 P2= 3.20" |
| 1.1 | 59 | 0.0169 | 0.91 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 6.7 | 198 | 0.0050 | 0.49 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 136 | 0.0074 | 0.60 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 44 | 0.0227 | 1.05 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.0 | 7 | 0.1429 | 2.65 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 13 | 0.0333 | 1.28 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 18.1 | 507 | Total | | | |

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 14.640 ac, 12.98% Impervious, Inflow Depth > 3.47" for BWSC-010yr event
Inflow = 42.35 cfs @ 12.24 hrs, Volume= 4.231 af
Outflow = 42.35 cfs @ 12.24 hrs, Volume= 4.231 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 1.677 ac, 0.00% Impervious, Inflow Depth > 3.17" for BWSC-010yr event
Inflow = 4.38 cfs @ 12.25 hrs, Volume= 0.443 af
Outflow = 4.38 cfs @ 12.25 hrs, Volume= 0.443 af, Atten= 0%, Lag= 0.0 min

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

285418HC001A*Type III 24-hr BWSC-100yr Rainfall=8.78"*

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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 EDA-1: EDA-1 Runoff Area=14.640 ac 12.98% Impervious Runoff Depth>5.98"
Flow Length=635' Tc=17.5 min UI Adjusted CN=77 Runoff=72.32 cfs 7.292 af

Subcatchment EDA-2: EDA-2 Runoff Area=1.677 ac 0.00% Impervious Runoff Depth>5.61"
Flow Length=507' Tc=18.1 min CN=74 Runoff=7.72 cfs 0.784 af

Reach 1R: Design Point 1: Sales Creek Inflow=72.32 cfs 7.292 af
Outflow=72.32 cfs 7.292 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=7.72 cfs 0.784 af
Outflow=7.72 cfs 0.784 af

Total Runoff Area = 16.317 ac Runoff Volume = 8.076 af Average Runoff Depth = 5.94"
88.35% Pervious = 14.416 ac 11.65% Impervious = 1.901 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 72.32 cfs @ 12.24 hrs, Volume= 7.292 af, Depth> 5.98"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 10.870 | 74 | | >75% Grass cover, Good, HSG C |
| 1.815 | 87 | | Dirt roads, HSG C |
| 0.054 | 89 | | Gravel roads, HSG C |
| 1.881 | 98 | | Unconnected pavement, HSG C |
| 0.020 | 98 | | Water Surface, HSG C |
| 14.640 | 79 | 77 | Weighted Average, UI Adjusted |
| 12.739 | | | 87.02% Pervious Area |
| 1.901 | | | 12.98% Impervious Area |
| 1.881 | | | 98.95% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 6.0 | 50 | 0.0172 | 0.14 | | Sheet Flow, Grass |
| | | | | | Grass: Short n= 0.150 P2= 3.20" |
| 0.1 | 8 | 0.0172 | 0.92 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 68 | 0.0147 | 0.85 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 74 | 0.0135 | 0.81 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.0 | 55 | 0.0182 | 0.94 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 46 | 0.0217 | 1.03 | | Shallow Concentrated Flow, Grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.5 | 75 | 0.0133 | 0.81 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 1.3 | 65 | 0.0153 | 0.87 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 3.0 | 118 | 0.0085 | 0.65 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.9 | 52 | 0.0192 | 0.97 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 24 | 0.1250 | 2.47 | | Shallow Concentrated Flow, grass |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 17.5 | 635 | Total | | | |

Summary for Subcatchment EDA-2: EDA-2

Runoff = 7.72 cfs @ 12.25 hrs, Volume= 0.784 af, Depth> 5.61"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 1.677 | 74 | >75% Grass cover, Good, HSG C |
| 1.677 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 5.6 | 50 | 0.0200 | 0.15 | | Sheet Flow, grass Grass: Short n= 0.150 P2= 3.20" |
| 1.1 | 59 | 0.0169 | 0.91 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 6.7 | 198 | 0.0050 | 0.49 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 3.8 | 136 | 0.0074 | 0.60 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.7 | 44 | 0.0227 | 1.05 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.0 | 7 | 0.1429 | 2.65 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 0.2 | 13 | 0.0333 | 1.28 | | Shallow Concentrated Flow, grass Short Grass Pasture Kv= 7.0 fps |
| 18.1 | 507 | Total | | | |

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 14.640 ac, 12.98% Impervious, Inflow Depth > 5.98" for BWSC-100yr event
Inflow = 72.32 cfs @ 12.24 hrs, Volume= 7.292 af
Outflow = 72.32 cfs @ 12.24 hrs, Volume= 7.292 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 1.677 ac, 0.00% Impervious, Inflow Depth > 5.61" for BWSC-100yr event
Inflow = 7.72 cfs @ 12.25 hrs, Volume= 0.784 af
Outflow = 7.72 cfs @ 12.25 hrs, Volume= 0.784 af, Atten= 0%, Lag= 0.0 min

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

POST-DEVELOPMENT HYDROLOGIC ANALYSIS

OBJECTIVE

To determine the post-development peak rates of runoff from the site for the 2-, 10-, and 100-year storm events.

CONCLUSION(S)

Peak Runoff Rates

The following numbers represent the peak rates of runoff from the site under post-development conditions:

| Storm Event | Design Point 1: Sales Creek (cfs) | Design Point 2: Horseshoe Pond (cfs) |
|---------------|-----------------------------------|--------------------------------------|
| 2-year | 12.84 | 0.54 |
| BWSC 10-year | 35.41 | 1.69 |
| BWSC 100-year | 59.89 | 2.94 |

Post-development peak runoff rates are less than pre-development rates in accordance with the MassDEP Stormwater Handbook.

CALCULATION METHODS

1. CN and T_c determined based on TR-55 methodology.
2. Runoff rates computed using HydroCAD version 10.10-5a.
3. Area take-offs performed using Civil 3D.

ASSUMPTIONS

1. Surface cover types and boundaries have been estimated based upon MassGIS, USGS Color Ortho Imagery 2016, aerial photography viewed on Google Earth, and AutoCAD file 285418B025A.dwg.
2. Proposed Surface Treatment A and B (heavy and light duty bituminous concrete) were modeled as impervious pavement with a curve number (CN) of 98.
3. Proposed Surface Treatment C and D (gravel drive and pad) were modeled as gravel roads with a CN of 89.
4. Proposed Surface Treatment E (stone dust pad) was modeled as gravel roads with a CN of 89.
5. For a conservative design approach, the trench drains with crushed stone and the proposed stone diaphragms were modeled as gravel roads with a CN of 89.
6. All proposed event structures and accessories were not considered in this analysis because they are all temporary in nature and will not create any earth disturbance upon setup.
7. Urban Land, Udorthents, and Ipswich Mucky Peat modeled as Hydrologic soil class "C" soils.
8. Based on information from Table 2.3.3 in Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook, the on-site soils are assumed to have an infiltration rate of 0.17 in/hr.

| REV | CALC. BY | DATE | CHECKED BY | DATE | APPROVED BY | DATE |
|-----|----------|------------|------------|------------|-------------|------------|
| 0 | RFK | 12/30/2021 | KJP | 01/03/2022 | JAH | 01/18/2022 |
| 1 | RFK | 02/16/2022 | EAC | 02/16/2022 | JAH | 02/17/2022 |
| | | | | | | |

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9. For design purposes, the groundwater elevation is assumed to be at 10' BCB based on a "Groundwater Elevation Contours" exhibit of the Suffolk Downs site, prepared by GEI Consultants, dated 12/27/2006.
10. Rainfall depth for 10-year storm event and 100-year storm event based on "BWSC Climate Change Risk Assessment, Findings and Mitigation/Adaptation Strategies for Wastewater and Storm Drainage" dated 01/28/2015.

SOURCES OF DATA/ EQUATIONS

1. Post-Development Conditions Watershed Map, dated 02/16/2022, prepared by Beals and Thomas, Inc. (285418P444B-002).
2. TR-55 Urban Hydrology for Small Watersheds, SCS, 1986.
3. NRCS Soil Survey for Norfolk and Suffolk Counties, downloaded from Web Soil Survey 2.0 on 05/04/2017.

LIST OF ATTACHMENTS

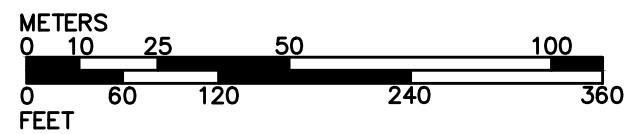
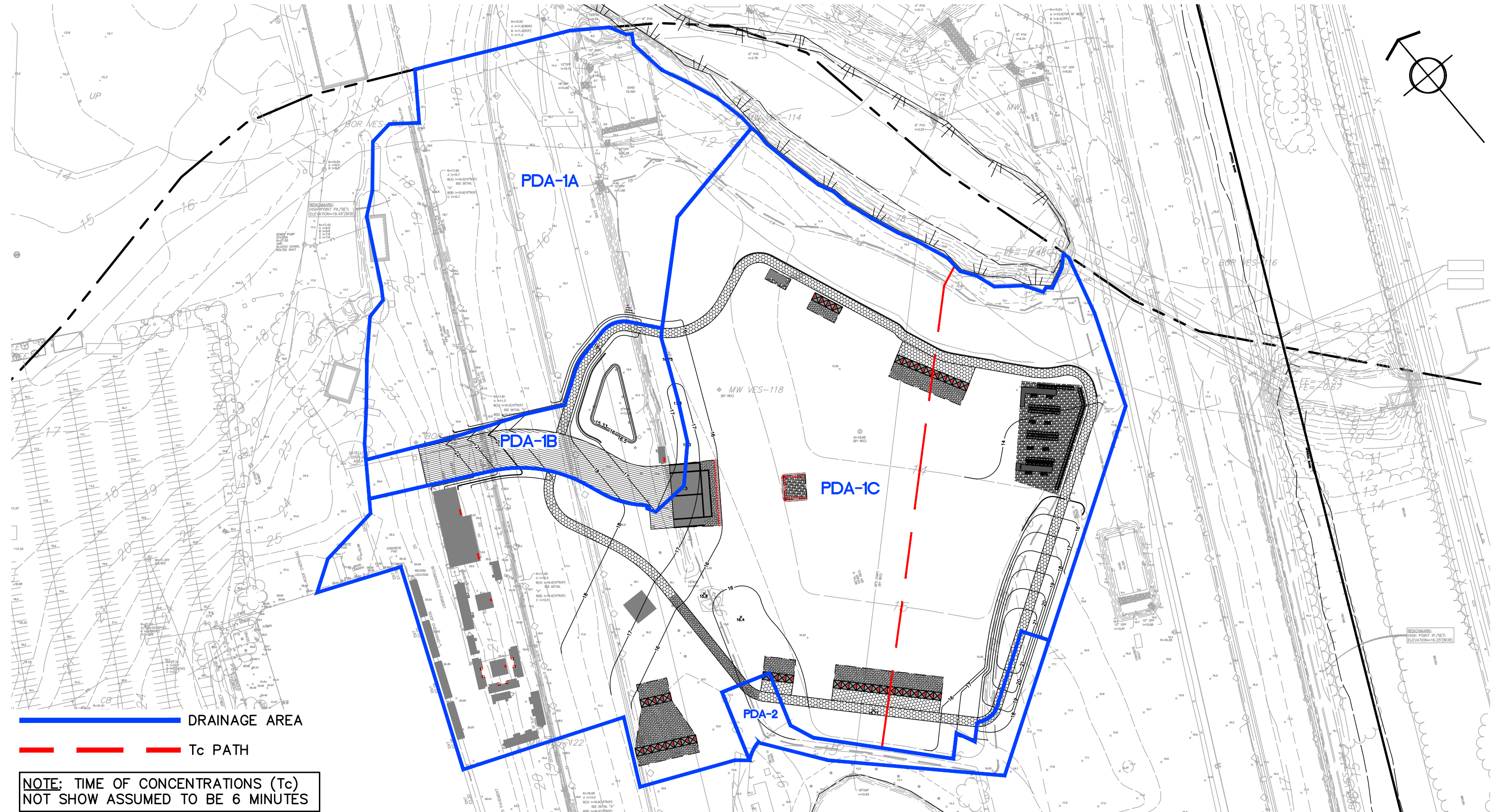
1. Post-Development Conditions Watershed Map, dated 02/16/2022, prepared by Beals and Thomas, Inc.
2. Post-Development Conditions Hydrology Report from HydroCAD file 285418HC002B, dated 02/16/2022.

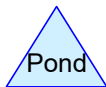
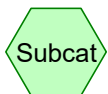
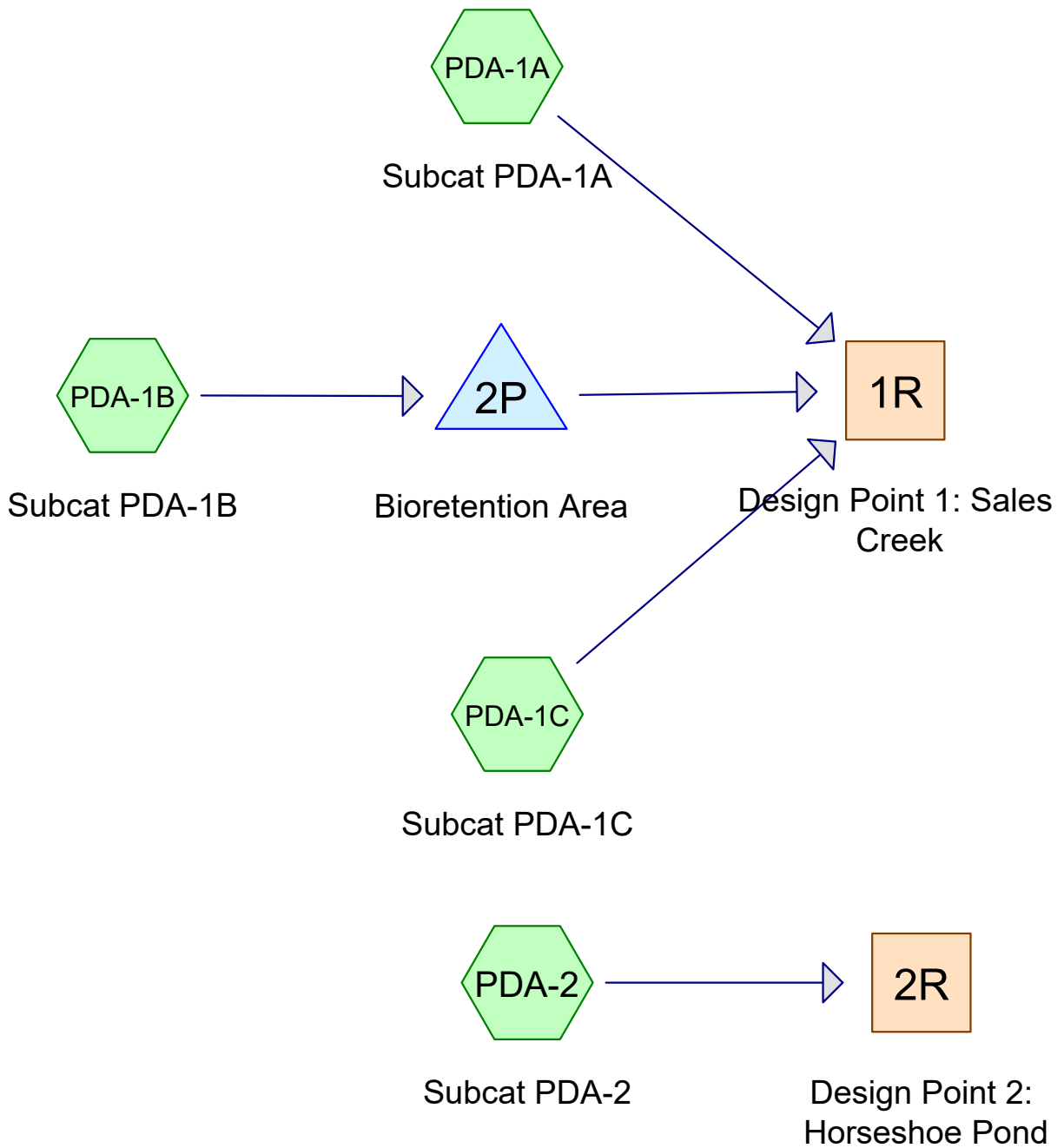
| REV | CALC. BY | DATE | CHECKED BY | DATE | APPROVED BY | DATE |
|-----|----------|------------|------------|------------|-------------|------------|
| 0 | RFK | 12/30/2021 | KJP | 01/03/2022 | JAH | 01/18/2022 |
| 1 | RFK | 02/16/2022 | EAC | 02/16/2022 | JAH | 02/17/2022 |
| | | | | | | |

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Suffolk Downs Redevelopment - Outdoor Entertainment Venue

Boston, Massachusetts





285418HC002B

Prepared by Beals and Thomas, Inc.

Printed 2/16/2022

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Page 2

Rainfall Events Listing (selected events)

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|--------|------------|----------------|-------|---------|------------------|-----|----------------|-----|
| 1 | BWSC-002yr | Type III 24-hr | | Default | 24.00 | 1 | 3.20 | 2 |
| 2 | BWSC-010yr | Type III 24-hr | | Default | 24.00 | 1 | 6.00 | 2 |
| 3 | BWSC-100yr | Type III 24-hr | | Default | 24.00 | 1 | 8.78 | 2 |

Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|---|
| 10.571 | 74 | >75% Grass cover, Good, HSG C (PDA-1A, PDA-1B, PDA-1C, PDA-2) |
| 1.678 | 87 | Dirt roads, HSG C (PDA-1A, PDA-1B, PDA-1C) |
| 1.802 | 89 | Gravel roads, HSG C (PDA-1A, PDA-1B, PDA-1C, PDA-2) |
| 2.259 | 98 | Unconnected pavement, HSG C (PDA-1A, PDA-1B, PDA-1C) |
| 0.007 | 98 | Water Surface, HSG C (PDA-1A) |
| 16.317 | 80 | 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 PDA-1A: Subcat PDA-1A Runoff Area=4.143 ac 21.53% Impervious Runoff Depth>1.47"
Tc=6.0 min UI Adjusted CN=81 Runoff=6.96 cfs 0.507 af

Subcatchment PDA-1B: Subcat PDA-1B Runoff Area=1.041 ac 45.57% Impervious Runoff Depth>1.91"
Tc=6.0 min CN=87 Runoff=2.29 cfs 0.166 af

Subcatchment PDA-1C: Subcat PDA-1C Runoff Area=10.684 ac 8.42% Impervious Runoff Depth>1.27"
Flow Length=653' Tc=27.7 min UI Adjusted CN=78 Runoff=9.11 cfs 1.126 af

Subcatchment PDA-2: Subcat PDA-2 Runoff Area=0.449 ac 0.00% Impervious Runoff Depth>1.09"
Tc=6.0 min CN=75 Runoff=0.54 cfs 0.041 af

Reach 1R: Design Point 1: Sales Creek Inflow=12.84 cfs 1.737 af
Outflow=12.84 cfs 1.737 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=0.54 cfs 0.041 af
Outflow=0.54 cfs 0.041 af

Pond 2P: Bioretention Area Peak Elev=16.17' Storage=2,457 cf Inflow=2.29 cfs 0.166 af
Discarded=0.01 cfs 0.017 af Primary=1.40 cfs 0.104 af Outflow=1.42 cfs 0.121 af

Total Runoff Area = 16.317 ac Runoff Volume = 1.840 af Average Runoff Depth = 1.35"
86.11% Pervious = 14.051 ac 13.89% Impervious = 2.266 ac

Summary for Subcatchment PDA-1A: Subcat PDA-1A

Runoff = 6.96 cfs @ 12.10 hrs, Volume= 0.507 af, Depth> 1.47"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 2.035 | 74 | | >75% Grass cover, Good, HSG C |
| 0.960 | 87 | | Dirt roads, HSG C |
| 0.256 | 89 | | Gravel roads, HSG C |
| 0.007 | 98 | | Water Surface, HSG C |
| 0.884 | 98 | | Unconnected pavement, HSG C |
| 4.143 | 83 | 81 | Weighted Average, UI Adjusted |
| 3.251 | | | 78.47% Pervious Area |
| 0.892 | | | 21.53% Impervious Area |
| 0.884 | | | 99.18% Unconnected |

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

Summary for Subcatchment PDA-1B: Subcat PDA-1B

Runoff = 2.29 cfs @ 12.09 hrs, Volume= 0.166 af, Depth> 1.91"

Routed to Pond 2P : Bioretention Area

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.447 | 74 | >75% Grass cover, Good, HSG C |
| 0.039 | 87 | Dirt roads, HSG C |
| 0.081 | 89 | Gravel roads, HSG C |
| 0.474 | 98 | Unconnected pavement, HSG C |
| 1.041 | 87 | Weighted Average |
| 0.567 | | 54.43% Pervious Area |
| 0.474 | | 45.57% Impervious Area |
| 0.474 | | 100.00% Unconnected |

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

Summary for Subcatchment PDA-1C: Subcat PDA-1C

Runoff = 9.11 cfs @ 12.41 hrs, Volume= 1.126 af, Depth> 1.27"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 7.683 | 74 | | >75% Grass cover, Good, HSG C |
| 0.680 | 87 | | Dirt roads, HSG C |
| 1.421 | 89 | | Gravel roads, HSG C |
| 0.900 | 98 | | Unconnected pavement, HSG C |
| 10.684 | 79 | 78 | Weighted Average, UI Adjusted |
| 9.784 | | | 91.58% Pervious Area |
| 0.900 | | | 8.42% Impervious Area |
| 0.900 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 8.6 | 50 | 0.0070 | 0.10 | | Sheet Flow, Tc-1 Grass: Short n= 0.150 P2= 3.20" |
| 9.6 | 312 | 0.0060 | 0.54 | | Shallow Concentrated Flow, Tc-2 Short Grass Pasture Kv= 7.0 fps |
| 9.1 | 241 | 0.0040 | 0.44 | | Shallow Concentrated Flow, Tc-3 Short Grass Pasture Kv= 7.0 fps |
| 0.4 | 50 | 0.0900 | 2.10 | | Shallow Concentrated Flow, Tc-4 Short Grass Pasture Kv= 7.0 fps |
| 27.7 | 653 | Total | | | |

Summary for Subcatchment PDA-2: Subcat PDA-2

Runoff = 0.54 cfs @ 12.10 hrs, Volume= 0.041 af, Depth> 1.09"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-002yr Rainfall=3.20"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.406 | 74 | >75% Grass cover, Good, HSG C |
| 0.043 | 89 | Gravel roads, HSG C |
| 0.449 | 75 | Weighted Average |
| 0.449 | | 100.00% Pervious Area |

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

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 15.867 ac, 14.28% Impervious, Inflow Depth > 1.31" for BWSC-002yr event
Inflow = 12.84 cfs @ 12.34 hrs, Volume= 1.737 af
Outflow = 12.84 cfs @ 12.34 hrs, Volume= 1.737 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 0.449 ac, 0.00% Impervious, Inflow Depth > 1.09" for BWSC-002yr event
Inflow = 0.54 cfs @ 12.10 hrs, Volume= 0.041 af
Outflow = 0.54 cfs @ 12.10 hrs, Volume= 0.041 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 Pond 2P: Bioretention Area

Inflow Area = 1.041 ac, 45.57% Impervious, Inflow Depth > 1.91" for BWSC-002yr event
 Inflow = 2.29 cfs @ 12.09 hrs, Volume= 0.166 af
 Outflow = 1.42 cfs @ 12.21 hrs, Volume= 0.121 af, Atten= 38%, Lag= 7.2 min
 Discarded = 0.01 cfs @ 12.21 hrs, Volume= 0.017 af
 Primary = 1.40 cfs @ 12.21 hrs, Volume= 0.104 af
 Routed to Reach 1R : Design Point 1: Sales Creek

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 16.17' @ 12.21 hrs Surf.Area= 3,239 sf Storage= 2,457 cf

Plug-Flow detention time= 143.7 min calculated for 0.121 af (73% of inflow)
 Center-of-Mass det. time= 54.6 min (872.9 - 818.3)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 15.33' | 3,577 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 15.33 | 2,635 | 0 | 0 |
| 16.00 | 3,114 | 1,926 | 1,926 |
| 16.50 | 3,489 | 1,651 | 3,577 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 16.00' | 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #2 | Discarded | 15.33' | 0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 10.00' |

Discarded OutFlow Max=0.01 cfs @ 12.21 hrs HW=16.16' (Free Discharge)
 ↑2=Exfiltration (Controls 0.01 cfs)

Primary OutFlow Max=1.38 cfs @ 12.21 hrs HW=16.17' (Free Discharge)
 ↑1=Orifice/Grate (Weir Controls 1.38 cfs @ 1.33 fps)

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 PDA-1A: Subcat PDA-1A Runoff Area=4.143 ac 21.53% Impervious Runoff Depth>3.88"
Tc=6.0 min UI Adjusted CN=81 Runoff=18.35 cfs 1.340 af

Subcatchment PDA-1B: Subcat PDA-1B Runoff Area=1.041 ac 45.57% Impervious Runoff Depth>4.51"
Tc=6.0 min CN=87 Runoff=5.24 cfs 0.392 af

Subcatchment PDA-1C: Subcat PDA-1C Runoff Area=10.684 ac 8.42% Impervious Runoff Depth>3.56"
Flow Length=653' Tc=27.7 min UI Adjusted CN=78 Runoff=26.21 cfs 3.170 af

Subcatchment PDA-2: Subcat PDA-2 Runoff Area=0.449 ac 0.00% Impervious Runoff Depth>3.28"
Tc=6.0 min CN=75 Runoff=1.69 cfs 0.123 af

Reach 1R: Design Point 1: Sales Creek Inflow=35.41 cfs 4.836 af
Outflow=35.41 cfs 4.836 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=1.69 cfs 0.123 af
Outflow=1.69 cfs 0.123 af

Pond 2P: Bioretention Area Peak Elev=16.37' Storage=3,127 cf Inflow=5.24 cfs 0.392 af
Discarded=0.02 cfs 0.020 af Primary=4.61 cfs 0.326 af Outflow=4.63 cfs 0.346 af

Total Runoff Area = 16.317 ac Runoff Volume = 5.024 af Average Runoff Depth = 3.69"
86.11% Pervious = 14.051 ac 13.89% Impervious = 2.266 ac

Summary for Subcatchment PDA-1A: Subcat PDA-1A

Runoff = 18.35 cfs @ 12.09 hrs, Volume= 1.340 af, Depth> 3.88"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 2.035 | 74 | | >75% Grass cover, Good, HSG C |
| 0.960 | 87 | | Dirt roads, HSG C |
| 0.256 | 89 | | Gravel roads, HSG C |
| 0.007 | 98 | | Water Surface, HSG C |
| 0.884 | 98 | | Unconnected pavement, HSG C |
| 4.143 | 83 | 81 | Weighted Average, UI Adjusted |
| 3.251 | | | 78.47% Pervious Area |
| 0.892 | | | 21.53% Impervious Area |
| 0.884 | | | 99.18% Unconnected |

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

Summary for Subcatchment PDA-1B: Subcat PDA-1B

Runoff = 5.24 cfs @ 12.09 hrs, Volume= 0.392 af, Depth> 4.51"
 Routed to Pond 2P : Bioretention Area

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.447 | 74 | >75% Grass cover, Good, HSG C |
| 0.039 | 87 | Dirt roads, HSG C |
| 0.081 | 89 | Gravel roads, HSG C |
| 0.474 | 98 | Unconnected pavement, HSG C |
| 1.041 | 87 | Weighted Average |
| 0.567 | | 54.43% Pervious Area |
| 0.474 | | 45.57% Impervious Area |
| 0.474 | | 100.00% Unconnected |

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

Summary for Subcatchment PDA-1C: Subcat PDA-1C

Runoff = 26.21 cfs @ 12.38 hrs, Volume= 3.170 af, Depth> 3.56"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 7.683 | 74 | | >75% Grass cover, Good, HSG C |
| 0.680 | 87 | | Dirt roads, HSG C |
| 1.421 | 89 | | Gravel roads, HSG C |
| 0.900 | 98 | | Unconnected pavement, HSG C |
| 10.684 | 79 | 78 | Weighted Average, UI Adjusted |
| 9.784 | | | 91.58% Pervious Area |
| 0.900 | | | 8.42% Impervious Area |
| 0.900 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 8.6 | 50 | 0.0070 | 0.10 | | Sheet Flow, Tc-1 |
| | | | | | Grass: Short n= 0.150 P2= 3.20" |
| 9.6 | 312 | 0.0060 | 0.54 | | Shallow Concentrated Flow, Tc-2 |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 9.1 | 241 | 0.0040 | 0.44 | | Shallow Concentrated Flow, Tc-3 |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 0.4 | 50 | 0.0900 | 2.10 | | Shallow Concentrated Flow, Tc-4 |
| | | | | | Short Grass Pasture Kv= 7.0 fps |
| 27.7 | 653 | Total | | | |

Summary for Subcatchment PDA-2: Subcat PDA-2

Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.123 af, Depth> 3.28"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-010yr Rainfall=6.00"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.406 | 74 | >75% Grass cover, Good, HSG C |
| 0.043 | 89 | Gravel roads, HSG C |
| 0.449 | 75 | Weighted Average |
| 0.449 | | 100.00% Pervious Area |

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

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 15.867 ac, 14.28% Impervious, Inflow Depth > 3.66" for BWSC-010yr event
Inflow = 35.41 cfs @ 12.32 hrs, Volume= 4.836 af
Outflow = 35.41 cfs @ 12.32 hrs, Volume= 4.836 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 0.449 ac, 0.00% Impervious, Inflow Depth > 3.28" for BWSC-010yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.123 af
Outflow = 1.69 cfs @ 12.09 hrs, Volume= 0.123 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 Pond 2P: Bioretention Area

Inflow Area = 1.041 ac, 45.57% Impervious, Inflow Depth > 4.51" for BWSC-010yr event
 Inflow = 5.24 cfs @ 12.09 hrs, Volume= 0.392 af
 Outflow = 4.63 cfs @ 12.13 hrs, Volume= 0.346 af, Atten= 12%, Lag= 2.8 min
 Discarded = 0.02 cfs @ 12.13 hrs, Volume= 0.020 af
 Primary = 4.61 cfs @ 12.13 hrs, Volume= 0.326 af
 Routed to Reach 1R : Design Point 1: Sales Creek

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 16.37' @ 12.13 hrs Surf.Area= 3,391 sf Storage= 3,127 cf

Plug-Flow detention time= 86.0 min calculated for 0.346 af (88% of inflow)
 Center-of-Mass det. time= 32.5 min (826.7 - 794.2)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 15.33' | 3,577 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 15.33 | 2,635 | 0 | 0 |
| 16.00 | 3,114 | 1,926 | 1,926 |
| 16.50 | 3,489 | 1,651 | 3,577 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 16.00' | 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #2 | Discarded | 15.33' | 0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 10.00' |

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=16.36' (Free Discharge)
 ↑**2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=4.53 cfs @ 12.13 hrs HW=16.36' (Free Discharge)
 ↑**1=Orifice/Grate** (Weir Controls 4.53 cfs @ 1.97 fps)

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 PDA-1A: Subcat PDA-1A Runoff Area=4.143 ac 21.53% Impervious Runoff Depth>6.48"
Tc=6.0 min UI Adjusted CN=81 Runoff=30.03 cfs 2.236 af

Subcatchment PDA-1B: Subcat PDA-1B Runoff Area=1.041 ac 45.57% Impervious Runoff Depth>7.21"
Tc=6.0 min CN=87 Runoff=8.15 cfs 0.625 af

Subcatchment PDA-1C: Subcat PDA-1C Runoff Area=10.684 ac 8.42% Impervious Runoff Depth>6.09"
Flow Length=653' Tc=27.7 min UI Adjusted CN=78 Runoff=44.38 cfs 5.420 af

Subcatchment PDA-2: Subcat PDA-2 Runoff Area=0.449 ac 0.00% Impervious Runoff Depth>5.75"
Tc=6.0 min CN=75 Runoff=2.94 cfs 0.215 af

Reach 1R: Design Point 1: Sales Creek Inflow=59.89 cfs 8.213 af
Outflow=59.89 cfs 8.213 af

Reach 2R: Design Point 2: Horseshoe Pond Inflow=2.94 cfs 0.215 af
Outflow=2.94 cfs 0.215 af

Pond 2P: Bioretention Area Peak Elev=16.50' Storage=3,577 cf Inflow=8.15 cfs 0.625 af
Discarded=0.02 cfs 0.022 af Primary=7.31 cfs 0.558 af Outflow=7.33 cfs 0.579 af

Total Runoff Area = 16.317 ac Runoff Volume = 8.495 af Average Runoff Depth = 6.25"
86.11% Pervious = 14.051 ac 13.89% Impervious = 2.266 ac

Summary for Subcatchment PDA-1A: Subcat PDA-1A

Runoff = 30.03 cfs @ 12.09 hrs, Volume= 2.236 af, Depth> 6.48"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 2.035 | 74 | | >75% Grass cover, Good, HSG C |
| 0.960 | 87 | | Dirt roads, HSG C |
| 0.256 | 89 | | Gravel roads, HSG C |
| 0.007 | 98 | | Water Surface, HSG C |
| 0.884 | 98 | | Unconnected pavement, HSG C |
| 4.143 | 83 | 81 | Weighted Average, UI Adjusted |
| 3.251 | | | 78.47% Pervious Area |
| 0.892 | | | 21.53% Impervious Area |
| 0.884 | | | 99.18% Unconnected |

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

Summary for Subcatchment PDA-1B: Subcat PDA-1B

Runoff = 8.15 cfs @ 12.09 hrs, Volume= 0.625 af, Depth> 7.21"
 Routed to Pond 2P : Bioretention Area

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.447 | 74 | >75% Grass cover, Good, HSG C |
| 0.039 | 87 | Dirt roads, HSG C |
| 0.081 | 89 | Gravel roads, HSG C |
| 0.474 | 98 | Unconnected pavement, HSG C |
| 1.041 | 87 | Weighted Average |
| 0.567 | | 54.43% Pervious Area |
| 0.474 | | 45.57% Impervious Area |
| 0.474 | | 100.00% Unconnected |

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

Summary for Subcatchment PDA-1C: Subcat PDA-1C

Runoff = 44.38 cfs @ 12.37 hrs, Volume= 5.420 af, Depth> 6.09"

Routed to Reach 1R : Design Point 1: Sales Creek

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Adj | Description |
|-----------|----|-----|-------------------------------|
| 7.683 | 74 | | >75% Grass cover, Good, HSG C |
| 0.680 | 87 | | Dirt roads, HSG C |
| 1.421 | 89 | | Gravel roads, HSG C |
| 0.900 | 98 | | Unconnected pavement, HSG C |
| 10.684 | 79 | 78 | Weighted Average, UI Adjusted |
| 9.784 | | | 91.58% Pervious Area |
| 0.900 | | | 8.42% Impervious Area |
| 0.900 | | | 100.00% Unconnected |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 8.6 | 50 | 0.0070 | 0.10 | | Sheet Flow, Tc-1 Grass: Short n= 0.150 P2= 3.20" |
| 9.6 | 312 | 0.0060 | 0.54 | | Shallow Concentrated Flow, Tc-2 Short Grass Pasture Kv= 7.0 fps |
| 9.1 | 241 | 0.0040 | 0.44 | | Shallow Concentrated Flow, Tc-3 Short Grass Pasture Kv= 7.0 fps |
| 0.4 | 50 | 0.0900 | 2.10 | | Shallow Concentrated Flow, Tc-4 Short Grass Pasture Kv= 7.0 fps |
| 27.7 | 653 | Total | | | |

Summary for Subcatchment PDA-2: Subcat PDA-2

Runoff = 2.94 cfs @ 12.09 hrs, Volume= 0.215 af, Depth> 5.75"

Routed to Reach 2R : Design Point 2: Horseshoe Pond

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 BWSC-100yr Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.406 | 74 | >75% Grass cover, Good, HSG C |
| 0.043 | 89 | Gravel roads, HSG C |
| 0.449 | 75 | Weighted Average |
| 0.449 | | 100.00% Pervious Area |

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

Summary for Reach 1R: Design Point 1: Sales Creek

Inflow Area = 15.867 ac, 14.28% Impervious, Inflow Depth > 6.21" for BWSC-100yr event
Inflow = 59.89 cfs @ 12.12 hrs, Volume= 8.213 af
Outflow = 59.89 cfs @ 12.12 hrs, Volume= 8.213 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 Reach 2R: Design Point 2: Horseshoe Pond

Inflow Area = 0.449 ac, 0.00% Impervious, Inflow Depth > 5.75" for BWSC-100yr event
Inflow = 2.94 cfs @ 12.09 hrs, Volume= 0.215 af
Outflow = 2.94 cfs @ 12.09 hrs, Volume= 0.215 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 Pond 2P: Bioretention Area

Inflow Area = 1.041 ac, 45.57% Impervious, Inflow Depth > 7.21" for BWSC-100yr event
 Inflow = 8.15 cfs @ 12.09 hrs, Volume= 0.625 af
 Outflow = 7.33 cfs @ 12.13 hrs, Volume= 0.579 af, Atten= 10%, Lag= 2.4 min
 Discarded = 0.02 cfs @ 12.13 hrs, Volume= 0.022 af
 Primary = 7.31 cfs @ 12.13 hrs, Volume= 0.558 af
 Routed to Reach 1R : Design Point 1: Sales Creek

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 16.50' @ 12.13 hrs Surf.Area= 3,489 sf Storage= 3,577 cf

Plug-Flow detention time= 65.6 min calculated for 0.579 af (93% of inflow)
 Center-of-Mass det. time= 27.2 min (808.8 - 781.6)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 15.33' | 3,577 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 15.33 | 2,635 | 0 | 0 |
| 16.00 | 3,114 | 1,926 | 1,926 |
| 16.50 | 3,489 | 1,651 | 3,577 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 16.00' | 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #2 | Discarded | 15.33' | 0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 10.00' |

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=16.50' (Free Discharge)
 ↑2=Exfiltration (Controls 0.02 cfs)

Primary OutFlow Max=7.16 cfs @ 12.13 hrs HW=16.50' (Free Discharge)
 ↑1=Orifice/Grate (Weir Controls 7.16 cfs @ 2.30 fps)

Attachment 3

Groundwater Recharge, Water Quality Volume, and TSS Removal Calculations



BEALS + THOMAS

Outdoor Entertainment Venue - Required Infiltration Volume

Existing Conditions

| Design Point | Total Area (acres) | Impervious Area (acres) |
|----------------------|-----------------------|----------------------------|
| DP-1: Sales Creek | 14.640 | 1.881 |
| DP-2: Horseshoe Pond | 1.677 | 0.000 |

Proposed Conditions

| Design Point | Total Area (acres) | Impervious Area (acres) | New Impervious Area (acres) | New Impervious Area (SF) | Required Infiltration Volume (CF) |
|----------------------|-----------------------|----------------------------|-----------------------------------|--------------------------------|---|
| DP-1: Sales Creek | 15.868 | 2.259 | 0.378 | 16,466 | 1,715 |
| DP-2: Horseshoe Pond | 0.449 | 0.000 | 0.000 | 0.00 | 0 |
| Total | | | | | 1,715 |

In accordance with the BWSC requirements, the proposed site is required to infiltrate 1.25 inches of rainfall times the total new impervious area on site, which is calculated to be 1,715 cubic feet of volume.

Notes:

1. Existing conditions were derived from B+T File No. 285402B004N
2. Proposed conditions were derived from B+T File No. 285418D066C
3. Required infiltration volume is 1.25 inches times the proposed new impervious area
4. On-site soils are modeled as Hydrologic soil class "C" soils.

JOB NO. 2854.18

PROJECT: Outdoor Entertainment Venue



BEALS + THOMAS

Bioretention Area Provided Recharge and Water Quality Volume

Bioretention Area

Provided Volume:

| Elevation | Area (SF) | Voids | STORAGE (Cubic Feet) | | |
|-----------|-----------|-------|----------------------|------------|-------|
| | | | INTERVAL | CUMULATIVE | |
| 15.333 | 2,635 | 100% | 0 | 0 | |
| 16.000 | 3,114 | 100% | 1,917 | 1,917 | |
| | | | | = | 0.044 |
| | | | | | Ac-Ft |

Notes:

1. The volume provided is from the designed ponding depth of the bioretention area, and includes all storage below the outlet.

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 JOB: Outdoor Entertainment Venue DATE: 02/16/22

CHECKED BY: EAC
 DATE: 2/16/2022



BEALS + THOMAS
Standard 3: Groundwater Recharge

Groundwater Recharge Volume Required:

Rv = F x Impervious Area, where:

Rv = Required Recharge Volume [Ac-ft]

F = Target Depth Factor associated with each Hydrologic Soil Group (HSG) [in]

New Impervious Area = Total New Pavement and Rooftop Area under Post-development Conditions [Ac]

Existing Conditions Impervious Area: 1.881 Acres
 Proposed Conditions Impervious Area (includes existing impervious area): 2.259 Acres
 New Impervious Area: 0.378 Acres

| | | | Impervious Area [Acres] | Required Recharge Volume [Ac-ft] |
|--|---------|--|----------------------------|-------------------------------------|
| HSG "A", use F = | 0.6 in | | 0.000 | 0.000 |
| HSG "B", use F = | 0.35 in | | 0.000 | 0.000 |
| HSG "C", use F = | 0.25 in | | 0.378 | 0.008 |
| HSG "D", use F = | 0.1 in | | 0.000 | 0.000 |
| Total Required Recharge Volume (Rv) = | | | | 0.00788 Ac-ft |

Capture Area Adjustment: (Ref: DEP Handbook V.3 Ch.1 P.27-28)

New Impervious Area (Total)= 0.378 Acres
 Impervious Area Draining to Infiltrative BMPs (infil) = 0.474 Acres (PDA-1B)
 Percent Imp. Area Draining to Infiltrative BMPs = 125.4%

Capture Area Adjustment Factor = (Total)/(Infil) = Ca = 0.80
Adjusted Required Recharge Volume = Ca x Rv 0.00628 Ac-ft

Groundwater Recharge Volume Provided :

| BMP | Provided Recharge Volume [Ac-ft] |
|---|-------------------------------------|
| Bioretention Area = | 0.044 |
| Total Provided Recharge Volume = | 0.044 Ac-ft |

PROVIDED GROUNDWATER RECHARGE VOLUME IS GREATER THAN OR EQUAL TO THE REQUIRED RECHARGE VOLUME, THEREFORE PROPOSED STORMWATER MANAGEMENT DESIGN IS IN COMPLIANCE WITH STANDARD 3.

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Standard 3: Drawdown

$$\text{Drawdown Time} = \frac{Rv}{(K) (\text{Bottom Area})}$$

where:

Rv = Storage Volume Below Outlet [Ac-ft]

K= Infiltration Rate [in/hr]

Bottom Area= Bottom Area of Recharge System [Ac]

Rain Garden-01 (ponding area only)

Rv = 0.044 Ac-ft

K = 0.170 in/hr

Bottom Area = 0.060 Acres

Drawdown Time = 51.765 Hours < 72 Hours, Design is in compliance with the standard.

Note:

1. The infiltration BMPs have been designed to fully drain within 72 hours, therefore the proposed stormwater management design is in compliance with Standard 3 .
2. Infiltration Rate based on Volume 3, Chapter 1, Table 2.3.3 *Rawls Rates* from the 2008 MA DEP Stormwater Management Handbook.

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Standard 4: Water Quality Volume Summary

$$V_{WQ} = (D_{WQ} / 12 \text{ in/ft}) \times (A_{IMP} \times 43,560 \text{ SF/Ac}) \text{ where:}$$

V_{WQ} = Required Water Quality Volume [CF]

D_{WQ} = Water Quality Depth : 1-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near critical areas, runoff from LUHPPL, or exfiltration to soil with infiltration rate 2.4 in/hr or greater; ½-inch for discharges to other areas.

A_{IMP} = Post-development Impervious Area; may exclude roof top areas [Ac]

Required Water Quality Volume:

| Drainage Area/ Treatment Train | A_{IMP} [Ac] | D_{WQ} [in] | V_{WQ} Required [CF] | |
|---|-------------------|------------------|---------------------------|--|
| PDA-1A | 0.884 | 1 | 0 | (existing impervious area) |
| PDA-1B | 0.474 | 1 | 1,721 | (mix of existing and proposed impervious area) |
| PDA-1C | 0.900 | 1 | 0 | (existing impervious area) |
| PDA-2 | 0.000 | 1 | 0 | |
| Total Required Water Quality Volume: | | | 1,721 | Cubic Feet |

Provided Water Quality Volume:

| Drainage Area/ Treatment Train | BMP | Water Quality Volume Provided [CF] | |
|---|-------------------|--|-------------------|
| PDA-1B | Bioretention Area | 1,917 | |
| Total Provided Water Quality Volume: | | 1,917 | Cubic Feet |

WATER QUALITY VOLUME PROVIDED IS GREATER THAN OR EQUAL TO THE REQUIRED WATER QUALITY VOLUME, THEREFORE PROPOSED STORMWATER MANAGEMENT DESIGN IS IN COMPLIANCE WITH STANDARD 4.

Note:

1. The proposed stormwater management BMPs provide water quality volume for the new impervious areas on-site under proposed conditions.

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DATE: 2/16/2022



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TSS Removal Calculations

Location:

| A BMP ¹ | B TSS Removal Rate ¹ | C Starting TSS Load* | D Amount Removed (B*C) | E Remaining Load (C-D) |
|-----------------------|---------------------------------------|----------------------------|------------------------------|------------------------------|
| Bioretention Area | 0.90 | 1.00 | 0.90 | 0.10 |
| | | | | |

Total TSS Removal =

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Attachment 4

Site Owner's Manual

Site Owner's Manual

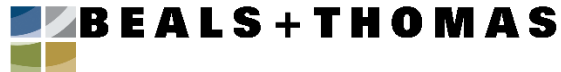
OUTDOOR ENTERTAINMENT VENUE

**Suffolk Downs
Boston, Massachusetts**



Prepared for:
**The McClellan Highway Department Company, LLC
c/o the HYM Investment Group, LLC
One Congress Street
Boston, Massachusetts, 02114**

Prepared by:



February 17, 2022

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REFER TO THE APPROVED PLANS

APPENDICES

APPENDIX A: OPERATION AND MAINTENANCE LOG

APPENDIX B: LIST OF EMERGENCY CONTACTS

1.0 INTRODUCTION

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (DEP) Stormwater Handbook. The Manual outlines source control and pollution prevention measures and maintenance requirements of stormwater best management practices (BMPs) associated with the proposed development.

2.0 SITE OWNER'S AGREEMENT

2.1 Operation and Maintenance Compliance Statement

Site Owner: The McClellen Highway Development Company, LLC
 c/o The HYM Investment Group, LLC
 One Congress Street
 Boston, Massachusetts, 02114

Responsible Party: The HYM Investment Group, LLC

The McClellen Highway Development Company, LLC or their successors shall maintain ownership of the on-site stormwater management system as well as the responsibility for operation and maintenance during the post-development stages of the Project. The site has been inspected for erosion and appropriate measures have been taken to permanently stabilize any eroded areas. All aspects of stormwater best management practices (BMPs) have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the stormwater at the site may be managed in accordance with the Stormwater Management Standards. Future responsible parties shall be notified of their continuing legal responsibility to operate and maintain the BMPs. The operation and maintenance plan for the stormwater BMPs is being implemented.

Responsible Party Signature

Date

2.2 Stormwater Maintenance Easements

There are no off-site areas utilized for stormwater control, therefore no stormwater management easements are required. The Site Owner will have access to all stormwater practices for inspection and maintenance, including direct maintenance access by heavy equipment to structures requiring regular maintenance.

2.3 Record Keeping

The Site Owner shall maintain a rolling log in which all inspections and maintenance activities for the past three years shall be recorded. The Operation and Maintenance Log includes information pertaining to inspections, repairs, and disposal relevant to the Project's stormwater management system. The Log is located in Appendix A.

The Operation and Maintenance Log shall be made available to the Conservation Commission and the DEP upon request. The Conservation Commission and the DEP shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the maintenance requirements for each BMP.

2.4 Training

Employees involved in grounds maintenance and emergency response will be educated on the general concepts of stormwater management and groundwater protection. The Site Owner's Manual will be reviewed with the maintenance staff. The staff will be trained on the proper course of action for specific events expected to be incurred during routine maintenance or emergency situations.

3.0 LONG-TERM POLLUTION PREVENTION PLAN

In compliance with Standard 4 of the 2008 DEP Stormwater Management Handbook, this section outlines source control and pollution prevention measures to be employed on-site after construction.

3.1 Storage of Materials and Waste

The site shall be kept clear of trash and debris at all times. Certain materials and waste products shall be stored inside or outside upon an impervious surface and covered, as required by local and state regulations.

3.2 Vehicle Washing

No commercial vehicle washing shall take place on site.

3.3 Routine Inspections and Maintenance of Stormwater BMPs

See Section 4.0 Long-Term Operation and Maintenance Plan, for routine inspection and maintenance requirements for all proposed stormwater BMPs.

3.4 Spill Prevention and Response

A contingency plan shall be implemented to address the spill or release of petroleum products and hazardous materials and will include the following measures:

1. Equipment necessary to quickly attend to inadvertent spills or leaks shall be stored on-site in a secure but accessible location. Such equipment shall include but not be limited to the following: safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, sand and shovels, suitable absorbent materials, storage containers and first aid equipment (i.e. Indian Valley Industries, Inc. 55-gallon Spill Containment kit or approved equivalent).
2. Spills or leaks shall be treated properly according to material type, volume of spillage and location of spill. Mitigation shall include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally-friendly manner, and remediation of any damage to the environment.
3. For large spills, Massachusetts DEP Hazardous Waste Incident Response Group shall be notified immediately at 888-304-1133 and an emergency response contractor shall be consulted.

3.5 Maintenance of Lawns, Gardens, and other Landscaped Areas

Lawns, gardens, and other landscaped areas shall be maintained regularly by the site owner. Vegetated and landscaped BMPs will be maintained as outlined in Section 4.0.

3.6 Storage and Use of Fertilizers, Herbicides, and Pesticides

All fertilizers, herbicides, and pesticides shall be stored in accordance with local, state, and federal regulations. The application rate and use of fertilizers, herbicides, and pesticides on the site shall at no time exceed local, state, or federal specifications.

3.7 Pet Waste Management

Pet owners shall be required to pick up after their animals and dispose of waste in the trash.

3.8 Nutrient Management Plan

A nutrient management plan is required if a Total Maximum Daily Load (TMDL) has been developed that indicates that use of fertilizers containing nutrients or other specific pollutants must be reduced. The proposed Project is located within the Boston Harbor watershed, which has a final TMDL issued for pathogen indicators (i.e. fecal coliform, E. coli, and enterococcus bacteria). Urban runoff, combined sewer overflows, sewer overflows and heavy industrial activity have impaired Boston Harbor. Through implementing stormwater treatment BMPs and pollution prevention measures outlined in this manual, the Project will not have any further impact on Boston Harbor.

4.0 LONG-TERM OPERATION AND MAINTENANCE PLAN

This section outlines the stormwater best management practices (BMPs) associated with the proposed stormwater management system and identifies the long-term inspection and maintenance requirements for each BMP.

4.1 Stormwater Management System Components

The following table outlines the type and quantity of the BMPs and their general location. Please reference the site plan(s) provided in the Figures section for exact location. The BMPs are all accessible for maintenance from the development driveway.

| BMP Type | Quantity | Location |
|-------------------|----------|--|
| Bioretention Area | 1 | Adjacent to the paved access driveway. |

4.2 Inspection and Maintenance Schedules

4.2.1 Bioretention Areas

Annual maintenance of all bioretention area components, including plants, soil, and mulch, shall be performed to ensure the overall success. Specific maintenance activities and their required frequency are outlined below:

- Vegetation shall be watered at the end of the day for 14 consecutive days after planting.
- Trash shall be removed from the surface monthly.
- The soil surface shall be inspected on a monthly basis and any observed erosion shall be repaired.
- All void areas within the bioretention area shall be remulched on an annual basis. If the existing mulch layer has deteriorated, it shall be removed prior to applying the new layer.
- All dead and diseased vegetation shall be removed and replaced on an annual basis. Diseased trees and shrubs shall be treated as necessary.
- Inlet and outlet pipes shall be inspected every 6 months and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) for evidence of clogging.
- During and after major storm, the length of time standing water remains in the bioretention area shall be recorded:
 - If the time is greater than 72 hours, thoroughly inspect the basin for signs of clogging.
 - A corrective action plan shall be developed by a qualified professional to restore infiltrative function. The Site Owner shall take immediate action to implement these corrective measures.

4.2.2 Stone Diaphragm

Stone Diaphragms shall be inspected on a semi-annual basis during the first year after construction, and annually thereafter. Inspection and maintenance requirements include:

- The stone diaphragm shall be inspected for sediment buildup and accumulated sediment shall be removed from the toe of the slope or top of diaphragm.
- Mowing shall occur on a regular basis as needed.
- Any sediment that accumulates at the top of the slope shall be removed to maintain the appropriate slope and prevent formation of a berm that would prevent runoff from flowing as sheet flow.

4.3 Estimated Operation and Maintenance Budget

An operations and maintenance budget was prepared to approximate the annual cost of the inspections required in compliance with the DEP Stormwater Management Policy. The table below estimates the annual cost to inspect and maintain each proposed BMP, based on the requirements in Section 4.2.

| BMP Type | # of BMPS | Annual O&M Cost (per BMP) ¹ | Total Cost |
|-------------------|-----------|--|------------------|
| Bioretention Area | 1 | \$200-\$400 | \$200-\$400 |
| Total | | | \$200-400 |

¹ Annual maintenance cost is based on estimate of the cost to complete all inspection and maintenance measures outlined in Section 4.2. For BMPs that require sediment removal at regular intervals (i.e. every 5 or 10 years), the annual cost includes the annual percentage of that cost.

Figures

Refer to the Approved Plans

Appendices

Appendix A

Operation and Maintenance Log

OPERATION AND MAINTENANCE LOG

This template is intended to comply with the operation and maintenance log requirements of the 2008 DEP Stormwater Management Handbook. Copies of this log should be made for all inspections and kept on file for three years from the inspection date.

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| Name/Company of Inspector: |
| Date/Time of Inspection: |
| Weather Conditions: (Note current weather and any recent precipitation events) |

| Stormwater BMP | Inspection Observations | Actions Required |
|-----------------------|--------------------------------|-------------------------|
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Appendix B

List of Emergency Contacts

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- Massachusetts DEP Hazardous Waste Incident Response Group
1-888-304-1133

- The McClellan Highway Development Company, LLC
c/o The HYM Investment Group, LLC
One Congress Street
Boston, Massachusetts, 02114
(617) 248-8905

- Boston Fire Department
115 Southamptton Street
Boston, MA 02118
(617) 343-3550

- Boston Police Department
Boston Police Headquarters
1 Schroeder Plaza
Boston, MA 02120
(617) 343-4500

- Boston Water and Sewer Commission (BWSC)
980 Harrison Avenue
Boston, MA 02119
(617) 989-7000

- Department of Public Works
1 City Hall Square
Room 714
Boston, MA 02201-2024
Tel: (617) 635-4900

SECTION 329115
HIGH USE LAWN SOILS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Subgrade preparation.
 2. Planting soil material acquisition.
 3. Stripping and stockpiling existing soils.
 4. Testing and analysis for specification conformance.
 5. Preparation of mixes and testing for conformance.
 6. Installation and placement of soils.
 7. De-compaction and re-compaction of soils.
 8. Final in-place testing of soils.
 9. Coordination with other contractors.
 10. Clean-up.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 312310 – EXCAVATION AND BACKFILLING for subgrade preparation and grading.
 2. Section 328400 – IRRIGATION for automated irrigation system.
 3. Section 329200 – LAWNS for seeding.

1.3 QUALITY ASSURANCE/DEFINITIONS

- A. Definitions:
1. ASA: American Society of Agronomy.
 2. Subgrade: Soil material and levels resulting from the approved rough grading work. Cultivation of all subgrade areas prior to placing planting soil is included in this Section.
 3. High-use Lawn Soils: Lawn Soil is composed of a blend of three base components: base loam, organic material and sand. The quality of the blend depends on the quality of the original components. Locate and obtain approval of sources for base loam, organic material and sand that meet the Specification requirements. Contractor is then responsible for mixing the components. Approximate mixing ratios are provided, but may require adjustment, depending on the final materials and with the approval of the Landscape Architect or their representative, in order to meet Specification requirements for each blend.
- B. Contractor is solely responsible for quality control of the Work.

- C. The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom planting mixes in urban locations.
 - 1. Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Planting Soil preparation work is in progress.
 - 2. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.
- D. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.
- E. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- F. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect.
- G. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section 3.1(D).
- H. Layout and Grading:
 - 1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.
 - 2. The Contractor shall maintain at the site, sufficient surveying equipment to accurately excavate to the required subgrade and install soil to the required finish grade. The Contractor shall be responsible to install soil profiles at the elevations and thickness shown on the Plans.

1.4 TESTING, SUBMITTALS, MOCK-UPS AND INSPECTIONS

- A. Testing for Subgrade, Planting Soil Components and Planting Soil Mixes: Testing is required at the following intervals:
 - 1. Testing of individual components (Base Loam, Sand, and Compost) for planting soil mixes prior to blending of any soils for use at the Project Site. Tests are as described in this Section.
 - 2. After test results for components have been accepted, create sample Lawn Soil Mix of each planting soil mix and perform tests described in this Section.
 - 3. After the test results for each Planting Soil Mix have been accepted, and during the production of planting soils, test every 200 cubic yards of Lawn Soil Mix blended for: organic matter content, gradation, and pH. Before shipping of any Lawn Soil Mix, the Contractor shall confirm that the Soil Scientist has accepted the mix. Testing applies to all soil layers of the planting profile. After three consecutive compliant tests, the Contractor may increase the interval of testing to 500 cubic yards.
 - 4. After horticultural tests have been approved, contractor shall submit representative samples of Lawn Soil to a geotechnical testing laboratory for ASAM 698 Standard Proctor tests to obtain optimum moisture content and maximum dry density values.
 - 5. In-place tests: Compaction tests of each type of material (soil layer) placed shall be in accordance with this Section. Infiltration tests shall be in accordance with this Section.

6. Testing of Subgrade: Prior to placement of the lawn soil profile, test the subgrade as described in this Section. Coordinate the testing of the subgrade with the Earthwork Contractor before the planting soil profile is placed.

B. Test Reports: Submit certified reports for tests as described in this Section.

1. Mechanical gradation (sieve analysis) shall be performed for sand, silt, and clay content and compared to the USDA Soil Classification System using sieve size numbers: 10, 18, 35, 60, 140 and 270. The silt and clay (0.002 mm) content shall be determined by a Hydrometer Test (ASTM D-422-63) of soil passing the #270 sieve.
2. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium, Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, organic matter content, acidity (pH) and buffer pH.
3. Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia. Tests include the following:
 - a. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.
 - b. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.
 - c. Test for soil Soluble Salts shall be by the 1:2 (v:v) soil : water Extract Method as described in Northeastern Regional Publication No. 493.
 - d. Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.
 - e. Tests for pH shall be conducted on a 1:1 soil to distilled water ratio.
4. Certified reports on analyses from producers of composted organic materials shall be required and new test reports shall be submitted when compost sources are changed. Analyses shall include all tests for criteria specified in 2.1, K.
5. Saturated Hydraulic Conductivity: Test procedure ASTM D5856-95 (2000).
 - a. Hydraulic Conductivity tests shall be performed on samples during QA/QC testing from samples collected at the Soil Supplier's facility.
6. Testing Agencies: The following firms are acceptable testing agencies for the various components and blends.
 - a. Leaf Yard Waste Compost Stability Test and Pathogens/ Metals/ Vector Attraction: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.
 - b. Leaf Yard Waste Compost/ All other tests except those listed above: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931 or approved equal.
 - c. Mechanical Gradation, Chemical Analysis and Organic Matter Content, All Soil Components and Planting Soil Mixes: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931 or approved equal.
7. Laboratory Density Testing: ASTM D698 - 12 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - a. Density tests shall be performed on samples collected at the Soil Supplier's facility, to obtain the optimum moisture content and maximum dry density values.

C. In-Place Testing

1. Density Tests: ASTM D1556 Density of soil and rock in place using "Sand Cone Method" or ASTM D6938-08a Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (Standard Proctor).
 - a. In-place density tests shall be carried out at a rate of one test per 1,000 square feet.
 - b. Soil density shall meet the requirements specified herein, see PART 3.
2. In-place infiltration tests shall be performed using Turf-Tec IN2-W Infiltrometer utilizing manufacturer's operating instructions. Turf-Tec IN2-W Infiltrometer as manufactured by Turf Tec International, 1471 Capital Circle NW, Suite #13, Tallahassee, FL 32303. Order Line 800-258-7477, Phone 850-580-4026, Fax 850-580-4027.
 - a. In-place infiltration tests shall be carried out at a rate of one test per 1,000 square feet.
3. At the direction of the Landscape Architect, in-place lawn soil shall be sampled and tested by the Contractor for compliance with gradation and organic matter content as specified herein. Non-compliant materials shall be removed from the site.

D. Samples: Prior to ordering the below listed materials, submit representative composite samples to the Landscape Architect for selection and approval. Representative composite samples shall be composed of at least five equal-sized subsamples mixed thoroughly and resampled for submittal. Do not order materials until Landscape Architect's acceptance has been obtained. Delivered materials shall closely match the approved samples.

1. Components
 - a. Compost: duplicate samples of 1 gallon.
 - b. Base Loam: duplicate samples of 1 gallon.
 - c. Medium to Coarse Sand: duplicate samples 1 gallon.
 - d. Stripped and Stockpiled existing topsoil: duplicate samples 1 gallon.
2. Test Blends
 - a. High Use Lawn Soil: duplicate samples of 1 gallon.
3. Production Stockpiles
 - a. High Use Lawn Soil: duplicate samples of 1 gallon.

E. Sources for Base Loam, Sand, and Compost: Submit information identifying sources for all soil components and the firm responsible for mixing of planting soil mixes.

1. Landscape Architect and Owner shall have the right to reject any soil supplier or mixing facility.
2. Soil mix supplier shall have a minimum of five years' experience at supplying custom planting soil mixes.
3. Submit supplier name, address, telephone and fax numbers and contact name.
4. Submit certification that accepted supplier/ mixer is able to provide sufficient quantities and qualities of materials for the entire project.

5. Final approval of soil supplier/ mixer shall be made after on-site review of supplier's and mixer's facility (ies) by the Soil Scientist.

F. Subgrade Survey

1. Contractor shall submit for approval by the Landscape Architect a survey of final subgrade in all areas where planting soils will be placed. Placement of any drainage layer or lawn soil shall not precede acceptance by the Landscape Architect.

G. Mock Up and Inspection

1. At the beginning of site work, the contractor shall demonstrate, in the presence of the Landscape Architect, subgrade preparations, including de-compaction, sand incorporation and re-compaction methods that achieve the requirements of this Section. All subsequent subgrade preparations shall be in accordance with approved methods.
2. The Contractor shall not place High Use Lawn Soil on prepared subgrade prior to inspection and approval of Landscape Architect for compliance with depth, compaction and percolation rate. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.
3. The Contractor shall not place seed prior to inspection and approval of Landscape Architect for compliance with soil depth and compaction specifications. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Soil Materials shall not be handled or hauled, placed or compacted when wet as after a heavy rainfall, early spring or if frozen. The Landscape Architect and the Owner shall be consulted to determine if the soil is too wet to handle.
- B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- C. Sequence deliveries to avoid delay. Deliver materials only after preparations for placement of planting soil have been completed.
- D. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- E. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.
- F. Soil Moisture Content
 1. Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM D698 prior to compaction, grading or planting.
 2. Field Soil Moisture Test procedure is applicable for general soil moving and placement only and shall not be considered appropriate for compaction of soils, nor is a replacement for the above testing procedure.
 - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
 - b. If the soil will not retain shape it is too dry and should not be worked.
 - c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
 - d. If the soil glistens or free water is observed when the sample is patted in the palm of hand the soil is too wet and should not be worked.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General

1. High Use Lawn Soil shall be manufactured from off-site sources and / or stripped and stockpiled existing on site topsoil provided it complies with these Specifications for Base Loam component.
2. The extent of the existing topsoil for manufacturing into High Use Lawn Soil shall be carefully delineated in the field and then stripped and stockpiled off site without incorporation of the underlying subsoil or adjacent topsoil.
3. Stripped and stockpiled topsoil for incorporation into High-use Lawn Soil shall be sampled and tested to confirm that it meets the requirements of this Specification. Stripped and stockpiled topsoil that becomes contaminated with underlying subsoil or adjacent topsoil shall be replaced at no additional cost to the owner.
4. For manufactured High Use Lawn Soil, samples of individual components in addition to the blended soil mix shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.
 - a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved testing laboratory have been received and approved by the Landscape Architect.
 - b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.
5. The Landscape Architect may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion. Changes in mix ratios may be required.

B. Soil Testing and Soils Testing Report Submittal

1. All testing of the soil, mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor by the Soil Scientist after approval by the Landscape Architect.
2. Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.
3. The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for "staying on project construction schedule."

C. Soil Samples: Contractor is responsible for paying costs for testing. Submit one gallon soil samples in two phases. Submit samples concurrent with horticultural soil test reports in both phases. Submit as phase one, planting soil base components and stripped existing high use lawn soil for approval. Only after approval of phase one components, submit as phase two, soil blend mixes / mediums for approval. All reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.

1. Phase One Submittals of Planting Soil Base Components:
 - a. Base Loam (Imported Topsoil)
 - b. Organic Amendment Materials (Compost)
 - c. Coarse Sand for Amending Soil
 - d. Stripped and Stockpiled Topsoil

2. Phase Two Submittal of High Use Lawn Soil: mixing and batching of high use lawn soil to be submitted in the same manner as bulk soils and will be prepared prior to delivery to site.
 - a. High Use Lawn Soil
3. Phase Three Submittals shall be identical to Phase Two Submittals and be conducted for each 500 cubic yards of soil material prepared for the project site.
4. Submit reports for each of the above samples: Submit sample from each proposed source for testing and approval. Deliver samples to both the testing laboratory and the project soil scientist and pay costs. Send report directly to Owner's Representative.
5. Soil Sample Submittals: Sampling shall be done by the Contractor. The size of the samples and method of sampling shall be as follows: Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.
6. The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals.

D. Imported Base Loam

1. Imported Base Loam, as required for blending with sand and compost, shall be a naturally occurring A-Horizon soil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil, shall not be acceptable for use. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

| U.S. Sieve Size Number | Percent Passing | |
|------------------------|-----------------|---------|
| | Minimum | Maximum |
| 10 | --- | 100 |
| 18 | 85 | 100 |
| 35 | 70 | 95 |
| 60 | 50 | 85 |
| 140 | 36 | 53 |
| 270 | 32 | 42 |
| 0.002mm | 3 | 6 |

2. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 8 or less ($D80/D30 < 8$).
3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
4. The organic content shall be between 4.0 and 8.0 percent by weight.
5. pH shall be between 5.8 and 7.0.
6. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Coarse Sand

1. Sand for High Use Lawn Soil, protection of filter fabric and for drainage incorporation into subgrade as required, shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

| U.S. Sieve Size Number | Percent Passing | |
|------------------------|-----------------|---------|
| | Minimum | Maximum |
| 10 | 100 | -- |
| 18 | 60 | 80 |
| 35 | 25 | 45 |
| 60 | 8 | 20 |
| 140 | 0 | 8 |
| 270 | 0 | 3 |
| 0.002mm | 0 | 0.5 |

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
3. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 2.8 or less ($D70/D20 < 2.8$). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
4. pH shall be less than 7.5.

F. Organic Amendment (Compost)

1. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
 - a. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
 - b. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.
 - c. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule and applicable regulations for the State of Connecticut.
 - d. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve according to procedures performed by the West Experiment Station at the University of Massachusetts, Amherst or equal.
 - e. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy Methods of Soil Analysis.

- f. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
- g. The compost shall be screened to 1/2-inch maximum particle size and shall contain not more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.
- h. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

G. Filter Fabric, as required, shall be Mirafi 140N or approved equivalent.

2.2 PLANTING SOIL MIXES

A. All existing vegetation shall be removed from stockpiles prior to blending. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area or by alternately processing materials through a screening plant. All soil components and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components are approximate, and will be verified upon completion of individual test results for components of the various mixes. Due to variability of soil materials, mix ratios may require adjustment and re-submittal at the expense of the Contractor.

B. High Use Lawn Soil shall be tested for physical and chemical analysis. Component percentages may be modified at any time by the soil scientist dependent upon the results of testing of the various components or final blends.

C. High Use Lawn Soil (manufactured and stripped existing)

- 1. Imported Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of two parts by volume Sand to one part by volume Base Loam to one and one half parts by volume Compost (2S:1L:1.5C) to create a uniform blend which meets the following requirements.
- 2. Gradation for Material Passing the Number 10 Sieve:

| U.S. Sieve Size No. | Percent Passing | |
|---------------------|-----------------|---------|
| | Minimum | Maximum |
| 10 | 100 | 100 |
| 18 | 70 | 90 |
| 35 | 45 | 72 |
| 60 | 26 | 40 |
| 140 | 14 | 20 |
| 270 | 10 | 13 |
| 0.002mm | 2 | 4 |

- 3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
- 4. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 4.2 or less (D70/D20 <4.2).
- 5. Saturated hydraulic conductivity of the mix shall not be less than 4.0 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 88% Standard Proctor, ASTM 698.
- 6. Organic content shall be between 4.0 and 6.0 percent by weight.
- 7. pH shall be between 6.2 and 6.8

8. Chemical analysis shall be undertaken for Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION EXAMINATION AND PREPARATION

- A. Reference Other Sections as necessary.
- B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any lawn soil until all work in adjacent areas is complete and approved by the Landscape Architect.
- D. Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the Owner's Representative and Landscape Architect, and any other parties involved with landscape construction. The contractor must demonstrate familiarity with this Section 329115 Lawn Soils, and other relevant sections of the construction documents. The contractor shall articulate the means and methods of soil blending, subgrade preparation, soil placement and other steps outlined in the Specification.
- E. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the Landscape Architect in writing prior to acceptance of the subgrade by the Landscape Contractor. Deficiencies include, but shall not be limited to the following:
 1. Construction debris present within the planting areas.
 2. The subgrade is at incorrect depths for installing the designed soil profile and drainage layer.
 3. Incomplete irrigation and/or subsurface drainage installation.
 4. Incomplete lighting and exterior electrical installation.
 5. Conflict with underground utilities.
 6. Subgrade contaminated with oils, compressible material, silt or clay
 7. Prepared subgrade must infiltrate water at the rate of at least two inches per hour.
- F. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
 1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.
 2. All subgrade areas to be filled with High Use Lawn Soil shall be free of construction debris, refuse, vegetation, compressible or decay able materials, all stones greater than 6 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the High Use Lawn Soil into the subsoil; and/or standing water. Such material shall be removed from the site.
 3. The subgrade must slope at a minimum of two percent towards the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to ensure that all planting and lawn areas have adequate drainage.

- G. Do not proceed with Subgrade Preparations or placement of High Use Lawn Soil, until all utility work in the area has been installed.
 - 1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.

3.2 MIXING OF PLANTING SOIL MIXES

- A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three handling events on a hard surfaced area with earth moving equipment or by alternately passing soil components through a screener.
- B. Base components and Soil Mix stockpiles should be protected from wind and rain and shall not be permitted to be stored in standing water.

3.3 WORKING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Known underground and surface utility lines are indicated on the utilities drawings – See Civil and Architect's plans. Contact the local Dig Safe organization and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor's expense.

3.4 SUBGRADE PREPARATION, INSPECTION AND PERCOLATION TESTING

- A. After subgrade levels have been reached, the Landscape Architect shall observe de-compaction and preparation of the subgrade according to this Section and inspect soil conditions to evaluate subsurface drainage conditions.
- B. Coordinate the following scarification work to eliminate subgrade compaction and improve drainage conditions when located in lawn areas outside of tree protection zones. Maintain 12" clearance from any underground utilities during subgrade de-compaction.
 - 1. Heavy Site Subgrade Compaction Mitigation:
 - a. Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.
 - b. Prior to establishing the final subgrade, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
 - 2. General Site Subgrade Preparation for High Use Lawn Soil Areas:
 - a. Subgrade preparation shall be conducted after subgrade elevations have been established and approved and all utility and other construction activities have concluded. Notify the Landscape Architect within 10 days of subgrade preparation. Conduct the initial work of subgrade preparation in the presence of the Landscape Architect and conduct all subsequent work according to approved methods.

- b. Immediately prior to placing High Use Lawn Soil, spread a two-inch (2") layer of approved sand over the subgrade.
 - c. The entire subgrade shall then be loosened to a minimum depth of 4-inches using the teeth of an excavator or other suitable equipment in a coarse manner. The object is to shatter the subsoil and create sand drainage channels, and not to uniformly incorporate the sand.
 - d. The subgrade shall then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
- C. After Subgrade has been prepared as described above, it shall be recompressed by using the tracks of a wide-tracked bulldozer, multiple passes of a skid steer loader, or the curled bucket of an excavator. Verify the subgrade passes water at or greater than the minimum requirement.
- D. Remove all stones or debris greater than 6" in any dimension from the subgrade prior to placing High Use Lawn Soil.
- E. After the subgrade has been prepared, Percolation Tests shall be performed according to the following test procedures.
1. Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high.
 2. A test hole shall be hand dug at the soil horizon to be tested approximately one-inch larger than the diameter of the test canister and approximately six inches deep. The sides of the test hole shall not be smoothed.
 3. Place one-half inch of clean coarse sand in the bottom of the hole and place the canister firmly into the hole. The space around the canister shall then be filled with coarse sand. Tamp the coarse sand to firmly fill any void space around the test canister.
 4. Fill the canister with water to the soil horizon level and allow to drain until approximately one inch of water remains, or a minimum of 1 hour.
 5. Refill the canister to the soil horizon level. After the water level drops approximately one inch, start the test. Record time versus water level as the water level drops. The percolation rate is the length of time for the water level to drop per inch. The field scientist shall record the rate of percolation for a minimum of two hours or until the water level has dropped a minimum of three inches after the start of measurements.
 6. Prepared subgrade shall infiltrate water at a minimum rate of two-inches per hour. If subgrade fails to pass water at the minimum rate, notify Landscape Architect. Addition subgrade preparation may be required.

3.5 BACKFILLING OF HIGH USE LAWN SOIL

A. Soil Placement Preparation:

1. Verify that the underdrains and plumbing for the irrigation system has been installed and accepted.
2. Verify that the subgrade preparations have been reviewed and accepted, including de-compaction, sand incorporation and removal of large stones.
3. Notify the Landscape Architect of soil placement operations at least seven calendar days prior to the beginning of work.
4. Verify that the subgrade passes the minimum water infiltration requirement.
5. Do not proceed with the installation of High Use Lawn Soil, until all utility work in the area has been installed.
6. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
7. Do not begin High Use Lawn Soil installation until all drainage, irrigation main lines, lateral lines, subgrade preparations and irrigation risers shown on the drawings are viewed and approved by the Landscape Architect.

8. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
 - a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
 - b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.

- B. After the subgrade soils have been loosened, re-compressed and inspected, High Use Lawn Soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of an excavator from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.

- C. Placement of High Use Lawn Soil:
 1. High Use Lawn Soil shall be placed in lifts not to exceed 4 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
 - a. Place High Use Lawn Soil on prepared subgrade in a manner that does not over compact the prepared subgrade.
 - b. High Use Lawn Soil shall be compacted to between 86 and 88 percent Standard Proctor by using two passes with the tracks of a of a wide tracked bulldozer.
 - c. High Use Lawn Soil shall not be compacted with vibratory equipment.
 - d. Density testing for High Use Lawn Soil must be by ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon Method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test for each plant bed for each lift. Geotechnical testing agency must be on-site to conduct soil moisture and density tests during installation of High Use Lawn Soil.

 2. In all cases, the soil being placed shall be in a dry to damp condition. No wet or frozen soils shall be placed. Soil moisture content must be compliant with Section 329115 1.6.H prior to compaction.

 3. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.

 4. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.

 5. After High Use Lawn Soil has been spread, amendments should be added according to, and at rates provided in the soil tests. The soil shall then be carefully prepared by hand raking or with a Rotadairon or equivalent equipment. Stones and debris over one inch in any direction shall be removed from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

3.6 PROTECTION

- A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during

installation until acceptance. Treat, repair or replace damaged Lawn Soil installation work immediately.

- B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area that becomes compacted, shall be de-compacted and tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.
- C. Phase the installation of the High Use Lawn Soil such that equipment does not have to travel over already installed soil. Use of haul roads is acceptable provided that the haul road is completely re-worked to meet the requirements of this Specification.
- D. Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of High Use Lawn Soil.
- E. Till compacted High Use Lawn Soil and replace High Use Lawn Soil that has become over compacted or contaminated as determined by the Soil Scientist or Landscape Architect. Non-Compliant High Use Lawn Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.7 CLEAN-UP

- A. During installation, keep pavements clean and work area in an orderly condition.
- B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.
- C. All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.
- D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

3.8 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- B. Excess Planting Soil Mixtures and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless otherwise requested.

3.9 POST-INSTALLATION TESTING

- A. In-place density testing is required in all areas. Placed High Use Lawn Soil must be inspected for compaction level by the soil scientist or by the following acceptable Density Test Methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test every 1,000 square feet.
- B. Placed High Use Lawn Soil must be capable of infiltrating water at the minimum rate provided in this Specification.

END OF SECTION

LANDSCAPE MAINTENANCE OUTLINE

PART 1 – GENERAL

1.1 SUMMARY

- A. The following Operation and Maintenance (O&M) outline describes the proper maintenance program to be followed for the infield site.

1.2 SCOPE

- A. Landscape maintenance work and related items shall be as specified in this section and includes, but is not necessarily limited to, the following:
- B. Landscape Maintenance Items
 1. Spring Clean Up
 2. Weekly Maintenance Tasks
 3. Fall Shut Down
 4. Mowing
 5. Edging of Lawn Areas
 6. Testing of Soil Chemistry to determine fertilization requirements
 7. Fertilizing Lawns
 8. Lime and Sulfur Application to Lawns
 9. Replacement Sod
 10. New Seeding
 11. Over-seeding
 12. De-thatching
 13. Core Aeration of Lawns

1.3 SAMPLES AND SUBMITTALS

- A. At least 30 days prior to intended use, the Contractor shall provide the following samples and submittals for approval by the Owner. Do not order materials until Owner's approval of samples, certifications or test results has been obtained. Delivered materials shall closely match the approved samples.
 1. Fertilizer: Submit 4 certificates of analysis for each type of fertilizer used.
 2. Seed: Submit a manufacturer's Certificate of Compliance to the Specifications with each shipment of each type of seed. These certificates shall include the guaranteed percentages of purity, weed content, and germination of the seed, and also the net weight and date of shipment. No seed shall be sown until the Contractor has submitted the certificates.
 3. Sod: Submit a supplier's certificate that sod composition by grass species conforms to the Specification requirements.
 4. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1.4 EXAMINATION OF CONDITIONS

- A. All areas to be maintained shall be inspected by the Contractor before starting work and any conflicts between these Specifications, the Drawings, and the site shall be reported to the Owner prior to beginning this work. The commencement of work by the Contractor shall indicate his acceptance of the areas to be maintained, and he shall assume full responsibility for the work of this section.
- B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to the potential need for storing and maintaining materials off site temporarily, rehandling materials prior to final installation, or both.

PART 2 – PRODUCTS

2.1 SOD

- A. Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.

2.2 SEED

- A. Grass seed shall be clean, new crop seed, composed of a mixture of varieties, mixed in proportion by weight and tested for minimum percentages of purity and germination. Submit proposed mixture to the Landscape Architect for approval.

- B. Athletic Field Mix: The seed shall consist of 20% perennial ryegrass and 80% Kentucky bluegrass on a weight basis. The Kentucky bluegrass portion of the mix shall be a blend of three (3) Kentucky bluegrass varieties, of which 60% of the seed mix shall be at least two of the following varieties: Able I, Aspen, Banff, Blacksburg, Challenger, Classic, Eclipse, Estate, Midnight, Princeton (P-104), Ram I, Touchdown, or Trenton. The bluegrass shall have a minimum germination percentage of 80%. The perennial ryegrass may be any one of the following: Advent, Affinity, Assure, Brightstar, Dandy, Gettysburg, Legacy, Manhattan II, Palmer II, Pinnacle, Prelude II, Prizm, Quickstart, Saturn, Seville, Sherwood, SR 4200, or Yorktown III. The perennial ryegrass shall have a minimum germination percentage of 85%. The percentage of weed seed shall not exceed 1%, and other crop seed 1% by weight of the mixture. Any variety substitutions or deviations from these specifications must be approved by the engineer/architect.

1. Bluegrass and rye grass varieties shall be within the top 50 percent of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.

2. Seeding rate for the Athletic Seed Mix shall be 5 pounds per 1,000 square feet.

3. Seed may be mixed by an approved method on the site or may be mixed by a dealer. If the seed is mixed on the site, each variety shall be delivered in the original containers that shall bear the dealer's guaranteed analysis. If seed is mixed by a dealer then the Contractor shall furnish the Owner's Representative the dealer's guaranteed statement of the composition of the mixture.

- C. General Lawn Area Mix:

| Common Name | Proportion By Weight | Germination Minimum | Purity Minimum |
|---------------------|-------------------------|------------------------|-------------------|
| Creeping Red Fescue | 30% | 85% | 95% |
| Kentucky Bluegrass | 60% | 85% | 90% |
| Perennial Rye | 10% | 90% | 90% |

1. Bluegrass and ryegrass varieties shall be within the top 50 percent and 25 percent respectively, of varieties tested in National Turfgrass Evaluation Program, or

currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.

2. Seeding rate for the General Lawn Seed Mix shall be 6 pounds per 1,000 square feet.

2.3 LIME AND SULPHUR

- A. Lime shall be granular dolomitic limestone with 95 percent passing a No. 20 sieve and at least 50 percent passing a No. 100 sieve.
- B. Sulfur shall be commercial or flour sulfur, unadulterated, and shall be delivered in containers with the name of the manufacturer, material, analysis and net weight appearing on each container.

2.4 WATER

- A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be held responsible to furnish adequate supplies at his own cost. All work injured or damaged due to the lack of water, or the use of too much water, shall be the Contractor's responsibility to correct. Water shall be free from impurities injurious to vegetation. Water shall be potable.

2.5 LAWN FERTILIZER

- A. Commercial fertilizer shall be a product complying with the State and United States Fertilizer. At least 50 percent by weight of the nitrogen content shall be derived from organic materials.
 1. Use organic, slow-release fertilizers with zero phosphorous component; these types are less likely to wash off your lawn than inorganic or fast-release fertilizers.
- B. Fertilizers approved for the use under this O&M Plan are as follows:
 1. LESCO® 28-0-12 Lawn Fertilizer
 2. MERIT® 0.2 14-0-0 Plus Turf Fertilizer
 3. MOMENTUM Force 21-0-11 Weed & Feed

2.6 IRRIGATION COMPONENTS

- A. Irrigation component shall be equal to:
 1. Irrigation heads shall be No. 13 as manufactured by Weather-matic Sprinkler Division of Telsco Industries. Heads shall have non-adjustable, fixed orifice nozzles which pop-up not less than 1-1/8 inches and have 1/2 IPS riser connection.
 2. Piping for main lines shall be PVC 160, Type 1-1120, SDR 21, CS-256-63 as manufactured by Triangle.
 3. Piping for zone lines shall be polyethylene, 100 psi, MSF approved, type PE 2306 or equal as manufactured by HYCOA.
 4. Electric solenoid zone valves shall be Weather-matic 8000 Series, 1 1/2 inches size.

PART 3 – EXECUTION

3.1 GENERAL

- A. Perform the work of Landscape Maintenance as described in this section on the schedules noted for each work item. Work of Landscape Maintenance shall commence at the beginning of the third week of March and shall continue until the end of November.

3.2 SPRING CLEAN UP

- A. Schedule:
 - 1. Perform general clean up prior to the end of the last week in April or as requested by the Owner.
 - 2. Work of removal of sand, salt and debris from all landscaped areas of the site shall occur on Saturdays, or Holidays as approved by the Owner.
- B. Dispose of all sand, litter, leaves, branches, straw mulch, and miscellaneous debris collected during general clean up activities off site in a legal manner. Disposal shall occur at the end of each day of work. Do not store debris on site over night.
- C. Remove all sand, salt, leaves, branches, litter and debris from all lawn areas. No material shall be blown onto any motor vehicles, walks or buildings.
- D. Snow stakes shall be removed and stored as directed by the Owner.
- E. Irrigation Start Up:
 - 1. The start up of the irrigation system shall be performed in the presence of the Owner.
 - 2. Inspect sprinkler heights.
 - 3. Adjust spray patterns of all sprinkler heads as required to provide complete and adequate coverage of areas to be watered.
 - 4. Review the condition of automatic and manual features of the irrigation system. Report any unsatisfactory performance of the controller system to the Owner in writing.

3.3 WEEKLY MAINTENANCE TASKS

- A. Scheduling:
 - 1. Perform the work of paragraph 3.3, Weekly Maintenance, each week from the first week in April through to the last week in November.
- B. Dispose of all material and debris collected during weekly maintenance activities off site in a legal manner. Disposal shall occur at the end of each day of work. Do not store debris on site overnight.
- C. The tasks of weekly maintenance shall include but are not limited to the following: Weekly inspection of the facility.
 - 2. Removal of all litter and debris from the site.
 - 3. Cleaning of all walkways of grass and debris.
 - 4. Inspection and repair of irrigation system.
 - 5. Monitoring and reporting of pest and disease conditions.
 - 6. Debris removal.
 - 7. Maintenance of written reports of maintenance activities.
- D. The work of this item includes the following:
- E. Inspect the site each week and remove all paper, debris, litter, trash, branches and leaves from all walkways, roadways, parking lots, lawn areas, tree rings, and plant beds. Remove all grass from walkways and paved surfaces. Do not blow any material onto buildings or motor vehicles.
- F. Inspect entrances and exits of all culverts each week and remove all debris obstructing the flow of water.

- G. Inspect all swales and ditches weekly and remove all debris and vegetation obstructing the flow of water.
- H. Control Weed Growth:
 - 1. Inspect the site for weed growth and remove weeds from all areas.
 - 2. In paved areas the control of weeds shall combine the physical removal of weeds over two inches in height and the spot application of the herbicide, 'Roundup', to weeds less than two inches in height.
 - 3. Keep tree pits and plant beds weed free. Remove all weeds growing in tree rings and plant beds. Weeds greater than two inches in height shall be removed by hand in all tree rings and plant beds. Weeds less than two inches in height that are growing in tree rings may be killed by spot application of a leaf-applied herbicide. Do not spray herbicide in plant beds. Weeds and grasses which are growing in shrub beds, groundcover beds, and flower beds may be controlled by using a wicking device to apply herbicide to the leaves of the weeds. Materials, methods and mechanisms of leaf application of herbicide shall be approved by the Owner prior to application.
- I. Inspect irrigation system on a weekly basis to ensure that the system and all components are functioning properly. Inspect irrigation system for the following conditions:
 - 1. Irrigation heads which are set too high or too low.
 - 2. Irrigation heads which are broken, damaged or otherwise do not work.
 - 3. Lawn areas, tree rings, plant beds which are drying out do to improper water coverage.
 - 4. Lawn areas, tree rings, plant beds which appear over watered and wet.
 - 5. Report any problems with irrigation system to the Owner immediately. Provide written report detailing type and location of problem.
 - 6. Irrigation components which have been damaged by maintenance activities shall be replaced at no additional cost to the Owner.
- J. Monitoring for Pest and Disease Control
 - 1. Monitor all trees and shrubs on a weekly basis for the appearance of pests and disease or damage to plants by pests and disease.
 - 2. Report either the appearance of pests and disease or damage to plants by pests and diseases to the Owner by telephone within four hours of discovery. Follow up telephone call with a written report to the Owner.
 - 3. Maintain a log of weekly pest and disease appearance and damage for review at the end of the season.
- K. Debris removal:
 - 1. Remove all leaves, branches, twigs, and miscellaneous tree and shrub debris from all lawn areas, tree rings, plant beds, walks, parking lots, and roadways.
 - 2. Do not blow leaves, branches, twigs, and miscellaneous tree and shrub debris onto walkways or passenger or delivery vehicles.
 - 3. Do not allow wet leaves to accumulate on lawns or plant beds. Remove leaves as required to avoid any accumulation. Maintain a neat appearance of the site each week.

3.4 FALL SHUT DOWN

- A. Scheduling:
 - 1. Perform the work of paragraph 3.4 prior to the first snowfall of the season, but no later than the third week in November.
- B. Dispose of all material and debris collected during the work of the fall shut down off site in a legal manner. Disposal shall occur at the end of each day of work. Do not store debris on site overnight.
- C. The work of this paragraph include the following:
 - 1. Shut down of irrigation system.
 - 2. Install snow plowing stakes.

- D. Shut down of the irrigation system shall include draining all water from all main lines, zone lines and all irrigation lines, blowing out entire system, and shutting down the controller.
- E. Install snow stakes on the edges of all roadways and walkways. Snow stakes will be provided by the Owner. Contractor shall move stakes from storage area and install stakes six inches into soil in locations as directed by the Owner.

3.5 MOWING

A. Schedule:

1. Mow lawn areas designated for High Frequency Mowing, on a weekly schedule ranging between 5 and 10 days. The average shall be once every 7 days, approximately 30 cuttings. Mowing frequency shall be scheduled so as to maintain a neat, trim appearance.
 2. Mow lawn areas designated for Medium Frequency Mowing, on a 7 to 12 day basis. The average shall be once every 10 days, approximately 21 cuttings.
 3. Mow lawn areas designated for low Frequency Mowing, 5 times during the year. Mowing shall occur in the last week of May, the last week of June, the third week of August, the third week of September, and during the last week of October.
 4. Mow lawn areas designated for Very Low Frequency Mowing, once. Mowing shall occur in late autumn, after November 14, to ensure that all seeds have been produced and dropped. Mowings which cannot be scheduled for late autumn due to early snow fall shall be re-scheduled for the following spring and shall occur during the spring clean-up as described in paragraph 3.2, SPRING CLEAN UP, of this section.
 5. Mowing shall be scheduled to avoid conflict with pedestrians at employee arrival and departure times at the beginning and end of the day.
- B. Dispose of all material and debris generated during the mowing operation. Dispose of material and debris off site in a legal manner.
 - C. Review the Maintenance Plans for a clear understanding of the scope of work for this item. Mowing of the landscape facility shall be High Frequency Mowing, Medium Frequency Mowing, Low Frequency Mowing and Very Low Frequency Mowing as indicated on the Maintenance Plans, and as scheduled in this section.
 - D. The work of this item shall include both mowing of turf areas and trimming as described in this section. The final appearance of all High Frequency and Medium Frequency lawn areas shall be neat and uniform. The lawn shall have smooth contours without ridges, lines, and bald/scalped areas. Clippings shall not be visible.
 - E. Immediately prior to beginning any mowing, remove all surface trash, litter, foreign matter and debris from the area to be mowed in accordance with paragraph 3.3, WEEKLY MAINTENANCE TASKS, of this section.
 - F. Mow turf areas to a mowing height of not less than 2 1/2 inches. If the turf is cut lower than 2 1/2 inches, the proportional cost of the cutting will be deducted from the payment. Use only mowers which have sharp cutting edges.
 - G. Final cut of the season shall be 2-inch height.
 - H. Under High Frequency Mowing and Medium Frequency Mowing, do not remove more than one-third of the blades of the grass plants at any moving.
 - I. Clippings shall either be vacuumed or blown off walks and other hard surfaces. Clippings do not need to be caught and removed unless directed by the Owner. Catch and remove clippings from the lawn areas if they appear to be unsightly in a given location; if the clippings lay so densely as to cause damage to the lawn; or if the clippings might contribute to an existing or potential insect or disease problem, or as directed by the Owner.

- J. Do not mow during rain storms or when lawn areas are wet. If, due to scheduling problems, the lawns are mown when wet then the clippings shall be collected from the lawn areas and removed off site.
- K. Care shall be taken to avoid damage to trees, shrubs, groundcovers, flowers and irrigation heads. Damage to any site item shall be reported to the Owner immediately. Contractor shall repair or replace trees, shrubs, irrigation parts, etc damaged by the mowing operation as directed by the Owner.
- L. Replace all grass which has been 'crowned' or 'scalped' by the mowing operation with new sod.
- M. Trim around buildings, structures, walks, curbs, posts, fences, hydrants, and all vertical elements, after each mowing using herbicides, hand labor, and/or mechanical devices. The cost of trimming shall be included in the mowing. To reduce trim time, the contractor may establish and maintain a controlled two-inch wide no-grow area around buildings, structures, posts, fences and utilities using an approved herbicide applied in accordance with the label. Use of herbicides for trimming shall be at no additional cost to the Owner. Review use of herbicide for trimming with the Owner prior to commencing work.
- N. Do not trim around trees, shrubs, groundcovers, or flower beds using a nylon cord trimmer or herbicide application.
- O. All mowing equipment shall have deflector shields in place at all times.
- P. Cutting pattern shall be changed week to week to ensure that permanent wheel rutting and irregular growth patterns of grass blades is prevented.

3.6 EDGING OF LAWN AREAS

- A. Schedule:
 1. Lawn areas designated for High Frequency Edging shall be edged three times during the year: during the last 2 weeks of April; during the last 2 weeks of June; and during the last week of August and the first 2 weeks of September.
 2. Edge lawn areas designated for Medium Frequency Edging shall be edge twice during the year: during the last 2 weeks of April; and during the last week of August and the first 2 weeks of September.
 3. Edge lawn areas designated for Low Frequency Edging shall be edge once each year, during the last 2 weeks of April.
 4. Edging shall be scheduled to avoid conflict with pedestrians.
- B. Dispose of all material and debris generated during the edging operation. Dispose of material and debris off site in a legal manner.
- C. Review the Maintenance Plans for a clear understanding of the scope of work for this Item. Edging of lawn areas of the landscape facility shall be High Frequency Edging, Medium Frequency Edging, and Low Frequency Edging as indicated on the Maintenance Plans, and as scheduled in this section.
- D. The goal of edging shall be to redefine the line between the grass and tree ring, shrub bed, pavement or curb. Edges shall be even, unbroken lines, smooth and true.
- E. All curbs, walks, landscape edges, tree rings, shrub and groundcover beds, and flower beds shall be mechanically edged to prevent turf encroachment.
- F. All edging cuts shall be vertical.
- G. Edging cuts at curbs, walkways, and landscape edges shall be made at the edge of curb,

pavement or landscape edge. Depth of edging cut shall be minimum two inches below curb, steel edge, or pavement line.

- H. Edging cuts at shrub beds and flower beds shall be to the full depth of the root zone of the turf.
- I. Edging cuts at tree rings shall be to the full depth of the root zone of the turf but special care shall be taken to avoid cutting tree roots.
- J. Edge tree rings of flowering deciduous trees three feet from the trunk of the tree.
- K. Edge tree rings of deciduous shade trees four feet from the trunk of the tree.
- L. Edge tree rings of evergreen trees six inches from the drip line of the tree.
- M. Tree rings shall be round.
- N. After edging, pull out the grass and the grass roots. Dispose of grass and grass roots after edging activity.
- O. Do not mix grass or grass roots into the mulch of tree rings and beds.

3.7 FERTILIZING LAWNS

- A. Scheduling:
- B. At the beginning of the spring maintenance period, Contractor shall perform testing of existing lawn soils to determine nutrient levels ahead of applying fertilizer as follows:
 - 1. Existing On-Site Topsoil: Sample and test existing on-site topsoil. The Contractor shall sample the existing loam soils of the site.
 - 2. Testing will be at the Contractor's expense. Perform all tests for soil chemistry and pH by UMASS Soil and Plant Tissue Laboratory, or approved equal.
 - 3. Testing reports shall include the following tests and recommendations: Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, extractable Aluminum, Lead, Zinc, Cadmium, Copper, Soluble Salts, and pH and buffer pH. A Conductivity Meter shall be used to measure Soluble Salts in 1:2 soil/water (v/v).
 - 4. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary.
- C. The early summer application of fertilizer shall occur during the last two weeks of June.
- D. The fall application of fertilizer shall occur during the last two weeks of September.
- E. Dispose of all material and debris generated during the edging operation. Dispose of material and debris off site in a legal manner.
- F. Spring, early summer and fall applications of fertilizer shall be with low nitrogen, zero phosphorus fertilizer. Exact proportions will be determined following review of soil tests results.
- G. Fertilizer shall be applied when the grass is dry.
- H. Fertilizer shall be evenly distributed. Turn the fertilizer spreader off when making sharp turns to avoid high concentrations of fertilizer.
- I. Temporarily store, mix and load fertilizer on parking lot or roadway pavement areas. If fertilizer spills, sweep up fertilizer immediately and dispose of the fertilizer off site at the end of the day in a legal manner.

- J. Do not fertilize or contaminate wetland areas. Do no mixing or loading of fertilizer within 25 feet of a catch basin.
- K. Pre-emergent crab grass control and pre-emergent broad leaf weed control shall be mixed and -applied with the first spring application of fertilizer. Submit pre-emergent weed control products to the Owner for approval prior to application.

3.8 LIME AND SULFUR APPLICATION TO LAWNS AND BEDS

- A. Contractor shall not perform any lime or sulfur applications unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Apply lime and sulfur in late October unless otherwise directed by the Owner.
- C. Dispose of all material and debris generated during lime or sulfur applications. Dispose of material and debris off site in a legal manner.
- D. The goal of lime or sulfur application to lawn areas shall be to adjust pH levels to approximately 6.5 and as defined by soil test results.
- E. Lime and sulfur shall be broadcast spread at rates specified by the Owner after review of soil test result.
- F. Soil tests will be performed by the Owner.

3.9 REPLACEMENT SOD

- A. Contractor shall not install replacement sod unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Install sod from April 1 to June 1, and August 15 to October 15 as directed by the Owner.
- C. Dispose of all material and debris generated during the replacement sodding operation. Dispose of material and debris off site in a legal manner.
- D. The goal of replacement sodding shall be to repair seasonal damage to existing lawn areas. The final appearance of a newly installed replacement sod area shall be neat and uniform. The lawn shall have smooth contours without gaps or humps between new sod pieces and between new and adjacent lawn. All sod pieces shall butt against each other and existing lawn evenly. Sodding operations shall be as directed by the Owner.
- E. Furnish sod in rectangular sod strips stored in roles with grass top inverted, soil out.
- F. Sod shall be harvested, delivered and installed within a period of 36 hours.
- G. Cut existing sod to a straight edge, removing all existing sod, roots and thatch in the area to receive new sod. Discard existing sod and debris off site.
- H. Loosen existing loam surface to a depth of four inches. Top dress existing loam with an approved loam as required to bring new sod up to grade of adjacent sod. Install sod when prepared bed is in a friable condition, not muddy or hard.
- I. Lay new sod smoothly, edge to edge with adjacent sod, new or existing. Immediately after laying, sod shall be pressed firmly into contact with the sod bed by tamping or rolling.
- J. Maintain new sod until a close stand of grass has been established without weeds. Water frequently during summer months to prevent drying out.

3.10 NEW SEEDING

- A. Contractor shall not perform any seeding operations unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Plant grass seed from April 1 to June 1, and August 15 to October ...15 as directed by the Owner.
- C. Dispose of all material and debris generated during the seeding operation. Dispose of material and debris off site in a legal manner.
- D. The goal of new seeding shall be to repair seasonal damage to existing lawn areas. The final appearance of a newly seeded lawn area shall be neat and uniform. The lawn shall have a close stand of grass with no weeds present and no bare spots. Seed new lawns as directed by the Owner.
- E. Lime shall be granular dolomitic limestone with 95 percent passing a No. 20 sieve and at least 50 percent passing a No. 100 sieve.
- F. Remove all existing vegetation from the areas to be seeded.
- G. Spread and incorporate fertilizer and limestone into the topsoil to a depth of four inches.
- H. Fine grade the whole surface by hand raking. Remove all debris. Compact surface with a roller.
- I. Apply seed at a rate of 5 pounds per 1,000 square feet. Seed by broadcast method.
- J. Lightly rake seed into the soil, covering the seed with 1/4 inch to 1/2 inch of soil or spread the seed and press seed into the soil with a roller.
- K. Keep seeded areas moist throughout germination period.
- L. Continue maintenance of seeded areas throughout the growing season.
- M. The Owner shall determine when a satisfactory stand of turf has been grown. To be acceptable a seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than 3 inches in diameter. At least 90 percent of the grass established shall be permanent grass species. Absolutely no debris shall be left on the site.

3.11 OVERSEEDING

- A. Contractor shall not perform any overseeding unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Overseed from April 1 to June 1, and August 15 to October 15 as directed by the Owner.
- C. Dispose of all material and debris generated during the overseeding operation. Dispose of material and debris off site in a legal manner.
- D. The goal of overseeding shall be to increase grass thickness and health in existing lawn areas which are sparse and bare. Overseeding shall be as directed by the Owner.
- E. Starter fertilizer shall be with low nitrogen, zero phosphorus fertilizer.
- F. Lime shall be granular dolomitic limestone with 95 percent passing a No. 20 sieve and at least 50 percent passing a No. 100 sieve.
- G. Overseed designated turf areas using a slice seeding system which slices the existing turf with

parallel blades and places the seed in direct contact with the soil. Submit description of system to the Owner for review and approval.

- H. Apply seed at a rate of 5 pounds per 1,000 square feet.
- I. Keep overseeded areas moist throughout germination period.
- J. Continue maintenance of overseeded areas throughout the growing season.
- K. The Owner shall determine when a satisfactory stand of grass has been established. To be acceptable a seeded areas shall have a close stand of grass with no weeds present and no bare spots greater than 3 inches in diameter. At least 90 percent of the grass established shall be permanent grass species. Absolutely no debris shall be left on the site.

3.12 DE-THATCHING

- A. Contractor shall not perform any de-thatching operations unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. De-thatch lawn areas from April 1 to June 1 as directed by the Owner.
- C. Dispose of all material and debris generated during the de-thatching operation. Dispose of material and debris off site in a legal manner.
- D. The goal of de-thatching lawn areas shall be to remove excessive thatch which inhibits water infiltration and promotes the volatilization of nitrogen fertilizers.
- E. De-thatching shall be accomplished as directed by the Owner. De-thatching shall be provided when thatch level exceed 1/2 inch thickness.
- F. Machine for de-thatching shall be a vertical mower which uses metal blades to slice through the thatch, thinning the thatch out and bringing it to the surf ace. Set blades deep enough to get just under the thatch layer and not cut into the root system. If dethatching activity beings to rip up the turf from the soil surface, adjust the depth of blade penetration. If adjustment of blade depth does not prevent ripping sod from the soil surface, then stop with work immediately and report condition to the Owner immediately.

3.13 CORE AERATION OF LAWNS

- A. Contractor shall not perform any core aeration of lawns unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Core aerate lawn areas during the last half of September as directed by the Owner. Core aerate immediately prior to fall fertilizing of turf areas, see paragraph 3.7, FERTILIZING LAWNS, of this section.
- C. Dispose of all material and debris generated during the core aeration operation. Dispose of material and debris off site in a legal manner.
- D. The goal of core aeration is to loosen compacted lawn areas.
- E. Core aeration of turf areas shall as directed by the Owner and shall include the following:
- F. Aeration shall be accomplished utilizing a roller, drum, or piston-type aerator with coring tines of 1/2 inch to 3/4 inch diameter.
- G. Cores shall penetrate the soil to a minimum depth of 1-1 1/2 inches.

- H. Contractor shall make as many passes as are necessary across the area to be core aerated to establish a pattern of six aeration holes per square foot of surface area minimum.
- I. Break up the plugs after aeration.

3.14 REPLACEMENT OF IRRIGATION COMPONENTS

- A. Contractor shall not perform any irrigation component replacement operations unless directed to do so by the Owner in writing.
- B. Scheduling:
 - 1. Replacement of irrigation components shall occur at any time between April 1 and November 15 as directed by the Owner.
- C. Dispose of all material and debris generated during the replacement operation.
- D. Dispose of material and debris off site in a legal manner.
- E. It is understood by the Owner that routine maintenance of the irrigation system requires occasional replacement of standard components. Paragraph 3.3, WEEKLY MAINTENANCE, requires the contractor to inspect the irrigation system each week to ensure that the system and all components are functioning properly. Under paragraph 3.14, REPLACEMENT OF IRRIGATION COMPONENTS, remove and discard off site any existing component of the irrigation system which is not functioning properly and replace with new components. Prior to installing a new irrigation component contact the Owner and obtain permission to proceed.

END OF SECTION

Suffolk Downs
Outdoor Entertainment Venue
Operations Overview

Stage

- Seasonal
 - Stage, consisting of stage decking and truss system, to be installed one (1) week prior to first show.
 - Cement ballast system will anchor stage and truss system in place.
 - Stage to be removed offsite one (1) to two (2) days after final event of the season
- Event Basis
 - Ballasted stage and roof truss structure to stay in place in between events.
- Storm Basis
 - Ballasted stage and truss system to stay in place
 - In a high wind event, stage is lowered to the deck and the skin is removed from the roof system.
 - In an emergency flooding situation, the stage can be removed over one (1) to two (2) days.
 - Weather tracking used to determine high wind event

Lighting/Audio

- Seasonal
 - Lighting and Audio systems will never be installed for an entire season
- Event Basis
 - Installed to stage truss, flown via motor system
 - Removed after each show, unless there are multiple show days in a row
- Storm Basis
 - During high wind/storm events, motors will lower all lighting/audio systems to stage deck level

Trailers

- Seasonal
 - All trailers to be installed one (1) week prior to first show
 - Hurricane ties/cement ballast used on each trailer
 - Removed offsite up to four (4) days after final event of the season
- Event Basis
 - Tied/ballasted trailers to stay in place after each event
- Storm Basis
 - In a high wind event, tied/ballasted trailers to stay in place
 - In an emergency flooding situation, the trailers can be removed over one to two days

Concessions, First Aid, and Merchandise Tents

- Seasonal
 - All tents to be installed one (1) week prior to start of season
 - All tents will be ballasted to the ground using cement or water ballasts
 - Serviced during the season via perimeter access road to mitigate vehicle traffic on the infield
 - All tents to be removed offsite up to one (1) day after final event of the season
- Event Basis

- All concession supplies and materials will be stored in trailers located onsite or stored offsite in between events.
- All food and beverage will be taken offsite by vendors after each event, regardless of multiple show days in a row.
- Storm Basis
 - In a high wind event, ballasted tents to stay in place
 - In an emergency flooding situation, tents can be removed from ballast over a 12-hour period
 - When removed, tents will be stored in securely indoors or be taken offsite

VIP Viewing Platform

- Seasonal
 - The VIP viewing platform will be installed one (1) week prior to start of season
 - Tiered decking system which will be ballasted by cement
 - Removed offsite up to two (2) days after final event of the season
- Event Basis
 - Ballasted VIP viewing platform to stay in place after each event
- Storm Basis
 - In a high wind event, ballasted VIP viewing platform to stay in place
 - In an emergency flooding situation, viewing platform can be removed from ballast over a 24-hour period
 - When removed, decking system will be stored offsite

Portable Toilets

- Seasonal
 - Portable toilets to be installed up to three (3) days prior to start of season
 - Portable toilets will be staked/anchored to the ground to prevent tipping over
 - Portable toilets will be serviced via the perimeter access road
 - Removed offsite one (1) day after final event of the season
- Event Basis
 - All portable toilets will be cleaned/emptied following each event, either overnight or the following morning
- Storm Basis
 - In a high wind event, ballasted toilets to stay in place
 - In an emergency flooding situation, toilets can be removed from stakes/ballast over a 24-hour period

Trash

- Seasonal
 - Trash receptacles will never be installed for an entire season
 - All trash receptacles used during the season will be cardboard and lined with trash bags and weighted as necessary
 - Dumpsters to be placed on property and away from the public area for trash/recycling/compost
 - Plan to be evaluated should metal trash/recycling/compost bins be required especially in high traffic areas
- Event Basis
 - All trash receptacles will be placed in necessary areas prior to the start of each event
 - Filled trash bags will be placed in collection dumpsters
 - Collection dumpsters will be contracted for collection by vendor after each event
 - All reusable cardboard receptacles will be stored in secure location onsite between events
 - Cleaning staff on hand for continuous trash collection, to empty full trash receptacles, and to optimize waste diversion during events
 - Overnight staffing to ensure grounds are cleaned following an event
- Storm Basis
 - In a high wind event, weighted trash receptacles will each be closely monitored by cleaning staff

- In a storm or flooding event all trash and dumpsters to be removed and relocated by waste services company