Stormwater Report

Achievement First Iluminar School Addition
85 Garfield Ave, Cranston, Rhode Island

Prepared for

Achievement First

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Prepared by

GREEN INTERNATIONAL AFFILIATES, INC.
Civil and Structural Engineers

Building Strong Client Relationships Through Engineering Excellence

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EXECUTIVE SUMMARY

This stormwater management report has been prepared as part of the Stormwater Management Application to the Rhode Island Department Environmental Management (RIDEM) for the Improvements to the Achievement First Iluminar School project in Cranston, RI. This report describes the existing and proposed conditions and drainage patterns.

The project limits encompass the existing school at 85 Garfield Avenue in Cranston RI. The approximate project area is 201,360 square feet or 4.62 acres; however, only 2.38 acres will be disturbed.

The proposed project includes the construction of a new approximately 13,500 SF building addition, playground area, and site improvements to the existing school and parking lots. The proposed building addition will be constructed primarily over existing pervious area. Two proprietary stormwater treatment units and one subsurface stormwater infiltration basin are proposed on site for stormwater mitigation and treatment purposes.

The proposed redevelopment of this site does not disturb any resource areas but is located adjacent to resource areas. Tongue Pond is part of the Spectacle Pond subwatershed (Waterbody ID RI0006017L-07). The proposed stormwater mitigation systems will be designed in accordance with the RI State Stormwater Standards.

The proposed work will result in a minor increase in impervious area and a decrease in peak rates from the site for all applicable storm events. The proposed project qualifies as a redevelopment project as the existing conditions consists of more than 40% existing impervious surface coverage. Therefore, only Standards 2, 3, and 7-11 will be addressed in this report.

This report outlines the conditions that presently exist at 85 Garfield Avenue and impacts on those conditions from localized changes to the areas of the paved surfaces that will result from the proposed work. Effects of modified surface drainage systems will be described in addition to how these improvements are intended to address the requirements of the “Rhode Island Stormwater Design and Installations Standards Manual” last amended in March 2015.

This project improves the functionality of the existing school lot and improves the quality of stormwater runoff discharged from the site. This project incorporates the installation of practical BMPs.

The following report was created in accordance with the “Rhode Island Stormwater Design and Installations Standards Manual” last amended in March 2015 and is organized into sections that correspond to the categories listed in the “Rhode Island Stormwater Management Checklist”. The checklist is included in Appendix A of this report. The following is a more detailed description of the existing and proposed drainage areas and the design methodology for this project.

1.0 GENERAL INFORMATION

The proposed project consists of a new building addition, parking lot and driveway improvements, and a basketball court. Stormwater Best Management Practices (BMP's) have been incorporated into the design to meet the required standards to the maximum extent practicable.

1.1 Existing Conditions

1.1.1 General

The site at 85 Garfield Ave is located in Cranston, Rhode Island and is the location of Achievement First Iluminar School. There is an existing three-story school building currently on the property that is approximately 20,000 SF. There are existing parking lots adjacent to the school building to the north, east, and south. Vehicle entrance and egress points exist on the east side of the project limit toward Garfield Ave.

The project limits surrounding the school property of 85 Garfield Ave totals approximately 4.62 acres. The project site is situated just west of the Huntington Expressway (Route 10). The property is abutted by Garfield Avenue to the east, a Cranston Police Station and associated paved parking lot to the north, a paved bike trail, the Washington Secondary Trial, Tongue Pond to the south, and residential buildings to the west.

1.2 Topography, Geology and Soils

The site topography generally slopes from north to south towards Tongue Pond. Parking lots within the site limits generally have slopes that are close to 4%. Pervious grass areas outside of the work limits to the south slope more sharply toward Tongue Pond.

The Natural Resources Conservation Service (NRCS) Soil Survey for Providence County, RI defines most of the soils within the project as Merrimac-Urban (MU) with a portion of the project having (UD) Udorthents-Urban land complex, both falling under hydrologic soil group "A". The site is also divided into soil groups (Pg) Pits, gravel, (Ur) Urban land, and (W) Water. Table 1.1 lists soil designations, soil names and the associated hydrological soil groups. Soils on site are contaminated with Polycyclic Aromatic Hydrocarbons (PAHs) in several locations; however, based on our pre-application meeting with RIDEM on 4/14/2022, stormwater treatment practices are suitable for infiltration.

A subsurface exploration program consisting of four test borings was completed by Sage EnviroTech Drilling Services of Pawtucket, Rhode Island in January 2022to determine the soil conditions more accurately within the site. A layer of silty granular fill was discovered to depths approximately one foot below the existing ground surface, placed as part of an earthen site capping. The earthen cap also consists of geotextile fabric underlying the clean granular fill. The full results of the soil testing and soil conditions are included in the Geotechnical Engineering Report prepared for the site by Paul B. Aldinger & Associated, dated February 2022 and included in Appendix D.

Refer to Figure 3, Soils Map, for locations of soils within the site. Appendix D contains a soils report generated using the NRCS website containing soil definitions for the soils within the analyzed watershed.

Table 1.1 – NRCS Soil Classification

MAP DESIGNATION STATE/PUBL. SYM.	SOIL NAME	HYDROLOGIC SOIL GROUP
Mu	Merrimac-Urban	A
Pg	Pits, gravel	
UD	Udorthents-Urban land complex	A
Ur	Urban Land	
W	Water	

Groundwater readings were taken at the time of the drilling and measured at depths between approximately 21.6 and 25 feet below the ground surface. While groundwater levels could shift due to variations in rainfall and temperature, they are well below the bottom of the proposed infiltration basin, which is approximately 7.5’ below finish grade. Based on these results, the proposed infiltration system will exceed separation to groundwater requirements. The full results of the geotechnical engineering report are included in Appendix D.

1.3 Existing Contributing Areas

The existing site is mostly covered by impervious surfaces including the existing school building, bituminous concrete parking lots, and driveways. The site also includes some pervious areas with a small lawn to the north of the building and intermittent grassed medians. Drainage on the site sheets flows from north to south towards Tongue Pond. Stormwater runoff is collected by two separate closed drainage systems via catch basins in the parking lots and surrounding the school. The majority of runoff is collected along the eastern side and the closed drainage system discharges into an existing subsurface detention system that flows to an outlet control structure that eventually discharges to a Sediment basin to the south of the site. A small portion of runoff from the western side of the site discharges to a closed drainage system and directly to the sedimentation pond for treatment with an overflow directly into tongue pond. All stormwater within the project limits eventually discharges to DP-1 at Tongue Pond.

Offsite flow tributary is minimal due to the flat grading surrounding the site that slopes away. There are no jurisdictional wetlands within the project limits, but there are wetlands associated with Tongue Pond. The Water Quality Volume Calculation Worksheet in Appendix C further details the extents of the project area.

1.4 Proposed Conditions

1.4.1 General

In general, the proposed site will follow the same stormwater patterns from existing conditions. There will be improvements to the parking lots adjacent to both buildings, resulting in general geometry changes. The proposed building will replace a portion of the pervious lawn area to the north of the existing building. The new roof area from the building will be routed directly to a new subsurface infiltration system. Several existing catch basins will be rerouted at the west of the building, and new catch basins are proposed to capture the required volume of stormwater on site to be treated in order to meet RI state requirements.

The site will implement BMP’s for stormwater management. A new drainage connection to the existing closed drainage system will be necessary as an overflow from the proposed subsurface infiltration system.

1.5 Proposed Contributing Areas

The basis of comparison between existing and proposed contributing area will be the same (4.62 acres). The proposed impervious area on site will increase by 0.52 acres due to the new building addition as well as geometry improvements to the surrounding parking lots and driveways. Under proposed conditions, stormwater runoff from the increase in impervious area plus 50% of the disturbed existing impervious area will be treated to the full extent, which is an improvement to existing conditions. The entire site will continue to eventually discharge the same as existing discharge point, Tongue Pond.

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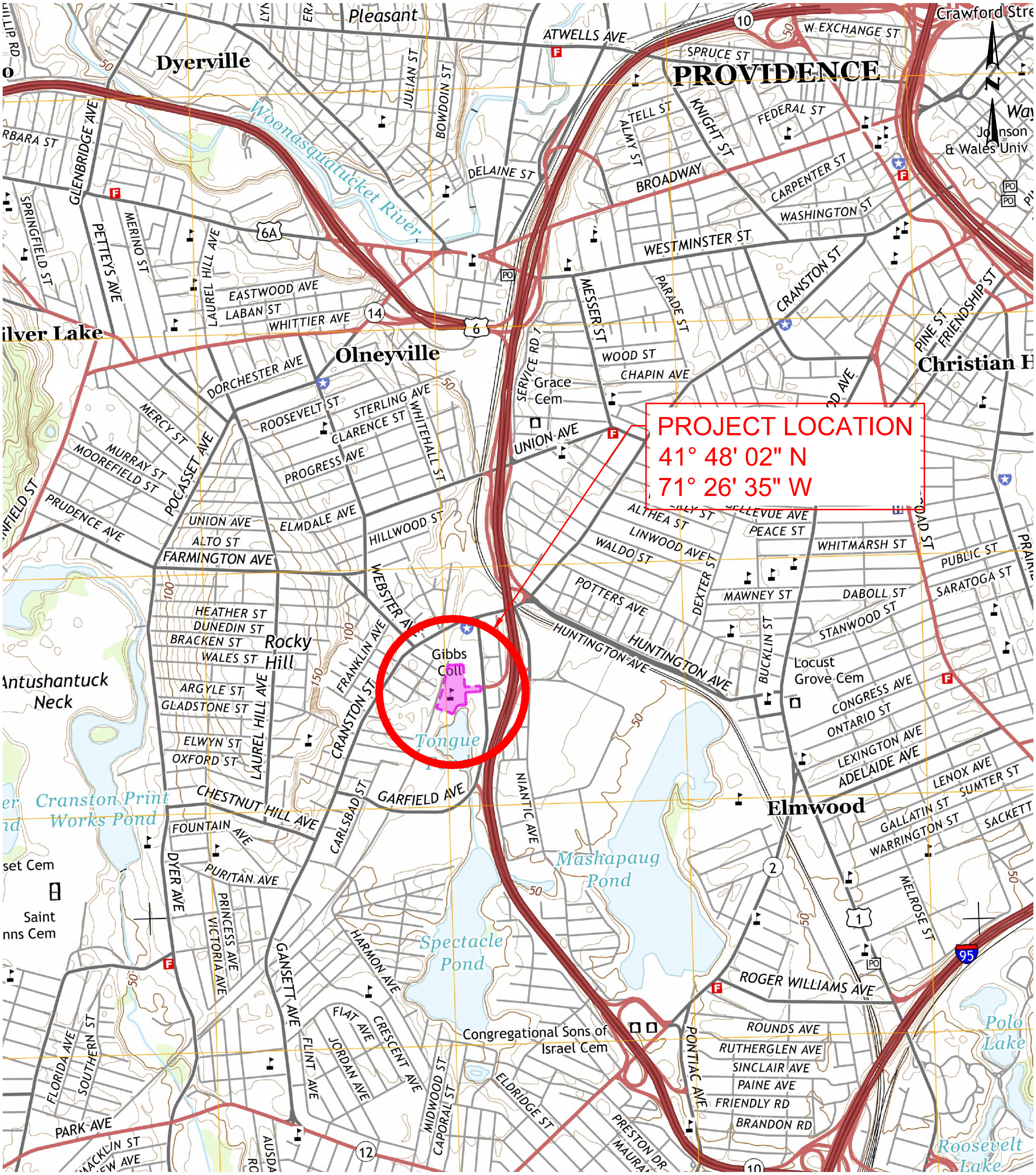

LEGEND:

APPROXIMATE PROJECT LOCATION

SCALE IN FEET

1000 0 1000 2000

ELEVATIONS IN FEET

NOTE: DATA TAKEN FROM RIGIS

USGS LOCUS MAP

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION
85 GARFIELD AVE, CRANSTON, RI, 02920

PREPARED BY:	PREPARED FOR:
GREEN INTERNATIONAL AFFILIATES, INC. CIVIL AND STRUCTURAL ENGINEERS 100 AMES POND DRIVE, TEWKSBURY, MA 01786 978.923.0400 | WWW.GREENINTL.COM	KAESTLE BOOS associates, inc 16 Chestnut Street, Suite 301, Foxborough, MA 02035 Phone: 508-549-9906

SCALE: AS NOTED	PROJECT NO. 21075	FIGURE 1
DATE: 01/14/2022 REVISED:	DRAWN BY: ED CHECKED BY: KK	

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LEGEND:

- - - - APPROXIMATE LIMIT OF WORK

SCALE IN FEET

250 0 250 500

1" = 500'

NOTE: DATA TAKEN FROM RIGIS

AERIAL LOCUS MAP

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION

85 GARFIELD AVE, CRANSTON, RI, 02920

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Phone: 508-549-9906

SCALE: AS NOTED

PROJECT NO. 21075

FIGURE 2

DATE: 01/14/2022

REVISED:

DRAWN BY: ED

CHECKED BY: KK

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LEGEND:

- - - - - - - - APPROXIMATE LIMIT OF WORK

——— NRCS SOIL SURVEY BOUNDARY

Ur NRCS SOIL SOIL SYMBOL

NOTE: DATA TAKEN FROM RIGIS AND THE U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SCALE IN FEET

250 0 250 500

1" = 500'

SOILS MAP

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION

85 GARFIELD AVE, CRANSTON, RI, 02920

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SCALE: AS NOTED	PROJECT NO. 21075	FIGURE 3
DATE: 01/14/2022 REVISED:	DRAWN BY: ED CHECKED BY: KK	

Y:\Shared\Engineering\Projects\2021\21075\DWG\FIGS\Figure 3 - Soils Map.dwg Printed: 1/13/2022 4:58 PM

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2.0 STANDARD 1: LID SITE PLANNING AND DESIGN STRATEGIES

The proposed project is a redevelopment project. Therefore, Standard 1 does not apply; however, the project is incorporating some LID design strategies. The project will propose a subsurface system that will treat 100% of the increase in impervious area as well as 50% of the disturbed impervious area from the site.

3.0 STANDARD 2: GROUNDWATER RECHARGE

Standard 2 requires that *stormwater must be recharged within the same subwatershed to maintain baseflow at pre-development recharge levels to the maximum extent practicable in accordance with the requirements and exemptions*.

A subsurface infiltration system is proposed and sized based on the required treatment area. The project site soils are classified as “A” soils based on the Natural Resource Conservation Service (NRCS) soils report. Groundwater is located at depths between 21.6 and 25 feet below the ground surface as noted in the Geotechnical Engineering report in Appendix D.

The proposed project provides the required recharge for the site. The subsurface infiltration basin is sized to recharge the required recharge volume. Pertinent recharge calculations showing the required and provided recharge volume to the BMP are included in Appendix C of this report. A summary table of these calculations is below.

Table 3.1 – Recharge Volume Summary

Designation	RE_V Required (ft^3)	RE_V Provided (ft^3)
Subsurface Basin	2,475	4,489

4.0 STANDARD 3: WATER QUALITY

Standard 3 requires that stormwater runoff must be treated before discharge. The RI Stormwater Manual states that this standard is met when:

a. The required water quality volume (WQ_v) is the amount of stormwater runoff that must be captured and treated from the entire runoff for 90% of the average annual storm event.

   $WQ_V = (1")(I)/12$

   WQ_V = water quality volume (acre-feet)

   I = impervious area (acres)

b. The WQ_V must be treated by at least one of the structural BMPs listed in Chapter 5 of the RI Stormwater Manual at each location where a discharge of stormwater will occur.

c. Structural BMPs that are used achieve the following minimum average pollutant removal efficiencies:

   - 85% Total Suspended Solids (TSS)
   - 60% Pathogens
   - 30% Total Nitrogen (TN) for discharges to saltwater or tidal systems
   - 30% Total Phosphorous (TP) for discharges to freshwater system

4.1 Water Quality Treatment Area

As stated above, the required stormwater treatment area for the project is 1.02 acres. The total impervious area treated through the proposed BMP (subsurface basin) is approximately 1.14 acres. Stormwater runoff on the existing site is captured by catch basins which either flow into an existing subsurface system for detention purposes, or directly discharges into an existing sedimentation pond. Overflow conditions during larger storms discharge directly into Tongue Pond. The proposed subsurface system will not add a new discharge point and will utilize the existing outlet control structure that discharges into the sedimentation pond.

A Water Quality Volume Calculation Worksheet for the entire project has been prepared and included in Appendix C of this report. The following table is a summary of the required Stormwater Treatment Area (amount of impervious area that is required to be treated) and what is provided.

Table 4.1 – Stormwater Treatment Area

Designation	STA Required (acres)	STA Provided (acres)
Subsurface Basin	1.02	1.14

4.2 Water Quality Treatment Volume

The water quality volume provided for the subsurface infiltration system is based on the volume provided beneath the lowest orifice. Calculations showing the required and provided water quality volume to the stormwater BMP is included in Appendix C of this report. The required WQv is based on the subsurface basin's catchment area. A summary table of these calculations is below.

Table 4.2 – Water Quality Volume Summary

Designation	WQ_V Required (ft^3)	WQ_V Provided (ft^3)
Subsurface Basin	4,125	4,489

The project will require two Water Quality Structures (WQS) for pretreatment prior to discharging to the subsurface infiltration basin. The proposed water quality pretreatment devices were sized to treat the required water quality flow rate. Calculations showing the required and provided water quality flow rates to the proprietary devices are included in Appendix B of this report. A summary table of these calculations is below.

Table 4.3 – Water Quality Flow Summary

Designation	WQ_F Required (cfs)	WQ_F Provided (cfs)
Subsurface Basin Pretreatment (WQS-1)	0.33	0.33
Subsurface Basin Pretreatment (WQS-2)	0.64	0.64

4.3 Total Suspended Solids (TSS) Removal Computations

Per the Rhode Island Stormwater Design and Installation Standards Manual, structural BMPs are required to achieve 85% total suspended solids (TSS) removal. The subsurface system is treating roof runoff, which does not require pretreatment; therefore, roof runoff will be connected directly to the subsurface infiltration system. The system will only provide pretreatment for all other areas coming into the system through catch basins.

The subsurface infiltration basin will utilize two hydrodynamic separators (WQS) for the required pretreatment and will achieve a minimum of 25% TSS removal per Table H-4 – *BMP Pollutant Removal Rating Values for Other BMPs* in the Rhode Island Stormwater Design and Installation Standards Manual. See Appendix C for TSS calculations showing the removal rates for the hydrodynamic separators provided by Contech. After pretreatment, the infiltration basin will achieve 90% TSS removal per Table H-3 – *Pollutant Removal Efficiency Rating Values for Water Quality BMPs* in the RI Stormwater Manual.

4.4 Total Phosphorus (TP) Removal Computations

Per the Rhode Island Stormwater Design and Installation Standards Manual, structural BMPs are required to achieve 30% total phosphorus (TP) removal.

The subsurface infiltration system (StormTech chambers) will achieve 65% TP removal per Table H-3. This system will therefore meet the required 30% TP removal.

4.5 Pathogen Removal Computations

A review of the RIDEM GIS Environmental Resource Map for Tongue Pond indicates that there is no current TMDL. The proposed work is a site project and will not generate an increase in pathogens to the wetland systems around the project, which eventually discharge to Tongue Pond. Per the Rhode Island Stormwater Design and Installation Standards Manual, structural BMP is required to achieve 60% pathogen removal.

Per Table H-3 in the RI Stormwater Manual, the subsurface infiltration basin will achieve 90% pathogen removal. The system will therefore meet the required 60% pathogen removal.

As summarized above, the area discharging to the subsurface infiltration BMP will meet the required pollutant removal efficiencies, as shown in Table 4.4, below.

Table 4.4 – TSS, Pathogen, & TP Removal Summary

Designation	TSS Removal	Pathogen Removal	TP Removal
Subsurface Basin with Pretreatment	90%	95%	65%

5.0 STANDARD 4: CONVEYANCE AND NATURAL CHANNEL PROTECTION

The proposed project is a redevelopment project which provides stormwater treatment via catch basins and roof drains to a subsurface infiltration system. There are no existing or proposed natural channels or open drainage ways; therefore, Standard 4 does not apply.

6.0 STANDARD 5: OVERBANK FLOOD PROTECTION (Q_P)

The proposed project is a redevelopment project and fully meets Standard 5 requirements.

6.1 Existing Tributary Areas

6.1.1 Existing Contributing Areas

The existing drainage area is delineated in *Figure 4 – Existing Conditions Watershed Plan*. As shown on Figure 4, the existing stormwater management analysis can be summarized as three watershed areas of the entire site at the 85 Garfield Ave school property that contributes runoff to one discharge point. For the purpose of this hydrologic analysis, the following assumption was made:

- The total watershed area for the existing conditions was used as the comparison base for the watershed area in the proposed conditions.

A brief description of the contributing areas are below (see Table 6.1 – Existing Conditions Drainage Area Characteristics):

DRAINAGE AREA EDA-1A

This area consists of a small section of impervious driveway at the eastern limit of work and a small section of grass past the curb line to the southeast of the school. This area is the only section within the project limits that is not captured by an existing sedimentation pond. Stormwater from this area travels mostly via overland sheet flow into Tongue Pond at DP-1.

DRAINAGE AREA EDA-1B

This area consists of impervious roof area from the building footprint and bituminous concrete pavement from several parking lots to the east of the school. There are also small landscaped pervious areas, including parking medians and the lawn area to the north of the existing building. Stormwater runoff from this area travels via sheet flow and gutter flow towards several catch basins at low points. The catch basins discharge to a closed drainage system that connect to an existing subsurface detention system that outlets to the south. A roof leader from the building also connects into the existing subsurface detention system. Stormwater then travels south out of the subsurface system into an outlet control structure. The outlet control structure has a primary outlet that discharges into a sedimentation pond and an overflow that discharges directly into Tongue Pond for larger storm events. The sedimentation pond stores stormwater and overflows to Tongue Pond at DP-1.

DRAINAGE AREA EDA-1C

This area consists of the impervious driveway to the west of the school and a small parking lot to the south of the school. This area also consists of a portion of pervious grass at the northern lawn area and adjacent to the bus access driveway. Stormwater from this area travels via sheet flow and gutter flow into catch basins at low points. Stormwater then travels through a closed drainage system into an outlet control structure. The outlet control structure has a primary outlet that discharges into a sedimentation pond and an overflow that discharges directly into Tongue Pond for larger storm events. The sedimentation pond stores stormwater and overflows to Tongue Pond at DP-1.

6.1.2 Existing Drainage Area Summary

The following Table 6.1 – Existing Conditions Drainage Area Characteristics summarizes the existing drainage area including the pertinent information used for the hydrologic analysis.

Table 6.1 – Existing Conditions Drainage Area Characteristics

DRAINAGE AREA	AREA (ACRES)	% IMPERVIOUS	HSG	CURVE NUMBER	T_C (MIN)
EDA-1A	0.281	38	A	61	6.0
EDA-1B	3.481	82	A	87	6.0
EDA-1C	1.380	47	A	67	6.0

6.1.3 Peak Discharge Runoff Rates & Volume

The existing peak flow rates, tributary to the design, were calculated for the 1-year, 2-year, 10-year, 25-year, and 100-year storm events. The results are presented in table 6.3 Peak Rates of Runoff.

6.2 Proposed Tributary Areas

6.2.1 Proposed Contributing Areas

The proposed stormwater management analysis can be summarized as four watershed areas that contribute runoff to one discharge point. The proposed tributary area of analysis will remain the same as the existing tributary area. Stormwater runoff on the site will be treated by proposed BMP's at one of the four proposed drainage areas. The proposed drainage system is designed to maintain the characteristics of the existing watershed area and post development runoff rates will be maintained at or below existing levels discharging into Tongue Pond at DP-1. The redevelopment of this site will result in a net increase in impervious area of 0.52 acres. The drainage area with the proposed subsurface BMP will have an overflow that will eventually discharge into the Tongue Pond at DP-1.

Tongue Pond is used as the only discharge point in the hydrologic analysis, as indicated on the attached Figure 5 - Proposed Watershed Plan. A brief description of the contributing area is below (see Table 6.2 – Proposed Conditions Drainage Area Characteristics for each drainage area):

DRAINAGE AREA PDA-1A

This area remains the same as existing conditions and consists of a small section of impervious driveway at the eastern limit of work and a small section of grass past the curb line to the southeast of the school. This area is the only section within the project limits that is not captured by an existing sedimentation pond. Stormwater from this area travels mostly via overland sheet flow into Tongue Pond at DP-1.

DRAINAGE AREA PDA-1B

This area is mostly the same as existing conditions but has reduced in size due to rerouting area to PDA-1D. This area consists of impervious roof area from the building footprint and bituminous concrete pavement from several parking lots to the east of the school. There are also small landscaped pervious areas from parking medians. Stormwater runoff from this area travels the same as existing conditions via sheet flow and gutter flow towards several catch basins at low points. The catch basins discharge to a closed drainage system that connect to an existing subsurface detention system that outlets to the south. A roof leader from the existing building also connects into the subsurface system. Stormwater then travels south out of the subsurface system into an outlet control structure. The outlet control structure has a primary outlet that discharges into a sedimentation pond and an overflow that discharges directly into Tongue Pond for larger storm events. The sedimentation pond stores stormwater and overflows to Tongue Pond at DP-1.

DRAINAGE AREA PDA-1C

This area is cut by approximately half under proposed conditions due to rerouting stormwater to PDA-1D. This area consists of a portion of the impervious driveway to the west of the school and a small parking lot to the south of the school. This area no longer includes a portion of pervious grass at the northern lawn area. Stormwater from this area travels the same as existing conditions via sheet flow and gutter flow into catch basins at low points. Stormwater then travels through a closed drainage system into an outlet control structure. The outlet control structure has a primary outlet that discharges into a sedimentation pond and an overflow that discharges directly into Tongue Pond for larger storm events. The sedimentation pond stores stormwater and overflows to Tongue Pond at DP-1.

DRAINAGE AREA PDA-1D

This area consists mostly of impervious area from the proposed building addition, a portion of the abutting driveway to the west, a section of the parking lot to the east, and the proposed basketball court to the north. Stormwater from this area travels via sheet flow and gutter flow into catch basins at low points. The runoff then enters a closed drainage system that discharges into a proposed subsurface infiltration system with pretreatment structures. Stormwater leaves the system either via infiltration or an outlet control structure to the south of the system. The stormwater continues to the south and connects into the downstream end of the existing subsurface detention system that discharges to the sedimentation pond which overflows to Tongue Pond at DP-1.

6.2.2 Proposed Drainage Area Summary

The following Table 6.2 – Proposed Conditions Drainage Area Characteristics summarizes the existing drainage area including the pertinent information used for the hydrologic analysis.

Table 6.2 – Proposed Conditions Drainage Area Characteristics

DRAINAGE AREA	AREA (ACRES)	% IMPERVIOUS	HSG	CURVE NUMBER	T_C (MIN)
PDA-1A	0.281	38%	A	61	6.0
PDA-1B	2.690	90%	A	92	6.0
PDA-1C	0.654	68%	A	79	6.0
PDA-1D	1.518	75%	A	83	6.0

6.2.3 Peak Discharge Runoff Rates & Volume

The proposed peak flow rates, tributary to the design, were calculated for the 1-year, 2-year, 10-year, 25-year, and 100-year storm events. The results are presented in table 6.3 Peak Rates of Runoff.

6.3 Peak Discharge Runoff Rates

The peak flow rates were calculated for the 2-year, 10-year, 25-year, and 100-year storm events under existing conditions and proposed conditions. The net increase of impervious area of 0.52 acres will be mitigated with an Stormwater BMP and will result in a decrease in peak rates for all storm events analyzed. These results are demonstrated in the Hydrologic Calculations in Appendix B. The following Table 6.3 represents a comparison between existing and proposed conditions of the peak rates of runoff from the proposed development site tributary to the discharge point.

Table 6.3 – Peak Rates of Runoff

DISCHARGE POINT		1-YEAR STORM (CFS)	2-YEAR STORM (CFS)	10-YEAR STORM (CFS)	25-YEAR STORM (CFS)	100-YEAR STORM (CFS)
DP-1	Existing	6.52	9.08	16.65	22.58	35.71
	Proposed	6.51	8.50	15.30	20.85	30.53

6.4 Methodology and Design Criteria

The drainage analysis was performed using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies and the computer program HydroCAD 10.0 by HydroCAD Software Solutions, LLC.

The analysis was performed on the 1-year, 2-year, 10-year, 25-year, and 100-year frequency rainfall events. Rainfall depths were taken from Table 3-1 Design Rainfall Amounts for Rhode Island in the Rhode Island Stormwater Design Manual, dated 2015. The events were based on the 24-Hour Type-III duration storm.

The following rainfall depths were used in the calculations:

Storm Event	Rainfall Depth
1-Year	2.72 inches
2-Year	3.30 inches
10-Year	4.90 inches
25-Year	6.10 inches
100-Year	8.70 inches

The "time of concentration" (T_c) for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of concentration. The travel path was drawn based on the topography and the time was calculated using the TR-55 Method and HydroCAD. A minimum T_c of 6.0 minutes was used.

Curve numbers were developed for each of the different use categories and hydrologic soil group types within each watershed area. The curve numbers were based on the SCS TR-55 methodology and are included in the HydroCAD input and output found in Appendix B.

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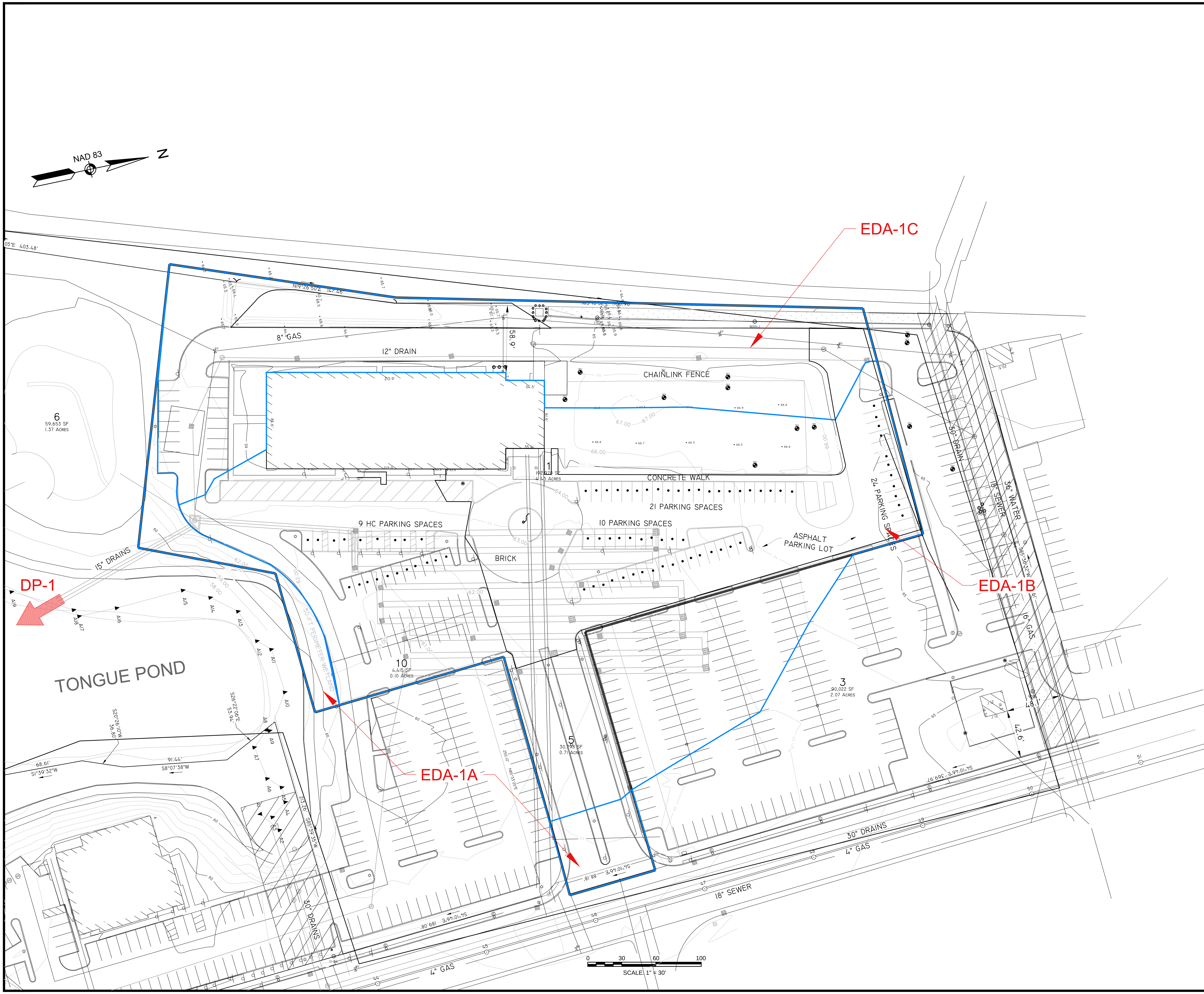

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ISSUE DATE

DATE	DESCRIPTION
5/3/2022	PERMIT PLANS

REVISIONS

DATE	DESCRIPTION

FOR ALL ABBREVIATIONS, SYMBOL LEGENDS, AND GENERAL NOTES SEE SHEET R0.01

EXISTING

KEY PLAN

0 15' 30' 60'
SCALE: 1" = 30'

PROJECT TRUE

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION

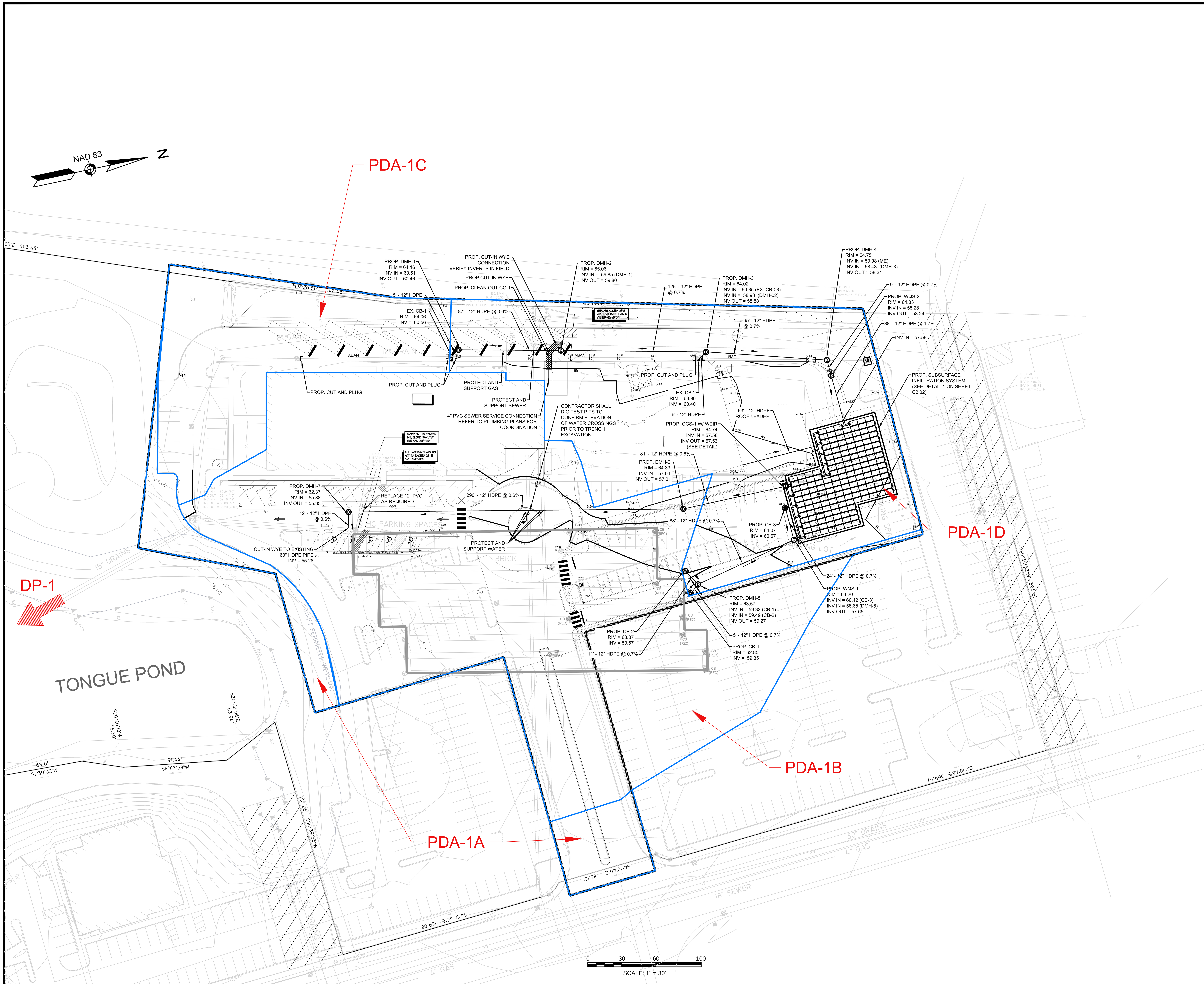
85 GARFIELD AVE, CRANSTON, RI, 02920

PROJECT NO.: 21012.02 DRAWN BY: BV

EXISTING WATERSHED PLAN

DRAWING NO.:

FIGURE 4



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Project Consultant

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Civil and Structural Engineers
100 Ames Pond Drive,
Tewksbury, MA 01876
GreenIntl.com
(978) 923-0400

ISSUE DATE

DATE	DESCRIPTION
MAY 2, 2022	ISSUED FOR BID

REVISIONS

DATE	DESCRIPTION

FOR ALL ABBREVIATIONS, SYMBOL LEGENDS, AND GENERAL NOTES SEE SHEET R0.01

EXISTING

KEY PLAN

0 15' 30' 60' SCALE: 1" = 30' PROJECT TRUE

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION

85 GARFIELD AVE, CRANSTON, RI, 02920

PROJECT NO.: 21012.02 DRAWN BY: BV

PROPOSED WATERSHED PLAN

DRAWING NO.:

FIGURE 5

7.0 STANDARD 6: REDEVELOPMENT

The improvements to Achievement First Iluminar School project are considered Redevelopment and therefore Standard 6 is applicable to this project. Redevelopment is defined as any construction, alteration, or improvement that disturbs a total of 10,000 sf or more of existing impervious area where the existing land use is commercial, industrial, institutional, governmental, recreational, or multi-family residential. Standard 6 requires that sites with 40% or more existing impervious surface coverage only need to address Standards 2, 3 and 7 – 11. The total site area is 4.62 acres. The total existing impervious area within the limit of work is 3.08 acres (67% impervious) (see Water Quality Volume Calculation Worksheet in Appendix C) of the total area within the limit of work; therefore, the project site is considered Redevelopment.

This project provides an opportunity to improve the functionality of the existing site, and to improve upon the quality of discharged stormwater, to the extent that it is practical to do so. The proposed stormwater enhancements are summarized below:

- The new system will install catch basins with 4’ sumps and hoods in areas where new catch basins are proposed.
- Following construction of the site and drainage improvements, the storm drainage system will be flushed, and accumulated sediment will be removed from the proposed drainage structures. Sediment will be disposed of legally offsite.
- The quality of stormwater runoff will be significantly improved with the installation of two proprietary water quality structures and an additional subsurface infiltration system.

8.0 STANDARD 7: POLLUTION PREVENTION

Standard 7 requires that all development sites use source control and pollution prevention measures to minimize the impact that the land use may have on stormwater runoff quality. These measures shall be outlined in a stormwater pollution prevention plan for post-development conditions.

The project will disturb more than one acre of land during the construction process and will require a RIPDES Construction General Permit issued by the Rhode Island Department of Environmental Management (RIDEM). As a result, a Soil Erosion and Sediment Control Plan (SESC) will be required. The SESC document will satisfy the requirements of the Construction General Permit and the construction period erosion, sedimentation and pollution prevention plan requirements outlined in Standard 7 of the Rhode Island Stormwater Design and Installation Standards Manual. A draft SESC has been prepared and is included in Appendix E of this report (bound separately).

9.0 STANDARD 8: LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

While the soils on site are contaminated with Polycyclic Aromatic Hydrocarbons (PAHs) the improvements to the Achievement First Iluminar School are not considered a Land Use with Higher Potential Pollutant Loads (LUHPPL) and therefore Standard 8 is not applicable to this project. As noted above, during the pre-application meeting with RIDEM, it was noted that infiltration BMP's are allowed on-site to mitigate stormwater runoff and are not subject to Standard 8. .

10.0 STANDARD 9: ILLICIT DISCHARGES

Standard 9 of the RI Stormwater Manual prohibits illicit discharges to stormwater management systems, including discharges from onsite wastewater treatment systems (OWTS), and subdrains and French drains near OWTS that do not meet the State's OWTS Rules. Illicit Discharges to the stormwater system are discharges not entirely comprised of stormwater that are not specifically authorized by a National Pollutant Discharge Elimination System (NPDES) or Rhode Island Pollutant Discharge System (RIPDES) permit.

Included with the report is a Drainage and Utility Plan that displays the location of all stormwater management components as well as other utilities (existing and proposed) on the project site. There are no known combined sewer pipes within the site to the best of our knowledge and closed stormwater systems discharge per the RIPDES permit.

11.0 STANDARD 10: CONSTRUCTION EROSION AND SEDIMENTATION CONTROL

Standard 10 of the RI Stormwater Manual requires *erosion and sedimentation control (ESC) practices to be utilized during the construction phase as well as during any land disturbing activities. ESC practices must meet the following minimum design criteria:*

- *Temporary sediment trapping practices must be sized to store 1-inch of runoff from the contributing area or per the sediment volume method (Rhode Island Soil Erosion and Sediment Control Handbook), whichever is greater;*

- *And temporary conveyance practices must be sized to handle the peak flow from the 10-year, 24-hour, Type III design storm.*

The Soil Erosion and Sediment Control Plan (SESC) document required per the RIPDES Construction General Permit will satisfy the erosion, sedimentation and pollution prevention plan requirements outlined in Standard 10 of the Rhode Island Stormwater Design and Installation Standards Manual. A draft SESC has been prepared and is included in Appendix E of this report (bound separately).

12.0 STANDARD 11: STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE

The goal of the Operation and Maintenance (O&M) plan is not only to protect resources on-site or nearby, but also to protect resources in the region that may be affected by the activities at the site. The Achievement First Iluminar School will be responsible for the operation and maintenance of the stormwater management system which include street sweeping, operations and maintenance of the proposed BMPs, and catch basin cleaning. See attached O&M memo for more information.

13.0 LID STORMWATER CREDIT

The project is not seeking any stormwater credit; therefore, this section is not applicable.

14.0 BEST MANAGEMENT PRACTICES (BMPS)

The Rhode Island Stormwater Design and Installation Standards Manual requires detailed information for all structural stormwater BMPs.

Several types of structural best management practices (BMPs), in various combinations, are proposed to treat stormwater generated on the site. These measures include deep sump catch basins with hoods, proprietary water quality treatment devices, and a subsurface infiltration basin. Stormwater BMPs implemented at the site are briefly described below and are detailed on the Plans.

14.1 Deep Sump and Hooded Catch Basins

New catch basins specified for the project are constructed with sumps (minimum 4 feet) and hooded outlets to trap debris, sediments, and floating contaminants. The proper removal of sediments and associated pollutants and trash occurs only when catch basin inlets and sumps are cleaned out regularly. With proper maintenance deep sump/hooded basins are effective traps for large sediment, trash and debris that could otherwise be deposited in the downstream stormwater management features and/or resource areas.

14.2 Subsurface Infiltration Chambers (StormTech)

Subsurface infiltration chambers are manufactured chambers designed to retain and infiltrate stormwater runoff. They are most useful in constrained areas where aboveground systems may not be possible. It was sized to treat the required water quality volume per the RI Stormwater Manual.

14.3 Hydrodynamic Separators (CDS)

Hydrodynamic separators are manufactured structures designed to pretreat stormwater. The CDS hydrodynamic separator uses swirl concentration and continuous deflective separation to screen, separate and trap trash, debris, sediment, and hydrocarbons from stormwater runoff. CDS captures and retains 100% of floatables and neutrally buoyant debris 4.7 mm or larger, effectively removes sediment, and incorporates a non-blocking screen. The two units were sized to treat the required water quality flow per the RI Stormwater Manual.

Table 14.1, below, lists the BMPs used throughout the site and describes the function they provide.

Table 14.1 – BMP Descriptions

BMP Number	Type of BMP	Function Provided by the BMP					
		Pretreatment	RE_V	WQ_V	WQ_F	CP_V	Q_P
1	Catch basins with hoods and 4-foot sumps	X				N/A	N/A
2	Subsurface Infiltration Chambers		X	X		N/A	X
3	Hydrodynamic Separators (WQS)	X			X	N/A	N/A

14.4 Stormwater Components

In addition to the description of the BMPs, the following components are also required per the Stormwater Management Checklist:

14.4.1 Hydrologic and Hydraulic Analysis

The proposed project is a redevelopment project, so a Standards 4 and 5 did not apply. Therefore, a hydrologic and hydraulic analysis was not completed.

14.4.2 Drainage Area Map

Pre- and post-development watershed maps (Figures 4 and 5) are included in this report.

14.4.3 Details and elevations of the BMPs

Details of each stormwater BMP, including rim and invert elevations, are included in the plan set in Appendix E of this report.

14.4.4 Applicable Local and State Permits

The following are the applicable State and local permits:

- RIPDES Construction General Permit
- RIDEM Wetlands Permit (Request for Preliminary Determination)

14.4.5 Anticipated Legal Agreements Related to Stormwater

There are no anticipated legal agreements for this proposed project site related to stormwater.

Y:\Shared\Engineering\Projects\2021\21075\DOCS\RPTS\Stormwater\rpt-Stormwater_Illuminar School.docx

APPENDIX A – STORMWATER MANAGEMENT PLAN CHECKLIST

- Stormwater Management Plan Checklist

APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME **Achievement First Iluminar School Addition**	**(RIDEM USE ONLY)** **STW/WQC File #:** **Date Received:**
TOWN **Cranston, RI**	
BRIEF PROJECT DESCRIPTION: Site drainage and layout improvements and school building addition.	

Stormwater Management Plan (SMP) Elements – Minimum Standards

When submitting a SMP,[1] submit four separately bound documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to Suggestions to Promote Brevity.

Note: **All stormwater construction projects must create a Stormwater Management Plan (SMP). However, not every element listed below is required per the** RIDEM Stormwater Rules **and the** RIPDES Construction General Permit (CGP)**. This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.**

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)				
☐ Residential	☐ Commercial	☐ Federal	☐ Retrofit	☐ Restoration
☐ Road	☐ Utility	☐ Fill	☐ Dredge	☐ Mine
☒ Other (specify): Institutional				

SITE INFORMATION
☒ Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.)		
☒ **Groundwater**	☒ **Surface Water**	☐ **MS4**
☐ GAA	☐ Isolated Wetland	☐ RIDOT
☐ GA	☒ Named Waterbody	☐ RIDOT Alteration Permit is Approved
☒ GB	☐ Unnamed Waterbody Connected to Named Waterbody	☐ Town
		☐ Other (specify):

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQ_v and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.			
☒ Groundwater or Disconnected Wetland	☐ SRWP		
☒ Waterbody Name: Tongue Pond	☐ Coldwater	☐ Warmwater	☒ Unassessed
☒ Waterbody ID: RI0006017L-10	☐ 4th order stream of pond 50 acres or more		
☐ TMDL for: N/A	☐ Watershed of flood prone river (e.g., Pocasset River)		
☐ Contributes to a priority outfall listed in the TMDL	☐ Contributes stormwater to a public beach		
☐ 303(d) list – Impairment(s) for: N/A	☐ Contributes to shellfishing grounds		

[1] Applications for a Construction General Permit that do not require any other permits from RIDEM and will disturb less than 5 acres over the entire course of the project do not need to submit a SMP. The Appendix A checklist must still be submitted.

PROJECT HISTORY		
☒ RIDEM Pre- Application Meeting	Meeting Date: 4/14/2022	☒ Minutes Attached
☐ Municipal Master Plan Approval	Approval Date:	☐ Minutes Attached
☐ Subdivision Suitability Required	Approval #:	
☐ Previous Enforcement Action has been taken on the property	Enforcement #:	

FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways	
☐ Riverine 100-year floodplain: **FEMA FLOODPLAIN FIRMETTE** has been reviewed and the 100-year floodplain is on site	
☐ Delineated from FEMA Maps	
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional	
☐ Calculated by Professional Engineer	
☐ Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY): Amount of Cut (CY):
☐ Restrictions or modifications are proposed to the flow path or velocities in a floodway	
☐ Floodplain storage capacity is impacted	
☒ Project area is not within 100-year floodplain as defined by RIDEM	

CRMC JURISDICTION
☐ CRMC Assent required
☐ Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:
☐ Sea level rise mitigation has been designed into this project

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:			
1. OFFICE OF Land Revitalization and Sustainable Materials Management (OLRSMM)			
	☒ Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))		**RIDEM CONTACT:** Ashley Blauvelt
	☐ Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)		
	☒ This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities		**SITE ID#:**
		☐ CERCLIS/Superfund (NPL)	
		☐ State Hazardous Waste Site (SHWS)	
		☒ Environmental Land Usage Restriction (ELUR)	SR-07-0455 B
		☐ Leaking Underground Storage Tank (LUST)	
		☐ Closed Landfill	
Note:	If any boxes in 1 above are checked, the applicant must contact the RIDEM OLRSMM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds to "Red," "Yellow" or "Green" as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration.		
2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 "LUHPPLS," THE SITE IS/HAS:			
	☐ Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php		
	☐ Auto Fueling Facility (e.g., gas station)		
	☐ Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area		

	☐ Road Salt Storage and Loading Areas (exposed to rainwater)	
	☐ Outdoor Storage and Loading/Unloading of Hazardous Substances	
3.	**STORMWATER INDUSTRIAL PERMITTING**	
	☐ The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Sector:
	☐ Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
	☐ Additional stormwater treatment is required by the MSGP Explain:	

REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
☒ Pre Construction Impervious Area		
3.08 ac	☒ Total Pre-Construction Impervious Area (**TIA**)	
4.62 ac	☒ Total Site Area (**TSA**)	
	☐ Jurisdictional Wetlands (**JW**)	
	☐ Conservation Land (**CL**)	
☐ Calculate the Site Size (defined as contiguous properties under same ownership)		
4.62 ac	☒ Site Size (**SS**) = (**TSA**) – (**JW**) – (**CL**)	
0.67	☒ (**TIA**) / (**SS**) =	☒ (**TIA**) / (**SS**) >**0.4**?
☒ YES, Redevelopment		

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2		
YES	**NO**	
☒	☐	The project has been designed to meet the groundwater recharge standard.
☐	☐	If "No," the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
☐	☐	Your waiver request has been explained in the Narrative, if applicable.
☒	☐	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
☒	☐	If "Yes," has approval for infiltration by the OLRSMM Site Project Manager, per Part 1, Minimum Standard 8, been requested?

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)
(Add or Subtract Rows as Necessary)

Design Point	Impervious Area Treated (sq ft)	Total Re_v Required (cu ft)	LID Stormwater Credits (see RISDISM Section 4.6.1) Portion of Re_v directed to a QPA (cu ft)	Recharge Required by Remaining BMPs (cu ft)	Recharge Provided by BMPs (cu ft)
DP-1:	49,498	2,475	0	2,475	4,489
TOTALS:	49,498	2,475	0	2,475	4,489

Notes:
1. Only BMPs listed in RISDISM Table 3-5 "List of BMPs Acceptable for Recharge" may be used to meet the recharge

requirement. 2. Recharge requirement must be satisfied for each waterbody ID.
☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.): Recharge Calculations are included in Appendix C of the Stormwater Report.

WATER QUALITY – MINIMUM STANDARD 3		
YES	**NO**	
☒	☐	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
☒	☐	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
☐	☐	If "Yes," either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,
☒	☐	If "Yes," either TR-55 or TR-20 was used to calculate WQv; and,
☐	☐	If "No," the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
☐	☐	Not Applicable
☒	☐	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
☐	☒	Does this project propose an increase of impervious cover to a receiving water body with impairments? If "Yes," please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water.
☐	☒	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
☐	☒	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable.
☒	☐	BMPs are proposed that are on the approved technology list . If "Yes," please provide all required worksheets from the manufacturer.
☐	☒	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If "Yes," please describe:

TABLE 3-1: Summary of Water Quality (see RICR 8.9)					
Design Point and WB ID	**Impervious area treated (sq ft)**	**Total WQ_v Required (cu ft)**	**LID Stormwater Credits** (see RICR 8.18) **WQv directed to a QPA (cu ft)**	**Water Quality Treatment Remaining (cu ft)**	**Water Quality Provided by BMPs (cu ft)**
DP-1:	49,498	4,125	0	4,125	4,489
TOTALS:	49,498	4,125	0	0	4,489

Notes:

1. Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.
2. For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.

☒ YES ☐ NO	This project has met the setback requirements for each BMP. If "No," please explain:

☒ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.): Water Quality calculations are included in Appendix C of the Stormwater Report.

CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4			
YES	**NO**		
☐	☒	Is this standard waived? If "Yes," please indicate one or more of the reasons below:	
		☐	The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters.
		☐	The project is a small facility with impervious cover of less than or equal to 1 acre.
		☐	The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (Note: LID design strategies can greatly reduce the peak discharge rate).
☐	☒	Conveyance and natural channel protection for the site have been met. If "No,' explain why: N/A – There are no existing or proposed natural channels or open drainage ways.	

TABLE 4-1: Summary of Channel Protection Volumes (see RICR 8.10)					
Design Point	**Receiving Water Body Name**	**Coldwater Fishery? (Y/N)**	**Total CPv Required (cu ft)**	**Total CPv Provided (cu ft)**	**Average Release Rate Modeled in the 1-yr storm (cfs)**
DP-1:					
TOTALS:					
Note: The Channel Protection Volume Standard must be met in each waterbody ID.					
☐ YES ☐ NO	The CPv is released at roughly a uniform rate over a 24-hour duration (see examples of sizing calculations in Appendix D of the RISDISM).				
☐ YES ☐ NO	Do additional design restrictions apply resulting from any discharge to cold-water fisheries; If "Yes," please indicate restrictions and solutions below.				
☐ Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).					

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5			
YES	**NO**		
☐	☒	Is this standard waived? If yes, please indicate one or more of the reasons below:	
		☐	The project directs discharge to a large river (i.e., 4th-order stream or larger. See Appendix I for state-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters.
		☐	A Downstream Analysis (see RICR 8.11.D and E) indicates that peak discharge control would not be beneficial or would exacerbate peak flows in a downstream tributary of a particular site (e.g., through coincident peaks).
☐	☒	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:	
		☐	RIDOT
		☐	Other (specify):
Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be **less** than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.			
		Indicate below which model was used for your analysis. ☐ TR-55 ☐ TR-20 ☒ HydroCAD ☐ Bentley/Haestad ☐ Intellisolve ☐ Other (Specify):	
YES	**NO**		
☒	☐	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):	
☐	☒	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"	
☐	☐	Are the areas modeled as "present condition" for both pre- and post-development analysis?	
☐	☐	Are the off-site areas shown on the subwatershed maps?	
☒	☐	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?	
☐	☒	Is a Downstream Analysis required (see RICR 8.11.E.1)?	
☒	☐	Calculate the following:	
		☒	Area of disturbance within the sub-watershed (areas) 2.38 acres
		☒	Impervious cover (%) 78% Proposed
☐	☒	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?	
☒	☐	Does this project meet the overbank flood protection standard?	

Table 5-1 Hydraulic Analysis Summary								
Subwatershed (Design Point)	**1.2" Peak Flow** (cfs) **		**1-yr Peak Flow** (cfs)		**10-yr Peak Flow** (cfs)		**100-yr Peak Flow** (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
DP-1:	1.25	1.75	6.52	6.51	16.65	15.30	35.71	30.53
TOTALS:	1.25	1.75	6.52	6.51	16.65	15.30	35.71	30.53

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Indicate as follows where the pertinent calculations and/or information for the items above are provided	**Name of report/document, page numbers, appendices, etc.**
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	Stormwater Report Appendix B
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	Stormwater Report Appendix B
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	Stormwater Report Appendix C
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	Stormwater Report Appendix B/C

Table 5-2 Summary of Best Management Practices											
BMP ID	**DP #**	**BMP Type** (e.g., bioretention, tree filter)	**BMP Functions**					**Bypass Type**	**Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4**		
			Pre-Treatment (Y/N/ NA)	Re_v	WQ_v	CP_v (Y/N/ NA)	Overbank Flood Reduction (Y/N/NA)	External (E) Internal (I) or NA	Yes/ No	Technical Justification (Design Report page number)	Distance Provided
1	1	Subsurface Infiltration System	Y	Y	Y	N/A	Y	I	Y		
		TOTALS:	Y	Y	Y	N/A	Y	I	Y		

Table 5.3 Summary of Soils to Evaluate Each BMP									
DP #	BMP ID	BMP Type (e.g., bioretention, tree filter)	Soils Analysis for Each BMP						
			Test Pit ID# and Ground Elevation		SHWT Elevation (ft)	Bottom of Practice Elevation* (ft)	Separation Distance Provided (ft)	Hydrologic Soil Group (A, B, C, D)	Exfiltration Rate Applied (in/hr)
			Primary	Secondary					
1	1	Infiltration Basin	PBA-6		44.7	56.6	11.9	A	2.14
		TOTALS:							

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8			
YES	**NO**	**N/A**	
☐	☐	☒	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9.
☐	☐	☐	Are these activities already covered under an MSGP? If "No," please explain if you have applied for an MSGP or intend to do so?
☐	☐	☐	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, "Acceptable BMPs for Use at LUHPPLs." Please list BMPs:
☐	☐	☐	Additional BMPs, or additional pretreatment BMP's if any, that meet RIPDES MSGP requirements; Please list BMPs:
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).

ILLICIT DISCHARGES – MINIMUM STANDARD 9			
Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.			
YES	**NO**	**N/A**	
☒	☐	☐	Have you checked for illicit discharges?
☐	☒	☐	Have any been found and/or corrected? If "Yes," please identify. *To the best of our knowledge based on the information provided, there are no known illicit discharges.*
☒	☐	☐	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10			
YES	**NO**	**N/A**	
☒	☐	☐	Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?
☒	☐	☐	Have you provided a **separately-bound** document based upon the SESC Template? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).

	If "No," include a document with your submittal that addresses the following elements of an SESC Plan:	
	☐	Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:
	☐	Provide Natural Buffers and Maintain Existing Vegetation
	☐	Minimize Area of Disturbance
	☐	Minimize the Disturbance of Steep Slopes
	☐	Preserve Topsoil
	☐	Stabilize Soils
	☐	Protect Storm Drain Inlets
	☐	Protect Storm Drain Outlets
	☐	Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures
	☐	Establish Perimeter Controls and Sediment Barriers
	☐	Divert or Manage Run-On from Up-Gradient Areas
	☐	Properly Design Constructed Stormwater Conveyance Channels
	☐	Retain Sediment On-Site
	☐	Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows
	☐	Apply Construction Activity Pollution Prevention Control Measures
	☐	Install, Inspect, and Maintain Control Measures and Take Corrective Actions
	☐	Qualified SESC Plan Preparer's Information and Certification
	☐	Operator's Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities
	☐	Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9		
Operation and Maintenance Section		
YES	**NO**	
☒	☐	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
☒	☐	Have you provided a **separately-bound** Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
☒	☐	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If "No," why not?
☒	☐	Is the property owner or homeowner's association responsible for the stormwater maintenance of all BMP's? If "No," you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.).
☐	☒	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If "Yes," have you obtained them? Or please explain your plan to obtain them:
☐	☒	Is stormwater being directed from public areas to private property? If "Yes," note the following: <u>Note</u>: This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.

Pollution Prevention Section		
☒	☐	Designated snow stockpile locations?
☒	☐	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
☒	☐	Asphalt-only based sealants?
☐	☒	Pet waste stations? (Note: If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
☒	☐	Regular sweeping? Please describe:
☒	☐	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
☐	☒	A prohibition of phosphate-based fertilizers? (Note: If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

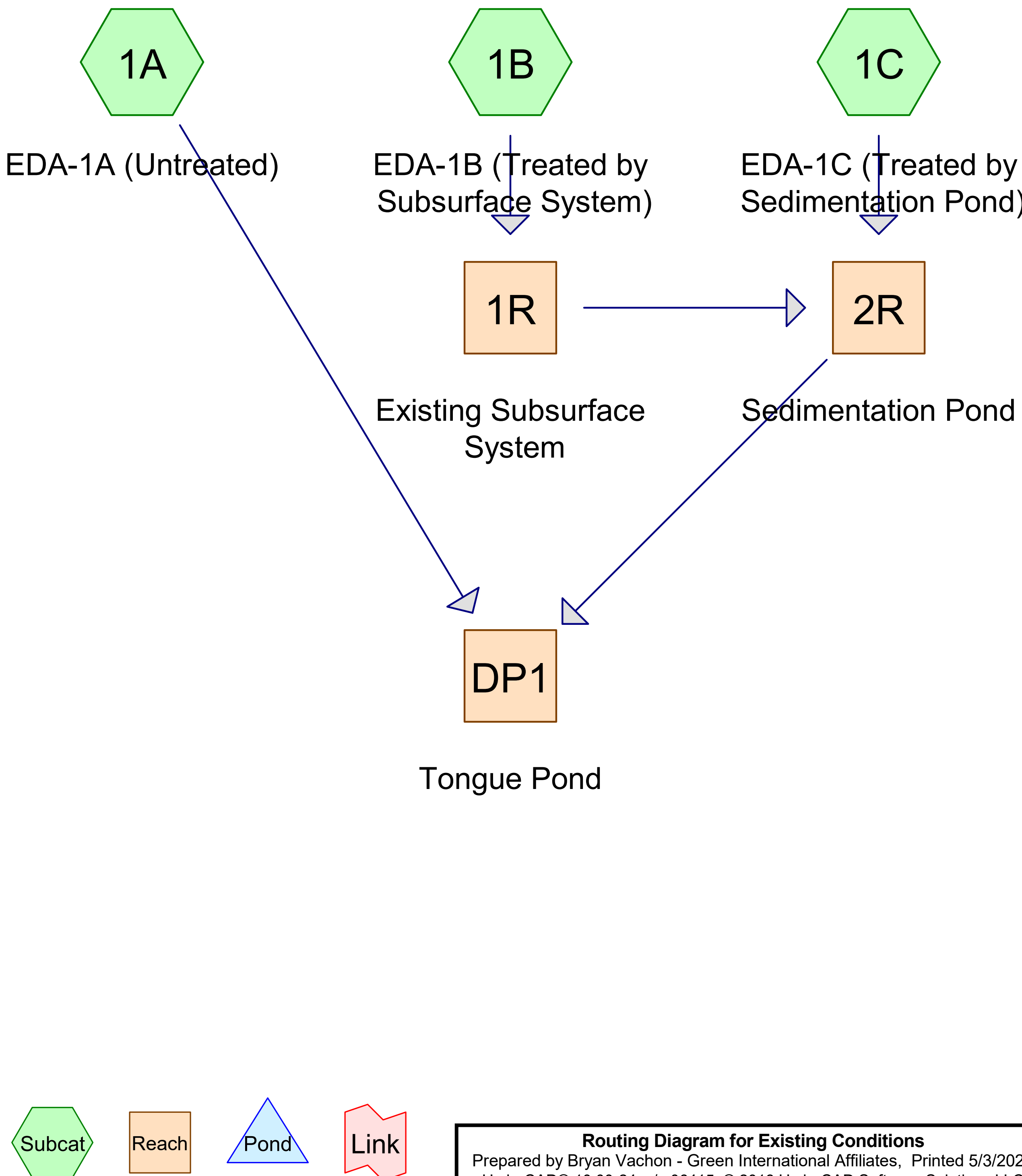
Existing and Proposed Subwatershed Mapping (REQUIRED)			
YES	NO		
☒	☐	Existing and proposed drainage area delineations	
☒	☐	Locations of all streams and drainage swales	
☒	☐	Drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in RISDISM Appendix K)	
☒	☐	Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable	
☒	☐	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report	
☒	☐	Mapped seasonal high-water-table test pit locations	
☒	☐	Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs	
☒	☐	Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans	
☐	☒	Mapped bedrock outcrops adjacent to any infiltration BMP	
☒	☐	Soils were logged by a:	
		☐	DEM-licensed Class IV soil evaluator Name:
		☒	RI-registered P.E. Name: Paul Aldinger, P.E.

Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	**First Receiving Water ID or MS4**	**Area Disturbed (acres)**	**Existing Impervious (acres)**	**Proposed Impervious (acres)**
DP-1:	RI0006017L-10	2.38	3.08	3.60
TOTALS:	RI0006017L-10	2.38	3.08	3.60

Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	**NO**	
☒	☐	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
☒	☐	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
☒	☐	Boundaries of existing predominant vegetation and proposed limits of clearing
☒	☐	Site Location clarification
☒	☐	Location and field-verified boundaries of resource protection areas such as: ► freshwater and coastal wetlands, including lakes and ponds ► coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
☒	☐	All required setbacks (e.g., buffers, water-supply wells, septic systems)
☒	☐	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: ► Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ► Design water surface elevations (applicable storms); ► Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ► Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ► Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ► Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
☒	☐	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
☐	☒	Mapping of any OLRSMM-approved remedial actions/systems (including ELURs)
☒	☐	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; ► Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ► Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ► Cross sections of roadways, with edge details such as curbs and sidewalks; ► Location and dimensions of channel modifications, such as bridge or culvert crossings
☐	☒	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization

APPENDIX B – HYDROLOGIC CALCULATIONS

- Existing Conditions Hydrologic Calculations
- Proposed Conditions Hydrologic Calculations



Routing Diagram for Existing Conditions
Prepared by Bryan Vachon - Green International Affiliates, Printed 5/3/2022
HydroCAD® 10.00-24 s/n 06415 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.539	39	>75% Grass cover, Good, HSG A (1A, 1B, 1C)
0.459	98	Existing Building Roof (1B)
3.145	98	Unconnected pavement, HSG A (1A, 1B, 1C)
5.142	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.683	HSG A	1A, 1B, 1C
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.459	Other	1B
5.142		**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: EDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=61 Runoff=0.04 cfs 0.006 af

Subcatchment 1B: EDA-1B (Treated by Runoff Area=151,624 sf 81.98% Impervious Runoff Depth=1.50"
Tc=6.0 min CN=87 Runoff=5.99 cfs 0.434 af

Subcatchment 1C: EDA-1C (Treated by Runoff Area=60,132 sf 46.62% Impervious Runoff Depth=0.45"
Tc=6.0 min CN=67 Runoff=0.52 cfs 0.052 af

Reach 1R: Existing Subsurface System Inflow=5.99 cfs 0.434 af
Outflow=5.99 cfs 0.434 af

Reach 2R: Sedimentation Pond Inflow=6.50 cfs 0.486 af
Outflow=6.50 cfs 0.486 af

Reach DP1: Tongue Pond Inflow=6.52 cfs 0.492 af
Outflow=6.52 cfs 0.492 af

Total Runoff Area = 5.142 ac Runoff Volume = 0.492 af Average Runoff Depth = 1.15"
29.93% Pervious = 1.539 ac 70.07% Impervious = 3.603 ac

Summary for Subcatchment 1A: EDA-1A (Untreated)

Runoff = 0.04 cfs @ 12.27 hrs, Volume= 0.006 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

	Area (sf)	CN	Description
	4,638	98	Unconnected pavement, HSG A
	7,607	39	>75% Grass cover, Good, HSG A
	12,245	61	Weighted Average
	7,607		62.12% Pervious Area
	4,638		37.88% Impervious Area
	4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: EDA-1B (Treated by Subsurface System)

Runoff = 5.99 cfs @ 12.09 hrs, Volume= 0.434 af, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

	Area (sf)	CN	Description
	104,306	98	Unconnected pavement, HSG A
	27,328	39	>75% Grass cover, Good, HSG A
*	19,990	98	Existing Building Roof
	151,624	87	Weighted Average
	27,328		18.02% Pervious Area
	124,296		81.98% Impervious Area
	104,306		83.92% Unconnected

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

Summary for Subcatchment 1C: EDA-1C (Treated by Sedimentation Pond)

Runoff = 0.52 cfs @ 12.12 hrs, Volume= 0.052 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

Area (sf)	CN	Description
28,032	98	Unconnected pavement, HSG A
32,100	39	>75% Grass cover, Good, HSG A
60,132	67	Weighted Average
32,100		53.38% Pervious Area
28,032		46.62% Impervious Area
28,032		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.481 ac, 81.98% Impervious, Inflow Depth = 1.50" for 1-Year event
Inflow = 5.99 cfs @ 12.09 hrs, Volume= 0.434 af
Outflow = 5.99 cfs @ 12.09 hrs, Volume= 0.434 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.861 ac, 71.94% Impervious, Inflow Depth = 1.20" for 1-Year event
Inflow = 6.50 cfs @ 12.10 hrs, Volume= 0.486 af
Outflow = 6.50 cfs @ 12.10 hrs, Volume= 0.486 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.142 ac, 70.07% Impervious, Inflow Depth = 1.15" for 1-Year event
Inflow = 6.52 cfs @ 12.10 hrs, Volume= 0.492 af
Outflow = 6.52 cfs @ 12.10 hrs, Volume= 0.492 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: EDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=61 Runoff=0.10 cfs 0.011 af

Subcatchment 1B: EDA-1B (Treated by Runoff Area=151,624 sf 81.98% Impervious Runoff Depth=2.00"
Tc=6.0 min CN=87 Runoff=7.99 cfs 0.581 af

Subcatchment 1C: EDA-1C (Treated by Runoff Area=60,132 sf 46.62% Impervious Runoff Depth=0.74"
Tc=6.0 min CN=67 Runoff=1.01 cfs 0.085 af

Reach 1R: Existing Subsurface System Inflow=7.99 cfs 0.581 af
Outflow=7.99 cfs 0.581 af

Reach 2R: Sedimentation Pond Inflow=8.98 cfs 0.666 af
Outflow=8.98 cfs 0.666 af

Reach DP1: Tongue Pond Inflow=9.08 cfs 0.678 af
Outflow=9.08 cfs 0.678 af

Total Runoff Area = 5.142 ac Runoff Volume = 0.678 af Average Runoff Depth = 1.58"
29.93% Pervious = 1.539 ac 70.07% Impervious = 3.603 ac

Summary for Subcatchment 1A: EDA-1A (Untreated)

Runoff = 0.10 cfs @ 12.12 hrs, Volume= 0.011 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	4,638	98	Unconnected pavement, HSG A
	7,607	39	>75% Grass cover, Good, HSG A
	12,245	61	Weighted Average
	7,607		62.12% Pervious Area
	4,638		37.88% Impervious Area
	4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: EDA-1B (Treated by Subsurface System)

Runoff = 7.99 cfs @ 12.09 hrs, Volume= 0.581 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

	Area (sf)	CN	Description
	104,306	98	Unconnected pavement, HSG A
	27,328	39	>75% Grass cover, Good, HSG A
*	19,990	98	Existing Building Roof
	151,624	87	Weighted Average
	27,328		18.02% Pervious Area
	124,296		81.98% Impervious Area
	104,306		83.92% Unconnected

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

Summary for Subcatchment 1C: EDA-1C (Treated by Sedimentation Pond)

Runoff = 1.01 cfs @ 12.11 hrs, Volume= 0.085 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
28,032	98	Unconnected pavement, HSG A
32,100	39	>75% Grass cover, Good, HSG A
60,132	67	Weighted Average
32,100		53.38% Pervious Area
28,032		46.62% Impervious Area
28,032		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.481 ac, 81.98% Impervious, Inflow Depth = 2.00" for 2-Year event
Inflow = 7.99 cfs @ 12.09 hrs, Volume= 0.581 af
Outflow = 7.99 cfs @ 12.09 hrs, Volume= 0.581 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.861 ac, 71.94% Impervious, Inflow Depth = 1.64" for 2-Year event
Inflow = 8.98 cfs @ 12.09 hrs, Volume= 0.666 af
Outflow = 8.98 cfs @ 12.09 hrs, Volume= 0.666 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.142 ac, 70.07% Impervious, Inflow Depth = 1.58" for 2-Year event
Inflow = 9.08 cfs @ 12.09 hrs, Volume= 0.678 af
Outflow = 9.08 cfs @ 12.09 hrs, Volume= 0.678 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: EDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=1.31"
Tc=6.0 min CN=61 Runoff=0.38 cfs 0.031 af

Subcatchment 1B: EDA-1B (Treated by Runoff Area=151,624 sf 81.98% Impervious Runoff Depth=3.47"
Tc=6.0 min CN=87 Runoff=13.63 cfs 1.007 af

Subcatchment 1C: EDA-1C (Treated by Runoff Area=60,132 sf 46.62% Impervious Runoff Depth=1.73"
Tc=6.0 min CN=67 Runoff=2.66 cfs 0.199 af

Reach 1R: Existing Subsurface System Inflow=13.63 cfs 1.007 af
Outflow=13.63 cfs 1.007 af

Reach 2R: Sedimentation Pond Inflow=16.27 cfs 1.207 af
Outflow=16.27 cfs 1.207 af

Reach DP1: Tongue Pond Inflow=16.65 cfs 1.238 af
Outflow=16.65 cfs 1.238 af

Total Runoff Area = 5.142 ac Runoff Volume = 1.238 af Average Runoff Depth = 2.89"
29.93% Pervious = 1.539 ac 70.07% Impervious = 3.603 ac

Summary for Subcatchment 1A: EDA-1A (Untreated)

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.031 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
	4,638	98	Unconnected pavement, HSG A
	7,607	39	>75% Grass cover, Good, HSG A
	12,245	61	Weighted Average
	7,607		62.12% Pervious Area
	4,638		37.88% Impervious Area
	4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: EDA-1B (Treated by Subsurface System)

Runoff = 13.63 cfs @ 12.09 hrs, Volume= 1.007 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
	104,306	98	Unconnected pavement, HSG A
	27,328	39	>75% Grass cover, Good, HSG A
*	19,990	98	Existing Building Roof
	151,624	87	Weighted Average
	27,328		18.02% Pervious Area
	124,296		81.98% Impervious Area
	104,306		83.92% Unconnected

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

Summary for Subcatchment 1C: EDA-1C (Treated by Sedimentation Pond)

Runoff = 2.66 cfs @ 12.10 hrs, Volume= 0.199 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
28,032	98	Unconnected pavement, HSG A
32,100	39	>75% Grass cover, Good, HSG A
60,132	67	Weighted Average
32,100		53.38% Pervious Area
28,032		46.62% Impervious Area
28,032		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.481 ac, 81.98% Impervious, Inflow Depth = 3.47" for 10-Year event
Inflow = 13.63 cfs @ 12.09 hrs, Volume= 1.007 af
Outflow = 13.63 cfs @ 12.09 hrs, Volume= 1.007 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.861 ac, 71.94% Impervious, Inflow Depth = 2.98" for 10-Year event
Inflow = 16.27 cfs @ 12.09 hrs, Volume= 1.207 af
Outflow = 16.27 cfs @ 12.09 hrs, Volume= 1.207 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.142 ac, 70.07% Impervious, Inflow Depth = 2.89" for 10-Year event
Inflow = 16.65 cfs @ 12.09 hrs, Volume= 1.238 af
Outflow = 16.65 cfs @ 12.09 hrs, Volume= 1.238 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: EDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=61 Runoff=0.64 cfs 0.049 af

Subcatchment 1B: EDA-1B (Treated by Runoff Area=151,624 sf 81.98% Impervious Runoff Depth=4.61"
Tc=6.0 min CN=87 Runoff=17.86 cfs 1.338 af

Subcatchment 1C: EDA-1C (Treated by Runoff Area=60,132 sf 46.62% Impervious Runoff Depth=2.61"
Tc=6.0 min CN=67 Runoff=4.09 cfs 0.300 af

Reach 1R: Existing Subsurface System Inflow=17.86 cfs 1.338 af
Outflow=17.86 cfs 1.338 af

Reach 2R: Sedimentation Pond Inflow=21.94 cfs 1.638 af
Outflow=21.94 cfs 1.638 af

Reach DP1: Tongue Pond Inflow=22.58 cfs 1.686 af
Outflow=22.58 cfs 1.686 af

Total Runoff Area = 5.142 ac Runoff Volume = 1.686 af Average Runoff Depth = 3.94"
29.93% Pervious = 1.539 ac 70.07% Impervious = 3.603 ac

Summary for Subcatchment 1A: EDA-1A (Untreated)

Runoff = 0.64 cfs @ 12.10 hrs, Volume= 0.049 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: EDA-1B (Treated by Subsurface System)

Runoff = 17.86 cfs @ 12.09 hrs, Volume= 1.338 af, Depth= 4.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

	Area (sf)	CN	Description
	104,306	98	Unconnected pavement, HSG A
	27,328	39	>75% Grass cover, Good, HSG A
*	19,990	98	Existing Building Roof
	151,624	87	Weighted Average
	27,328		18.02% Pervious Area
	124,296		81.98% Impervious Area
	104,306		83.92% Unconnected

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

Summary for Subcatchment 1C: EDA-1C (Treated by Sedimentation Pond)

Runoff = 4.09 cfs @ 12.10 hrs, Volume= 0.300 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
28,032	98	Unconnected pavement, HSG A
32,100	39	>75% Grass cover, Good, HSG A
60,132	67	Weighted Average
32,100		53.38% Pervious Area
28,032		46.62% Impervious Area
28,032		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.481 ac, 81.98% Impervious, Inflow Depth = 4.61" for 25-Year event
Inflow = 17.86 cfs @ 12.09 hrs, Volume= 1.338 af
Outflow = 17.86 cfs @ 12.09 hrs, Volume= 1.338 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.861 ac, 71.94% Impervious, Inflow Depth = 4.04" for 25-Year event
Inflow = 21.94 cfs @ 12.09 hrs, Volume= 1.638 af
Outflow = 21.94 cfs @ 12.09 hrs, Volume= 1.638 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.142 ac, 70.07% Impervious, Inflow Depth = 3.94" for 25-Year event
Inflow = 22.58 cfs @ 12.09 hrs, Volume= 1.686 af
Outflow = 22.58 cfs @ 12.09 hrs, Volume= 1.686 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: EDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=61 Runoff=1.28 cfs 0.093 af

Subcatchment 1B: EDA-1B (Treated by Runoff Area=151,624 sf 81.98% Impervious Runoff Depth=7.13"
Tc=6.0 min CN=87 Runoff=26.97 cfs 2.069 af

Subcatchment 1C: EDA-1C (Treated by Runoff Area=60,132 sf 46.62% Impervious Runoff Depth=4.71"
Tc=6.0 min CN=67 Runoff=7.47 cfs 0.542 af

Reach 1R: Existing Subsurface System Inflow=26.97 cfs 2.069 af
Outflow=26.97 cfs 2.069 af

Reach 2R: Sedimentation Pond Inflow=34.44 cfs 2.611 af
Outflow=34.44 cfs 2.611 af

Reach DP1: Tongue Pond Inflow=35.71 cfs 2.704 af
Outflow=35.71 cfs 2.704 af

Total Runoff Area = 5.142 ac Runoff Volume = 2.704 af Average Runoff Depth = 6.31"
29.93% Pervious = 1.539 ac 70.07% Impervious = 3.603 ac

Summary for Subcatchment 1A: EDA-1A (Untreated)

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 0.093 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
	4,638	98	Unconnected pavement, HSG A
	7,607	39	>75% Grass cover, Good, HSG A
	12,245	61	Weighted Average
	7,607		62.12% Pervious Area
	4,638		37.88% Impervious Area
	4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: EDA-1B (Treated by Subsurface System)

Runoff = 26.97 cfs @ 12.09 hrs, Volume= 2.069 af, Depth= 7.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
	104,306	98	Unconnected pavement, HSG A
	27,328	39	>75% Grass cover, Good, HSG A
*	19,990	98	Existing Building Roof
	151,624	87	Weighted Average
	27,328		18.02% Pervious Area
	124,296		81.98% Impervious Area
	104,306		83.92% Unconnected

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

Summary for Subcatchment 1C: EDA-1C (Treated by Sedimentation Pond)

Runoff = 7.47 cfs @ 12.09 hrs, Volume= 0.542 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
28,032	98	Unconnected pavement, HSG A
32,100	39	>75% Grass cover, Good, HSG A
60,132	67	Weighted Average
32,100		53.38% Pervious Area
28,032		46.62% Impervious Area
28,032		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.481 ac, 81.98% Impervious, Inflow Depth = 7.13" for 100-Year event
Inflow = 26.97 cfs @ 12.09 hrs, Volume= 2.069 af
Outflow = 26.97 cfs @ 12.09 hrs, Volume= 2.069 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.861 ac, 71.94% Impervious, Inflow Depth = 6.44" for 100-Year event
Inflow = 34.44 cfs @ 12.09 hrs, Volume= 2.611 af
Outflow = 34.44 cfs @ 12.09 hrs, Volume= 2.611 af, Atten= 0%, Lag= 0.0 min

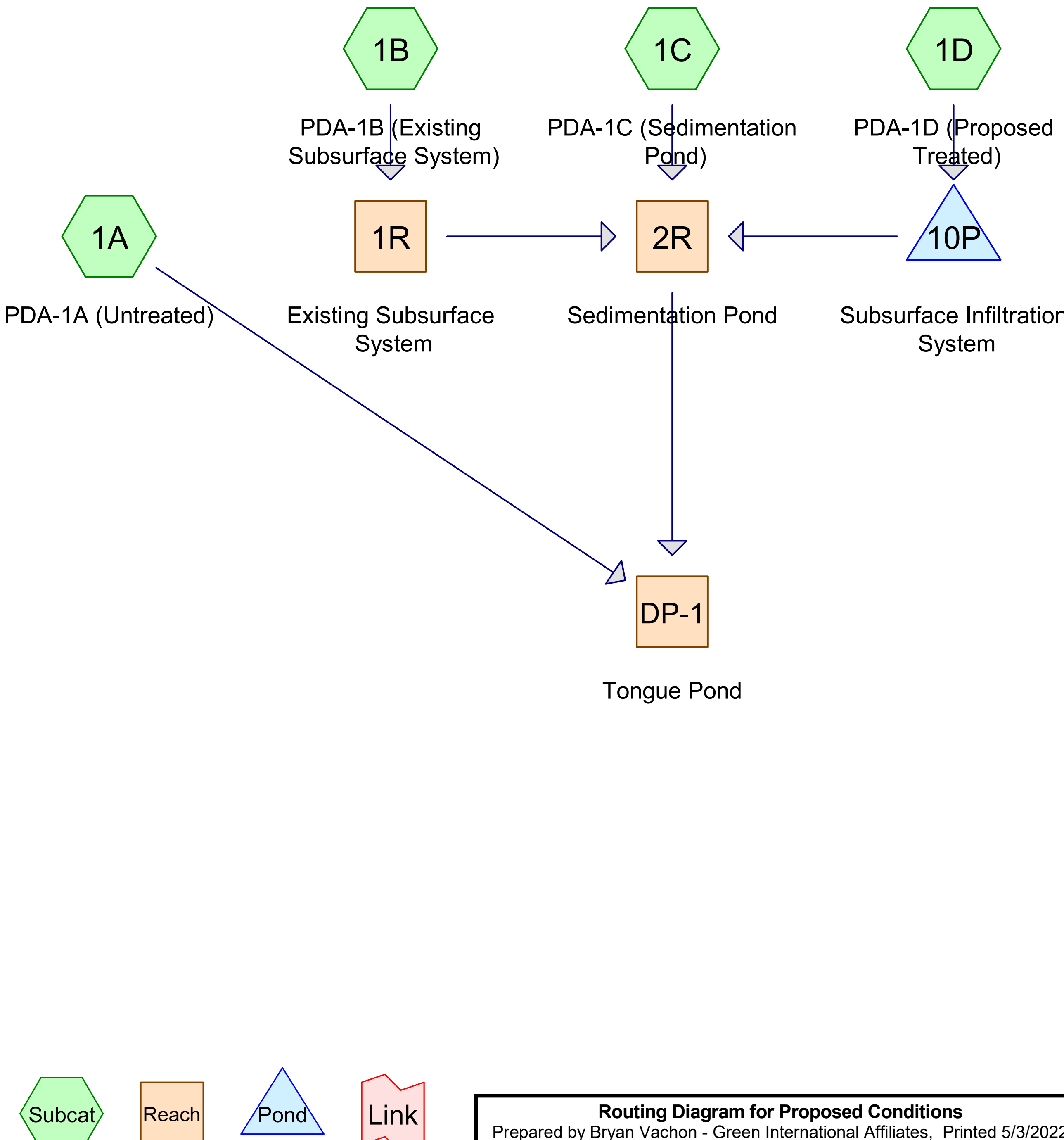
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.142 ac, 70.07% Impervious, Inflow Depth = 6.31" for 100-Year event
Inflow = 35.71 cfs @ 12.09 hrs, Volume= 2.704 af
Outflow = 35.71 cfs @ 12.09 hrs, Volume= 2.704 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Routing Diagram for Proposed Conditions
Prepared by Bryan Vachon - Green International Affiliates, Printed 5/3/2022
HydroCAD® 10.00-24 s/n 06415 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.024	39	>75% Grass cover, Good, HSG A (1A, 1B, 1C, 1D)
2.876	98	Paved parking, HSG A (1B, 1C)
1.243	98	Unconnected pavement, HSG A (1A, 1D)
5.143	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
5.143	HSG A	1A, 1B, 1C, 1D
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
5.143		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	10P	57.58	55.28	393.0	0.0059	0.013	15.0	0.0	0.0

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: PDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=61 Runoff=0.04 cfs 0.006 af

Subcatchment 1B: PDA-1B (Existing Runoff Area=117,174 sf 90.41% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=92 Runoff=5.77 cfs 0.425 af

Subcatchment 1C: PDA-1C (Sedimentation Runoff Area=28,470 sf 67.97% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=79 Runoff=0.72 cfs 0.054 af

Subcatchment 1D: PDA-1D (Proposed Runoff Area=66,138 sf 74.84% Impervious Runoff Depth=1.22"
Tc=6.0 min CN=83 Runoff=2.12 cfs 0.155 af

Reach 1R: Existing Subsurface System Inflow=5.77 cfs 0.425 af
Outflow=5.77 cfs 0.425 af

Reach 2R: Sedimentation Pond Inflow=6.49 cfs 0.531 af
Outflow=6.49 cfs 0.531 af

Reach DP-1: Tongue Pond Inflow=6.51 cfs 0.537 af
Outflow=6.51 cfs 0.537 af

Pond 10P: Subsurface Infiltration System Peak Elev=58.11' Storage=4,727 cf Inflow=2.12 cfs 0.155 af
Outflow=0.12 cfs 0.052 af

Total Runoff Area = 5.143 ac Runoff Volume = 0.640 af Average Runoff Depth = 1.49"
19.91% Pervious = 1.024 ac 80.09% Impervious = 4.119 ac

Summary for Subcatchment 1A: PDA-1A (Untreated)

Runoff = 0.04 cfs @ 12.27 hrs, Volume= 0.006 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: PDA-1B (Existing Subsurface System)

Runoff = 5.77 cfs @ 12.09 hrs, Volume= 0.425 af, Depth= 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

Area (sf)	CN	Description
105,939	98	Paved parking, HSG A
11,235	39	>75% Grass cover, Good, HSG A
117,174	92	Weighted Average
11,235		9.59% Pervious Area
105,939		90.41% Impervious Area

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

Summary for Subcatchment 1C: PDA-1C (Sedimentation Pond)

Runoff = 0.72 cfs @ 12.10 hrs, Volume= 0.054 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

Area (sf)	CN	Description
19,351	98	Paved parking, HSG A
9,119	39	>75% Grass cover, Good, HSG A
28,470	79	Weighted Average
9,119		32.03% Pervious Area
19,351		67.97% Impervious Area

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

Summary for Subcatchment 1D: PDA-1D (Proposed Treated)

Runoff = 2.12 cfs @ 12.10 hrs, Volume= 0.155 af, Depth= 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.72"

Area (sf)	CN	Description
49,498	98	Unconnected pavement, HSG A
16,640	39	>75% Grass cover, Good, HSG A
66,138	83	Weighted Average
16,640		25.16% Pervious Area
49,498		74.84% Impervious Area
49,498		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.690 ac, 90.41% Impervious, Inflow Depth = 1.90" for 1-Year event
Inflow = 5.77 cfs @ 12.09 hrs, Volume= 0.425 af
Outflow = 5.77 cfs @ 12.09 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.862 ac, 82.53% Impervious, Inflow Depth = 1.31" for 1-Year event
Inflow = 6.49 cfs @ 12.09 hrs, Volume= 0.531 af
Outflow = 6.49 cfs @ 12.09 hrs, Volume= 0.531 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP-1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.143 ac, 80.09% Impervious, Inflow Depth = 1.25" for 1-Year event
Inflow = 6.51 cfs @ 12.09 hrs, Volume= 0.537 af
Outflow = 6.51 cfs @ 12.09 hrs, Volume= 0.537 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Subsurface Infiltration System

Inflow Area = 1.518 ac, 74.84% Impervious, Inflow Depth = 1.22" for 1-Year event
Inflow = 2.12 cfs @ 12.10 hrs, Volume= 0.155 af
Outflow = 0.12 cfs @ 14.98 hrs, Volume= 0.052 af, Atten= 94%, Lag= 173.0 min
Primary = 0.12 cfs @ 14.98 hrs, Volume= 0.052 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 58.11' @ 14.98 hrs Surf.Area= 6,534 sf Storage= 4,727 cf

Plug-Flow detention time= 380.7 min calculated for 0.052 af (33% of inflow)
Center-of-Mass det. time= 250.5 min (1,091.4 - 840.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.58'	5,332 cf	**63.25'W x 103.30'L x 4.00'H Field A** 26,134 cf Overall - 8,361 cf Embedded = 17,773 cf x 30.0% Voids
#2A	57.58'	8,361 cf	**ADS_StormTech SC-740 +Cap** x 182 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 182 Chambers in 13 Rows
		13,693 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	57.58'	**15.0" Round Culvert** L= 393.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 57.58' / 55.28' S= 0.0059 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	58.06'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.11 cfs @ 14.98 hrs HW=58.11' (Free Discharge)
└─**1=Culvert** (Passes 0.11 cfs of 1.04 cfs potential flow)
  └─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.11 cfs @ 0.71 fps)

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: PDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=61 Runoff=0.10 cfs 0.011 af

Subcatchment 1B: PDA-1B (Existing Runoff Area=117,174 sf 90.41% Impervious Runoff Depth=2.45"
Tc=6.0 min CN=92 Runoff=7.35 cfs 0.548 af

Subcatchment 1C: PDA-1C (Sedimentation Runoff Area=28,470 sf 67.97% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=79 Runoff=1.05 cfs 0.077 af

Subcatchment 1D: PDA-1D (Proposed Runoff Area=66,138 sf 74.84% Impervious Runoff Depth=1.69"
Tc=6.0 min CN=83 Runoff=2.95 cfs 0.214 af

Reach 1R: Existing Subsurface System Inflow=7.35 cfs 0.548 af
Outflow=7.35 cfs 0.548 af

Reach 2R: Sedimentation Pond Inflow=8.40 cfs 0.736 af
Outflow=8.40 cfs 0.736 af

Reach DP-1: Tongue Pond Inflow=8.50 cfs 0.748 af
Outflow=8.50 cfs 0.748 af

Pond 10P: Subsurface Infiltration System Peak Elev=58.16' Storage=4,996 cf Inflow=2.95 cfs 0.214 af
Outflow=0.36 cfs 0.111 af

Total Runoff Area = 5.143 ac Runoff Volume = 0.851 af Average Runoff Depth = 1.98"
19.91% Pervious = 1.024 ac 80.09% Impervious = 4.119 ac

Summary for Subcatchment 1A: PDA-1A (Untreated)

Runoff = 0.10 cfs @ 12.12 hrs, Volume= 0.011 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: PDA-1B (Existing Subsurface System)

Runoff = 7.35 cfs @ 12.09 hrs, Volume= 0.548 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
105,939	98	Paved parking, HSG A
11,235	39	>75% Grass cover, Good, HSG A
117,174	92	Weighted Average
11,235		9.59% Pervious Area
105,939		90.41% Impervious Area

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

Summary for Subcatchment 1C: PDA-1C (Sedimentation Pond)

Runoff = 1.05 cfs @ 12.10 hrs, Volume= 0.077 af, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
19,351	98	Paved parking, HSG A
9,119	39	>75% Grass cover, Good, HSG A
28,470	79	Weighted Average
9,119		32.03% Pervious Area
19,351		67.97% Impervious Area

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

Summary for Subcatchment 1D: PDA-1D (Proposed Treated)

Runoff = 2.95 cfs @ 12.09 hrs, Volume= 0.214 af, Depth= 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.30"

Area (sf)	CN	Description
49,498	98	Unconnected pavement, HSG A
16,640	39	>75% Grass cover, Good, HSG A
66,138	83	Weighted Average
16,640		25.16% Pervious Area
49,498		74.84% Impervious Area
49,498		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.690 ac, 90.41% Impervious, Inflow Depth = 2.45" for 2-Year event
Inflow = 7.35 cfs @ 12.09 hrs, Volume= 0.548 af
Outflow = 7.35 cfs @ 12.09 hrs, Volume= 0.548 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.862 ac, 82.53% Impervious, Inflow Depth = 1.82" for 2-Year event
Inflow = 8.40 cfs @ 12.09 hrs, Volume= 0.736 af
Outflow = 8.40 cfs @ 12.09 hrs, Volume= 0.736 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP-1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.143 ac, 80.09% Impervious, Inflow Depth = 1.74" for 2-Year event
Inflow = 8.50 cfs @ 12.09 hrs, Volume= 0.748 af
Outflow = 8.50 cfs @ 12.09 hrs, Volume= 0.748 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Subsurface Infiltration System

Inflow Area = 1.518 ac, 74.84% Impervious, Inflow Depth = 1.69" for 2-Year event
Inflow = 2.95 cfs @ 12.09 hrs, Volume= 0.214 af
Outflow = 0.36 cfs @ 12.84 hrs, Volume= 0.111 af, Atten= 88%, Lag= 44.8 min
Primary = 0.36 cfs @ 12.84 hrs, Volume= 0.111 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 58.16' @ 12.84 hrs Surf.Area= 6,534 sf Storage= 4,996 cf

Plug-Flow detention time= 260.4 min calculated for 0.111 af (52% of inflow)
Center-of-Mass det. time= 143.2 min (974.7 - 831.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.58'	5,332 cf	**63.25'W x 103.30'L x 4.00'H Field A** 26,134 cf Overall - 8,361 cf Embedded = 17,773 cf x 30.0% Voids
#2A	57.58'	8,361 cf	**ADS_StormTech SC-740 +Cap** x 182 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 182 Chambers in 13 Rows
		13,693 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	57.58'	**15.0" Round Culvert** L= 393.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 57.58' / 55.28' S= 0.0059 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	58.06'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=0.36 cfs @ 12.84 hrs HW=58.16' (Free Discharge)
↑—**1=Culvert** (Passes 0.36 cfs of 1.25 cfs potential flow)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.36 cfs @ 1.05 fps)

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: PDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=1.31"
Tc=6.0 min CN=61 Runoff=0.38 cfs 0.031 af

Subcatchment 1B: PDA-1B (Existing Runoff Area=117,174 sf 90.41% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=92 Runoff=11.69 cfs 0.895 af

Subcatchment 1C: PDA-1C (Sedimentation Runoff Area=28,470 sf 67.97% Impervious Runoff Depth=2.72"
Tc=6.0 min CN=79 Runoff=2.04 cfs 0.148 af

Subcatchment 1D: PDA-1D (Proposed Runoff Area=66,138 sf 74.84% Impervious Runoff Depth=3.08"
Tc=6.0 min CN=83 Runoff=5.35 cfs 0.390 af

Reach 1R: Existing Subsurface System Inflow=11.69 cfs 0.895 af
Outflow=11.69 cfs 0.895 af

Reach 2R: Sedimentation Pond Inflow=14.92 cfs 1.330 af
Outflow=14.92 cfs 1.330 af

Reach DP-1: Tongue Pond Inflow=15.30 cfs 1.360 af
Outflow=15.30 cfs 1.360 af

Pond 10P: Subsurface Infiltration System Peak Elev=58.46' Storage=6,500 cf Inflow=5.35 cfs 0.390 af
Outflow=2.61 cfs 0.287 af

Total Runoff Area = 5.143 ac Runoff Volume = 1.464 af Average Runoff Depth = 3.41"
19.91% Pervious = 1.024 ac 80.09% Impervious = 4.119 ac

Summary for Subcatchment 1A: PDA-1A (Untreated)

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.031 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: PDA-1B (Existing Subsurface System)

Runoff = 11.69 cfs @ 12.09 hrs, Volume= 0.895 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
105,939	98	Paved parking, HSG A
11,235	39	>75% Grass cover, Good, HSG A
117,174	92	Weighted Average
11,235		9.59% Pervious Area
105,939		90.41% Impervious Area

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

Summary for Subcatchment 1C: PDA-1C (Sedimentation Pond)

Runoff = 2.04 cfs @ 12.09 hrs, Volume= 0.148 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
19,351	98	Paved parking, HSG A
9,119	39	>75% Grass cover, Good, HSG A
28,470	79	Weighted Average
9,119		32.03% Pervious Area
19,351		67.97% Impervious Area

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

Summary for Subcatchment 1D: PDA-1D (Proposed Treated)

Runoff = 5.35 cfs @ 12.09 hrs, Volume= 0.390 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.90"

Area (sf)	CN	Description
49,498	98	Unconnected pavement, HSG A
16,640	39	>75% Grass cover, Good, HSG A
66,138	83	Weighted Average
16,640		25.16% Pervious Area
49,498		74.84% Impervious Area
49,498		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.690 ac, 90.41% Impervious, Inflow Depth = 3.99" for 10-Year event
Inflow = 11.69 cfs @ 12.09 hrs, Volume= 0.895 af
Outflow = 11.69 cfs @ 12.09 hrs, Volume= 0.895 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.862 ac, 82.53% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 14.92 cfs @ 12.10 hrs, Volume= 1.330 af
Outflow = 14.92 cfs @ 12.10 hrs, Volume= 1.330 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP-1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.143 ac, 80.09% Impervious, Inflow Depth = 3.17" for 10-Year event
Inflow = 15.30 cfs @ 12.10 hrs, Volume= 1.360 af
Outflow = 15.30 cfs @ 12.10 hrs, Volume= 1.360 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Subsurface Infiltration System

Inflow Area = 1.518 ac, 74.84% Impervious, Inflow Depth = 3.08" for 10-Year event
Inflow = 5.35 cfs @ 12.09 hrs, Volume= 0.390 af
Outflow = 2.61 cfs @ 12.26 hrs, Volume= 0.287 af, Atten= 51%, Lag= 10.4 min
Primary = 2.61 cfs @ 12.26 hrs, Volume= 0.287 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 58.46' @ 12.26 hrs Surf.Area= 6,534 sf Storage= 6,500 cf

Plug-Flow detention time= 161.8 min calculated for 0.287 af (74% of inflow)
Center-of-Mass det. time= 72.0 min (886.3 - 814.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.58'	5,332 cf	**63.25'W x 103.30'L x 4.00'H Field A** 26,134 cf Overall - 8,361 cf Embedded = 17,773 cf x 30.0% Voids
#2A	57.58'	8,361 cf	**ADS_StormTech SC-740 +Cap** x 182 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 182 Chambers in 13 Rows
		13,693 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	57.58'	**15.0" Round Culvert** L= 393.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 57.58' / 55.28' S= 0.0059 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	58.06'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=2.60 cfs @ 12.26 hrs HW=58.46' (Free Discharge)
└─**1=Culvert** (Barrel Controls 2.60 cfs @ 3.97 fps)
  └─**2=Sharp-Crested Rectangular Weir** (Passes 2.60 cfs of 3.07 cfs potential flow)

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: PDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=2.07"
Tc=6.0 min CN=61 Runoff=0.64 cfs 0.049 af

Subcatchment 1B: PDA-1B (Existing Runoff Area=117,174 sf 90.41% Impervious Runoff Depth=5.17"
Tc=6.0 min CN=92 Runoff=14.91 cfs 1.158 af

Subcatchment 1C: PDA-1C (Sedimentation Runoff Area=28,470 sf 67.97% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=79 Runoff=2.82 cfs 0.205 af

Subcatchment 1D: PDA-1D (Proposed Runoff Area=66,138 sf 74.84% Impervious Runoff Depth=4.18"
Tc=6.0 min CN=83 Runoff=7.20 cfs 0.529 af

Reach 1R: Existing Subsurface System Inflow=14.91 cfs 1.158 af
Outflow=14.91 cfs 1.158 af

Reach 2R: Sedimentation Pond Inflow=20.89 cfs 1.790 af
Outflow=20.89 cfs 1.790 af

Reach DP-1: Tongue Pond Inflow=21.54 cfs 1.839 af
Outflow=21.54 cfs 1.839 af

Pond 10P: Subsurface Infiltration System Peak Elev=58.75' Storage=7,907 cf Inflow=7.20 cfs 0.529 af
Outflow=4.02 cfs 0.426 af

Total Runoff Area = 5.143 ac Runoff Volume = 1.942 af Average Runoff Depth = 4.53"
19.91% Pervious = 1.024 ac 80.09% Impervious = 4.119 ac

Summary for Subcatchment 1A: PDA-1A (Untreated)

Runoff = 0.64 cfs @ 12.10 hrs, Volume= 0.049 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: PDA-1B (Existing Subsurface System)

Runoff = 14.91 cfs @ 12.09 hrs, Volume= 1.158 af, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
105,939	98	Paved parking, HSG A
11,235	39	>75% Grass cover, Good, HSG A
117,174	92	Weighted Average
11,235		9.59% Pervious Area
105,939		90.41% Impervious Area

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

Summary for Subcatchment 1C: PDA-1C (Sedimentation Pond)

Runoff = 2.82 cfs @ 12.09 hrs, Volume= 0.205 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
19,351	98	Paved parking, HSG A
9,119	39	>75% Grass cover, Good, HSG A
28,470	79	Weighted Average
9,119		32.03% Pervious Area
19,351		67.97% Impervious Area

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

Summary for Subcatchment 1D: PDA-1D (Proposed Treated)

Runoff = 7.20 cfs @ 12.09 hrs, Volume= 0.529 af, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.10"

Area (sf)	CN	Description
49,498	98	Unconnected pavement, HSG A
16,640	39	>75% Grass cover, Good, HSG A
66,138	83	Weighted Average
16,640		25.16% Pervious Area
49,498		74.84% Impervious Area
49,498		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.690 ac, 90.41% Impervious, Inflow Depth = 5.17" for 25-Year event
Inflow = 14.91 cfs @ 12.09 hrs, Volume= 1.158 af
Outflow = 14.91 cfs @ 12.09 hrs, Volume= 1.158 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.862 ac, 82.53% Impervious, Inflow Depth = 4.42" for 25-Year event
Inflow = 20.89 cfs @ 12.09 hrs, Volume= 1.790 af
Outflow = 20.89 cfs @ 12.09 hrs, Volume= 1.790 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP-1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.143 ac, 80.09% Impervious, Inflow Depth = 4.29" for 25-Year event
Inflow = 21.54 cfs @ 12.09 hrs, Volume= 1.839 af
Outflow = 21.54 cfs @ 12.09 hrs, Volume= 1.839 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Subsurface Infiltration System

Inflow Area = 1.518 ac, 74.84% Impervious, Inflow Depth = 4.18" for 25-Year event
Inflow = 7.20 cfs @ 12.09 hrs, Volume= 0.529 af
Outflow = 4.02 cfs @ 12.22 hrs, Volume= 0.426 af, Atten= 44%, Lag= 7.9 min
Primary = 4.02 cfs @ 12.22 hrs, Volume= 0.426 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 58.75' @ 12.22 hrs Surf.Area= 6,534 sf Storage= 7,907 cf

Plug-Flow detention time= 134.5 min calculated for 0.426 af (81% of inflow)
Center-of-Mass det. time= 59.2 min (864.8 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.58'	5,332 cf	**63.25'W x 103.30'L x 4.00'H Field A** 26,134 cf Overall - 8,361 cf Embedded = 17,773 cf x 30.0% Voids
#2A	57.58'	8,361 cf	**ADS_StormTech SC-740 +Cap** x 182 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 182 Chambers in 13 Rows
		13,693 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	57.58'	**15.0" Round Culvert** L= 393.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 57.58' / 55.28' S= 0.0059 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	58.06'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=3.99 cfs @ 12.22 hrs HW=58.75' (Free Discharge)
└─**1=Culvert** (Barrel Controls 3.99 cfs @ 4.35 fps)
  └─**2=Sharp-Crested Rectangular Weir** (Passes 3.99 cfs of 7.29 cfs potential flow)

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 1A: PDA-1A (Untreated) Runoff Area=12,245 sf 37.88% Impervious Runoff Depth=3.99"
Tc=6.0 min CN=61 Runoff=1.28 cfs 0.093 af

Subcatchment 1B: PDA-1B (Existing Runoff Area=117,174 sf 90.41% Impervious Runoff Depth=7.74"
Tc=6.0 min CN=92 Runoff=21.81 cfs 1.734 af

Subcatchment 1C: PDA-1C (Sedimentation Runoff Area=28,470 sf 67.97% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=79 Runoff=4.54 cfs 0.336 af

Subcatchment 1D: PDA-1D (Proposed Runoff Area=66,138 sf 74.84% Impervious Runoff Depth=6.65"
Tc=6.0 min CN=83 Runoff=11.20 cfs 0.841 af

Reach 1R: Existing Subsurface System Inflow=21.81 cfs 1.734 af
Outflow=21.81 cfs 1.734 af

Reach 2R: Sedimentation Pond Inflow=31.39 cfs 2.808 af
Outflow=31.39 cfs 2.808 af

Reach DP-1: Tongue Pond Inflow=32.67 cfs 2.901 af
Outflow=32.67 cfs 2.901 af

Pond 10P: Subsurface Infiltration System Peak Elev=59.44' Storage=10,847 cf Inflow=11.20 cfs 0.841 af
Outflow=5.25 cfs 0.738 af

Total Runoff Area = 5.143 ac Runoff Volume = 3.005 af Average Runoff Depth = 7.01"
19.91% Pervious = 1.024 ac 80.09% Impervious = 4.119 ac

Summary for Subcatchment 1A: PDA-1A (Untreated)

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 0.093 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
4,638	98	Unconnected pavement, HSG A
7,607	39	>75% Grass cover, Good, HSG A
12,245	61	Weighted Average
7,607		62.12% Pervious Area
4,638		37.88% Impervious Area
4,638		100.00% Unconnected

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

Summary for Subcatchment 1B: PDA-1B (Existing Subsurface System)

Runoff = 21.81 cfs @ 12.09 hrs, Volume= 1.734 af, Depth= 7.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
105,939	98	Paved parking, HSG A
11,235	39	>75% Grass cover, Good, HSG A
117,174	92	Weighted Average
11,235		9.59% Pervious Area
105,939		90.41% Impervious Area

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

Summary for Subcatchment 1C: PDA-1C (Sedimentation Pond)

Runoff = 4.54 cfs @ 12.09 hrs, Volume= 0.336 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
19,351	98	Paved parking, HSG A
9,119	39	>75% Grass cover, Good, HSG A
28,470	79	Weighted Average
9,119		32.03% Pervious Area
19,351		67.97% Impervious Area

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

Summary for Subcatchment 1D: PDA-1D (Proposed Treated)

Runoff = 11.20 cfs @ 12.09 hrs, Volume= 0.841 af, Depth= 6.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
49,498	98	Unconnected pavement, HSG A
16,640	39	>75% Grass cover, Good, HSG A
66,138	83	Weighted Average
16,640		25.16% Pervious Area
49,498		74.84% Impervious Area
49,498		100.00% Unconnected

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

Summary for Reach 1R: Existing Subsurface System

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.690 ac, 90.41% Impervious, Inflow Depth = 7.74" for 100-Year event
Inflow = 21.81 cfs @ 12.09 hrs, Volume= 1.734 af
Outflow = 21.81 cfs @ 12.09 hrs, Volume= 1.734 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach 2R: Sedimentation Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.862 ac, 82.53% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 31.39 cfs @ 12.09 hrs, Volume= 2.808 af
Outflow = 31.39 cfs @ 12.09 hrs, Volume= 2.808 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Reach DP-1: Tongue Pond

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 5.143 ac, 80.09% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 32.67 cfs @ 12.09 hrs, Volume= 2.901 af
Outflow = 32.67 cfs @ 12.09 hrs, Volume= 2.901 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Pond 10P: Subsurface Infiltration System

Inflow Area = 1.518 ac, 74.84% Impervious, Inflow Depth = 6.65" for 100-Year event
Inflow = 11.20 cfs @ 12.09 hrs, Volume= 0.841 af
Outflow = 5.25 cfs @ 12.50 hrs, Volume= 0.738 af, Atten= 53%, Lag= 24.9 min
Primary = 5.25 cfs @ 12.50 hrs, Volume= 0.738 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 59.44' @ 12.27 hrs Surf.Area= 6,534 sf Storage= 10,847 cf

Plug-Flow detention time= 106.8 min calculated for 0.738 af (88% of inflow)
Center-of-Mass det. time= 50.3 min (843.0 - 792.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	56.58'	5,332 cf	**63.25'W x 103.30'L x 4.00'H Field A** 26,134 cf Overall - 8,361 cf Embedded = 17,773 cf x 30.0% Voids
#2A	57.58'	8,361 cf	**ADS_StormTech SC-740 +Cap** x 182 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 182 Chambers in 13 Rows
		13,693 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	57.58'	**15.0" Round Culvert** L= 393.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 57.58' / 55.28' S= 0.0059 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 1.23 sf
#2	Device 1	58.06'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height

Primary OutFlow Max=5.24 cfs @ 12.50 hrs HW=59.15' (Free Discharge)
└─**1=Culvert** (Barrel Controls 5.24 cfs @ 4.38 fps)
  └─**2=Sharp-Crested Rectangular Weir** (Passes 5.24 cfs of 15.38 cfs potential flow)

APPENDIX C – SIZING CRITERIA CALCULATIONS

- Water Quality Volume Calculation Worksheet
- Water Quality Volume Calculations
- Water Quality Flow Rate Calculations for Proprietary Devices
- TSS Calculations provided by Contech
- Recharge Volume Calculations
- Stage-Area Storage for Subsurface Infiltration System

Version: 4/2015

Project Name	AF-Illuminar School
Date	4/15/2022

Water Quality Volume Calculation WorkSheet

This worksheet is designed to assist the project engineer with a determination of the required water quality treatment area. The worksheet leads the designer through redevelopment applicability first and then receiving water requirements. This tool is intended to compliment to the Redevelopment Criteria Guidance and the Water Quality Guidance and assist both the designer and the permit application reviewer towards consistent results. Enter information into only the YELLOW Boxes.

Redevelopment Criteria Guidance

Water Quality Goals "Stormwater Compensation Method"

Step 1 - Determine which office in OWR you are applying to: Application Guidance

Step 2 - Site Information value/calculation units

Total Site Area (total area of project parcels)	TSA=	4.62	acres
Total Jurisdictional Wetlands and/or floodplain within the above TSA	JW1=	0.00	acres
Existing impervious also within the Jurisdictonal Wetlands	-JW2=	0.00	acres
Conservation Land within the TSA	CL	0.00	acres
Site Size = (TSA)-(JW1-JW2)-CL	**SS=**	**4.62**	acres

Step 3 - Redevelopment Applicability

Total Impervious Area (pre-construction)	TIA=	3.08	acres
% Impervious (if ≥40% - redevelopment standard 3.2.6 applies)		**0.67**	

REPEAT IF NECESSARY Steps 4, 5 and 6 for EACH Waterbody ID (RIVER-ID as found in the GIS Map Server)

Step 4 - Receiving waterbody information

RI0006017L-10	
Waterbody Name from GIS Map Server	
Name the sub-watersheds (design-points) contributing to this Waterbody ID	
Is this Waterbody Impaired/TMDL for any Phosphorus, Metals or Bacteria?	NO
Is this Waterbody Impaired for Nitrogen?	NO

Step 5 - Pre-Post Construction Conditions to the Waterbody

Total Pre-Construction Impervious Surface to this Waterbody ID	3.08	acres
Total Disturbed Existing Impervious (DI)	1.01	acres
Total Post-Construction Impervious to this Waterbody ID	3.60	acres
Net Increased Impervious (NII)	0.52	acres

Step 6 - Infiltration and BMP information - Note: Increasing infiltration will likely decrease stormwater treatment area for Metals, Bacteria and Phosporus

I am proposing to infiltrate this percentage WQv to this WBID	100%	%
I am proposing this number of BMP's	1	#

RESULTS - Select the Larger Number of the 2 numbers provided

Applicable Condition	**Min Water Quality Treatment Area**	**Min Treatment w/o WQ consideration**
No Impairement or TMDL - New Development		
No Impairment or TMDL - Redevelopment	1.02	1.02
Only Phosphorus, Metals or Bacteria Impairment - New Development		
Only Phosphorus, Metals or Bacteria Impairment - Redevelopment		
Nitrogen Impairment - New Development		
Nitrogen Impairment - Redevelopment		

REQUIRED STORMWATER TREATMENT AREA **1.0** acres

* Enter the name of the STP (both type and label) which has been designed to treat this particular Rev or Rea.

Green International Affiliates, Inc

WATER QUALITY CALCULATIONS

Date: April 27, 2022
Revised:
Project: AF-Illuminar School Addition
Project No: 21075
Location: Cranston, RI

Prepared By: BV — Date: 4/14/2022
Revised By: — Date:
Checked By: DHS — Date: 4/27/2022

Objective: To determine the required Water Quality Volume (WQ_V) for adequate stormwater treatment

Methodology: Rhode Island Stormwater Design and Installation Standards Manual

Design Criteria:

WQ_v = [(1")(I)]/12 (ac-ft)

I = Impervious Area (acres)

Note: $WQ_{v(min)}$ = 0.2" ($A_{disturbed}$)/12 (watershed inches)

Calculation Results:

Designation	Volume Required (ft^3)	Volume Provided (ft^3)
Drainage Area to Subsurface I	4,125	4,489

Volume to be Treated:

<u>Drainage Area to Subsurface Infiltration System</u>

I =	1.14	ac		
WQ_v Required =	0.094693	ac-ft	**4,125 ft^3**	
A (disturbed) =	1.01	ac		
Check $WQ_{v(min)}$ =	0.016833	ac-ft	**733 ft^3**	**ok**

Volume Provided:

Required Stormwater Treatment Area (impervious) = 1.02 ac
Total Impervious area treated through BMPs = 1.14 ac **ok**

<u>Drainage Area to Subsurface Infiltration System</u>
Total Volume = 4,489 ft^3
(See "HydroCAD Storage Table" for volume provided in Appendix C)

Green International Affiliates, Inc

WATER QUALITY FLOW RATE CALCULATIONS FOR PROPRIETARY DEVICES

Date: April 27, 2022
Revised:
Project: AF-Illuminar School Addition
Project No: 21075
Location: Cranston, RI

Prepared By: BV Date: 4/14/2022
Checked By: DHS Date: 4/27/2022

Objective: To determine the required Water Quality Flow (WQ_F) for adequate stormwater treatment for proprietary treatment devices

Methodology: Rhode Island Stormwater Design and Installation Standards Manual using the CN method

Design Criteria:

CN= 1000/[10 + 5P + 10Q - 10(Q^2 + 1.25 QP)^1/2]
P= 1.2 Rainfall, in inches

$WQ_F = q_u * A * Q$ (ac-ft)

q_u = the unit peak discharge rate (cfs/mi^2/inch
A = drainage area (mi^2)
Q = runoff volume (WQ_v/A, in inches)

WQ_v = [(1")(I)]/12 (ac-ft)

I = Impervious Area (acres)

Calculation Results:

Designation	Flow Rate Required (cfs)	Flow Rate Provided (cfs)
Drainage Area to WQS-1	**0.33**	**0.33**
Drainage Area to WQS-2	**0.64**	**0.64**

Volume to be Treated:

Drainage Area to WQS-1 (CDS)

Q=	1.14	inches		
CN=	99			
T_c =	5.0	min	0.083333333	hr
Ia=	0.01			
Ia/P=	0.01			
I =	0.28	ac		
qu =	650.0	csm/in (TR-55 Exhibit 4-III, q_u for NRCS Type III Storm Distribution)		
WQ_v Required =	0.0237	ac-ft	**1,032**	**ft^3**
A =	12,389	sf	0.0004	mi^2
Q_{peak} =	0.33	cfs	ok	

Drainage Area to WQS-2 (CDS)

Q=	1.14	inches		
CN=	99			
T_c =	5.0	min	0.083333333	hr
Ia=	0.01			
Ia/P=	0.01			
I =	0.55	ac		
qu =	650.0	csm/in (TR-55 Exhibit 4-III, q_u for NRCS Type III Storm Distribution)		
WQ_v Required =	0.0458	ac-ft	**1,997**	**ft^3**
A =	24,010	sf	0.0009	mi^2
Q_{peak} =	0.64	cfs	**ok**	

Volume Provided:

Drainage Area to WQS-1

WQ Unit is =	CDS 1515-3		(see CDS First Flush Calculations in Appendix C)
WQ_f = flow rate treated before bypass		**0.33 cfs**	

Drainage Area to WQS-2

WQ Unit is =	CDS 1515-3		(see CDS First Flush Calculations in Appendix C)
WQ_f = flow rate treated before bypass		**0.64 cfs**	

Project: Achievement First Iluminar School
Location: Cranston, RI
Prepared For: Green International Affiliates / Bryan Vachon

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1" of rainfall and the WQF is produced using the first 1.2" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A (miles^2)	Runoff Coefficient	Percent Imp. (%)*	t_c (min)	t_c (hr)
WQS-1	0.28	0.00044	0.90	100.00	5.0	0.083

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
WQV(ac-ft) = 1" * I/12 PER RIDEM
P = design precipitation (inches) = (1.2" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)	WQV (ac-ft)
WQS-1	100.00	0.950	1.2	1.140	0.0237

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1.2" for water quality storm)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQS-1	1.140	99.48

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQS-1	0.010	0.009

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles.

Structure Name	**t_c (hr)**	**A (miles^2)**
WQS-1	0.083	0.00044

5. Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 for appropriate t_c for type III rainfall distribution.

Structure Name	**t_c (hr)**	**I_a/P**	**q_u (csm/in)**
WQS-1	0.083	0.008633541	650

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$\mathbf{WQF = (q_u)*(A)*(Q)}$$

where: WQF = water quality flow (cfs)
q_u = unit peak discharge (cfs/mi^2/inch)
A = drainage area (mi^2)
Q = runoff depth (watershed inches)

Structure Name	**q_u (csm/in)**	**A (miles^2)**	**Q (in)**	**WQF (cfs)**
WQS-1	650	0.00044	1.140	0.33

Project: **Achievement First Iluminar School**
Location: **Cranston, RI**
Prepared For: **Green International Affiliates / Bryan Vachon**

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1" of rainfall and the WQF is produced using the first 1.2" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A (miles^2)	Runoff Coefficient	Percent Imp. (%)*	t_c (min)	t_c (hr)
WQS-2	0.55	0.00086	0.90	100.00	5.0	0.083

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
WQV(ac-ft) = 1" * I/12 PER RIDEM
P = design precipitation (inches) = (1.2" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)	WQV (ac-ft)
WQS-2	100.00	0.950	1.2	1.140	0.0459

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10+5P+10Q-10(Q^2+1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1.2" for water quality storm)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQS-2	1.140	99.48

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQS-2	0.010	0.009

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles.

Structure Name	t_c (hr)	A (miles^2)
WQS-2	0.083	0.00086

5. Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 for appropriate t_c for type III rainfall distribution.

Structure Name	t_c (hr)	I_a/P	q_u (csm/in)
WQS-2	0.083	0.008633541	650

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$WQF = (q_u)*(A)*(Q)$$

where: WQF = water quality flow (cfs)
q_u = unit peak discharge (cfs/mi^2/inch)
A = drainage area (mi^2)
Q = runoff depth (watershed inches)

Structure Name	q_u (csm/in)	A (miles^2)	Q (in)	WQF (cfs)
WQS-2	650	0.00086	1.140	0.64

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

ACHIEVEMENT FIRST ILUMINAR SCHOOL
CRANSTON, RI

Area	0.28 ac	Unit Site Designation	WQS-1
Weighted C	0.90	Rainfall Station #	146
t_c	5 min		
CDS Model	1515-3	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.1%	9.1%	0.01	0.01	9.1
0.04	8.9%	18.0%	0.01	0.01	8.9
0.06	9.8%	27.7%	0.02	0.02	9.8
0.08	8.2%	35.9%	0.02	0.02	8.2
0.10	7.7%	43.6%	0.03	0.03	7.7
0.12	5.5%	49.1%	0.03	0.03	5.5
0.14	5.0%	54.2%	0.04	0.04	5.0
0.16	4.9%	59.1%	0.04	0.04	4.9
0.18	4.3%	63.4%	0.05	0.05	4.3
0.20	4.8%	68.2%	0.05	0.05	4.7
0.25	7.4%	75.6%	0.06	0.06	7.3
0.30	5.8%	81.5%	0.08	0.08	5.7
0.35	4.5%	85.9%	0.09	0.09	4.3
0.40	2.4%	88.3%	0.10	0.10	2.3
0.45	2.0%	90.3%	0.12	0.12	1.9
0.50	1.9%	92.1%	0.13	0.13	1.8
0.75	5.0%	97.1%	0.19	0.19	4.6
1.00	1.6%	98.7%	0.26	0.26	1.4
1.50	0.8%	99.5%	0.38	0.38	0.7
2.00	0.0%	99.5%	0.51	0.51	0.0
					98.4
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**91.9%**

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

ACHIEVEMENT FIRST ILUMINAR SCHOOL
CRANSTON, RI

Area	**0.55 ac**	Unit Site Designation	**WQS-2**
Weighted C	**0.90**	Rainfall Station #	**146**
t_c	**5 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**0.93**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.1%	9.1%	0.01	0.01	8.8
0.04	8.9%	18.0%	0.02	0.02	8.5
0.06	9.8%	27.7%	0.03	0.03	9.3
0.08	8.2%	35.9%	0.04	0.04	7.8
0.10	7.7%	43.6%	0.05	0.05	7.3
0.12	5.5%	49.1%	0.06	0.06	5.2
0.14	5.0%	54.2%	0.07	0.07	4.7
0.16	4.9%	59.1%	0.08	0.08	4.6
0.18	4.3%	63.4%	0.09	0.09	4.0
0.20	4.8%	68.2%	0.10	0.10	4.4
0.25	7.4%	75.6%	0.12	0.12	6.8
0.30	5.8%	81.5%	0.15	0.15	5.2
0.35	4.5%	85.9%	0.17	0.17	4.0
0.40	2.4%	88.3%	0.20	0.20	2.1
0.45	2.0%	90.3%	0.22	0.22	1.7
0.50	1.9%	92.1%	0.25	0.25	1.6
0.75	5.0%	97.1%	0.37	0.37	3.9
1.00	1.6%	98.7%	0.50	0.50	1.2
1.50	0.8%	99.5%	0.74	0.74	0.5
2.00	0.0%	99.5%	0.99	0.93	0.0
2.50	0.5%	100.0%	1.24	0.93	0.2
					91.9
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**85.4%**

1 - Based on 10 years of hourly precipitation data from NCDC 6698, Providence WSO Airport, Kent County, RI

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Green International Affiliates, Inc

RECHARGE VOLUME CALCULATIONS

Date: April 27, 2022
Revised:
Project: Illuminar School
Project No: 21075
Location: Cranston, RI

Prepared By: BV — Date: 4/15/2022
Revised By: — Date:
Checked By: DHS — Date: 4/27/2022

Recharge Volume Design

Objective: Size an infiltration basin that will approximate the annual recharge from the existing conditions

Methodology: Rhode Island Stormwater Design and Installation Standards Manual

Design Criteria: The required recharge volume equals a depth of runoff corresponding to the soil type times the impervious areas covering that soil type at the post-

Based on the Site Hydrologic Soil Group (HSG):

Hydrologic Soil Group	Soil Texture	Recharge Factor (F)
A	Sand	0.60 inches
B	Loam	0.35 inches
C	Silty Loam	0.25 inches
D	Clay	0.10 inches

The soils are defined by the Natural Resource Conservation Services (NRCS) Soil Survey for Providence, RI County. The site is comprised of 'A' soils. To be conservative, we have used 'A' hydrologic soil group for recharge requirements

Re_v = (1")(F)(I)/12 (ac-ft)

F = Recharge Factor
I = Impervious area (acres)

Note: Stormwater runoff from a LUHPPL is not allowed to infiltrate into the groundwater.

Calculation Results:

Designation	Volume Required (ft^3)	Volume Provided (ft^3)
Subsurface Infiltration System	**2,475**	**4,489**

Recharge Volume Required:

Subsurface Infiltration System

I =	1.14	ac	(impervious area draining to subsurface system)

(use impervious area draining to subsurface system)

F =	0.60	in	
Re_v Required =	0.0568	ac-ft	**2,475 ft^3**

Required Stormwater Treatment Area

I =	1.14	ac	(impervious area draining to subsurface system)
I =	1.02	ac	(Minimum treatment required - See WQV Calculation She

Re_v $Required_{(Total)}$ =	**1.02 ac**	<	**1.14 ac**	**ok**

Recharge Volume Provided:

Subsurface Infiltration System

Rv =	**4,489 ft^3**	(below lowest orifice based on Hydrocad Calculations)

Check that total recharge provided is greater than required stormwater treatment area:

Re_v $Required_{(Total)}$ =	**2,475 ft^3**	<	**4,489 ft^3**	**ok**

Stage-Area-Storage for Pond 10P: Subsurface Infiltration System

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
56.58	0	57.10	1,019	57.62	2,173
56.59	20	57.11	1,039	57.63	2,227
56.60	39	57.12	1,058	57.64	2,280
56.61	59	57.13	1,078	57.65	2,333
56.62	78	57.14	1,098	57.66	2,387
56.63	98	57.15	1,117	57.67	2,440
56.64	118	57.16	1,137	57.68	2,493
56.65	137	57.17	1,156	57.69	2,546
56.66	157	57.18	1,176	57.70	2,600
56.67	176	57.19	1,196	57.71	2,653
56.68	196	57.20	1,215	57.72	2,706
56.69	216	57.21	1,235	57.73	2,759
56.70	235	57.22	1,254	57.74	2,812
56.71	255	57.23	1,274	57.75	2,865
56.72	274	57.24	1,294	57.76	2,918
56.73	294	57.25	1,313	57.77	2,971
56.74	314	57.26	1,333	57.78	3,024
56.75	333	57.27	1,352	57.79	3,077
56.76	353	57.28	1,372	57.80	3,130
56.77	372	57.29	1,392	57.81	3,183
56.78	392	57.30	1,411	57.82	3,236
56.79	412	57.31	1,431	57.83	3,288
56.80	431	57.32	1,450	57.84	3,341
56.81	451	57.33	1,470	57.85	3,394
56.82	470	57.34	1,490	57.86	3,446
56.83	490	57.35	1,509	57.87	3,499
56.84	510	57.36	1,529	57.88	3,552
56.85	529	57.37	1,548	57.89	3,604
56.86	549	57.38	1,568	57.90	3,657
56.87	568	57.39	1,588	57.91	3,709
56.88	588	57.40	1,607	57.92	3,761
56.89	608	57.41	1,627	57.93	3,814
56.90	627	57.42	1,646	57.94	3,866
56.91	647	57.43	1,666	57.95	3,918
56.92	666	57.44	1,686	57.96	3,970
56.93	686	57.45	1,705	57.97	4,022
56.94	706	57.46	1,725	57.98	4,074
56.95	725	57.47	1,744	57.99	4,127
56.96	745	57.48	1,764	58.00	4,179
56.97	764	57.49	1,784	58.01	4,230
56.98	784	57.50	1,803	58.02	4,282
56.99	804	57.51	1,823	58.03	4,334
57.00	823	57.52	1,842	58.04	4,386
57.01	843	57.53	1,862	58.05	4,438
57.02	862	57.54	1,882	58.06	4,489
57.03	882	57.55	1,901	58.07	4,541
57.04	902	57.56	1,921	58.08	4,593
57.05	921	57.57	1,940	58.09	4,644
57.06	941	57.58	1,960	58.10	4,696
57.07	960	57.59	2,013	58.11	4,747
57.08	980	57.60	2,067	58.12	4,798
57.09	1,000	57.61	2,120	58.13	4,850

WATER QUALITY STORAGE VOLUME BELOW LOWEST OUTLET (58.06 / 4,489)

Stage-Area-Storage for Pond 10P: Subsurface Infiltration System (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
58.14	4,901	58.66	7,476	59.18	9,816
58.15	4,952	58.67	7,523	59.19	9,858
58.16	5,003	58.68	7,571	59.20	9,900
58.17	5,054	58.69	7,618	59.21	9,941
58.18	5,105	58.70	7,665	59.22	9,983
58.19	5,156	58.71	7,712	59.23	10,024
58.20	5,207	58.72	7,759	59.24	10,065
58.21	5,258	58.73	7,806	59.25	10,107
58.22	5,308	58.74	7,853	59.26	10,147
58.23	5,359	58.75	7,900	59.27	10,188
58.24	5,410	58.76	7,947	59.28	10,229
58.25	5,460	58.77	7,993	59.29	10,269
58.26	5,511	58.78	8,040	59.30	10,309
58.27	5,561	58.79	8,086	59.31	10,349
58.28	5,612	58.80	8,133	59.32	10,389
58.29	5,662	58.81	8,179	59.33	10,429
58.30	5,712	58.82	8,225	59.34	10,469
58.31	5,762	58.83	8,271	59.35	10,508
58.32	5,813	58.84	8,317	59.36	10,547
58.33	5,863	58.85	8,363	59.37	10,586
58.34	5,913	58.86	8,408	59.38	10,625
58.35	5,963	58.87	8,454	59.39	10,664
58.36	6,012	58.88	8,500	59.40	10,703
58.37	6,062	58.89	8,545	59.41	10,741
58.38	6,112	58.90	8,590	59.42	10,779
58.39	6,162	58.91	8,636	59.43	10,817
58.40	6,211	58.92	8,681	59.44	10,855
58.41	6,261	58.93	8,726	59.45	10,893
58.42	6,310	58.94	8,771	59.46	10,931
58.43	6,360	58.95	8,816	59.47	10,968
58.44	6,409	58.96	8,860	59.48	11,005
58.45	6,458	58.97	8,905	59.49	11,042
58.46	6,507	58.98	8,950	59.50	11,079
58.47	6,557	58.99	8,994	59.51	11,116
58.48	6,606	59.00	9,038	59.52	11,152
58.49	6,655	59.01	9,082	59.53	11,189
58.50	6,703	59.02	9,126	59.54	11,225
58.51	6,752	59.03	9,170	59.55	11,261
58.52	6,801	59.04	9,214	59.56	11,296
58.53	6,850	59.05	9,258	59.57	11,332
58.54	6,898	59.06	9,302	59.58	11,367
58.55	6,947	59.07	9,345	59.59	11,402
58.56	6,995	59.08	9,388	59.60	11,437
58.57	7,044	59.09	9,432	59.61	11,471
58.58	7,092	59.10	9,475	59.62	11,505
58.59	7,140	59.11	9,518	59.63	11,539
58.60	7,188	59.12	9,561	59.64	11,573
58.61	7,236	59.13	9,604	59.65	11,607
58.62	7,284	59.14	9,646	59.66	11,640
58.63	7,332	59.15	9,689	59.67	11,673
58.64	7,380	59.16	9,731	59.68	11,706
58.65	7,428	59.17	9,774	59.69	11,738

Stage-Area-Storage for Pond 10P: Subsurface Infiltration System (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
59.70	11,770	60.22	12,987
59.71	11,802	60.23	13,007
59.72	11,833	60.24	13,027
59.73	11,864	60.25	13,046
59.74	11,895	60.26	13,066
59.75	11,925	60.27	13,085
59.76	11,955	60.28	13,105
59.77	11,985	60.29	13,125
59.78	12,014	60.30	13,144
59.79	12,042	60.31	13,164
59.80	12,070	60.32	13,183
59.81	12,098	60.33	13,203
59.82	12,125	60.34	13,223
59.83	12,152	60.35	13,242
59.84	12,178	60.36	13,262
59.85	12,204	60.37	13,281
59.86	12,229	60.38	13,301
59.87	12,254	60.39	13,321
59.88	12,279	60.40	13,340
59.89	12,303	60.41	13,360
59.90	12,327	60.42	13,379
59.91	12,350	60.43	13,399
59.92	12,373	60.44	13,419
59.93	12,396	60.45	13,438
59.94	12,418	60.46	13,458
59.95	12,441	60.47	13,477
59.96	12,463	60.48	13,497
59.97	12,485	60.49	13,517
59.98	12,507	60.50	13,536
59.99	12,528	60.51	13,556
60.00	12,549	60.52	13,575
60.01	12,571	60.53	13,595
60.02	12,591	60.54	13,615
60.03	12,612	60.55	13,634
60.04	12,633	60.56	13,654
60.05	12,653	60.57	13,673
60.06	12,673	60.58	**13,693**
60.07	12,693		
60.08	12,713		
60.09	12,733		
60.10	12,752		
60.11	12,772		
60.12	12,791		
60.13	12,811		
60.14	12,831		
60.15	12,850		
60.16	12,870		
60.17	12,889		
60.18	12,909		
60.19	12,929		
60.20	12,948		
60.21	12,968		

APPENDIX D – SOIL INFORMATION

- NRCS Soil Survey
- Geotechnical Report

Map Scale: 1:5,930 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

N

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

MAP LEGEND

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

Soils

Soil 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 1:12,000.

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

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

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

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

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

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

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
Survey Area Data: Version 21, Sep 3, 2021

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

Date(s) aerial images were photographed: Jul 3, 2019—Jul 18, 2020

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
MU	Merrimac-Urban land complex, 0 to 8 percent slopes	A	61.6	41.0%
Pg	Pits, gravel		5.9	3.9%
UD	Udorthents-Urban land complex	A	34.9	23.2%
Ur	Urban land		43.0	28.6%
W	Water		4.8	3.2%
Totals for Area of Interest			**150.2**	**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

GEOTECHNICAL ENGINEERING REPORT
FOR THE PROPOSED
ACHIEVEMENT FIRST SCHOOL ADDITION
CRANSTON, RHODE ISLAND

Prepared for:

Achievement First Illuminar School
85 Garfield Avenue
Cranston, Rhode Island

Prepared by:

Paul B. Aldinger & Associates, Inc.
860A Waterman Avenue Suite 9
East Providence, Rhode Island 02914

PBA No. 21020
February 2022

PAUL B. ALDINGER & ASSOCIATES, INC.
Consulting in Geotechnical Engineering & Groundwater Hydrology
860A Waterman Avenue Suite 9 East Providence, Rhode Island 02914 (401) 435-5570

February 22, 2022

Ms. Sandra Waterman
Project Manager
Colliers Project Leaders
72 Pine Street
Providence, Rhode Island 02903

Re: Geotechnical Engineering Report
Achievement First School
85 Garfield Avenue
Cranston, Rhode Island
PBA No. 21020

Dear Ms. Waterman:

Paul B. Aldinger & Associates, Inc. (PBA) is pleased to provide Achievement First (AF) with this geotechnical engineering report for the above referenced project. This report is subject to the limitations that are outlined in Appendix A.

1.00 INTRODUCTION/PROJECT DESCRIPTION

The project site is located at 85 Garfield Avenue in Cranston, Rhode Island. Figure No. 1, Site Vicinity Plan, indicates the location of the project site. The project consists of the construction of an approximate 15,500 square foot building addition to an existing three-story building with an approximate footprint of 20,600 square feet. The proposed addition will be two-stories in height and be constructed north of the existing building, which will remain.

The project site is situated just west of the Huntington Expressway (Route 10) in Cranston, Rhode Island. The project site is immediately bordered by Garfield Avenue to the east, a Cranston Police Station and associated paved parking lot to the north, a paved bike trail, the Washington Secondary Trail, and residential structures to the west, and Tongue Pond to the south. The project site is currently relatively flat and consists of mostly paved parking areas, with the exception of an area just north of and just east of the existing building, which consists of grassy area.

We reviewed a set of four (4) drawings provided to us that were developed by Kaestle Boos Associates, Inc. Two (2) of the drawings, titled "Site Plan - Option 2" and "Site Plan - Option 2A," are dated April 5, 2021, and indicate an aerial photo of the site with the footprints of the existing building, the proposed addition, the proposed multi-purpose sports field and basketball court, and other proposed site features. The other two (2) drawings are undated and are titled "Achievement First Iluminar School." These plans appear to include the floor plans for the first and second floor of the proposed addition. The proposed floor plans indicate a gymnasium, stairwells, administration offices, storage rooms, bathrooms, classrooms, and areas proposed for other use. We were also provided with a plan developed by Sage Environmental entitled, Capping Site Plan, 85 Garfield Avenue, Cranston, Rhode Island and dated July 29, 2019. The plan indicates the details of an environmental cap installed at the site at the time of conversion from an office building to a school.

Review of available historical aerial photographs indicates that the site was developed prior to the earliest available aerial photograph, 1939. The historical aerial photographs also indicate that there was once a building situated in the northwest corner of the project site. Figure 1, Site Vicinity Plan appears to indicate the approximate footprint of the previously existing building. The former building appears to have been demolished in the late 1990s or early 2000s. The historical aerial photographs indicate that the existing on-site building was constructed in 2003.

The objectives of our engineering services were to coordinate and monitor a subsurface exploration program, perform geotechnical engineering analyses, and develop an engineering report with specific earthwork and foundation design recommendations for the proposed addition.

2.00 GEOLOGY

2.10 Surficial Geology

The 1956 US Geological Survey, *Geologic Map of the Providence Quadrangle, Rhode Island, Surficial Geology,* compiled by J. Hiram Smith indicates that the surficial geology underlying the project site is Outwash Plains. The Outwash Plains deposit is reportedly described as sorted sand and local deposits of coarse gravel.

The 1957 US Geological Survey Map, *Showing Location of Selected Wells and Test Borings, Contours on Bedrock Surface, and Outwash Deposits, Providence Quadrangle, Rhode Island,* complied by W. H. Bierschenk and J.H. Smith, indicates that the surficial geology underlying the project site consists of Outwash Deposits. This map also indicates the location of two wells, test borings or U.S. Geological Survey observation wells that were installed in the site vicinity. One of the wells or test borings was installed just south of the existing on-site building and the other was installed within the existing on-site parking lot, to the northeast of the existing building and proposed addition. The well or test boring installed just south of the existing on-site building encountered bedrock at an altitude of 34 feet below mean sea level, approximately 104 feet below the ground surface. The well or test boring installed within the existing on-site parking lot encountered bedrock at an altitude of 100 feet below mean sea level, approximately 170 feet below the ground surface.

2.20 Bedrock Geology

The 1959 US Geological Survey, *Geologic Map of the Providence Quadrangle, Rhode Island, Bedrock Geology*, compiled by Alonzo W. Quinn indicates that the bedrock underlying the project site is Rhode Island Formation. In 1994, US Geological Survey further refined its mapping with *Bedrock Geologic Map of Rhode Island*, compiled by O.D. Hermes, L.P. Gromet, and D.P. Murray indicating that the bedrock underlying the project site is Rhode Island Formation. In this part of Rhode Island, the Rhode Island Formation is described as gray to black, fine to coarse grained quartz.

3.00 SUBSURFACE INVESTIGATION PROGRAM

The subsurface exploration program consisted of 4 test borings (B-1, B-2, B-4 and B-6) completed between January 10 and 13, 2022 by Sage EnviroTech Drilling Services of Pawtucket, Rhode Island. The locations of the explorations were located by tape measurement from the existing building and are indicated on the Boring Location Plan included as Figure 2. Test borings were observed and logged by an engineering technician and the logs are included in Appendix B, Test Boring Logs. Test borings were completed within the footprint of the proposed building addition, where drill rig access was feasible.

The test borings were advanced with the dual tube method to depths between 52 and 87 feet below the ground surface. Standard split spoon soil samples were obtained at intervals of 5 feet using a 1⅜-inch inside diameter split spoon sampler in substantial conformance with ASTM D1586, the Standard Penetration Test (SPT). The standard ASTM method of driving the sampler was employed using a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler for each 6 inches of penetration was recorded. The number of blows required to drive the sampler from 6 to 18 inches of penetration is the SPT blow count (N-value), a commonly-used indicator of soil density.

4.00 SUBSURFACE CONDITIONS

Generalized soil conditions encountered in the subsurface explorations include the following strata from the ground surface downward. Actual conditions between the subsurface explorations will likely vary. Refer to the logs in Appendix B for more detailed descriptions of the conditions encountered.

4.10 Soil Conditions

Granular Fill - A layer of Silty Granular Fill was encountered beginning at the ground surface and extending to a depth of approximately one foot. This soil was placed as part of an earthen site capping. The earthen cap also consists of a geotextile fabric underlying the clean granular fill. The engineered earthen cap is underlain by;

Glacial Outwash - Very loose to medium dense glacial outwash consisting of light brown or gray, fine sand with varying amounts of silt present. The average SPT blow count value (uncorrected N-value) of the glacial outwash stratum was approximately 13.

4.20 Groundwater Conditions

Groundwater was measured at depths between approximately 21.6 and 25 feet below the ground surface at the time of the drilling. It should be noted that fluctuations in the levels of the groundwater will likely occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

5.00 LABORATORY TESTING DATA

Ten soil samples were laboratory tested to determine the percentage of fines (material passing the No. 200 sieve) present in order to refine our seismic evaluation of the site. The results of the laboratory analyses are included in Appendix C and a brief description is included in the table below.

Boring & Sample Number	Depth (feet)	Percent Finer than No. 200 sieve	Soil Description
B-1 S-10	45-47	9.2	fine to coarse SAND, some fine to coarse Gravel, trace Silt
B-1 S-11	50-52	12.8	fine to coarse SAND, little fine to coarse Gravel, little Silt
B-2 S-9	40-42	49.1	fine to medium SAND and SILT

Boring & Sample Number	Depth (feet)	Percent Finer than No. 200 sieve	Soil Description
B-2 S-10	45-47	41.3	fine to medium SAND and SILT
B-2 S-11	50-52	60.1	SILT & CLAY, some f-m Sand, little fine to coarse Gravel
B-4 S-10	30-32	6.9	fine to medium SAND, trace Silt, trace fine Gravel
B-4 S-13	45-47	43.5	fine to medium SAND and Clayey SILT
B-4 S-14	50-52	51.0	Clayey SILT and fine to medium SAND
B-6 S-6	25-27	5.0	fine to medium SAND, trace Silt, trace fine Gravel
B-6 S-7	30-32	11.2	fine to medium SAND, little Silt, trace fine Gravel

6.00 DISCUSSION AND FEASIBLE FOUNDATION OPTIONS

The proposed Achievement First School building addition will extend from the north side of the existing on-site building. It is our understanding that a basement will not be part of the proposed addition. Project test borings were drilled within the footprint of the proposed building addition. Subsurface soils encountered during the subsurface investigation program consisted of placed granular fill as part of an environmental capping system to a depth of 1 foot below grade underlain by glacial outwash. Groundwater was encountered at depths between 21.6 and 25 feet below the ground surface.

The soil encountered underlying the project site consisted of very loose sands to depths of approximately 50 feet. Loose sands below the groundwater table are problematic with respect to seismic considerations. Upon completion of the required seismic analyses for the site, we have determined that the site is not suitable for direct support of a structure on a typical shallow foundation. We have therefore considered two foundation alternatives for the proposed addition:

support on deep foundations, such as driven or cast-in-place piles, or ground modification, such as Geopier rammed aggregate piers into the glacial outwash with shallow spread footing support on the improved site. Support on a deep foundation would require the use of a structural slab and pile caps supported by either driven or cast-in-place piles while a shallow building foundation composed of a slab-on-grade and footings could be utilized for support after a ground modification program. With either approach, it is recommended that the edge columns closest to the existing building be located as far as possible from the existing building to minimize the potential disturbance during foundation construction.

We believe that support of the building foundation after subgrade improvement would efficiently and cost effectively allow for the existing poor quality site soils beneath the building to remain in-place and allow for an economical shallow footing with a slab-on-grade building foundation approach to be implemented. The recommended approach is referred to as a "ground modification" system.

6.10 Pile Foundation

A deep foundation consisting of driven or cast-in-place piles could be used for support the new addition. Piles would be installed at each footing as well as on a grid spacing beneath the slab-on-grade, requiring the use of a reinforced structural slab.

Piles extending below the loose saturated sands could be utilized for support of the structure. The anticipated pile lengths are greater than 60 to 70 feet in order to derive principal support from the medium dense to dense natural soils encountered at those greater depths. Although a pile load test is not required by the Rhode Island Building Code if the desired capacity is less than 40-tons, we recommend that one be completed to confirm the ability to achieve the desired capacity. A minimum of three piles would be required for each individual column.

6.20 Rammed Aggregate Piers

The recommenced building foundation ground improvement system consists of vertical subgrade soil reinforcing elements, relatively stiff columns, comprised of crushed aggregate with or without the use of cementitious grout. The aggregate columns are installed from the existing ground surface down into the competent natural soil stratum a sufficient distance and in sufficient numbers to develop the required shallow building foundation resistance. The reinforcing elements are considered stiff in relation to the existing soil stratigraphy being reinforced. In this report, we will refer to the stiff elements as Rammed Aggregate Piers (RAPs), which can be either with or without a cementitious component.

Over-excavation and replacement of loose saturated sands would not be required. The advantage of this system is that since the materials used are less expensive, the costs for moderate loadings should be lower than a competing pile system. The design would also incorporate a typical spread footing and slab-on-grade foundation rather than a structural slab and pile cap system which could also provide a cost savings. This is an advantage not only in the lower slab cost but also is much less restrictive in the event that utilities beneath the slab must be changed or upgraded.

Displacement Geopiers could be installed which are approximately 24 inches in diameter and would be installed with a mandrel that incorporates a beveled tamper plate through the loose saturated sands to the more dense glacial outwash layer. A lift of crushed aggregate is placed at the bottom of this excavation and vibrated to create a bulb of aggregate material at the bottom of the pier. Subsequent lifts of aggregate are placed and rammed in thicknesses of approximately 12 inches. The allowable bearing capacity is a function of the Geopier spacing and depth of the unsuitable soil. The interior and exterior footings may need to be slightly oversized to incorporate the proper design spacing of the Geopiers.

A typical shallow building footing and slab-on-grade system would be compatible with a properly designed building area specific ground improvement system. Assuming all installed stiff elements are of the same resistance capability, the plan-view spacing of the reinforcing elements would necessarily be closer beneath the building's principal load carrying components, the footings, and would be wider beneath the slab-on-grade. The stiff elements would not directly contact the building's footings or slab-on-grade, but would terminate typically a foot or less beneath bottom-of-footing, with more separation distance (on the order of several feet) between bottom of slab-on-grade and top of the supporting stiff elements. The slab-on-grade's increased separation distance is advantageous from the standpoint of providing an immediately below slab-on-grade space for the building footprint utilities.

Within the under-footing separation space, a compacted high friction angle crushed stone or well-graded gravel and sand product is constructed to transition the high stress resistance condition at the top of the stiff elements, to an acceptable bottom-of-footing subgrade resistance and resistance variation. This footing transition space component of the ground improvement system will be referred to as the footing "pad." The variation in resistance provided to the bottom-of-footing between the reinforced subgrade above the RAP and that between the RAPs must be limited to a level of variation which is acceptable to the project's Structural Engineer for the conventional reinforced concrete footing design.

Beneath the slab-on-grade, where a greater separation distance is provided above the wider spaced stiff elements, a lower and more uniform reinforced subgrade resistance and resistance variation is required at bottom of slab-on-grade, to be acceptable to the project's Structural Engineer for a conventional slab-on-grade reinforced concrete design.

The ground improvement system is designed to meet both footing and slab-on-grade requirements as far as subgrade resistance (bearing capacity), resistance variation at bottom of foundation, and total/differential settlement under building load. The design and construction of the ground improvement system is a specialty geotechnical Contractor work scope employing a proprietary construction approach, design technique and their unique system performance experience.

7.00 DESIGN RECOMMENDATIONS

Based on our understanding of the project and the anticipated loads, we believe either of the options provided above would be a feasible foundation for the proposed structure. However, we anticipate there may be a significant cost savings with the use of Geopiers, when compared to other options. The final selection of a foundation type, however, should include an economic evaluation. It is suggested that once a building structure design is finalized then the feasible foundation options presented above be considered by your design team with assistance from PBA and the contractor and the final selection be made on the basis of economic comparison.

7.10 Design of Piles

7.11 **Load Testing** - We recommend that three test piles be installed and one selected for testing to determine the capacity of the piles. The test must demonstrate that the pile, installed in accordance with the specified criteria, has an ultimate capacity of at least two times the design load. The procedures for conducting and interpreting the load test must satisfy the provisions of the International Building Code (IBC), Rhode Island State Building Code (RISBC) and ASTM D1143.

7.12 **Obstructions-** Although not expected, should obstructions be encountered when installing the piles, pre-augering or spudding of piles would be needed in the event obstructions are encountered. The spacing of the piles is also a consideration in pre-augering piles.

7.13 **Pile Spacing** - For preliminary design purposes the recommended minimum center to center spacing of the piles should be as indicated in the current edition of the Rhode Island State Building Code and the International Building Code.

7.14 **Foundation Installation Monitoring** - A field geotechnical engineer should be present to maintain a record of the pile test and installation operation for each pile to verify the installed bearing capacity as inferred from the pile installation record and to notify the project geotechnical engineer if any pile installation modifications are warranted.

7.20 Geopier Design Requirements

7.21 Modulus Test - A modulus test should be performed on a representative Geopier to verify parameters selected during design. The maximum static test load is recommended to be a minimum of twice the RAP design resistance. The test should be conducted in accordance with the manufacturer specifications and should meet the general test procedures for establishing load increments, load duration and load decrements as provided in ASTM D-1143.

7.22 Obstructions - Obstructions, if encountered, may require pre-augering or over-excavation. The auger should be spun in (part of the depth of the fill) and then spun out upon removal in order to leave the soil in a loosened state without leaving an open hole which may cave in.

7.23 Foundation and Slab Support - Shallow spread footings should be constructed bearing on Gravel Borrow placed on the completed improved site. All footings should be placed on a one foot minimum layer of Gravel Borrow. For estimating purposes, we recommend the allowable soil bearing pressure should not exceed 3 kips per square foot with footing widths of 2 feet or wider. Using this bearing pressure, we estimated a total settlement of less than 1 inch. This bearing capacity may be revised at the time the Geopier design is completed. No footings should be less than 2 feet wide. Minimum depths for frost protection of exterior footings should be a minimum of 3 feet-4 inches.

We recommend that the slabs-on-grade bear on compacted Gravel Borrow placed on a minimum of one foot of compacted Gravel Borrow after completion of the ground improvement. Compaction should be to a minimum of 95-percent of maximum dry density as determined by ASTM D-1557.

7.24 Foundation Installation Monitoring - A field geotechnical engineer should be present to maintain a record of the modulus test and installation operation for each RAP to verify the installed bearing capacity as inferred from the installation record and to notify the project geotechnical engineer if any installation modifications are warranted.

7.30 Additional Site Development Issues

7.31 Dewatering & Control of Surface Water Runoff- All excavation and backfill must be conducted in the dry. Based on the observed groundwater level of more than 20 feet below ground surface, dewatering is not anticipated to be required.

The contractor should provide for proper drainage of surface water away from any excavations. Surface water during construction should be minimal if work is performed during periods of low rainfall; however, if precipitation occurs during the work, the contractor should be required to divert surface water and pump out any collected water.

7.32 **Reuse of On-site Soils -** Based on the visual classification of the on-site soils, it would appear that some of the soil may meet the gradation requirements for reuse. Any material considered for reuse should be tested for compliance with the project specifications.

7.33 **Backfill and Compaction** - Granular fill to be used beneath footings and extending 10 feet outside the building footprint, under slabs and pavement should conform to the requirements of structural fill as indicated in the table below.

Sieve Size	Percent Passing by Weight
2"	100
½"	50-85
3/8"	45-80
No. 4	40-75
No. 40	0-45
No. 200	0-8

Where footings or slabs-on-grade are constructed on compacted structural fill, it should be placed and compacted in lifts not exceeding one foot in thickness to a minimum of 95-percent of the maximum dry density as determined by ASTM D-1557, the Modified Proctor Density Test. Under paved areas, fills and backfills should be compacted to 90-percent of the maximum material dry density, except the last two feet, which should be compacted to 95-percent.

7.34 **Seismic Design Requirements** - We have considered seismic design requirements for the site in accordance with the requirements of the Rhode Island State Building Code (RIBC). Based upon the subsurface data collected, it is our opinion that the site soils are considered susceptible to liquefaction. Using the results of the borings and recorded depths to groundwater between 21.6 and 25 feet below grade, we completed an evaluation of liquefaction susceptibility for the site during a credible earthquake. The results of the evaluation indicated that the loose saturated subsurface sands are susceptible to liquefaction, with an inadequate factor of safety from the analysis.

Based upon our interpretation of the Site Seismic Classifications provided in the ASCE 7, Site Classification Procedure for Seismic Design, as referenced by the International Building Code (IBC 2015, the basis for the RIBC), we recommend that a Site Class of E be utilized for design. From the most recent Rhode Island amendments to the IBC, the Seismic Site Coefficients, Ss and S1 for the City of Cranston are Ss=0.232 and S1=0.060.

7.35 **Excavation Support** - Given the open area for the new building addition and the minimal depth of excavation required, excavation support is not anticipated to be required. It is anticipated that during the excavation and foundation construction, temporary excavation slopes above the groundwater table (without surcharges) can be excavated at 1.5 horizontal to 1 vertical inclination.

7.36 **Lateral Earth Pressures** - We understand that the new addition will be slab-on-grade construction and do not anticipate that a basement will be included. However, should below-grade retaining walls be needed at the connection to the existing building, an at-rest lateral earth pressure coefficient of 0.47 for unyielding walls, an active lateral earth pressure coefficient of 0.31 for yielding walls, and a saturated unit weight of 130 pounds per cubic foot are recommend where the walls are to be backfilled with Gravel Borrow.

7.37 **Preconstruction Survey and Vibration Monitoring** - Significant construction vibration caused by compaction of earth fills could impact nearby structures. It is our experience that vibration from ground improvement techniques typically drop below disturbance levels within approximately 50 feet of the source. We recommend that PBA be hired to conduct a pre-construction survey of adjacent existing structures within 200 feet of construction activities, this would include the existing school building. The purpose of the survey is to document existing conditions in the event that structure damage is alleged to have occurred due to construction activities. The survey should consist of relevant photographs, video recording, sketches and descriptive text to document conditions prior to construction.

The Contractor should be required by specification to conduct their operations without causing damage to adjacent and nearby structures. The Contractor should limit construction vibration levels to acceptable peak particle velocity (PPV) levels at adjacent or near by structures consistent with structure type and condition, conservatively set at 0.5 inches per second for discrete impact type vibration event activity, and 0.2 to 0.3 inch per second for continuous vibration activities, e.g. vibratory compaction of backfill. A lower criteria may be required for specific structures and/or equipment known to be sensitive to vibrations. During construction, we recommend that PBA be hired to selectively monitor construction vibration at/near adjacent or nearby structures, specifically during the mentioned vibration producing construction activities. The specifications should require construction activity suspension and/or modification, if vibration levels approach or exceed specified threshold values.

8.00 FINAL DESIGN & CONSTRUCTION MONITORING

It is recommended that PBA be provided the opportunity to review foundation design plans and prepare or review project earthwork specifications to ensure that our recommendations have been properly interpreted. The Rhode State Island Building Code requires that the subgrade preparation and fill compaction be monitored and tested for compliance within its special inspections requirements. Accordingly we recommend that PBA provide a geotechnical engineer or qualified engineering technician, qualified by training and experience to be present during construction to perform the following:

A. conduct a preconstruction survey of structures within 200 feet of construction activities which may cause vibrations in order to document their existing conditions prior to construction,
B. monitor vibrations with a seismograph(s) during construction,
C. monitor the installation and testing of RAP elements, and
D. monitor the placement and compaction of backfill materials.

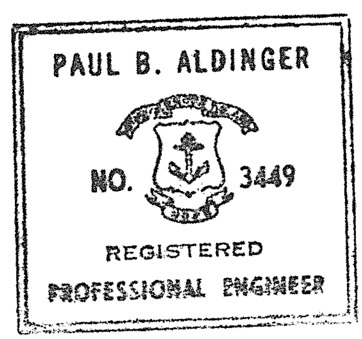
In addition, the PBA geotechnical engineer or qualified engineering technician would observe compliance with the design concepts, specifications and recommendations, and assist in developing design or construction changes in the event that subsurface conditions differs from those anticipated prior to start of construction.

We appreciate the opportunity to have been of service to Achievement First and we trust that the information contained in this report is adequate for your needs at this time. Please contact the undersigned if there are questions on these recommendations or if you need additional information.

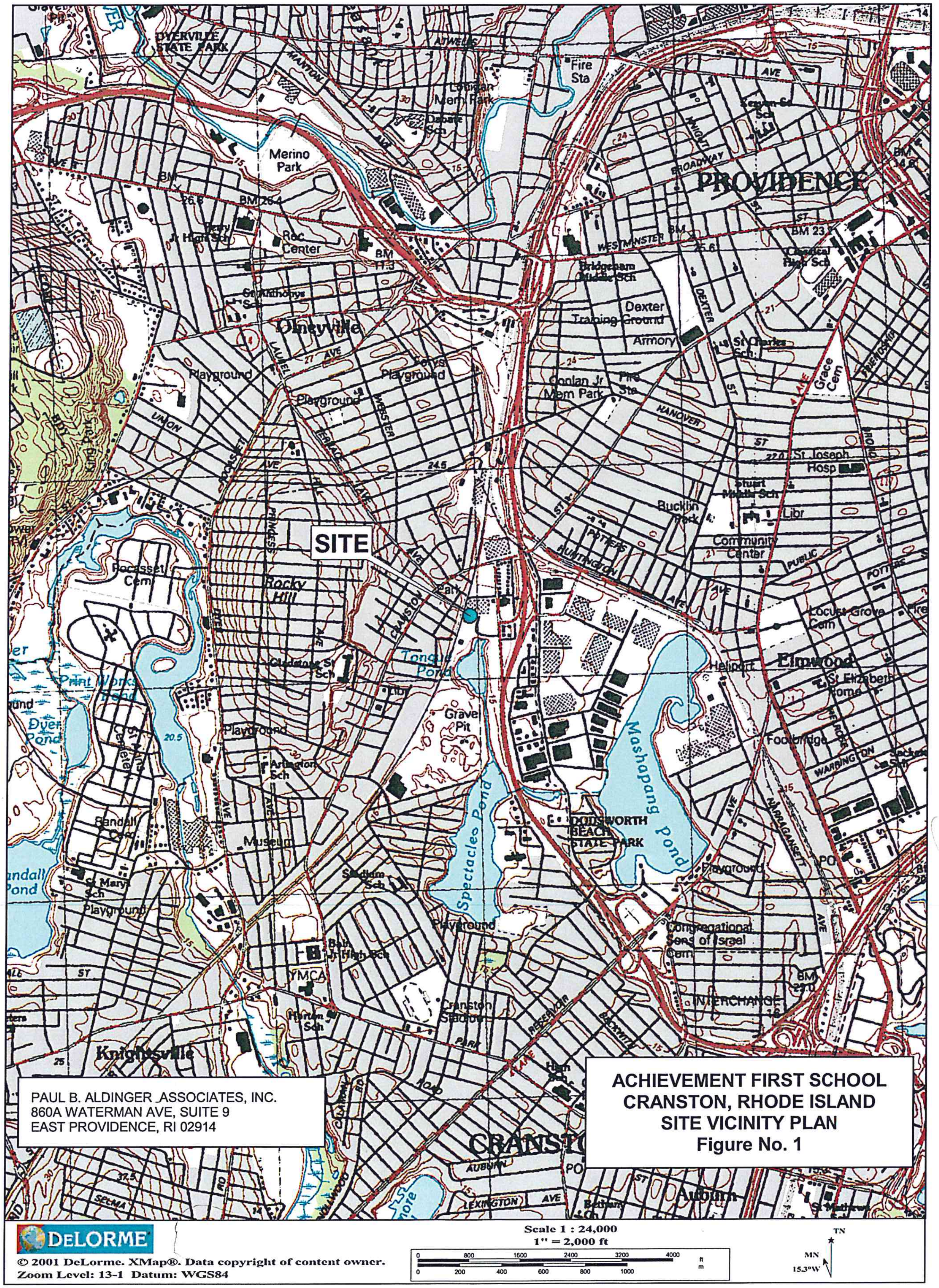
Very truly yours,

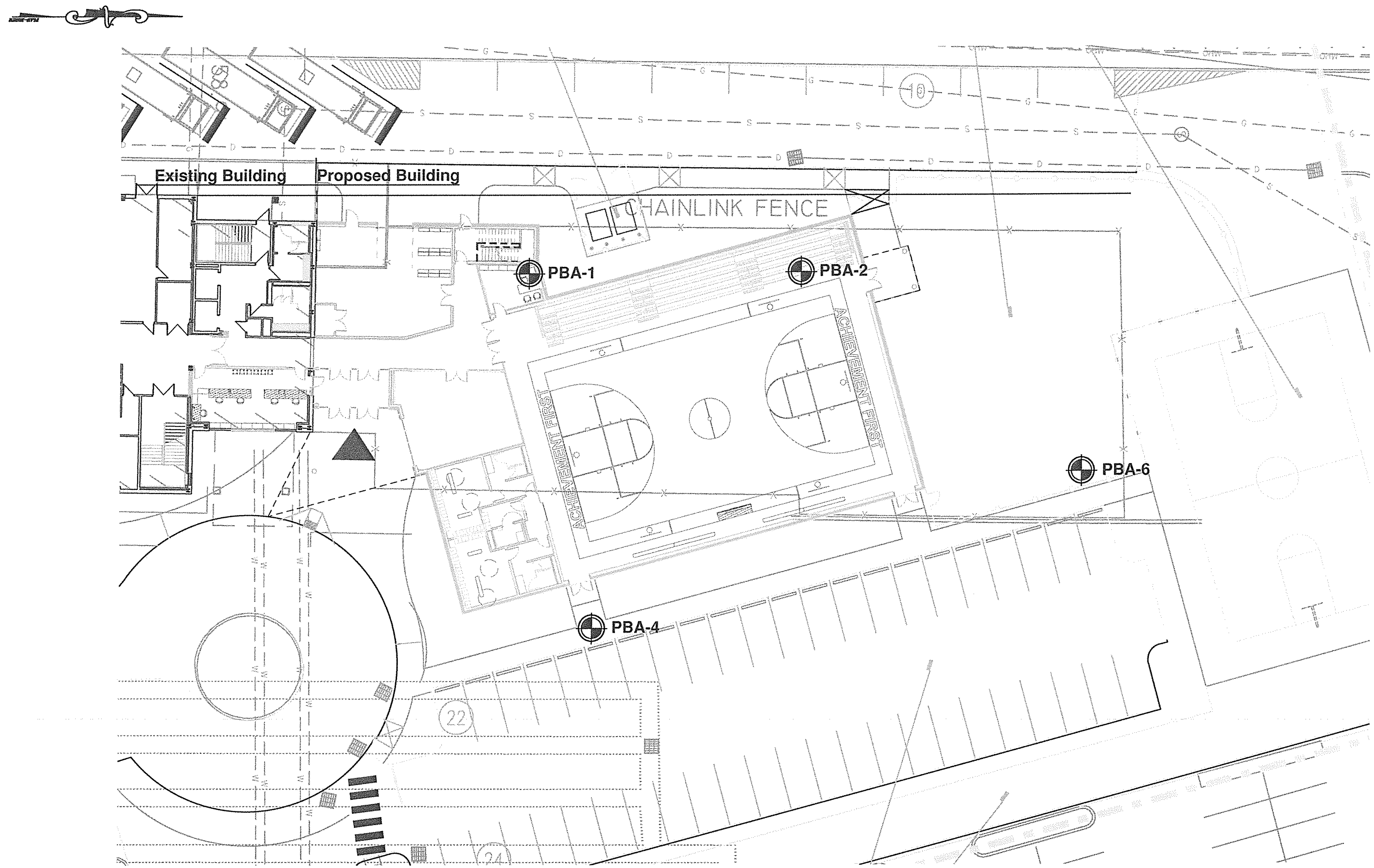
PAUL B. ALDINGER & ASSOCIATES, INC.

Paul B. Aldinger, Ph.D., P.E.
Chief Engineer



FIGURES


ACHIEVEMENT FIRST SCHOOL
CRANSTON, RHODE ISLAND
SITE VICINITY PLAN
Figure No. 1
PAUL B. ALDINGER ASSOCIATES, INC.
860A WATERMAN AVE, SUITE 9
EAST PROVIDENCE, RI 02914
SITE
PROVIDENCE
Olneyville
Elmwood
Knightsville
CRANSTON
Auburn
Merino Park
Rocky Hill
Tongue Pond
Spectacle Pond
Mashapaug Pond
Print Works Pond
Dyer Pond
Pocasset Cem
Grave Pit
Dexter Training Ground
Armory
Locust Grove Cem
Grace Cem
Cranston Stadium
YMCA
Museum
Playground
Heliport
Footbridge
INTERCHANGE
DYERVILLE STATE PARK
DOLLSWORTH BEACH STATE PARK
Congregational Sons of Israel Cem
St Joseph Hosp
Community Center
Buckin Park
Conlan Jr Mem Park
Rec Center
DELORME
© 2001 DeLorme. XMap®. Data copyright of content owner.
Zoom Level: 13-1 Datum: WGS84
Scale 1 : 24,000
1" = 2,000 ft
TN
MN
15.3°W



LEGEND:

PBA-1 APPROXIMATE LOCATION OF TEST BORING COMPLETED BY SAGE ENVIROTECH DRILLING BETWEEN JANUARY 10TH AND JANUARY 13TH, 2022.

NOTE:

PLAN DEVELOPED FROM "OVERALL SITE PLAN" DEVELOPED BY KAESTLE BOOS ASSOCIATES, INC DATED 2/11/22.

GRAPHIC SCALE

30 15 7.5 0 30

Paul B. Aldinger & Associates, Inc.
Geotechnical Engineering and Hydrogeology
860A Waterman Avenue, Suite 9
East Providence, RI 02914
Phone: (401) 435-5570 Fax: (401) 435-5569

ACHIEVEMENT FIRST ILUMINAR SCHOOL ADDITION

85 Garfield Ave, Cranston, Rhode Island

SUBSURFACE EXPLORATION PLAN

PBA JOB NO.: 21020	DRAWN BY: JC
DATE: FEBRUARY 2022	DESIGNED BY:
SCALE: 1" = 30'	CHECKED BY: PBA

Figure No: 2

APPENDIX A

LIMITATIONS

APPENDIX A

LIMITATIONS

A. Explorations

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

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

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report; however, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tide and other factors occurring since the time measurements were made.

B. Review

1. In the event that any changes in the nature, design, or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report are modified or verified in writing by Paul B. Aldinger & Associates, Inc. It is recommended that this firm be provided the opportunity for a general review of final design and specifications, in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

C. Construction

1. It is recommended that this firm be retained to provide soil engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface

conditions differ from those anticipated prior to the start of construction.

D. Use of Report

1. This report has been prepared for the exclusive use of **Achievement First** for specific application to the proposed **Achievement First School located at 85 Garfield Avenue in Cranston, Rhode Island** in accordance with generally accepted soil and foundation engineering practices. No warranty, express or implied, is made.

2. This report may contain comparative cost estimates for the purpose of evaluating alternative construction schemes. These estimates may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. Since Paul B. Aldinger & Associates, Inc. has no control over labor and materials cost and design, the estimates of construction costs have been made on the basis of experience. We cannot guarantee the accuracy of cost estimates as compared to contractors' bids for construction costs.

APPENDIX B

TEST BORING LOGS

BORING CONTRACTOR: Sage Environmental

Pawtucket, RI

LOG PREPARED BY: PBA

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Achievement First School
TOWN, STATE: Cranston, RI 02920
PBA NO.: 21020 OFFICE:

SHEET 1 OF 3
LOCATION:
HOLE NO.: PBA-1
BORING TYPE: Dual Tube
LINE & STA.:
OFFSET:

GROUND WATER OBSERVATIONS
AT 25.3 FT AFTER 0 HRS
AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	N/A	Steel	S/S	---
SIZE, I.D.		3"	1 3/8"	---
HAMMER WT.		140	140#	BIT
HAMMER FALL		30	30"	

SURFACE ELEV.:
DATE STARTED: 01/12/2022
DATE FINISHED: 01/13/2022
FOREMAN: T. Perry
INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0 - 2	SS	9	6	8	11		Brown SILT, some f-c Gravel, little f-c Sand, moist, stiff	1	24	13
5		5 - 7	SS	14	7	4	4		Redish Grey f-c Sand, and SILT, some f-c Gravel, moist, stiff, contains urban fill (asphalt brick, and concrete)	2	24	11
10		10 - 12	SS	4	3	3	3		Redish Grey f-c Sand, and SILT, some f-c Gravel, moist, medium stiff, contains urban fill (asphalt, brick, and concrete)	3	24	8
15		15 - 17	SS	7	3	2	2	17	Light Brown f-c SAND, some f-c Gravel, trace Silt, moist, loose, contains some urban fill	4	24	6
20		20 - 22	SS	6	6	4	5	25	Light Brown f-c SAND and f-c GRAVEL, trace Silt, moist, medium dense	5	24	12
25		25 - 27	SS	4	4	6	9		Brown fine SAND, little Silt, wet, medium dense	6	24	18
30		30 - 32	SS	5	5	5	5		Brown fine SAND, and SILT, some Clay, trace fine Grave saturated, stiff, slight plasticity	7	24	13
35		35 -37	SS	6	6	6	7		Grey fine SAND, and SILT, some Clay, saturated, stiff, slight plasticity	8	24	15
								35.9	CLAY, some Silt, little fine Sand, saturated, stiff, stiff, high plasticity			
40		40 - 42	SS	6	7	6	7		See Next Page	9	24	11

GROUND SURFACE TO ____ FT., USED ____ " CASING:
THEN ____

TYPE OF SAMPLE
D=DRY W=WASHED C=CORED SS= Split Spoon
TP=TEST PIT A=AUGER V=VANE TEST
UP=UNDISTURBED, PISTON
US=UNDISTURBED, SHELBY

PROPORTIONS USED:
TRACE=0-10%
LITTLE=10-20%
SOME=20-35%
AND=35-50%

COHESIONLESS DENSITY:
0-4 VERY LOOSE
5-9 LOOSE
10-29 MED. DENSE
30-49 DENSE
50 + VERY DENSE

FOOTAGE IN EARTH: 87
FOOTAGE IN ROCK: 0
WELL FOOTAGE: 0
NO. OF SAMPLES: 18
HOLE NO.: PBA-1
TYPE: Dual Tube

BORING CONTRACTOR: Sage Environmental Pawtucket, RI LOG PREPARED BY: PBA	**PAUL B. ALDINGER & ASSOCIATES, INC.** 860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI **BORING LOG** PROJECT NAME: Achievement First School TOWN, STATE: Cranston, RI 02920 PBA NO.: 21020 OFFICE:	SHEET 2 OF 3 LOCATION: HOLE NO.: PBA-1 BORING TYPE: Dual Tube LINE & STA.: OFFSET:

GROUND WATER OBSERVATIONS
AT 25.3 FT AFTER 0 HRS
AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	N/A	Steel	S/S	---
SIZE, I.D.		3"	1 3/8"	---
HAMMER WT.		140	140#	BIT
HAMMER FALL		30	30"	

SURFACE ELEV.:
DATE STARTED: 01/12/2022
DATE FINISHED: 01/13/2022
FOREMAN: T. Perry
INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
40		40 - 42	SS	6	7	6	7	42	Brownish Grey fine SAND, and SILT, some Clay, saturated, stiff, slight plasticity	9	24	11
45		45 - 47	SS	4	3	2	3		Grey f-c SAND, and f-c GRAVEL, trace Silt, wet, loose	10	24	7
50		50 - 52	SS	1	2	3	3		Grey f-c SAND, trace Silt, trace coarse Gravel, saturated, loose	11	24	12
55		55 - 57	SS	6	8	12	16		Grey f-c SAND, and f-c GRAVEL, trace Silt, saturated, medium dense	12	24	10
60		60 - 62	SS	18	15	15	18		Grey f-c SAND, and f-c GRAVEL, trace Silt, saturated, dense	13	24	12
65		65 - 67	SS	30	20	17	17	70	Brownish Orange f-c Gravel, and f-c SAND, trace Silt, saturated, dense	14	24	11
70		70 - 72	SS	8	13	15	17		Brown fine SAND, trace Silt, wet, medium dense, well-graded	15	24	12
75		75 - 77	SS	7	9	11	15		Brown fine SAND, trace Silt, moist, medium dense, well-graded zero recovery - sample taken from dual tube liner	16	24	0
80		80 - 82	SS	11	11	14	17		See Next Page	17	24	6.5

GROUND SURFACE TO ___ FT., USED ___ " CASING:
THEN ___

TYPE OF SAMPLE
D=DRY W=WASHED C=CORED SS= Split Spoon
TP=TEST PIT A=AUGER V=VANE TEST
UP=UNDISTURBED, PISTON
US=UNDISTURBED, SHELBY

PROPORTIONS USED:
TRACE=0-10%
LITTLE=10-20%
SOME=20-35%
AND=35-50%

COHESIONLESS DENSITY:
0-4 VERY LOOSE
5-9 LOOSE
10-29 MED. DENSE
30-49 DENSE
50 + VERY DENSE

FOOTAGE IN EARTH: 87
FOOTAGE IN ROCK: 0
WELL FOOTAGE: 0
NO. OF SAMPLES: 18
HOLE NO.: PBA-1
TYPE: Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 3 OF 3
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-1
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS

AT 25.3 FT AFTER 0 HRS

AT ___ FT AFTER ___ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	N/A	Steel	S/S	---
SIZE, I.D.		3"	1 3/8"	---
HAMMER WT.		140	140#	BIT
HAMMER FALL		30	30"	

SURFACE ELEV.:
DATE STARTED: 01/12/2022
DATE FINISHED: 01/13/2022
FOREMAN: T. Perry
INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
80		80 - 82	SS	11	11	14	17	80	Brown f-c SAND, and f-c GRAVEL, trace Silt, moist, medium dense	17	24	6.5
85		85 - 87	SS	11	16	18	17	85	Brown f-c SAND, some f-c Gravel, trace Silt, moist, dense	18	24	9
									Bottom of Boring 87'			
90												
95												
100												
105												
110												
115												
120												

GROUND SURFACE TO ___ FT., USED ___ " CASING:
THEN ___

TYPE OF SAMPLE
D=DRY W=WASHED C=CORED SS= Split Spoon
TP=TEST PIT A=AUGER V=VANE TEST
UP=UNDISTURBED, PISTON
US=UNDISTURBED, SHELBY

PROPORTIONS USED:
TRACE=0-10%
LITTLE=10-20%
SOME=20-35%
AND=35-50%

COHESIONLESS DENSITY:
0-4 VERY LOOSE
5-9 LOOSE
10-29 MED. DENSE
30-49 DENSE
50 + VERY DENSE

FOOTAGE IN EARTH:	87
FOOTAGE IN ROCK:	0
WELL FOOTAGE:	0
NO. OF SAMPLES:	18
HOLE NO.:	PBA-1
TYPE:	Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 1 OF 2
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-2
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS		AUGER	CASING	SAMPLER	CORE BAR.	
AT 25.2 FT AFTER 0 HRS	TYPE	N/A	Steel	S/S	---	SURFACE ELEV.:
AT FT AFTER HRS	SIZE, I.D.		3"	1 3/8"	---	DATE STARTED: 01/10/2022
	HAMMER WT.		140	140#	BIT	DATE FINISHED: 01/11/2022
	HAMMER FALL		30	30"		FOREMAN: T. Perry
						INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0 - 2	SS	4	4	4	10		Brown SILT, little Gravel, moist, medium stiff	1	24	14
								0.65	Brown f-c SAND, and f-c GRAVEL, trace Silt, moist, loose			
5		5 - 7	SS	18	11	8	5		Redish Grey f-c Sand, and f-c GRAVEL, little Silt, moist, medium dense, contains urban fill (asphalt, brick, and concrete)	2	24	15
10		10 - 12	SS	3	5	4	3		Redish Grey f-c GRAVEL, and f-c SAND, little Silt, moist, loose, contains urban fill (asphalt, brick, and concrete)	3	24	7
15		15 - 17	SS	25	10	4	2		Redish Grey f-c GRAVEL, and f-c SAND, little Silt, moist, medium dense, contains (asphalt, brick, and concrete)	4	24	9
								15.8	Light Brown f-c SAND, trace Silt, moist, medium dense			
20		20 - 22	SS	2	2	4	7		Light Brown to Brown f-c SAND, some f-c Gravel, trace Silt, moist tô saturated, loose	5	24	11
25		25 - 27	SS	7	3	3	5		Same as above	6	24	13
30		30 - 32	SS	8	8	11	12		Brown/Grey f-c SAND, and f-c GRAVEL, little Silt, moist, medium dense	7	24	13
35		35 -37	SS	5	5	6	4		Brown f-c SAND, trace Silt, moist, medium dense	8	24	11.5
								35.8	Brown fine SAND and f-c GRAVEL, some Silt, saturated, medium dense			
40		40 - 42	SS	4	4	3	2		See Next Page	9	24	13

GROUND SURFACE TO FT., USED " CASING:
THEN

TYPE OF SAMPLE	PROPORTIONS USED:	COHESIONLESS DENSITY:	
D=DRY W=WASHED C=CORED SS= Split Spoon	TRACE=0-10%	0-4 VERY LOOSE	FOOTAGE IN EARTH: 62
TP=TEST PIT A=AUGER V=VANE TEST	LITTLE=10-20%	5-9 LOOSE	FOOTAGE IN ROCK: 0
UP=UNDISTURBED, PISTON	SOME=20-35%	10-29 MED. DENSE	WELL FOOTAGE: 0
US=UNDISTURBED, SHELBY	AND=35-50%	30-49 DENSE	NO. OF SAMPLES: 13
		50 + VERY DENSE	HOLE NO.: PBA-2
			TYPE: Dual Tube

BORING CONTRACTOR: Sage Environmental

Pawtucket, RI

LOG PREPARED BY: PBA

PAUL B. ALDINGER & ASSOCIATES, INC.

860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI

BORING LOG

PROJECT NAME: Achievement First School

TOWN, STATE: Cranston, RI 02920

PBA NO.: 21020 OFFICE:

SHEET 2 OF 2

LOCATION:

HOLE NO.: PBA-2

BORING TYPE: Dual Tube

LINE & STA.:

OFFSET:

GROUND WATER OBSERVATIONS

AT 25.2 FT AFTER 0 HRS

AT ____ FT AFTER ____ HRS

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	N/A	Steel	S/S	---
SIZE, I.D.		3"	1 3/8"	---
HAMMER WT.		140	140#	BIT
HAMMER FALL		30	30"	

SURFACE ELEV.:

DATE STARTED: 01/10/2022

DATE FINISHED: 01/11/2022

FOREMAN: T. Perry

INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
40		40 - 42	SS	4	4	3	2		Brown fine SAND, and f-c GRAVEL, some Silt, saturated, loose	9	24	13
								40.4	Grey f-c SAND, little Silt, saturated, loose			
45		45 -47	SS	3	2	4	6		Same as Above	10	24	14
50		50 - 52	SS	6	4	4	5		Grey f-c SAND, little Gravel, trace Silt, saturated, loose	11	24	13
55		55 - 57	SS	3	5	5	6		Grey f-c SAND and f-c GRAVEL, little Silt, moist, medium dense	12	24	5
60		60 - 62	SS	5	6	7	9	62	Grey f-c SAND, little f-c GRAVEL, little Silt, moist, medium dense	13	24	9
									Bottom of Boring 62'			
65												
70												
75												
80												

GROUND SURFACE TO ____ FT., USED ____ " CASING:

THEN

TYPE OF SAMPLE

D=DRY W=WASHED C=CORED SS= Split Spoon

TP=TEST PIT A=AUGER V=VANE TEST

UP=UNDISTURBED, PISTON

US=UNDISTURBED, SHELBY

PROPORTIONS USED:

TRACE=0-10%

LITTLE=10-20%

SOME=20-35%

AND=35-50%

COHESIONLESS DENSITY:

0-4 VERY LOOSE

5-9 LOOSE

10-29 MED. DENSE

30-49 DENSE

50 + VERY DENSE

FOOTAGE IN EARTH: 62

FOOTAGE IN ROCK: 0

WELL FOOTAGE: 0

NO. OF SAMPLES: 13

HOLE NO.: PBA-2

TYPE: Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 1 OF 2
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-4
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS		AUGER	CASING	SAMPLER	CORE BAR.	
AT 23 FT AFTER 0 HRS	TYPE	N/A	Steel	S/S	---	SURFACE ELEV.:
AT FT AFTER HRS	SIZE, I.D.		3"	1 3/8"	---	DATE STARTED: 01/10/2022
	HAMMER WT.		140	140#	BIT	DATE FINISHED: 01/10/2022
	HAMMER FALL		30	30"		FOREMAN: T. Perry
						INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0 - 2	SS	19	15	12	12		Brown f-c GRAVEL, and f-c SAND, trace Silt, moist, medium dense	1	24	14
		2 - 4	SS	9	7	4	4		Brown f-c SAND, some f-c Gravel, trace Silt, moist, medium dense	2	24	14
5		4 - 6	SS	1	0	1	1		Dark Brown f-c GRAVEL, some f-c Sand, trace Silt, moist, very loose	3	24	9
		6 - 8	SS	4	3	5	7		Same As Above, loose	4	24	8
		8 - 10	SS	8	8	8	7		Grey f-c GRAVEL, and SILT, trace Sand, moist, stiff	5	24	13
10								8.25	Brown f-c SAND, some Gravel, trace Silt, moist, med. Dense			
		10 - 12	SS	7	5	3	1		Grey f-c SAND, little f-c Gravel, trace Silt, moist, loose	6	24	15
15		15 - 17	SS	6	4	4	5		Brown f-c SAND, and f-c GRAVEL, trace Silt, moist, loose, sub-rounded	7	24	13
20		20 - 22	SS	7	4	4	5		Same As Above	8	24	6
25		25 - 27	SS	10	8	13	15		Same As Above, wet, medium dense	9	24	4
30		30 - 32	SS	2	3	4	6		Brown f-c SAND, trace Silt, wet, loose	10	24	6.5
35		35 -37	SS	4	6	6	9		Same As Above, medium dense	11	24	7
40		40 - 42	SS	4	8	6	8		See Next Page	12	24	10

GROUND SURFACE TO FT., USED " CASING:
THEN

TYPE OF SAMPLE	PROPORTIONS USED:	COHESIONLESS DENSITY:	
D=DRY W=WASHED C=CORED SS= Split Spoon	TRACE=0-10%	0-4 VERY LOOSE	FOOTAGE IN EARTH: 52
TP=TEST PIT A=AUGER V=VANE TEST	LITTLE=10-20%	5-9 LOOSE	FOOTAGE IN ROCK: 0
UP=UNDISTURBED, PISTON	SOME=20-35%	10-29 MED. DENSE	WELL FOOTAGE: 0
US=UNDISTURBED, SHELBY	AND=35-50%	30-49 DENSE	NO. OF SAMPLES: 14
		50 + VERY DENSE	HOLE NO.: PBA-4
			TYPE: Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 2 OF 2
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-4
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS		AUGER	CASING	SAMPLER	CORE BAR.	
AT 23 FT AFTER 0 HRS	TYPE	N/A	Steel	S/S	---	SURFACE ELEV.:
AT FT AFTER HRS	SIZE, I.D.		3"	1 3/8"	---	DATE STARTED: 01/10/2022
	HAMMER WT.		140	140#	BIT	DATE FINISHED: 01/10/2022
	HAMMER FALL		30	30"		FOREMAN: T. Perry
						INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
40		40 - 42	SS	4	8	6	8		Greyish Light Brown f-c SAND, little Gravel, trace Silt, wet, medium dense	12	24	10
								40.5	Grey fine SAND, and SILT, wet, stiff			
45		45 -47	SS	4	3	5	6		Grey f-c SAND, trace Silt, trace fine Gravel, wet, loose	13	24	12
50		50 - 52	SS	4	4	5	6		Same as Above	14	24	13
								52				
									Bottom of Boring 52'			
55												
60												
65												
70												
75												
80												

GROUND SURFACE TO ____ FT., USED ____ " CASING:

THEN ____

TYPE OF SAMPLE	PROPORTIONS USED:	COHESIONLESS DENSITY:	
D=DRY W=WASHED C=CORED SS= Split Spoon	TRACE=0-10%	0-4 VERY LOOSE	FOOTAGE IN EARTH: 52
TP=TEST PIT A=AUGER V=VANE TEST	LITTLE=10-20%	5-9 LOOSE	FOOTAGE IN ROCK: 0
UP=UNDISTURBED, PISTON	SOME=20-35%	10-29 MED. DENSE	WELL FOOTAGE: 0
US=UNDISTURBED, SHELBY	AND=35-50%	30-49 DENSE	NO. OF SAMPLES: 14
		50 + VERY DENSE	HOLE NO.: PBA-4
			TYPE: Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 1 OF 2
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-6
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS		AUGER	CASING	SAMPLER	CORE BAR.	
AT 21.6 FT AFTER 0 HRS	TYPE	N/A	Steel	S/S	---	SURFACE ELEV.:
AT __ FT AFTER __ HRS	SIZE, I.D.		3"	1 3/8"	---	DATE STARTED: 01/11/2022
	HAMMER WT.		140	140#	BIT	DATE FINISHED: 01/12/2022
	HAMMER FALL		30	30"		FOREMAN: T. Perry
						INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
		0 - 2	SS	2	3	4	8		Brown SILT, some f-c Gravel, moist, medium stiff,	1	24	13
								0.5	Brown f-c SAND and SILT, moist, medium stiff, contains urban fill (asphalt, brick, and concrete)			
5		5 - 7	SS	6	5	3	4		Redish Grey f-c Sand, and SILT, moist, medium stiff, contains urban fill (asphalt, brick, and concrete)	2	24	12
10		10 - 12	SS	2	3	6	7		Same As Above	3	24	12
								12'				
15		15 - 17	SS	4	3	5	6		Light Brown f-c SAND, some Gravel, trace Silt, moist, loose	4	24	2
20		20 - 22	SS	9	8	9	14		Light Brown f-c SAND, and f-c GRAVEL, trace Silt,, moist, medium dense	5	24	14
25		25 - 27	SS	7	3	3	5		Light Brown f-c SAND, little Gravel, trace Silt, wet, loose	6	24	12
30		30 - 32	SS	5	4	5	7		Same As Above, saturated	7	24	10
35		35 -37	SS	7	6	7	7		Brown f-c GRAVEL, and f-c SAND, trace Silt, wet, medium dense	8	24	8
40		40 - 42	SS	6	6	9	12		See Next Page	9	24	10

GROUND SURFACE TO ___ FT., USED ___ " CASING:
THEN

TYPE OF SAMPLE	PROPORTIONS USED:	COHESIONLESS DENSITY:	
D=DRY W=WASHED C=CORED SS= Split Spoon	TRACE=0-10%	0-4 VERY LOOSE	FOOTAGE IN EARTH: 52
TP=TEST PIT A=AUGER V=VANE TEST	LITTLE=10-20%	5-9 LOOSE	FOOTAGE IN ROCK: 0
UP=UNDISTURBED, PISTON	SOME=20-35%	10-29 MED. DENSE	WELL FOOTAGE: 0
US=UNDISTURBED, SHELBY	AND=35-50%	30-49 DENSE	NO. OF SAMPLES: 11
		50 + VERY DENSE	HOLE NO.: PBA-6 TYPE: Dual Tube

BORING CONTRACTOR:	PAUL B. ALDINGER & ASSOCIATES, INC.	SHEET 2 OF 2
Sage Environmental	860A WATERMAN AVENUE, SUITE 9 EAST PROVIDENCE, RI	LOCATION:
	BORING LOG	HOLE NO.: PBA-6
Pawtucket, RI	PROJECT NAME: Achievement First School	BORING TYPE: Dual Tube
LOG PREPARED BY:	TOWN, STATE Cranston, RI 02920	LINE & STA.:
PBA	PBA NO.: 21020 OFFICE:	OFFSET:

GROUND WATER OBSERVATIONS		AUGER	CASING	SAMPLER	CORE BAR.	
AT 21.6 FT AFTER 0 HRS	TYPE	N/A	Steel	S/S	---	SURFACE ELEV.:
AT FT AFTER HRS	SIZE, I.D.		3"	1 3/8"	---	DATE STARTED: 01/11/2022
	HAMMER WT.		140	140#	BIT	DATE FINISHED: 01/12/2022
	HAMMER FALL		30	30"		FOREMAN: T. Perry
						INSPECTOR: A. Davis

LOCATION OF BORING:

DEPTH BELOW SURFACE	CASING BLOWS/ FOOT	SAMPLE DEPTH FROM - TO	TYPE OF SAMPLE	BLOWS PER 6" ON SAMPLER FROM-TO 0-6	6-12	12-18	18-24	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL & ROCK INCL. COLOR, LOSS OF WASH WATER, JOINTS IN ROCK, ETC.	SAMPLE NO.	PEN.	REC.
40		40 - 42	SS	6	6	9	12		Brown f-c SAND, some f-c Gravel, trace Silt, wet,	9	24	10
								42'	medium dense			
45		45 -47	SS	5	6	9	9		Grey fine SAND, trace Silt, wet, medium dense	10	24	3
									well graded			
50		50 - 52	SS	5	7	9	12		Same As Above, saturated	11	24	11.5
									Bottom of Boring 52'			
55												
60												
65												
70												
75												
80												

GROUND SURFACE TO FT., USED " CASING:
THEN

TYPE OF SAMPLE	PROPORTIONS USED:	COHESIONLESS DENSITY:	
D=DRY W=WASHED C=CORED SS= Split Spoon	TRACE=0-10%	0-4 VERY LOOSE	FOOTAGE IN EARTH: 52
TP=TEST PIT A=AUGER V=VANE TEST	LITTLE=10-20%	5-9 LOOSE	FOOTAGE IN ROCK: 0
UP=UNDISTURBED, PISTON	SOME=20-35%	10-29 MED. DENSE	WELL FOOTAGE: 0
US=UNDISTURBED, SHELBY	AND=35-50%	30-49 DENSE	NO. OF SAMPLES: 11
		50 + VERY DENSE	HOLE NO.: PBA-6
			TYPE: Dual Tube

APPENDIX C

LABORATORY TESTING RESULTS

THIELSCH ENGINEERING

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
thielsch.com
Let's Build a Solid Foundation

Client Information:
Paul B. Aldinger and Associates
East Providence, RI
PM: Mary Caouette
Assigned By: Dave Nacci
Collected By: Client

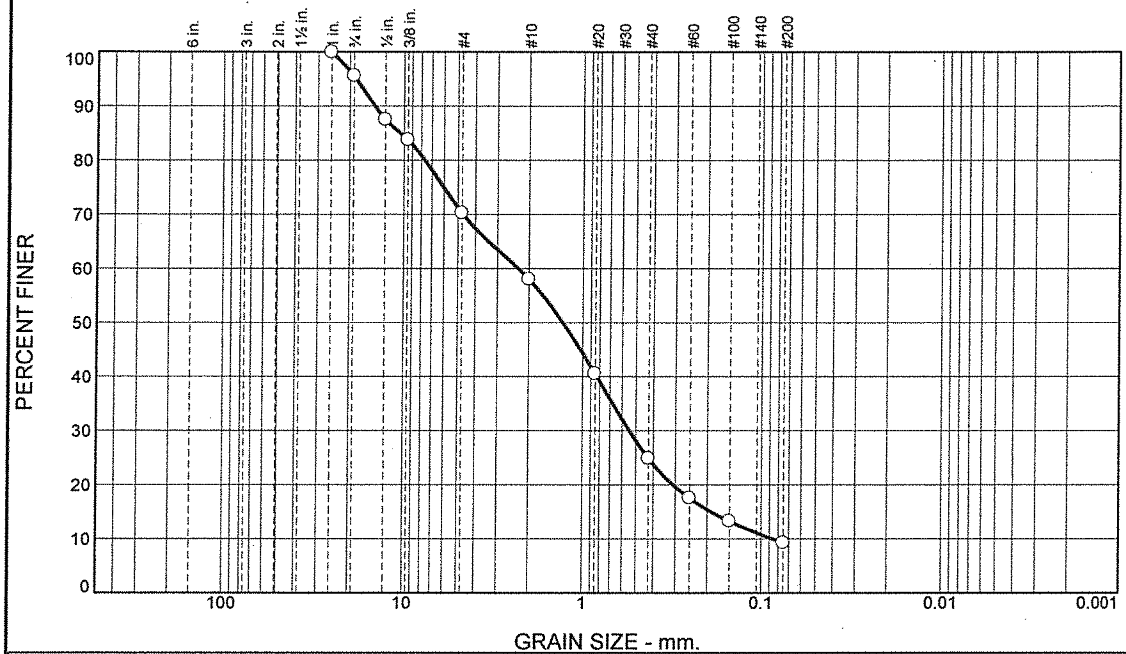
Project Information:
Achievement First School
Cranston, RI
PBA Project Number: 21020
Summary Page: 1 of 1
Report Date: 02.02.22

LABORATORY TESTING DATA SHEET, Report No.: 7422-A-154

Source	Sample No.	Depth (ft)	Laboratory No.	Identification Tests: As Received Moisture Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	G_s	Proctor / CBR / Permeability Tests: Dry unit wt. pcf	Test Moisture Content %	γ_d MAX (pcf) W_{opt} (%)	γ_d MAX (pcf) W_{opt} (%) (Corr.)	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	Laboratory Log and Soil Description
				D2216	D4318		D6913			D2974	D854			D1557						
SS	B1	45-47	22-S-242				29.7	61.1	9.2											Very Dark Gray f-c SAND, some f-c Gravel, trace Silt
SS	B1	50-52	22-S-243				13.2	74.0	12.8											Very Dark Gray f-c SAND, little f-c Gravel, little Silt
SS	B2	40-42	22-S-244				0.0	50.9	49.1											Dark Gray f-m SAND and SILT
SS	B2	45-47	22-S-245				0.0	58.7	41.3											Very Dark Gray f-m SAND and SILT
SS	B2	50-52	22-S-246				14.5	25.4	60.1											Dark Gray SILT & CLAY, some f-m Sand, little f-c Gravel
SS	B4	30-32	22-S-247				0.2	92.9	6.9											Olive f-m SAND, trace Silt, trace fine Gravel
SS	B4	45-47	22-S-248				0.0	56.5	43.5											Dark Gray f-m SAND and Clayey SILT
SS	B4	50-52	22-S-249				0.0	49.0	51.0											Dark Gray Clayey SILT and f-m SAND
SS	B6	25-27	22-S-250				3.6	91.4	5.0											Brown f-m SAND, trace Silt, trace fine Gravel
SS	B6	30-32	22-S-251				6.9	81.9	11.2											Olive Brown f-m SAND, little Silt, trace fine Gravel

Date Received: *01.25.22* Reviewed By: [signature] Date Reviewed: *02.03.22*

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	25.3	12.3	33.1	15.7	9.2	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	95.6		
0.5"	87.5		
0.375"	83.8		
#4	70.3		
#10	58.0		
#20	40.5		
#40	24.9		
#60	17.5		
#100	13.3		
#200	9.2		

* (no specification provided)

Material Description

Very Dark Gray f-c SAND, some f-c Gravel, trace Silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= **AASHTO (M 145)=** A-1-b

Coefficients

D_{90}= 14.5351 D_{85}= 10.4924 D_{60}= 2.2992
D_{50}= 1.2933 D_{30}= 0.5451 D_{15}= 0.1897
D_{10}= 0.0865 C_u= 26.58 C_c= 1.49

Remarks

Sample received with standing water.

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

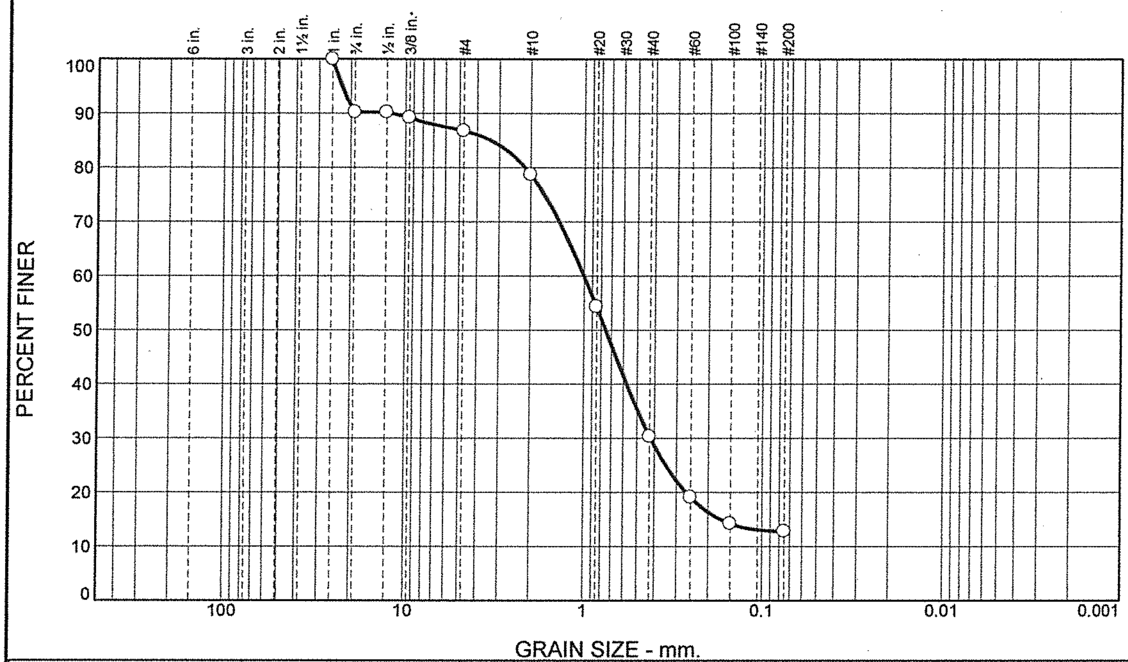
Source of Sample: Split Spoon **Depth:** 45-47' **Date Sampled:**
Sample Number: B1 S10

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-242

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.8	3.4	8.1	48.4	17.5	12.8	

Test Results (ASTM D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	90.2		
0.5"	90.2		
0.375"	89.3		
#4	86.8		
#10	78.7		
#20	54.3		
#40	30.3		
#60	19.1		
#100	14.2		
#200	12.8		

* (no specification provided)

Material Description

Very Dark Gray f-c SAND, little f-c Gravel, little Silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 11.8377 D_{85}= 3.3350 D_{60}= 1.0022
D_{50}= 0.7554 D_{30}= 0.4200 D_{15}= 0.1700
D_{10}= C_u= C_c=

Remarks

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

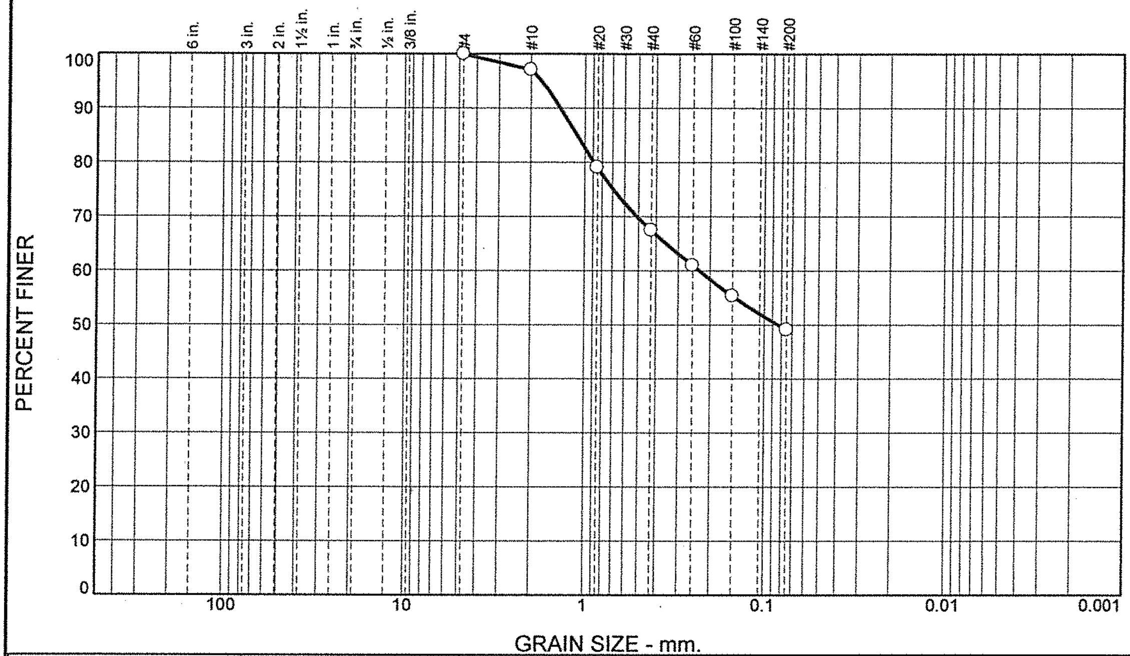
Source of Sample: Split Spoon **Depth:** 50-52' **Date Sampled:**
Sample Number: B1 S11

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-243

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.9	29.6	18.4	49.1	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.1		
#20	79.0		
#40	67.5		
#60	61.0		
#100	55.3		
#200	49.1		

* (no specification provided)

Material Description

Dark Gray f-m SAND and SILT

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 1.3684 D_{85}= 1.1039 D_{60}= 0.2295
D_{50}= 0.0837 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample received with standing water. Sample visually classified as non-plastic.

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

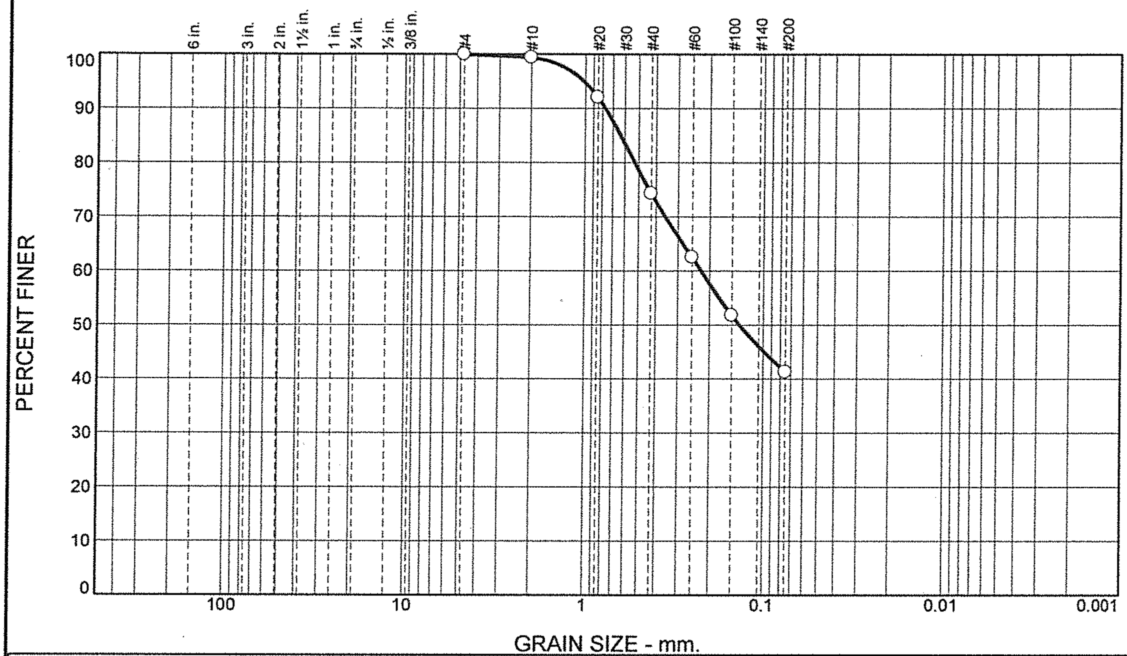
Source of Sample: Split Spoon **Depth:** 40-42' **Date Sampled:**
Sample Number: B2 S9

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-244

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	25.1	33.0	41.3	

Test Results (ASTM D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.4		
#20	92.0		
#40	74.3		
#60	62.5		
#100	51.8		
#200	41.3		

* (no specification provided)

Material Description

Very Dark Gray f-m SAND and SILT

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 0.7719 D_{85}= 0.6317 D_{60}= 0.2228
D_{50}= 0.1359 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample received with standing water. Sample visually classified as non-plastic.

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

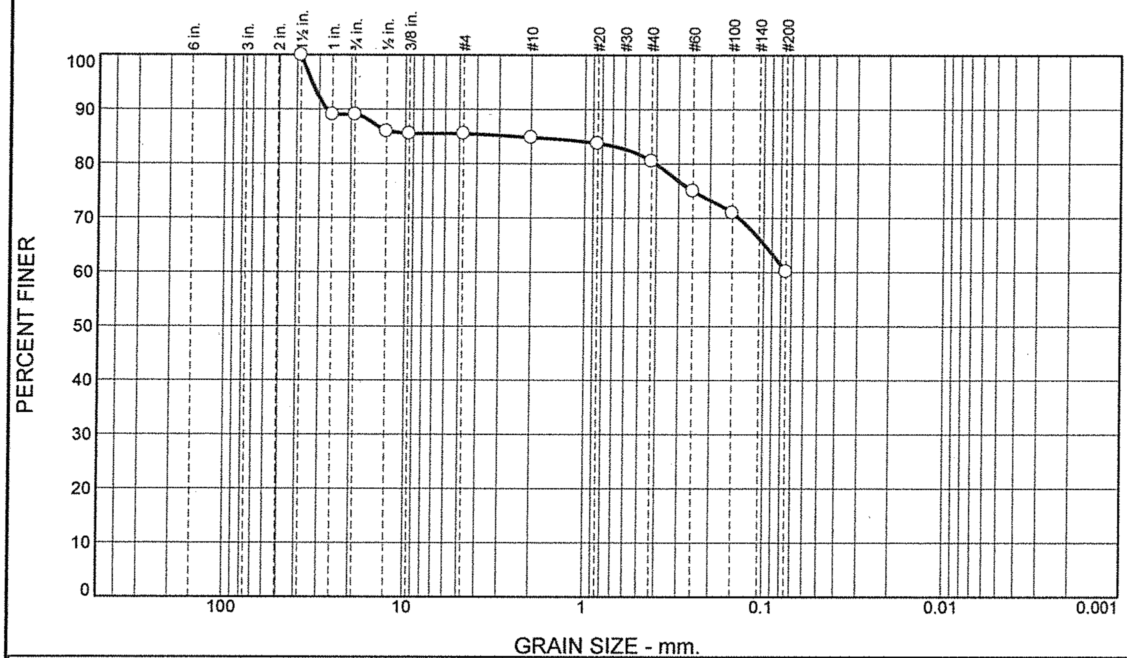
Source of Sample: Split Spoon **Depth:** 45-47' **Date Sampled:**
Sample Number: B2 S10

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-245

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.9	3.6	0.6	4.4	20.4	60.1	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	89.1		
0.75"	89.1		
0.5"	86.0		
0.375"	85.6		
#4	85.5		
#10	84.9		
#20	83.8		
#40	80.5		
#60	75.0		
#100	70.9		
#200	60.1		

* (no specification provided)

Material Description

Dark Gray SILT & CLAY, some f-m Sand, little f-c Gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 27.2446 D_{85}= 2.3596 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample received with standing water. Sample visually classified as plastic. Sample rolled to 1/8".

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

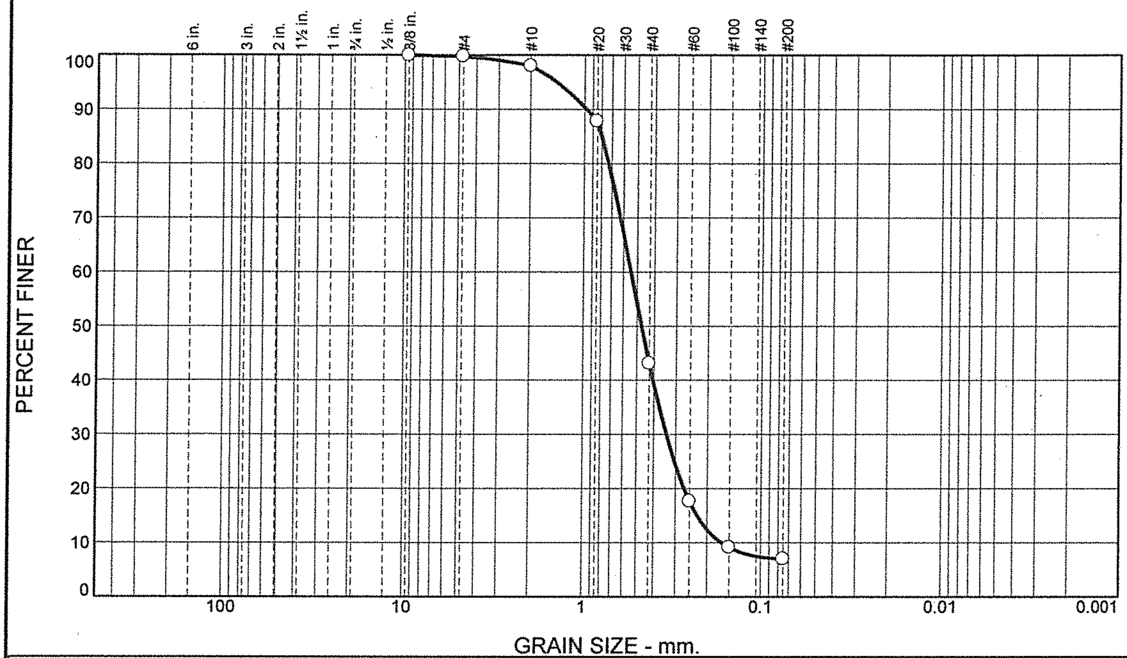
Source of Sample: Split Spoon **Depth:** 50-52' **Date Sampled:**
Sample Number: B2 S11

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-246

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	1.8	54.9	36.2	6.9	

Test Results (ASTM D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.375"	100.0		
#4	99.8		
#10	98.0		
#20	87.9		
#40	43.1		
#60	17.6		
#100	9.1		
#200	6.9		

* (no specification provided)

Material Description

Olive f-m SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= AASHTO (M 145)= A-1-b

Coefficients

D_{90}= 0.9706 D_{85}= 0.7998 D_{60}= 0.5423
D_{50}= 0.4710 D_{30}= 0.3389 D_{15}= 0.2267
D_{10}= 0.1657 C_u= 3.27 C_c= 1.28

Remarks

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

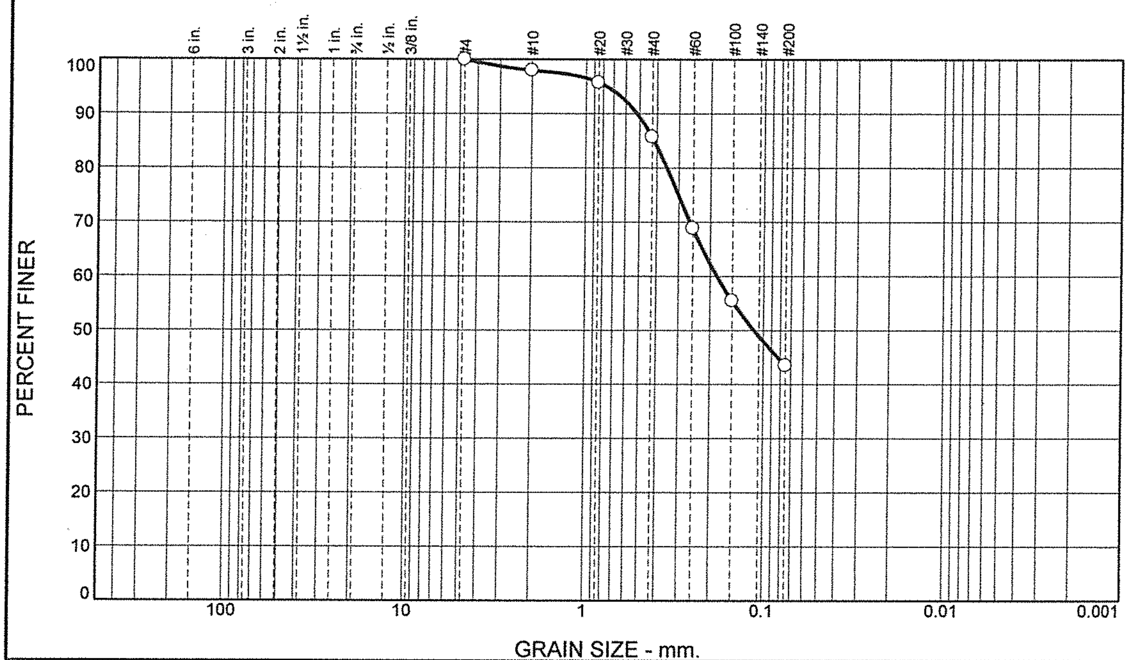
Source of Sample: Split Spoon **Depth:** 30-32' **Date Sampled:**
Sample Number: B4 S10

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-247

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.0	12.3	42.2	43.5	

Test Results (ASTM D6913 & ASTM D 1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	98.0		
#20	95.7		
#40	85.7		
#60	68.8		
#100	55.4		
#200	43.5		

* (no specification provided)

Material Description

Dark Gray f-m SAND and Clayey SILT

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 0.5165 D_{85}= 0.4145 D_{60}= 0.1828
D_{50}= 0.1129 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

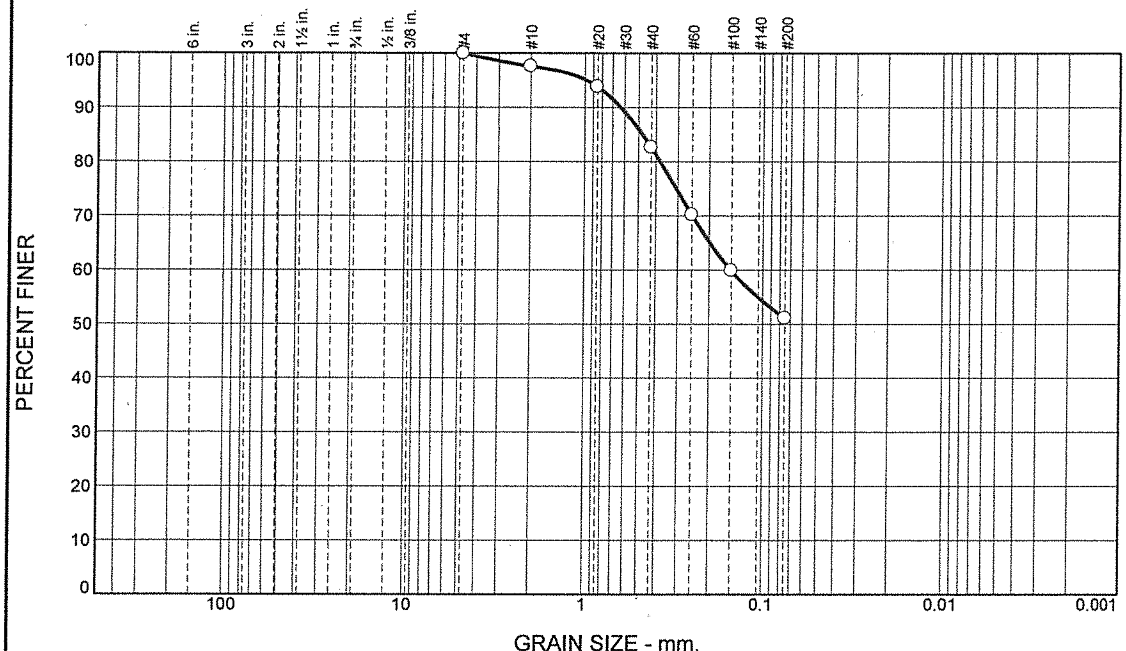
Source of Sample: Split Spoon **Depth:** 45-47' **Date Sampled:**
Sample Number: B4 S13

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-248

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	2.4	14.9	31.7	51.0	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	97.6		
#20	93.8		
#40	82.7		
#60	70.2		
#100	59.9		
#200	51.0		

* (no specification provided)

Material Description

Dark Gray Clayey SILT and f-m SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 0.6287 D_{85}= 0.4750 D_{60}= 0.1512
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample visually classified as plastic. Sample rolled to 1/4".

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

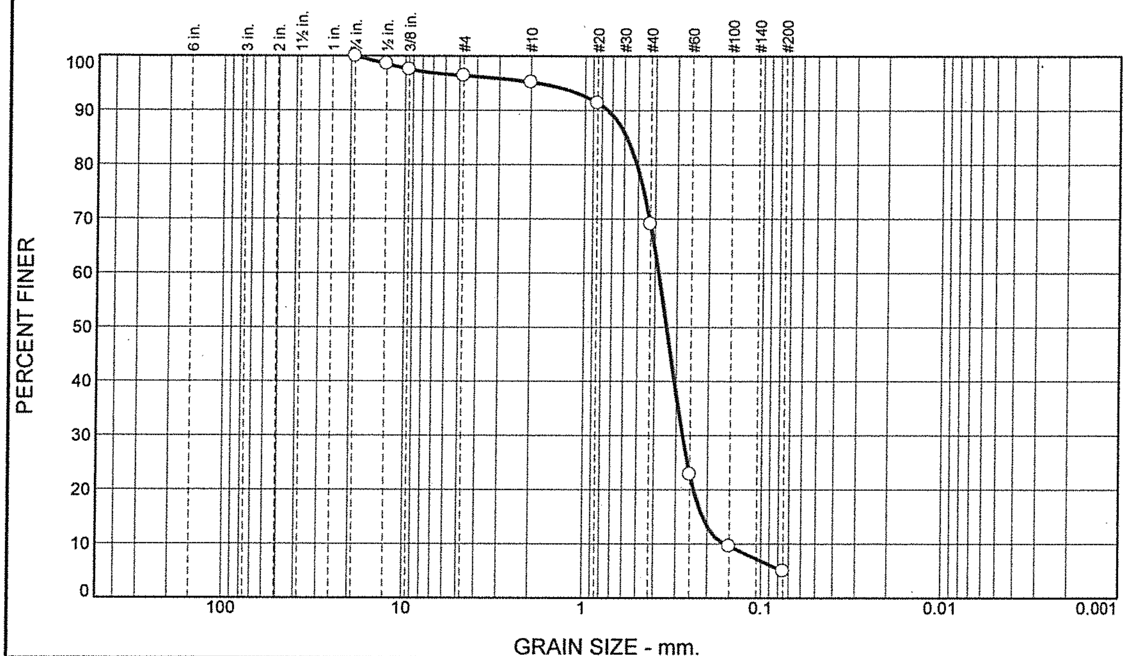
Source of Sample: Split Spoon **Depth:** 50-52' **Date Sampled:**
Sample Number: B4 S14

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-249

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.6	1.2	26.1	64.1	5.0	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	98.5		
0.375"	97.6		
#4	96.4		
#10	95.2		
#20	91.4		
#40	69.1		
#60	22.8		
#100	9.6		
#200	5.0		

* (no specification provided)

Material Description

Brown f-m SAND, trace Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.7417 D_{85}= 0.5805 D_{60}= 0.3810
D_{50}= 0.3425 D_{30}= 0.2756 D_{15}= 0.2120
D_{10}= 0.1592 C_u= 2.39 C_c= 1.25

Remarks

Sample received with standing water.

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

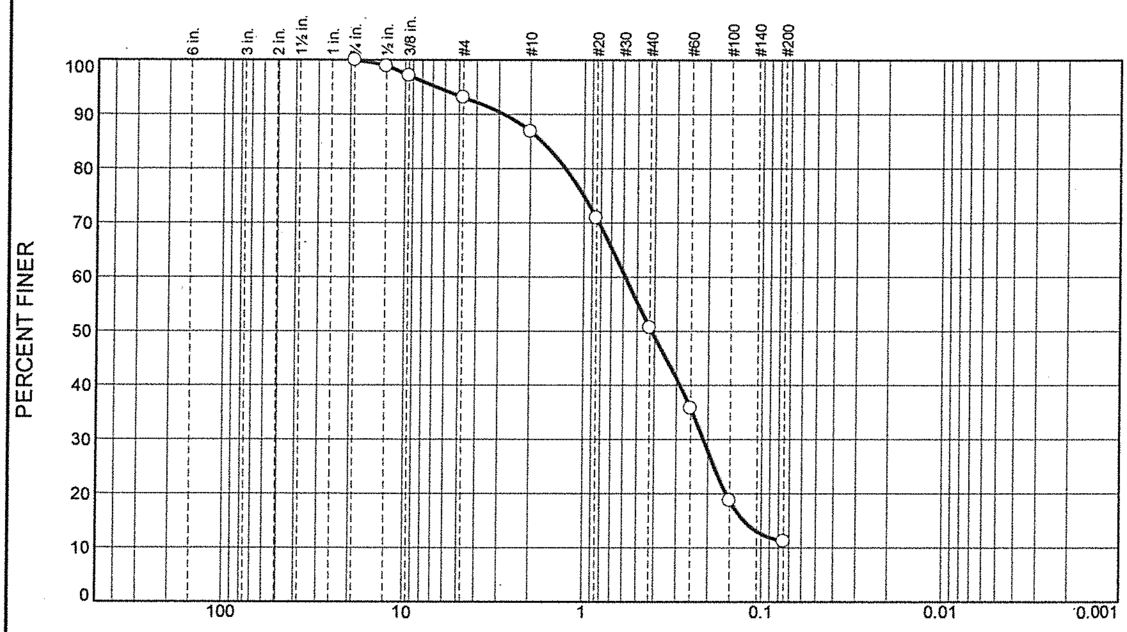
Source of Sample: Split Spoon **Depth:** 25-27' **Date Sampled:**
Sample Number: B6 S6

Thielsch Engineering Inc.

Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-250

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.9	6.3	36.2	39.4	11.2	

Test Results (ASTM D6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
0.75"	100.0		
0.5"	98.9		
0.375"	97.2		
#4	93.1		
#10	86.8		
#20	70.9		
#40	50.6		
#60	35.8		
#100	18.7		
#200	11.2		

* (no specification provided)

Material Description

Olive Brown f-m SAND, little Silt, trace fine Gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 2.8117 D_{85}= 1.7288 D_{60}= 0.5839
D_{50}= 0.4152 D_{30}= 0.2118 D_{15}= 0.1249
D_{10}= C_u= C_c=

Remarks

Date Received: 01.25.22 **Date Tested:** 02.01.22

Tested By: HS / SL

Checked By: Kris Roland

Title: Laboratory Supervisor

Source of Sample: Split Spoon **Depth:** 30-32' **Date Sampled:**
Sample Number: B6 S7

Thielsch Engineering Inc.
Cranston, RI

Client: Paul B. Aldinger and Associates
Project: Achievement First School
Cranston, RI
Project No: 21020 **Figure** 22-S-251

APPENDIX E – DRAFT SOIL AND EROSION AND SEDIMENT CONTROL PLAN (SESC) (BOUND SEPARATELY)

APPENDIX F –PLANS (BOUND SEPARATELY)