STORMWATER MANAGEMENT PLAN

for

SULLIVAN SCHOOL OF BUSINESS AND TECHNOLOGY

Prepared for
Carroll University
245 N. Barstow St.
Waukesha, WI 53186

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4/23/2026

April 24, 2026

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Project No.: 2022-0310.00

TABLE OF CONTENTS

TOC, Figures and Appendices hyperlinked

LIST OF FIGURES

LIST OF APPENDICES

I. Introduction

A. Site Overview

Carroll University is planning to remove and construct features including a building, parking lot, and utilities. This project is considered a redevelopment. The site is located in the SE ¼ of the SE ¼ of Section 03, T06 N, R19 E in the City of Waukesha, Waukesha County, Wisconsin. See **Figure 1 Location Map**. The site is located southeast of the intersection of Cutler St. and N. Barstow St. in the City of Waukesha.

The project site currently contains the existing Physical Therapy building and parking lot. Surface drainage of the site is generally collected by inlets that eventually discharge into a public storm sewer located in N. Barstow St. The WDNR Surface Water Data Viewer indicates that there are no wetlands likely present on the site. See **Figure 2 Surface Water Data Viewer.** There is no FEMA floodplain present on the site, see **Figure 3 FIRM**.

B. Project Overview

The Carroll University Sullivan School of Business and Technology project (herein after referred to as SOBT) includes the demolition of existing building and pavement, grading, construction of proposed building, pavement for surface parking, stormwater, potable water, and sanitary utilities, as well as construction of two bioretention basins and landscaping.

The project will disturb approximately 3.84 acres and will reduce the total impervious surface area by approximately 0.78 acres.

C. Jurisdictional Authority

The purpose of this report is to document design computations for storm water management facilities in accordance with the City of Waukesha Chapter 32 – Storm Water Management and Erosion Control (herein after referred to as Chapter 32) and the Wisconsin Department of Natural Resources code NR 151 (hereinafter referred to as NR 151). This site is classified as a redevelopment.

II. Hydrologic Data

Rainfall depths, rainfall distributions, and CN's contained within Chapter 32 was used in the analysis. Time of concentration was assumed to be 6 minutes, the minimum recommended value in TR-55, unless calculated to be greater.

JSD conducted a topographic survey of the project site. The site drainage areas were determined using the projects topography survey. Predevelopment and post-development conditions land cover types and drainage boundaries are shown on **Figures 4 and 5**, **Pre-Development** and **Post-Development Drainage Plans** respectively.

Soil types for the site were determined from the NRCS soil survey for Waukesha County. The soil survey shows the soils at the site to be Warsaw Loam (WeB); which is hydrological soil group B soil. A copy of the NRCS Soil Survey is provided in **Appendix A**.

III. Stormwater Management System Design

A. Peak Discharge and/or Volume Control

Requirement: Post-development peak storm water discharge rate shall not exceed the calculated pre-development discharge rates for the 1-year, 2-year, 10-year, and 100-year, 24-hour design storms.

NR 151.123(2) provides an exemption from their peak discharge performance standard for redevelopment sites; the City's Code exceeds the NR 151 standard.

Peak runoff rates and volumes were computed using NRCS's TR-55 and TR-20 methodologies, as implemented by HydroCAD. The proposed site reduces the peak flow rate in all modeled events. Two bio-filtration basins are provided to achieve the reduction requirements.

A schematic plan of the hydrological analysis and detailed hydrological computations for Pre-Development and Post-Development conditions are included in **Appendix B and C** respectively. Pre- and Post-Development Rate Reduction and BMP Hydraulic Summary data are provided below.

Table 1

Comparison of Peak Discharges

	Pre-Development (cfs)	Post-development (cfs)
1-year	10.35	5.20
2-year	11.79	6.07
10-year	17.41	11.28
100-year	29.97	25.43

Table 2 BMP Design Summary					
	Overflow Elevation	1-Year Storm	2-Year Storm	10-Year Storm	100-Year Storm
300P – North Basin	827.40				
Peak Outflow (cfs)	-	0.11	0.39	2.95	7.75
Max Water Surface Elevation (ft)	-	827.00	827.04	827.20	827.39
Maximum Storage Volume (AcFt)	0.159	0.110	0.113	0.128	0.147
200P – South Basin	828.00				
Peak Outflow (cfs)	-	1.20	1.38	2.17	4.01
Max Water Surface Elevation (ft)	-	827.40	827.41	827.47	827.58
Maximum Storage Volume (AcFt)	0.038	0.022	0.022	0.023	0.025

B. Total Suspended Solids

Requirement NR 151 and Chapter 32 states the TSS reduction standard for redevelopment shall be 40% of load from parking areas and roads.

Best Management Practices (BMP) have been designed to achieve the TSS reduction requirement. The analysis was completed using WinSLAMM and is based on parking areas and roads. The bio-filtration basin achieves the required TSS reduction. The detention pond was sized to over treat the detained areas of the site in order to compensate for areas of the site that will be untreated. The overall results of the WinSLAMM analysis of TSS Reduction are summarized below. Detailed computations are provided in **Appendix D**.

Table 3 TSS Removal		
Number of lbs (without controls)	Number of lbs (with controls)	% Reduction
698.1	331.0	52.59

C. Infiltration

Requirement: Sites of Medium Imperviousness (40% - 80% connected impervious surface shall be required to infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least seventy five percent (75%) of the pre-development infiltration volume, based on an average annual rainfall.

NR 151.124(3)(b)(3) provides an exemption from their Infiltration Performance Standard performance standard for redevelopment sites; the City's Code exceeds the NR 151 standard and as such is the controlling regulation.

Infiltration was analyzed using HydroCAD software. The results of the post-development HydroCAD analysis indicate approximately 24,000 cubic feet of runoff will infiltrate as a result of the open areas and bio-infiltration basin. This is approximately 200% of the pre-development infiltration volume which is in accordance with Chapter 32's infiltration requirements. Refer to **Appendix D** for details of the infiltration analysis.

Table 4
Infiltration

Pre-development Stay On (inches)	Required Stay On (inches)	Provided Stay On (inches)
0.71	0.53	1.05

The Geotechnical Exploration and Report, prepared by Giles Engineering Associates, Inc. and dated September 14, 2023 indicates soils within the area of infiltration basin 200P to be generally 8 feet of gravelly fine to medium sand. The geotechnical report indicates soils within the area of infiltration basin 300P to be generally 1.5 feet of gravelly fine to medium sand, followed by 2 feet of fine to medium sand, followed by 3 feet of gravelly fine to medium sand. Groundwater was not encountered within the borings performed near the proposed infiltration basin. Refer to **Appendix A** for a copy of the Geotechnical Exploration and Report.

D. Storm Sewer / Swales / Overland Flow Paths

The storm sewer system was designed to convey the 10-yr event. The project will connect a 24" HDPE storm sewer to the existing public 12" VCP storm sewer. Because the existing storm sewer is undersized, the proposed private storm sewer was sized to not surcharge in the 10-year storm event with a starting hydraulic grade line the crown of the 24" connection to existing. Full build-out of the green space north of Van Male was assumed when assigning runoff coefficients for this analysis. Supporting computations are included in **Appendix C**.

Overland flow paths convey runoff in excess of the storm sewer capacity to the public infrastructure. The detention basin overflow structure safely passes the 100-yr event; with all runoff either captured in basins or directed to public storm infrastructure.

A generator near the north infiltration basin maintains approximately 3' of freeboard between the 100-year HWL and the top of concrete transformer pad with elevations 827.38' and 830.30, respectively.

IV. Erosion Control

All erosion control and sediment control provisions will comply with the requirements of the State of Wisconsin and will employ methods as shown and outlined in the Wisconsin

Department of Natural Resources Construction Site Erosion and Sediment Control Technical Standards available at http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm.

A. Soil Loss / Sediment Discharge

Computations showing a maximum of 5 tons per acre during a 12-month period between initial disturbance and final stabilization of sediment per NR 151.11 is provided in **Appendix D**.

B. Silt Fence

Silt fence will be installed at the locations shown on the Demolition and Erosion Control Plans. Silt fence shall generally be used to control runoff from areas less than 0.25 acres per 100 feet of fence. Silt fence installation will meet WDNR standards. Sequencing of installation will be determined by the planned construction activities as outlined below.

C. Inlet Protection

Inlet Protection will be installed at all existing inlets to remain and proposed catch basins to trap sediment. Inlet Protection installation will meet WDNR standards and will match WisDOT Type A and Type D Inlet Protection. Type A Inlet Protection will be utilized in turf areas. Type D Inlet Protection will be utilized for all inlets and catch basins within streets and paved areas. Sand Bag Barriers will be also be used on hardscape surfaces when deemed necessary. Details for all Inlet Protection types are included in the construction documents.

D. Stabilized Construction Entrance

A stabilized construction entrance or aggregate tracking pad, as shown in the construction plans, will be installed to prevent tracking of soils and other materials on to the roadways outside the construction site. Stabilized construction entrance will meet WDNR standards. If tracking pad does not succeed in removing sediment from vehicle tires, pressurized washing will be utilized, as outlined in Technical Standard 1057.

E. Erosion Mat

Erosion Mat meeting the WisDOT Class I Urban Type A, Erosion Mat/ECRM will be installed on all slopes as shown on the Erosion Control Plan. Erosion Mat meeting the WisDOT Class I Urban Type B will be installed in all swales as shown on the Erosion Control Plan. Erosion Mat will be installed when final grading and seeding has been completed. Erosion mat installation will meet WDNR standards and shall consist entirely of biodegradable materials.

F. Dust Control

Dust Control will be implemented through the course of construction. The primary method to be used in areas where construction vehicles would travel is watering. A typical water truck would be used for application. Areas were traffic is not expected will be mulched and seeded. Tackifiers and/or Soil Stabilizers Type A may be used if previously noted techniques are not successful. The practice will follow WDNR Technical Standard No. 1068.

G. Construction Waste Material Management

Construction waste will be removed from the site. Some excess soil material may be used for berming on the site. As building waste is generated, dumpsters will be used to temporarily store some appropriate material. Concrete truck washout will occur within the construction limits with the hardened concrete either removed or used as fill in selected locations.

H. Temporary and Permanent Soil Stabilization

Due to the site restrictions, all excess soils from excavating or grading must be removed from the site. As noted under dust control, soil areas not expecting vehicle traffic but not at final graded elevation will be treated with temporary seed and mulch. Areas at final grade will be permanently seeded, mulched and treated with erosion mat, if applicable.

I. Excavation Water and Dewatering

For any stormwater or groundwater pumped from excavations along with any dewatering wells, sediment traps and/or polymers will be used to control sediment. A note is included on sheet C900.

V. Erosion Control Maintenance Plan

A. Where construction activities have permanently ceased or have temporarily been suspended for more than fourteen days, or when final grades are reached in any portion of the site, stabilization shall be implemented within seven days. When stabilization is not possible due to snow cover, stabilization measures shall be initiated as soon as possible.

B. All erosion and sediment control measures will be checked for stability and operation after a rainfall of 0.5 inches or more, but no less than once every week. Any needed repairs will be made immediately. Written reports will be kept of all erosion and sediment control inspections as required by the Wisconsin Department of Natural Resources.

C. Sediment deposits will be removed from behind the silt fence when deposits reach a depth of 6 inches. The silt fence will be repaired or replaced as necessary to maintain a barrier.

D. All seeded areas will be re-seeded and mulched as necessary to maintain a vigorous, dense vegetative cover.

E. Erosion and sediment control practices will not be removed until the site is stabilized, and permanent vegetation is planted on disturbed areas.

F. When the site has undergone final stabilization a signed Notice of Termination will be sent to the WDNR.

VI. Post-Construction Operations and Maintenance

Routine maintenance of storm water BMP devices is critical to proper performance. The owner will be the party responsible for stormwater facility maintenance. Funding for stormwater facility maintenance will be provided through Carroll University.

The stormwater management components should be inspected regularly at the following intervals:

- Immediately following rains with a depth of 4-inches or greater based on National Weather Service storm totals.
- One (1) time per month while there is snow melt or no snow.

The following stormwater management controls and associated maintenance practices will be implemented on this site:

A. Bio-filtration Basin, filtration Basin:

A minimum of 70 percent soil cover made up of native grasses and forbs must be maintained on the bio-retention basin bottom. Periodic mowing is recommended to enhance establishment of the grasses and maintain the minimum native cover. To reduce competition from cool season grasses (bluegrass, fescues, quack, etc.) and other weeds:

- For the first year, cut to a 6-inch height three times – once each in June, July and early August. To prevent damage to the native grasses, do not mow below a 6-inch height. Remove excessive accumulation of clippings to avoid smothering next year's seedlings.
- After the first year, mowing may only be needed in early June each year to help control the spread of cool season plants. The mowing should be raised to approximately 10 inches to avoid damage to the warm season plants.
- Any major bare areas or areas taken over by nonnative species must be reseeded. To clear area of weeds and cool season grasses, treat with an herbicide that contains glysophosphate in accordance with manufacturer's instructions. Ensure a firm seedbed is prepared to a depth of 3 inches. Seeding should occur in early to mid-June. A companion crop of oats is recommended. If broadcast seeding by hand, drag leaf rake over soil surface after seeding. Then roll it again and cover with a light layer of mulch and staked erosion control netting to hold it in place until germination.
- Biweekly inspections of vegetation health should be performed during the first growing season, when establishing or restoring vegetation or until the vegetation is established. Inspections of vegetation health, density, and diversity should be performed at least twice during both the growing and non-growing seasons. The vegetative cover should be maintained at 85 percent. If vegetation has experienced greater than 50 percent damage, the area should be reestablished in accordance with the original specifications. Use of fertilizers, mechanical treatments, pesticides and other means to assure optimum vegetation health should not compromise the intended purpose of

the bio-filtration system. Vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible.

The bio-retention basin and all components (grass swales, inlets, outlets, etc.) should be inspected after each heavy rain exceeding 1 inch of rainfall but at a minimum of once per year. If the basin is not draining properly (within 72 hours), further inspection may be required by persons with expertise in storm water management and/or soils. Structural components should be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually. The normal drain time should be used to evaluate the actual performance. If significant increases or decreases in the normal drain time are observed or if the 72-hour maximum is exceeded, the system's planting soil bed, underdrain system, and both groundwater and tailwater levels should be evaluated. Appropriate measures should be taken to maintain the proper functioning of the system and comply with the maximum drain time requirements.

If soil testing or observations show that the soil surface has become crusted, sealed or compacted, measures should be taken to unclog the basin. This may include removing the top 2 to 3 inches of soil, chisel plowing and adding topsoil and compost. Deep tillage may also be performed. Deep tillage will cut through the underlying soils at a 2-to-3-foot depth, loosening the soil and improving infiltration rates, with minimal disturbance of the surface vegetation. Types of tillage equipment that can be used include a subsoiler or straight, narrow-shanked chisel plow.

If sedimentation is determined to be causing the failure, the accumulated sediment must be removed and the area reseeded.

Heavy equipment and vehicles must be kept off of the bottom and side slopes of the bio-retention basin to prevent soil compaction. Soil compaction will reduce infiltration rates and may cause failure of the bio-retention basin, resulting in ponding and possible growth of wetland plants.

B. Erosion:

All grassed areas, embankments and flow control devices should be inspected frequently and particularly during high flow events (major rainstorms and spring snow melt) for rills, scour and short-circuiting. Areas showing signs of erosion shall be repaired, reinforced and revegetated immediately. Areas of erosion control matting showing signs of deterioration shall be repaired, replaced or reinforced as necessary.

C. Grassed Swales:

The primary maintenance responsibility of a grassed swale is care of the vegetative liner. Swales lined with earth, should be checked and inspected for scour or channelization.

D. Sedimentation:

Accumulated sediment, in significant proportions, should be removed and bare areas regraded, seeded or otherwise revegetated. Sediment material, free of trash and debris, may be used to fill and restore small depressions or shallow water pockets and then seeded.

E. Transport:

Silt, sod, stone, and any other material transported as a result of high-water volumes, velocities or scour shall be removed, replaced, and reinforced immediately to its proper condition and location occupied prior to the catastrophic event. Trash and other deleterious debris shall be properly disposed of.

F. Storm Sewers and Structures:

Storm sewers and structures should be inspected on an annual basis, cleaned when necessary and repaired immediately upon discovery of any structural defects.

G. Stone trench/swales:

Stone trench/swales shall be inspected on a regular basis, no less than three times per year. Remove any trash and debris. Replace stone as needed. Stone material will gradually turn brown as it becomes saturated, indicating time for replacement. Dispose of all oil and grease contaminated products in accordance with EPA guidelines.

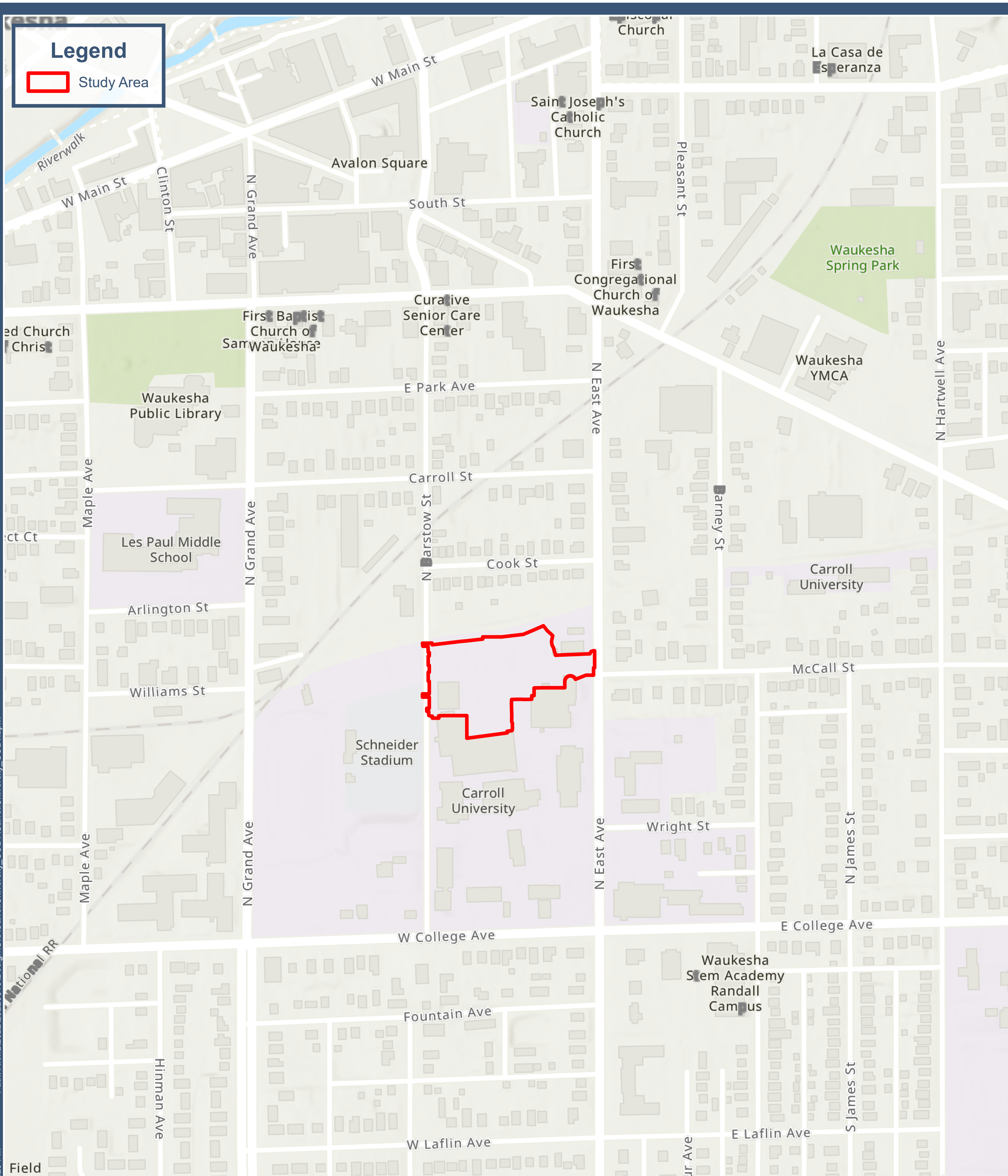
H. Enhanced Catch Basins and Vaults

Maintenance of catch basins requires regular cleaning by a vacuum truck to remove accumulated sediments and floatables. The frequency of maintenance would likely be every three months. Disposal of debris, trash, sediment, and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

VII. Conclusion

The proposed developed will maintain compliance with the City and County of Waukesha and the WDNR's requirements for management of stormwater. We request, on behalf of Carroll University, your approval of this Stormwater Management Plan to allow for construction of the Carroll University School of Business and Technology Building.

FIGURES



CARROLL UNIVERSITY - COBT

SITE LOCATION

CITY OF WAUKESHA
WAUKESHA COUNTY, WISCONSIN

N

0 250 500
Feet
1 in = 500 ft

GRAEF

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Date Saved: 9/5/2024 3:20 PM

User: 1956

Proj. Number: 2022-0310 Source: ESRI

Surface Water Data Viewer Map

Legend

- Wetland Indicators
- Lake Class Areas
- Riverine/ditch Class Areas
- Wetland Class Areas
- Wetland Class Points
  - Dammed pond
  - Excavated pond
  - Filled/drained wetland
  - Wetland too small to delineate
  - Filled excavated pond
- Filled Points
- Wetland Class Areas
- Filled Areas
- Lake Class Areas
- Riverine/ditch Class Areas
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- Wetland Class Points
  - Dammed pond
  - Excavated pond
  - Filled/drained wetland
  - Wetland too small to delineate
  - Filled excavated pond
- Filled Points
- Wetland Class Areas
- Filled Areas
- Wetland Identifications and Confirmations
- NRCS Wetspots
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway

0.1 0 0.06 0.1 Miles

NAD_1983_HARN_Wisconsin_TM

1: 3,960

Notes

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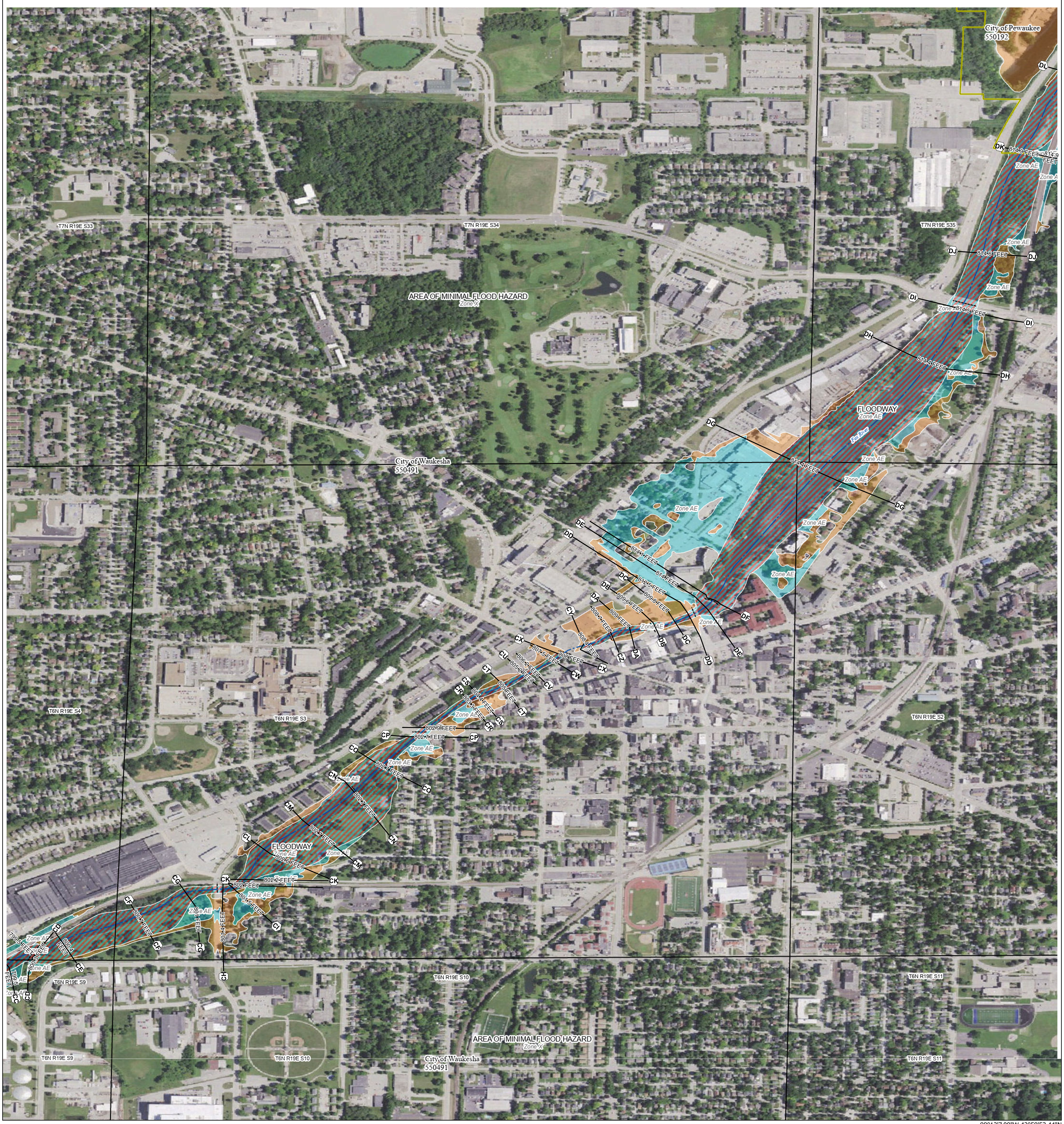

88°13'7.09"W 42°59'53.44"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR* Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* Future Conditions 1% Annual Chance Flood Hazard *Zone X* Area with Reduced Flood Risk due to Levee See Notes *Zone X* Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X* Effective LOMRs Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer Levee, Dike, or Floodwall
OTHER FEATURES	(B) 20.2 Cross Sections with 1% Annual Chance 17.5 Water Surface Elevation (8) Coastal Transect Coastal Transect Baseline Profile Baseline Hydrographic Feature 513 Base Flood Elevation Line (BFE) Limit of Study Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **9/5/2024 12:09 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

1 inch = 500 feet 1:6,000

N

Feet: 0 250 500 1,000 1,500 2,000
Meters: 0 50 100 200 300 400

FEMA
National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

PANEL 213 OF 479

Panel Contains:

COMMUNITY	NUMBER	PANEL
CITY OF WAUKESHA	550491	0213
CITY OF PEWAUKEE	550192	0213

MAP NUMBER
55133C0213H
EFFECTIVE DATE
October 19, 202

GRAEF

PROJECT NUMBER: 2022-0310.00
DATE: 08/15/2025
SCALE: 1" = 20'

PROJECT TITLE: SULLIVAN SCHOOL OF BUSINESS & TECHNOLOGY

SHEET TITLE: PRE-DEVELOPMENT DRAINAGE PLAN

FIGURE 4

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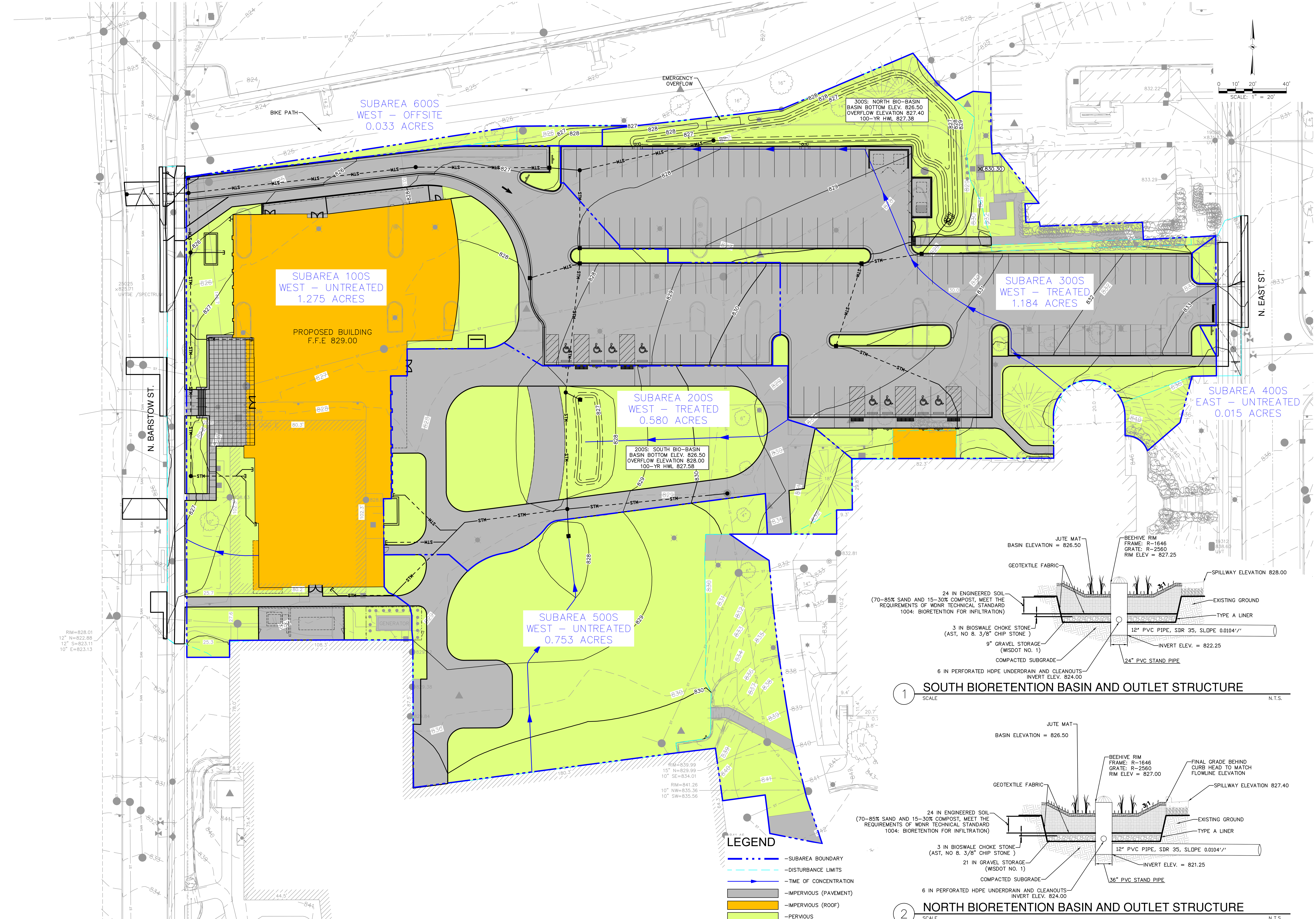


GRAEF

PROJECT NUMBER: 2022-0310.00
DATE: 08/15/2025
SCALE: 1" = 20'

PROJECT TITLE: SULLIVAN SCHOOL OF BUSINESS & TECHNOLOGY

SHEET TITLE: POST-DEVELOPMENT DRAINAGE PLAN

FIGURE 5

APPENDICIES

Appendix A	**Soil Survey, Soil Borings / GeoTech, Soil and Site Evaluation**
Appendix B	**Pre-Development Site Hydrologic & Hydraulic Analysis**
Appendix C	**Post-Development Site Hydrologic & Hydrologic Analysis**
Appendix D	**TSS / Water Quality / Infiltration Computations / Soil Loss**
Appendix I	**Other Communication / Documentation**

APPENDIX A

Soil Survey, Soil Borings / GeoTech, Soil and Site Evaluation

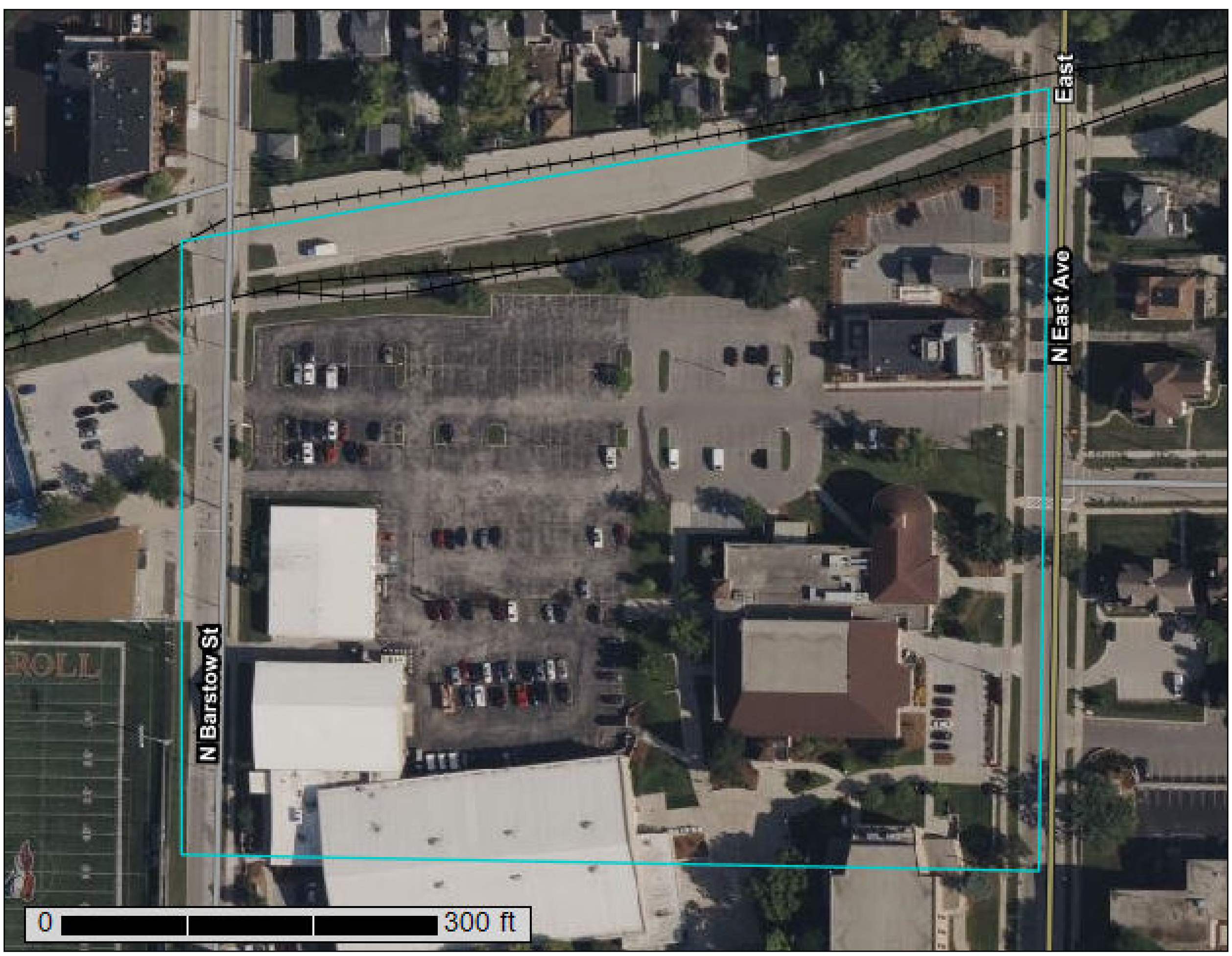
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Milwaukee and Waukesha Counties, Wisconsin



July 19, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,600 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 19, Sep 8, 2023

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

Date(s) aerial images were photographed: Aug 4, 2022—Sep 13, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HmB	Hochheim loam, 2 to 6 percent slopes	0.3	3.0%
WeB	Warsaw loam, 2 to 6 percent slopes	7.4	84.5%
WeC2	Warsaw loam, 6 to 12 percent slopes, eroded	1.1	12.5%
Totals for Area of Interest		**8.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Milwaukee and Waukesha Counties, Wisconsin

HmB—Hochheim loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2t03x
Elevation: 820 to 1,330 feet
Mean annual precipitation: 29 to 31 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 135 to 155 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hochheim and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hochheim

Setting

Landform: Drumlins
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy till and/or calcareous, dense loamy till

Typical profile

Ap - 0 to 9 inches: loam
Bt - 9 to 17 inches: clay loam
C - 17 to 33 inches: gravelly loam
Cd - 33 to 79 inches: gravelly loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F095XB007WI - Loamy Upland with Carbonates
Forage suitability group: Mod AWC, adequately drained (G095BY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095BY005WI)
Hydric soil rating: No

Minor Components

Theresa

Percent of map unit: 7 percent
Landform: Drumlins
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F095XB007WI - Loamy Upland with Carbonates
Hydric soil rating: No

Lamartine

Percent of map unit: 3 percent
Landform: Drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F095XB005WI - Moist Loamy or Clayey Lowland
Hydric soil rating: No

WeB—Warsaw loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2tjxb
Elevation: 590 to 1,020 feet
Mean annual precipitation: 33 to 37 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 138 to 193 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Warsaw and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warsaw

Setting

Landform: Outwash plains
Landform position (three-dimensional): Riser, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy glaciofluvial deposits over calcareous, stratified sandy and gravelly outwash

Typical profile

Ap - 0 to 12 inches: loam
Bt - 12 to 32 inches: sandy clay loam

2C - 32 to 79 inches: stratified sand to gravel

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 24 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F095XB010WI - Loamy and Clayey Upland
Forage suitability group: Mod AWC, adequately drained (G095BY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095BY005WI)
Hydric soil rating: No

Minor Components

Warsaw

Percent of map unit: 8 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F095XB010WI - Loamy and Clayey Upland
Other vegetative classification: Mod AWC, adequately drained (G095BY005WI)
Hydric soil rating: No

Fox

Percent of map unit: 7 percent
Landform: Outwash plains
Landform position (three-dimensional): Riser, rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F095XB010WI - Loamy and Clayey Upland
Hydric soil rating: No

WeC2—Warsaw loam, 6 to 12 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2tjxc
Elevation: 710 to 1,050 feet

Mean annual precipitation: 33 to 37 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 141 to 173 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Warsaw, eroded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warsaw, Eroded

Setting

Landform: Outwash plains
Landform position (three-dimensional): Riser, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy glaciofluvial deposits over calcareous, stratified sandy and gravelly outwash

Typical profile

Ap - 0 to 10 inches: loam
Bt - 10 to 32 inches: sandy clay loam
2C - 32 to 79 inches: stratified sand to gravel

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 24 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F095XB010WI - Loamy and Clayey Upland
Forage suitability group: Mod AWC, adequately drained (G095BY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095BY005WI)
Hydric soil rating: No

Minor Components

Fox

Percent of map unit: 3 percent
Landform: Outwash plains
Landform position (three-dimensional): Riser, rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F095XB010WI - Loamy and Clayey Upland

Hydric soil rating: No

Rodman, eroded

Percent of map unit: 2 percent
Landform: Outwash plains
Landform position (three-dimensional): Riser, rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F095XB009WI - Sandy Upland
Hydric soil rating: No

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Geotechnical Engineering Exploration and Analysis

Proposed Improvements
Carroll University
100 N. East Avenue
Waukesha, Wisconsin

Prepared for:

Carroll University
Waukesha, Wisconsin

September 14, 2023
Project No. 1G-2301011

GILES
ENGINEERING ASSOCIATES, INC.

GILES
ENGINEERING ASSOCIATES, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

- Dallas, TX
- Los Angeles, CA
- Manassas, VA
- Milwaukee, WI

September 14, 2023

Carroll University
100 N. East Avenue
Waukesha, WI 53186

Attention: Thomas Heffernan
Director of Facilities

Subject: Geotechnical Engineering Exploration and Analysis
Proposed Improvements
Carroll University
100 N. East Avenue
Waukesha, Wisconsin
Giles Project No. 1G-2301011

Dear Mr. Heffernan:

As requested, Giles Engineering Associates, Inc. conducted a *Geotechnical Engineering Exploration and Analysis* for the proposed project. The accompanying report describes the services that were performed, and it provides geotechnical-related findings, conclusions, and recommendations that were derived from those services.

We sincerely appreciate the opportunity to provide geotechnical services for the proposed project. Please contact the undersigned if there are questions about the report or if we may be of further service.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC.

Grace C. Hill
Staff Professional

Anthony C. Giles, P.E.
Vice President

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TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS

PROPOSED IMPROVEMENTS
CARROLL UNIVERSITY
100 N. EAST AVENUE
WAUKESHA, WISCONSIN
PROJECT NO. 1G-2301011

Section No. Description Page No.

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS

PROPOSED IMPROVEMENTS
CARROLL UNIVERSITY
100 N. EAST AVENUE
WAUKESHA, WISCONSIN
PROJECT NO. 1G-2301011

1.0 SCOPE OF SERVICES

This report provides the results of the *Geotechnical Engineering Exploration and Analysis* that Giles Engineering Associates, Inc. ("Giles") conducted for the proposed project. The *Geotechnical Engineering Exploration and Analysis* included a geotechnical subsurface exploration program, geotechnical laboratory services, and geotechnical engineering. The scope of each service area was narrow and limited as directed by our client and based on our understanding and assumptions about the proposed project. Service areas are briefly described later. Environmental consulting services were beyond our authorized scope.

Geotechnical-related recommendations are provided in this report for design and construction of the foundation and basement of the proposed building. Also, recommendations are provided for new pavement. Site preparation recommendations are given but are only preliminary because the means and methods of site preparation will depend on factors that were unknown when this report was prepared. These factors include, but are not limited to, the weather before and during construction, the subsurface conditions that are exposed during construction, and the final details of the proposed project.

2.0 SITE DESCRIPTION

The subject site is along the east side of N. Barstow Street, near Cutler Street, in Waukesha, Wisconsin. The site is shown on the *Test Boring Location Plan*, enclosed as Figure 1 in Appendix A. When the test borings (described below) were performed, Carroll University's Physical Therapy Building existing at the site along with an asphalt-concrete parking lot and grass areas; the Physical Therapy Building is planned to be demolished. The site was relatively flat but gradually sloped down to the northwest. Topographic contour lines on the *Existing Conditions Survey* (dated November 3, 2021), prepared by JSD Professional Services, Inc., show that ground elevations in the development area of the site generally vary between ±El. 825 and ±El. 833. The Van Male Athletic Complex is directly south of the site.

3.0 PROJECT DESCRIPTION

The new School of Business and Technology (SOBT) building will be constructed at the location shown on the *Test Boring Location Plan*. It is understood that the building will be a 52,000-square-foot, three-story structure that will include an auditorium, classrooms, student collaboration space, and faculty offices. Because details of the building were not provided to us, it is assumed that the building will be constructed of concrete masonry units (CMUs). It is understood that the building will have a full basement. Furthermore, it is assumed that bearing walls and columns will support the building. Maximum foundation loads were not provided to us and are, therefore, assumed to be 8,000 pounds per lineal foot (plf) from bearing walls and 300,000 pounds per column. The maximum basement floor load was not provided to us and was, therefore, assumed to be 100 pounds per square foot (psf). It is assumed that the at-grade floor of the building will match the at-grade floor of the existing Physical Therapy Building. According to the *Existing Conditions Survey*, referenced above, the floor of the Physical Therapy Building is at ±El. 828.6. Because details about the basement were not provided to us, this report assumes that the basement floor will be about 10 feet below the at-grade floor elevation. Therefore, it is assumed that the basement floor will be at ±El. 818.6.

The proposed pavement area is shown on the *Test Boring Location Plan*. It is assumed that the pavement will consist of asphalt concrete. Because Giles was not provided with traffic information, the pavement recommendations provided later are based on arbitrarily assumed traffic conditions. Also, because proposed pavement grades were not provided, this report assumes that the pavement grades will be within about two feet of the current site grades.

4.0 GEOTECHNICAL SUBSURFACE EXPLORATION PROGRAM

To explore subsurface conditions, ten geotechnical test borings were conducted at the site using a mechanical drill-rig. Test Borings 1 through 8 were in the proposed SOBT building area. These test borings were planned to be advanced to ±21 feet below-ground but were terminated due to auger refusal at depths between ±5 and ±10.2 feet below-ground. Test Borings 9 and 10 were in the proposed parking lot area and were planned to be ±11 feet deep but were terminated due to auger refusal at ±10 and ±8 feet below-ground, respectively. At each test boring, auger refusal was likely due to limestone bedrock but might have been due to cobbles and boulders. The test boring locations were positioned at the site based on measurements from existing site features and by approximating right angles. Approximate locations of the test borings are shown on the *Test Boring Location Plan*.

Samples were collected from each test boring, at certain depths, using the Standard Penetration Test (SPT), conducted with the drill rig. A brief description of the SPT is given in Appendix B along with descriptions of other field procedures. Immediately after sampling, select portions of the SPT samples were placed in containers that were labeled at the site for identification. A Standard Penetration Resistance value (N-value) was determined from each SPT. N-values are reported on the *Test Boring Logs* (in Appendix A), which are records of the test borings. N-values are used to estimate the in-place density of granular soil, such as the granular soil that was encountered at the test borings, as described below. However, most (or all) of the measured N-values are likely unrepresentative of in-place density because gravel, cobbles, or boulders were encountered during testing.

At Test Borings 1 and 7, rock coring was performed below the auger-refusal depths to evaluate the underlying bedrock. The coring was conducted using an NX core barrel. Two ±5-foot core runs were performed at each test boring. The coring was advanced to about 20 feet below-ground at Test Boring 1 and to about 18 feet below-ground at Test Boring 7.

The boreholes were backfilled upon completion, but backfill material will likely settle or heave, creating a hazard that can injure people and animals. The borehole areas should, therefore, be carefully and routinely monitored by the property owner or by others; settlement and heave of backfill material should be repaired immediately. Giles will not monitor or repair the boreholes.

The ground elevations at the test borings were estimated using the topographic contour lines on the provided *Existing Conditions Survey*. The test boring elevations are noted on the *Test Boring Logs* and are considered accurate within about one foot.

5.0 GEOTECHNICAL LABORATORY SERVICES

The soil samples that were retained from the test borings were transported to Giles' geotechnical laboratory where the samples were classified using the descriptive terms and particle-size criteria shown on the *General Notes* in Appendix D and by using the Unified Soil Classification System (ASTM D 2488) as a general guide. The classifications are shown on the *Test Boring Logs* along with horizontal lines that show estimated depths of material change. Field-related information pertaining to the test borings is also shown on the *Test Boring Logs*. For simplicity and abbreviation, terms and symbols are used on the *Test Boring Logs;* the terms and symbols are defined on the *General Notes*.

Unconfined compression (without measured strain), calibrated penetrometer resistance, vane shear, and moisture content tests were performed on select soil samples to evaluate their general engineering properties. The test results are on the *Test Boring Logs*. Because testing was conducted on SPT samples, which are categorized as disturbed samples, results of the strength-related tests are approximate. Laboratory procedures are briefly described in Appendix C.

The rock cores that were retained from Test Borings 1 and 7 were transported to Giles' geotechnical laboratory. Rock quality designation (RQD) values were determined for each of the bedrock core samples. The RQD values are reported on the *Test Boring Logs.* RQD is expressed as a percentage and is the summation of the length of intact core segments longer than 4 inches divided by the total length of the core run. RQD is a rough measure of the degree of jointing or fracture in a rock mass. In addition to the RQDs, unconfined compressive strength testing (ASTM D7012, Method C) was performed on bedrock core samples collected at about 12 feet below-ground at Test Boring 1 and at about 15 feet below-ground at Test Boring 7. Results of the unconfined compressive strength tests are provided on the *Test Boring Logs*.

As part of the geotechnical laboratory services, the soil samples that were retained from the test borings were screened with a photoionization detector (PID) to check for volatile organic compound (VOC) vapors, such as vapors associated with gasoline. The results of the PID screening are discussed below and are reported on the *Test Boring Logs*. The PID results on the *Test Boring Logs* are lab-screened values and may differ had the PID screening been conducted in the field immediately after sample recovery.

6.0 MATERIAL CONDITIONS

Because material sampling at the test borings was discontinuous, it was necessary to estimate conditions between sample intervals. Estimated conditions at the test borings are briefly discussed in this section and are described in more detail on the *Test Boring Logs*. The conclusions and recommendations in this report are based only on the estimated conditions shown on the *Test Boring Logs*.

6.1. Surface Materials

Asphalt-concrete pavement that was between ±3 and ±5 inches thick was at the surface of Test Borings 1, 5, 6, 7, 8, and 10. Base material that was about 5 to 6 inches thick was directly beneath the asphalt pavement at Test Borings 5, 6, 8, and 10, and about 15 inches of crushed limestone was beneath the asphalt pavement at Test Boring 7. Topsoil that was about 12 inches thick was at the surface at Test Borings 2 and 4. The topsoil generally consisted of lean clay and sandy clay and included an estimated trace amount of organic matter. Lean clay fill was at the surface of Test Boring 3, and gravelly sand fill was at the surface of Test Boring 9.

6.2. Fill Material

At the test borings, material classified as fill was beneath the surface materials and was encountered to depths between ±4 and ±10.2 feet below-ground. The fill material was encountered to the auger-refusal depths at Test Borings 2, 3, 5, 6, 8, and 9. The fill material was highly variable but generally consisted of lean clay, gravelly sand, sandy clay, silty sand, and silty gravel. Cobbles and boulders appeared to be within the fill material. Also, asphalt-concrete rubble was within the fill at Test Borings 1, 3, and 5 through 9; brick rubble was within the fill at Test Borings 7 and 9; glass debris was within the fill at Test Borings 3 and 4, and wood debris was within the fill at Test Boring 8. The fill material exhibited highly variable strength characteristics, based on SPT N-values and laboratory testing. Also, samples retained from Test Boring 8 exhibited slight to strong petroleum odors.

6.3. Native Soil

At Test Boring 10, native soil was beneath the fill material and was encountered to the ±8-foot auger-refusal depth of that test boring. The native soil generally consisted of fine to medium sand with an estimated little amount of gravel. Based on a corrected SPT N-value, the native sand appeared to exhibit a firm relative density.

6.4. Limestone Bedrock

Test Borings 1 through 8 were in the proposed SOBT building area. These test borings were planned to be advanced to ±21 feet below-ground but were terminated due to auger refusal at depths between ±5 and ±10.2 feet below-ground. Test Borings 9 and 10 were in the proposed parking lot area and were planned to be ±11 feet deep but were terminated due to auger refusal at ±10 and ±8 feet below-ground, respectively. At each test boring, auger refusal was likely due to limestone bedrock but could have been due to cobbles and boulders. Furthermore, weathered limestone bedrock was between ±6½ feet and the ±7½-foot auger-refusal depth at Test Boring 4

As described above, Test Borings 1 and 7 were advanced into limestone bedrock by coring methods. An RQD value was determined for each core sample. The RQD values for the core samples collected at Test Boring 1 are 40% and 60%, and the RQD values for the core samples collected at Test Boring 7 are 0% and 34.5%. The RQD values correlate to poor to fair quality rock at Test Boring 1 and very poor to poor quality rock at Test Boring 7. Also, the unconfined compressive strengths of the tested samples from Test Borings 1 and 7 were 49,660 psi and 48,910 psi, respectively.

7.0 GROUNDWATER CONDITIONS

It is estimated that the water table was deeper than the termination depths at the test boring locations when the test borings were conducted. However, the site appears to be subject to perched conditions, where groundwater perches within weathered bedrock and on the surface of un-weathered bedrock. Perched groundwater is expected to be variable in terms of area and depth and could be relatively shallow in some areas. Furthermore, groundwater could be within fissures or fractures of bedrock. Groundwater within fissures and fractures could be under pressure.

Because the groundwater conditions discussed above are only an approximation, based on the test borings, the water table could be higher than estimated. If a precise determination of the water table is needed, groundwater observation wells are recommended to be installed and observed at the site. Giles can install and monitor the wells.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1. Results of PID Screening

As described above, the SPT samples that were retained from each test boring were screened, in Giles' laboratory, with a photoionization detector (PID) to check for volatile organic compound (VOC) vapors, such as vapors associated with gasoline. Readings of 48.8 and 5.5 instrument units were measured when SPT samples from Test Boring 8 were screened with a PID. Also, samples retained from Test Boring 8 exhibited slight to strong petroleum odors. The results of the PID screening on SPT samples from the other test borings were *below detection limits* (BDL). Because the PID results on the *Test Boring Logs* are lab-screened values they might differ had the PID screening been done in the field at the time of sample collection.

8.2. Environmental Considerations

Based on the PID results and petroleum odors, discussed above, subsurface materials at the site appear to have been impacted by petroleum-related products. Care must, therefore, be taken to protect workers and others during construction of the proposed development. Special safety methods and equipment might be necessary. Special handling and disposal of petroleum-impacted soil and groundwater should be expected. It is recommended that an environmental site assessment be conducted. Giles can conduct the environmental site assessment, upon request and authorization.

8.3. Excavation Difficulties

Because limestone bedrock was encountered at relatively shallow depths, specialized excavation methods might be necessary. However, the actual methods of excavation and removal of weathered and un-weathered bedrock are recommended to be determined by earthwork contractors based on their interpretation of the subsurface conditions at the site and based on the possibility of differing conditions away from the test borings. The degree of excavation difficulty will generally depend on the required excavation depth, the bedrock hardness and degree of weathering, and the excavation equipment and methods chosen by the contractor. It is important to note that bedrock (including weathered bedrock) can be more easily penetrated with drilling equipment than it can be excavated with conventional earthwork equipment. Therefore, the auger-refusal depths discussed above and shown on the *Test Boring Logs* should not be relied upon by contractors as the depth where difficult excavation will be encountered. Special excavation and removal methods will likely be necessary at depths shallower than the auger-refusal depths.

Blasting might be required for the project. If blasting is necessary, it should be done by a qualified specialty contractor and must be done carefully so as not to damage nearby structures, including buildings, utilities, roads, etc. A video survey of surrounding properties should be completed before and after blasting in the presence of the adjacent property owners to help reduce any potential liability claims. Blasting vibrations should be monitored and controlled. The maximum peak particle velocity should be determined based on the type, distance, condition, and historical significance of nearby structures. Hard-rock excavation methods may require special permits and should be performed in accordance with local, state, and federal regulations.

8.4. Seismic Design Considerations

A soil Site Class B is recommended for seismic design. By definition, Site Class is based on the average properties of subsurface materials to 100 feet below-ground. Because a 100-foot test boring was not conducted for the project, it was necessary to estimate the Site Class based on the test borings, presumed area geology, and the International Building Code.

8.5. Foundation Recommendations

The foundation recommendations provided herein assume that the proposed building will have a full basement and that the basement floor will be at ±El. 818.6, referenced to the topographic contour lines on the provided *Existing Conditions Survey*. Giles must be notified if the building will not have a full basement or if the basement floor elevation will be different than assumed; revision of this report might be necessary.

A spread-footing foundation is recommended for the proposed building. However, existing fill is unsuitable for direct or indirect support of the foundation. Each footing must be directly supported by suitable native material, including soil, weathered bedrock, and sound bedrock. However, if a foundation is supported by significantly dissimilar materials, such as soil and sound bedrock, a minimum 12-inch-thick layer of compacted aggregate (approved by a geotechnical engineer) might need to be beneath the foundation in the area of the dissimilar materials to help control differential settlement. The compacted aggregate would serve as a cushion layer to lessen abrupt changes in foundation support. The need for a cushion layer should be determined by a geotechnical engineer during construction. The geotechnical engineer should also determine the actual thickness, location, and extent of a cushion layer.

Considering the relatively low RQD values of the bedrock core samples, the foundation is recommended to be designed using a 6,000 pound per square foot (psf) maximum, net, allowable bearing capacity. For geotechnical considerations and regardless of the calculated foundation-bearing stress, strip footings are recommended to be at least 16 inches wide and isolated footings are recommended to be at least 24 inches wide and long. It is recommended that a structural engineer provide specific foundation details, including footing dimensions, reinforcing, and other details.

A minimum 48-inch foundation-embedment depth is required by the building code. Therefore, it is recommended that footings for perimeter walls and other exterior elements of the building bear at least 48 inches below the finished ground-grade adjacent to the building. Because it is understood that the building will have a full basement, it is assumed that the foundation embedment requirement will be satisfied.

A frictional coefficient of 0.40 is recommended to determine lateral resistance at the base of the foundations. The recommended frictional coefficient is only for concrete cast directly on suitable native material, or on new engineered fill or lean-concrete backfill placed on suitable native material. Lateral resistance due to friction should be determined based on dead load only. Also, the ultimate lateral resistance determined from the frictional coefficient is recommended to be factored to determine an allowable value. Passive resistance is recommended to be neglected to at least the recommended 48-inch foundation-embedment depth due to seasonal changes and due to the amount of lateral movement necessary to develop full passive pressure.

Foundation excavations within native soil are recommended to be dug with a smooth-edge excavator bucket to develop a relatively undisturbed bearing grade. A toothed bucket will likely disturb foundation-bearing soil more than a smooth-edge bucket, thereby making soil at the excavation base more susceptible to saturation and instability, especially during adverse weather. It is critical that contractors protect foundation-support soil and foundation construction materials (concrete and reinforcing). Furthermore, engineered fill is recommended to be placed and compacted in benched excavations along foundation walls immediately after the foundation walls can properly support lateral pressures from backfill, compaction, and compaction equipment.

Foundation Support Requirements

Existing fill is unsuitable for direct or indirect support of the foundation. Each footing must be directly supported by suitable native material, including soil, weathered bedrock, and sound bedrock. Based on the recommended 6,000 psf maximum, net, allowable bearing capacity, the in-situ unconfined compressive strength of cohesive native soil, such as lean clay, within foundation influence zones is recommended to be at least 3.0 tons per square foot (tsf). Granular native soil, including weathered bedrock, within foundation influence zones is recommended to have a corrected N-value (determined from SPTs and correlated from other in-situ tests) of at least 20, based on the recommended bearing capacity. It is further recommended that the strength characteristics of native materials within all foundation influence zones (determined by a geotechnical engineer during construction) meet or exceed the recommended values unless Giles approves other values during construction.

Evaluation of foundation-support materials by a geotechnical engineer during foundation excavation and foundation construction is critical, especially considering the existing fill and the relatively high bearing capacity. The purpose of the recommended evaluation is (1) to confirm that the foundation will be properly supported by suitable native materials, (2) to determine where over-excavation of unsuitable material is needed, (3) to determine if a cushion layer is needed, and (4) to confirm that the foundation-support materials are similar to those described on the *Test Boring Logs*. If a firm other than Giles performs the recommended evaluation, Giles must be notified if the composition or strength characteristics of foundation-support materials differ from those shown on the *Test Boring Logs*; revision of this report might be necessary. OSHA requirements must be strictly followed when evaluating foundation-support materials; excavations that do not meet OSHA safety guidelines must not be entered.

Unsuitable materials beneath proposed foundation areas can likely be replaced with engineered fill consisting of properly compacted dense-graded crushed stone that meets the gradation requirements of *dense-graded base* (1¼-inch) in Section 305 of the Wisconsin Department of Transportation Standard Specifications (current edition). Granular material with other gradation characteristics can possibly be used but should be approved by a geotechnical engineer before the material is placed. Where engineered fill is used as backfill, lateral over-excavation of the unsuitable material will also be required, in addition to the required vertical over-excavation. The overall width of lateral over-excavation will depend on the depth of vertical over-excavation. For estimating purposes, the minimum lateral over-excavation can be approximated by extending an imaginary line outward and downward at a ratio of 1(horizontal):2(vertical) from the bottom edges of a footing pad, but the actual lateral extents of over-excavation are recommended to be approved by a geotechnical engineer during construction.

Lean Portland cement concrete (minimum 28-day compressive strength of 500 psi) can likely also be used to replace unsuitable materials beneath proposed foundation areas. Where it is used, footing construction must not begin until the lean-concrete backfill has gained sufficient strength. Also, over-excavations that are filled with lean concrete must be at least as wide (on all sides) as the footing pad that will be supported by the concrete, and excavation sidewalls are recommended to be plumb and parallel. To help control caving and to protect the support materials, lean-concrete backfill is recommended to be placed immediately after excavation. This trench-and-pour method requires close communication and scheduling between the general contractor, foundation contractor, geotechnical engineer, and concrete supply company. With a trench-and-pour method, it is critical that a geotechnical engineer observe excavations as they are made.

Estimated Foundation Settlement

The post-construction total and differential settlements of a spread-footing foundation designed and constructed based on this report are estimated to be less than about 1 inch and ½ inch, respectively. The post-construction angular distortion is estimated to be less than about 0.002 inch per inch across 20 feet. Estimated settlements assume that the site will be prepared in accordance with this report and that foundation-support materials will be thoroughly evaluated and approved by a geotechnical engineer during construction.

It is recommended that the actual depths and elevations of suitable native material within all foundation areas be approved by a geotechnical engineer during foundation excavation. The proposed building could be improperly supported if a geotechnical engineer does not approve foundation-support material. Foundations are recommended to be constructed immediately after foundation-support material is approved by a geotechnical engineer because weather can cause material to become unstable.

8.6. Basement Recommendations

Geotechnical-related recommendations regarding the basement are provided in this section. The recommendations assume that the building will have a full basement and that the basement floor will be at ±El. 818.6, referenced to the topographic contour lines on the provided *Existing Conditions Survey*. Giles must be notified if the building will not have a full basement or if the basement floor elevation will be different than assumed; revision of this report might be necessary.

Basement Floor Slab

Existing soil (including existing fill) can be used to support the basement floor slab. However, because the existing fill is highly variable and includes rubble and debris, the entire floor slab subgrade is recommended to be thoroughly evaluated and approved by a geotechnical engineer. Subgrade improvement, including over-excavation, might be necessary to properly support the floor slab. Removal of rubble and debris might also be necessary.

Assuming a maximum 100 psf floor load and from a geotechnical perspective, the basement floor slab is recommended to be at least 4 inches thick; this thickness assumes that the 28-day compressive strength of concrete will be at least 3,500 pounds per square inch (psi). The basement floor slab can be designed based on a *Modulus of Subgrade Reaction* (K_{V1}) value of 100 pounds per square inch per inch (psi/in). It is recommended that a structural engineer specify the floor slab thickness, reinforcing, joint details, and other parameters.

For moisture control only, a minimum 10-mil vapor retarder is recommended to be directly below the floor slab throughout the entire basement area. It is recommended that the vapor retarder extend to all foundation walls. Vapor retarder sheets are recommended to be overlapped at least 6 inches, and the overlaps are recommended to be continuously taped. Vapor retarder is recommended to be in accordance with ASTM E 1745, entitled *Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs,* and other relevant documents.

A minimum 8-inch-thick base course is recommended to be directly below the minimum 10-mil vapor retarder to serve as a capillary break and for sub-slab drainage. Because the base course will be a component of the recommended drainage system (discussed below), it is recommended that the base material consist of crushed stone that meets the gradation requirements of ASTM No. 57 aggregate (washed). Base material is recommended to be properly compacted. Also, it is recommended that a geotechnical engineer approve base material before it is placed. Geotextile might need to be below the base material to serve as a separator. The need for geotextile should be determined during construction with the assistance of a geotechnical engineer.

The post-construction total and differential settlements of an isolated floor slab constructed in accordance with this report are estimated to be less than about ½ inch and ¼ inch, respectively, over about 20 feet. Estimated settlements assume that support material will be thoroughly tested and approved by a geotechnical engineer.

Foundation Drainage System Recommendations

Continuous drainpipes are recommended to be along the interior and exterior sides of the perimeter strip footings in the basement area. Lateral drainpipes are recommended to be below the basement floor. The lateral drainpipes are recommended to be in a general east-west orientation and are recommended to be 40 feet on-center. Also, the lateral drainpipes are recommended to be connected to the interior perimeter drainpipes. Furthermore, the subgrade is recommended to be pitched to direct water toward the lateral drainpipes.

Drainpipes could consist of conduits specifically manufactured for foundation drainage, such as Form-A-Drain® conduits. Manufactured foundation drains are recommended to be installed per the manufacturer's recommendations. Circular drainpipes could also be used and are recommended to be minimum 4-inch-diameter perforated pipes suitable for foundation drainage. Circular drainpipes are recommended to be directly adjacent to the footing pads, not atop footing flanges. Interior drainpipes are to be properly situated within the base course, below the basement floor slab. Due to possible clogging, fabric socks are not recommended to be used with foundation drainpipes. It is recommended that a minimum 12-inch-thick layer of free-draining crushed stone (ASTM No. 57 aggregate) surround exterior drainpipes, but the crushed stone must not extend below the foundation and into a foundation-influence zone. Bleeder pipes are recommended to be cast in the perimeter strip-footing pads to serve as water conduits between interior and exterior drainpipes. Bleeder pipes are recommended to be 3 inches in diameter and about 10 to 15 feet on-center. This report assumes that all drainpipes will be above El. 817, referenced to the topographic contour lines on the provided *Existing Conditions Survey*.

It is recommended that the foundation drainage system discharge directly to a nearby storm sewer. **Because sump-pump operation could be frequent and possibly continuous, sump pumps should not be used to discharge water from the foundation drainage system to the ground surface, since pumped water will likely pond, becoming a nuisance and hazard, especially during cold weather when ponded water could freeze. Also, because of perched groundwater, water flow within the drainage system could be continuous.**

Free-Draining Backfill

Free-draining aggregate is recommended to be placed along the basement walls to serve as drainage media for the recommended drainage system. It is recommended that the drainage backfill consist of crushed stone that meets the gradation requirements of ASTM No. 57 aggregate. The drainage backfill layer is recommended to be at least two feet wide, measured from the outside face of the basement walls. Furthermore, the drainage backfill layer is recommended to be continuous along the length and height of the basement walls, except that pavement or a ±6-inch-thick layer of relatively impervious material is recommended to be above the drainage backfill to control surface-water intrusion. Also, the drainage backfill layer must extend to the base of the perimeter footings, thereby creating a continuous drainage path to the perimeter drainpipes. It is recommended that a geotechnical engineer approve drainage backfill before it is placed.

Drainage backfill that is placed adjacent to the basement walls is recommended to be compacted in maximum 8- to 12-inch-thick lifts, measured loose. The use of manual compaction equipment must be in strict accordance with current OSHA excavation and trench safety standards and other applicable safety requirements. Manual compaction equipment must not be used within spaces that do not meet OSHA requirements. Heavy compaction equipment, such as mechanical rollers, should be kept at least 10 feet from the basement walls because high lateral pressures could develop, possibly causing the walls to move laterally and fail. Drainage backfill should not be excessively compacted. For safety, the sides of the basement excavation must be properly sloped, benched, or restrained. The basement walls are recommended to be adequately braced before placing backfill to prevent the walls from moving or possibly even overturning during backfilling and compaction. The bracing must remain in-place until the top and bottom of each basement wall are structurally restrained.

Lateral Pressure Design Parameters

The basement walls must be designed to resist lateral pressures from drainage backfill, adjacent soil, and any surface and subsurface surcharges. An equivalent "at-rest" fluid pressure of 65 pounds per square foot per foot of depth (psf/ft) is recommended for the design of basement walls. The recommended “at-rest” value assumes that drainage backfill will continuously abut the basement walls and that the recommended drainage system will be installed and will remain functional. If drainage backfill or the drainage system are not installed, lateral pressures could exceed the recommended "at-rest" fluid pressure, possibly exceeding the lateral capacity of the walls.

The equivalent "at-rest" fluid pressure given above only pertains to earth pressure. Lateral pressures caused by surcharge loads (surface and subsurface) must be added to the "at-rest" fluid pressure. Giles can provide supplemental recommendations regarding surcharge loads on a case-by-case basis but would require specific structural information. Basement walls that are not designed to resist actual pressures could move laterally and possibly fail. It is recommended that a structural engineer design the basement walls.

8.7. Pavement Recommendations

Traffic-related information was not provided to us. Therefore, recommendations are provided herein for light-duty vehicle areas and medium-duty vehicle areas. The light-duty pavement section is for passenger-vehicle parking areas and is based on an assumed traffic condition of five 18-kip Equivalent Single Axle Loads (ESALs) per day. The medium-duty pavement section is for drives that will be subject to heavy vehicles and is based on an assumed traffic condition consisting of fifteen 18-kip ESALs per day. The light-duty and medium-duty pavement sections assume no increase in traffic volume and no changes in vehicle type or traffic pattern. It is assumed that the ESALs noted above will be in one direction for each lane.

It is important that the project owner, developer, civil engineer, and other design professionals involved with the project confirm that the ESALs noted above are appropriate for the expected traffic conditions, vehicle types, and axle loadings. If requested, Giles can provide supplemental pavement recommendations based on other traffic conditions, vehicle types, and axle loads. The recommended pavement sections could underperform or fail prematurely if the design ESALs are exceeded.

Based on the test borings, it is expected that pavement support materials will include lean clay and sandy clay. Therefore, the recommended pavement sections were developed based on an assumed field CBR value of 4 and a *Modulus of Subgrade Reaction* (K_{V1}) value of 100 psi/in. Engineered fill that is placed in proposed pavement areas is recommended to have a field CBR value and a *Modulus of Subgrade Reaction* (K_{V1}) value at least equal to these design values. Fill is recommended to be placed and compacted per this report.

Because of the existing fill, subgrade improvement will likely be necessary to develop proper support for new pavement. Furthermore, in some areas, an aggregate subbase underlain by geotextile or geogrid will likely be needed beneath the recommended pavement sections, provided below, depending on the site conditions during construction. The need for a subbase and geotextile or geogrid should be determined during construction with the assistance of a geotechnical engineer. The geotechnical engineer should also provide specific recommendations regarding a subbase, geotextile, and geogrid based on the subgrade conditions at the time of construction. Depending on the soil conditions, lime stabilization might be needed to develop a suitable subgrade for pavement support. Site preparation recommendations are given in Section 8.8 of this report.

<u>Asphalt-Concrete Pavement</u>

The following table shows the recommended thicknesses for hot-mix asphalt (HMA) pavement with an aggregate base course. State specifications are also included in the table. The recommended pavement sections are based on the traffic conditions described above.

TABLE 1
RECOMMENDED HMA PAVEMENT SECTION

Materials	**Light Duty**	**Medium Duty**	**Wisconsin DOT Standard Specifications**
Hot-Mix Asphalt Surface Course	1.5 inches	1.5 inches	Section 460
Hot Mix Asphalt Binder Course	1.5 inches	2.5 inches	Section 460
Dense-Graded Aggregate Base Course	7.0 inches	8.0 inches	Section 305, 1¼-inch Crushed Stone

Portland Cement Concrete Pavement

Portland cement concrete pavement is recommended in areas of higher traffic stress, such as the parking lot entrance and exit aprons and in areas where heavy vehicles will turn or will be parked. Based on the assumed ESALs, discussed above, the concrete pavement is recommended to be at least 6 inches thick and is recommended to be underlain by a minimum 4-inch-thick aggregate base course. It is recommended that concrete pavement have load-transfer reinforcement, where appropriate. Control-joint spacing should be determined in accordance with the current ACI code. Expansion joints should be provided where pavement abuts fixed objects, such as the building and light poles. This report assumes that the 28-day compressive strength of concrete will be at least 4,000 psi, and the concrete is recommended to be properly air-entrained for freeze-thaw durability. It is recommended and assumed that a civil engineer will provide specific recommendations for concrete pavement, including reinforcing details and control-joint spacing. Materials and construction procedures for concrete pavement and the aggregate base are recommended to be in accordance with Wisconsin DOT specifications.

General Pavement Considerations

The pavement recommendations assume that the pavement subgrade will be prepared according to this report, the base course will be properly drained, and a geotechnical engineer will observe and test pavement construction. Pavement was designed based on AASHTO design parameters for a twenty-year design period, but the actual service life will likely be much less, especially considering the existing fill, which is highly variable and includes rubble and debris. Furthermore, pavement might be subject to frost heave. Local codes may require specific testing to determine soil-support characteristics, and a minimum pavement section might be required.

8.8. Generalized Site Preparation Recommendations

This section provides recommendations for site preparation, including preparation of the proposed building, pavement, and engineered fill areas. The means and methods of site preparation will greatly depend on the weather conditions before and during construction, the subsurface conditions that are exposed during earthwork operations, and the finalized details of the proposed development. Therefore, only generalized site preparation recommendations are given. In addition to being generalized, the following site preparation recommendations are abbreviated; the *Guide Specifications* in Appendix D give further recommendations. The *Guide Specifications* should be read along with this section. Also, the *Guide Specifications* are recommended to be used as an aid to develop the project specifications.

Demolition and Removal

The existing Physical Therapy Building is recommended to be completely removed from the site. Excavations created during the removal of existing construction are recommended to be backfilled with engineered fill placed under engineering-controlled conditions. Disposal of rubble and debris is recommended to be in accordance with local, state, and federal regulations for the material type. An asbestos-containing materials (ACM) survey of the existing building is recommended to be performed, if not already done, to ensure proper handling and disposal of asbestos-containing materials, if any. Giles can conduct an ACM survey, if needed. It is recommended that a geotechnical engineer provide specific recommendations, on a case-by-case basis, regarding backfilling excavations created during the demolition and removal procedures.

Existing pavement, surface vegetation, trees and bushes (including root-balls), topsoil, and other unsuitable materials are recommended to be removed from the proposed building area, proposed pavement area, and other proposed structural areas. Stripping should extend at least several feet beyond the proposed development area, where feasible. Existing pavement should remain in place as long and possible to protect the underlying soil.

Proof-Rolling and Fill Placement

After the recommended demolition and removal, and once the site is cut (lowered) as needed, the subgrade within the proposed development area is recommended to be proof-rolled with a fully-loaded tandem-axle dump truck to help locate unstable soil based on subgrade deflection caused by wheel loads of the proof-roll equipment. The entire development area is recommended to be thoroughly proof-rolled. Where feasible, proof-rolling should extend at least several feet beyond the development limits. However, for safety, proof-roll equipment should not travel near excavations, such as the basement excavation. It is critical that a geotechnical engineer observe the proof-roll operations and evaluate subgrade stability based on those observations. Areas that are not safely accessible to proof-roll equipment are recommended to be evaluated and approved by a geotechnical engineer using appropriate means and methods.

Because of the existing fill, it is expected that unsuitable materials will be encountered during subgrade preparation, especially within the proposed pavement area. Unsuitable material is recommended to be removed and replaced with engineered fill or improved. Recommendations for subgrade improvement should, however, be made by a geotechnical engineer based on the site conditions during construction. Depending on the conditions during construction, areas requiring soil improvement might be large and improvement methods might need to extend significantly below the planned subgrade. Areas requiring subgrade improvement should be defined during construction with the assistance of a geotechnical engineer. Specific improvement methods should be determined during construction on an area-by-area basis. Where subgrade improvement is needed, it might be necessary to construct “test strips” to determine the most cost-effective and appropriate means of developing a suitable subgrade. Depending on the subgrade conditions at the time of construction, it might be necessary to install geotextile or geogrid within certain pavement-improvement areas, possibly along with a granular subbase. Depending on the soil conditions, lime stabilization might be needed to develop a suitable subgrade for pavement support.

The development area is recommended to be raised, where necessary, to the planned finished grades with engineered fill immediately after the subgrade is confirmed to be stable and suitable to support the proposed development. Engineered fill is recommended to be placed in relatively thin layers (lifts) that are uniform in elevation. Each layer of engineered fill is recommended to be compacted to at least 95 percent of the fill material's maximum dry density determined from the Standard Proctor compaction test (ASTM D698). As an exception, the in-place dry density of engineered fill within one foot of the pavement subgrade is recommended to be compacted to at least 100 percent of the fill material's maximum dry density. The water content of fill material is recommended to be uniform and within a narrow range of the optimum moisture content, determined by the Standard Proctor compaction test. Item Nos. 4 and 5 of the *Guide Specifications* give more information pertaining to selection and compaction of engineered fill.

Engineered fill that does not meet the density and water content requirements is recommended to be replaced, or it could possibly be scarified to a sufficient depth (likely 6 to 12 inches, or more), moisture-conditioned, and compacted to the required density. A subsequent lift of fill should only be placed after a geotechnical engineer confirms that the previous lift was properly placed and compacted. Subgrade soil might need to be recompacted immediately before construction since equipment traffic and adverse weather may reduce soil stability.

Use of Site Soil as Engineered Fill

Site soil that does not include rubble, debris, organic matter, or other deleterious materials possibly can be used as engineered fill. However, due to the variability of the existing fill, it might not be possible to monitor the in-place compaction and moisture content of non-native site soil using a nuclear gauge or sand cone, since the maximum dry density and optimum moisture content of the soil would also be variable. Instead, a method specification might need to be developed for placement and compaction of non-native site soil used as fill. In general, a method specification should be based on the actual compaction equipment used and should specify a maximum lift thickness along with the minimum quantity and direction of passes with the compaction equipment. The minimum overlap of the passes should also be specified.

Site soil will likely need to be moisture conditioned (uniformly moistened or dried) before it is used as engineered fill. If construction is during adverse weather (discussed below), drying site soil will likely not be feasible. In this case, aggregate fill with a low sensitivity will likely need to be imported to the site. Additional recommendations regarding fill selection, placement, and compaction are given in the *Guide Specifications*.

8.9. Generalized Construction Considerations

Adverse Weather

Site soil is extremely sensitive to moisture and will become unstable when exposed to adverse weather, such as rain, snow, and freezing temperatures. Therefore, it might be necessary to remove or stabilize the upper 6 to 12 inches (or more) of soil due to adverse weather, which commonly occurs during late fall, winter, and early spring. At least some over-excavation or stabilization of unstable soil should be expected if construction is during or after adverse weather. Because site preparation is weather dependent, bids for site preparation and other earthwork activities should consider the time of year that construction will be conducted.

To protect soil from adverse weather, the site is recommended to be smoothly graded and contoured during construction to divert surface water away from construction areas. Contoured subgrades are recommended to be rolled with a smooth-drum compactor before precipitation to "seal" the surface. Furthermore, construction traffic should be restricted to certain aggregate-covered areas to control traffic-related soil disturbance. Foundation, floor slab, and pavement construction should begin immediately after suitable support is confirmed.

Dewatering

Construction dewatering might be necessary due to perched groundwater. It is expected that filtered sump pumps, drawing water from sump pits excavated in the bottom of construction trenches, will be adequate to remove water that collects in excavations. However, multiple pumps might be necessary. Excavated sump pits should be lined with geotextile and filled with free-draining aggregate, such as crushed stone that meets the gradation requirements of ASTM No. 57 aggregate. It is recommended that a geotechnical engineer monitor and approve dewatering. Improper dewatering could cause support and settlement problems at the site and at nearby properties.

Excavation Stability

All excavations are recommended to be made in accordance with current OSHA excavation and trench safety standards and other applicable requirements. Sides of excavations might need to be sloped, benched, or braced to develop and maintain a safe work environment. Temporary shoring must be designed according to applicable regulatory requirements. Contractors are responsible for excavation safety. Excavations will be susceptible to caving.

Existing Utilities

All existing utilities are recommended to be identified and any planned to be reused should be relocated outside the proposed building area. Utilities that are not reused should be capped and removed in accordance with pertinent regulations. Excavations for utilities are recommended to be backfilled with engineered fill placed under engineering-controlled conditions. Earthwork operations must be done carefully so that existing utilities are not damaged or disturbed. Utility elevations, locations, and types should be checked relative to the proposed construction.

Questionable Materials

Questionable material, if encountered, is recommended to be evaluated by a geotechnical engineer to determine if removal and replacement with engineered fill is necessary. Disposal of unsuitable material is recommended to be in accordance with local, state, and federal regulations for the material type. This report might need to be revised if the actual subsurface conditions differ from those noted on the *Test Boring Logs*.

8.10. Recommended Construction Materials Testing Services

This report was prepared assuming that a geotechnical engineer will perform Construction Materials Testing ("CMT") services during construction of the proposed development. Supplemental geotechnical recommendations might be needed based on the results of CMT services and specific details of the project not known at this time.

9.0 BASIS OF REPORT

This report is strictly based on the project description given in Section 3.0. Giles must be notified if the project description or our assumptions are not accurate so that this report can be amended, if needed. This report assumes that the facility will be designed and constructed according to the codes that govern construction at the site.

The conclusions and recommendations in this report are based on the estimated subsurface conditions shown on the *Test Boring Logs*. Giles must be notified if the subsurface conditions that are encountered during construction of the proposed development differ from those shown on the *Test Boring Logs*; revision of this report might be necessary. General comments and limitations of this report are given in the appendix.

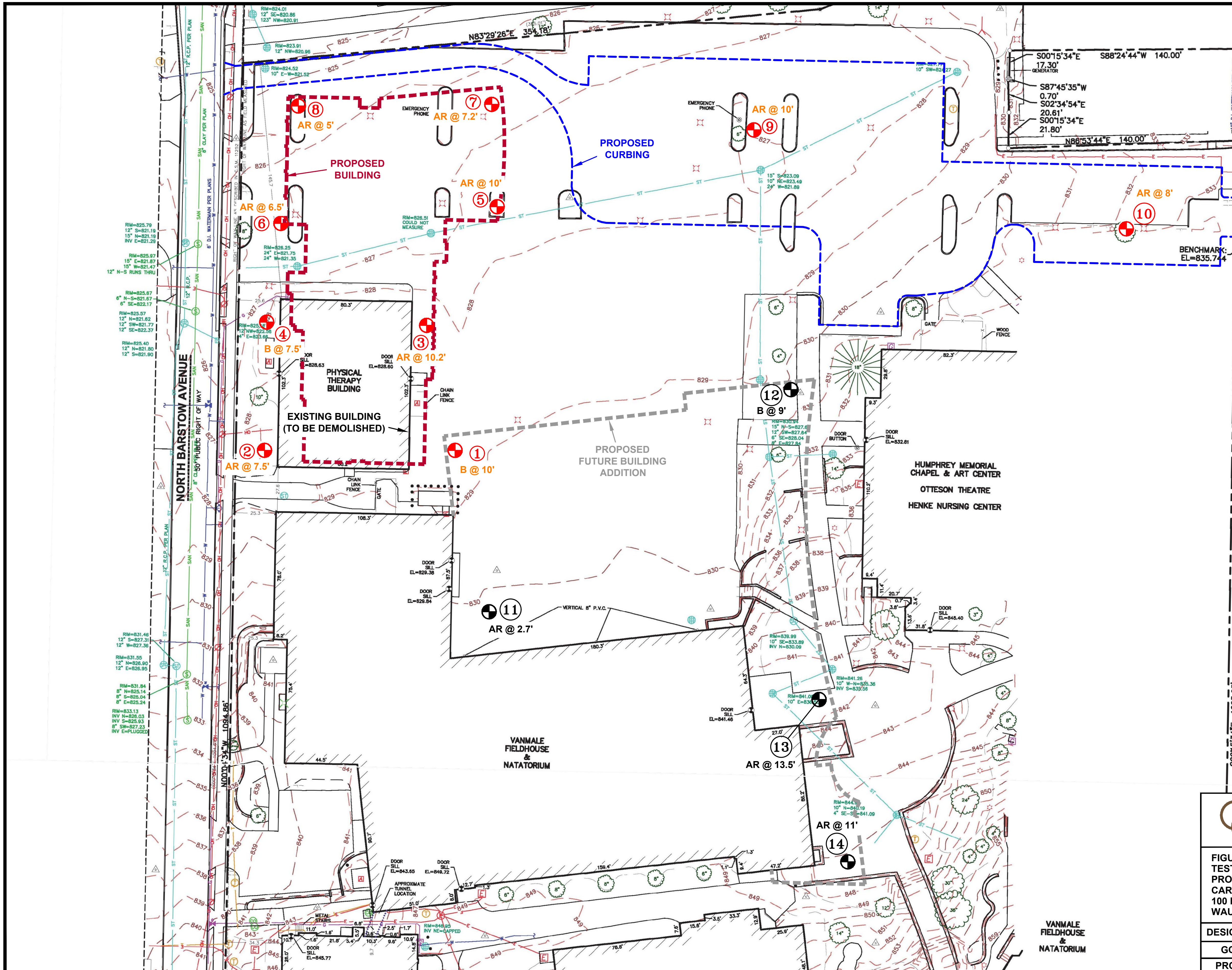
The conclusions and recommendations in this report have been promulgated in accordance with generally accepted professional engineering practices in the field of geotechnical engineering. No other warranty is either expressed or implied.

APPENDIX A

FIGURES AND TEST BORING LOGS

The Test Boring Location Plan contained herein was prepared based upon information supplied by *Giles'* client, or others, along with *Giles'* field measurements and observations. The diagram is presented for conceptual purposes only and is intended to assist the reader in report interpretation.

The Test Boring Logs and related information enclosed herein depict the subsurface (soil and water) conditions encountered at the specific boring locations on the date that the exploration was performed. Subsurface conditions may differ between boring locations and within areas of the site that were not explored with test borings. The subsurface conditions may also change at the boring locations over the passage of time.



NOTES:

1.) TEST BORING LOCATIONS ARE APPROXIMATE.

2.) PROPOSED FEATURES ARE APPROXIMATE BASED ON THE "SITE PLAN - BORINGS", DATED 12-14-2022, PREPARED BY KAHLER SLATER.

3.) BASE MAP DEVELOPED FROM THE "EXISTING CONDITIONS SURVEY" (SHEET 1 & 2), DATED 11-3-2021, PREPARED BY JSD PROFESSIONAL SERVICES, INC.

LEGEND:

①	GEOTECHNICAL TEST BORING
AR	AUGER REFUSAL
B	BEDROCK

GILES ENGINEERING ASSOCIATES, INC.
N8 W22350 JOHNSON DRIVE, SUITE A1
WAUKESHA, WI 53186 (262)544-0118
www.gilesengr.com

FIGURE 1
TEST BORING LOCATION PLAN
PROPOSED IMPROVEMENTS
CARROLL UNIVERSITY
100 N. EAST AVENUE
WAUKESHA, WISCONSIN

DESIGNED	DRAWN	SCALE	DATE	REVISED
GCH	ERA	approx. 1"=60'	09-13-23	--
PROJECT NO.: 1G-2301011			CAD No. 1g2301011-blp	

BORING NO. & LOCATION: 1	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 828.8 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±3" Asphalt-Concrete										
Fill: Dark Gray lean Clay, little Sand, trace Gravel-Moist			1-SS		1.5	2.0		15	BDL	
Fill: Brown Gravelly fine to medium Sand-Moist (Includes Asphalt rubble)			2-SS	14					BDL	
		825								
	5		3-SS	11					BDL	
			4-SS	6				40	BDL	
		820								
			5-SS	50/4"				16	BDL	
Limestone Bedrock	10									
			6-DB						BDL	Recovery=100% RQD=40%
		815								
	15									
			7-DB						BDL	Recovery=96.7% RQD=60%
		810								
	20									

Auger Refusal at 10 feet
Boring Terminated at about 20 feet (EL. 808.8')

Water Observation Data	Remarks:
Water Encountered During Drilling:	Auger Refusal at 10 feet. Rock coring starts at 10 feet BDL= Below Detection Limit
Water Level At End of Drilling:	
Cave Depth At End of Drilling:	
Water Level After Drilling:	
Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 2	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 828.1 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: KEITH FLOWERS	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±12" Topsoil: Dark Brown lean Clay, trace Sand and Organic Matter-Moist			1-SS	5				12	BDL	
Fill: Brown Sandy Clay, trace Gravel-Moist (Includes Cobbles and Boulders)		825	2-SS	4	1.6	2.0		18	BDL	
	5		3-SS	6			0.3	26	BDL	
			4-SS	50/0					BDL	(a)

Auger Refusal
Boring Terminated at about 7.5 feet (EL. 820.6')

	Water Observation Data	Remarks:
▽	Water Encountered During Drilling:	(a) Poor Sample Recovery BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 3	TEST BORING LOG	
SURFACE ELEVATION: 828.2 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	GILES ENGINEERING ASSOCIATES, INC.
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: KEITH FLOWERS	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Fill: Dark Gray lean Clay, little Sand and Gravel-Moist (Includes Asphalt rubble)			1-SS	50		0.8		22	BDL	
		825	2-SS	12				44	BDL	(a)
	5		3-SS	9		1.8		26	BDL	
Fill: Dark Brown Sandy Clay, trace Gravel-Moist		820	4-SS	4		1.5		18	BDL	
Fill: Brown Sandy Clay, little Gravel-Moist (Includes Cobbles and Boulders) (Includes Glass)	10		5-SS	50/3"				21	BDL	

Auger Refusal
Boring Terminated at about 10.2 feet (EL. 818')

	Water Observation Data	Remarks:
▽	Water Encountered During Drilling:	(a) No SPT Recovery - Auger Sample Obtained BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 4	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 828 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: KEITH FLOWERS	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±12" Topsoil: Dark Brown Sandy Clay, trace Organic Matter-Moist										
Fill: Dark Brown Gravelly Sand, little Silt-Moist (Includes Glass)			1-SS	8				21	BDL	
		825	2-SS	10				14	BDL	
Fill: Brown Silty fine to medium Sand, little Gravel-Moist	5		3-SS	2				27	BDL	
Weathered Limestone Bedrock			4-SS	50/2"					BDL	(a)

Auger Refusal
Boring Terminated at about 7.5 feet (EL. 820.5')

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling:	(a) Poor Sample Recovery BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 5	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 827.5 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±3" Asphalt-Concrete										
±5" Base Course										
Fill: Brown Sandy Clay, little Gravel-Moist (Includes Asphalt rubble)			1-SS	35		1.5		11	BDL	
Fill: Brown lean Clay, little Sand and Gravel-Moist (Includes Cobbles and Boulders)		825	2-SS	15				15	BDL	
Fill: Brown Gravelly fine to medium Sand-Moist	5		3-SS	10				8	BDL	
Fill: Dark Brown lean Clay, little Sand and Gravel-Moist		820	4-SS	26				15	BDL	(a)
Fill: Dark Gray Silty Gravel-Wet	10		5-SS	50/5"					BDL	(b)

Auger Refusal
Boring Terminated at about 10 feet (EL. 817.5')

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling:	(a) No SPT Recovery - Auger Sample Obtained (b) Poor Sample Recovery BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION:	TEST BORING LOG	
6		
SURFACE ELEVATION: 826.7 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	GILES ENGINEERING ASSOCIATES, INC.
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±3" Asphalt-Concrete										
±6" Base Course			1-SS	29				10	BDL	
Fill: Brown Sandy Clay, little Gravel-Moist (Includes Asphalt rubble)		825								
Fill: Brown Gravelly Sand, trace Clay-Moist (includes Asphalt rubble)			2-SS	11				30	BDL	
Fill: Dark Gray lean Clay, trace Sand and Gravel-Moist (Includes Cobbles and Boulders)	5		3-SS	17				31	BDL	

Auger Refusal
Boring Terminated at about 6.5 feet (EL. 820.2')

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling:	BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 7	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 826.5 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±3" Asphalt-Concrete										
±15" Crushed Limestone Base		825	1-SS	22				19	BDL	
Fill: Dark Brown Gravelly Sand-Moist (Includes Asphalt rubble)			2-SS	9					BDL	
Fill: Brown Sandy Clay, little Gravel-Moist (Includes Asphalt and Brick rubble)	5		3-SS	6		1.5		12	BDL	
Fill: Brown Silty fine to medium Sand, trace Gravel-Wet (Includes Asphalt rubble)		820								(a)
Limestone Bedrock			4-SS	50/4"					BDL	
	10	815	5-DB							Recovery=68.2% RQD=0%
	15	810	6-DB							Recovery=83.6% RQD=34.5%

Auger Refusal at 7.2 feet
Boring Terminated at about 18 feet (EL. 808.5')

Water Observation Data	Remarks:
Water Encountered During Drilling:	(a) Poor Sample Recovery Auger Refusal at 7.2 feet. Rock Coring starts at 8 feet BDL = Below Detection Limit
Water Level At End of Drilling:	
Cave Depth At End of Drilling:	
Water Level After Drilling:	
Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 8	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 825.5 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±3" Asphalt-Concrete		825								
±6" Base Course			1-SS	11				19	BDL	
Fill: Dark Brown Silty fine to medium Sand, trace Gravel-Moist (Includes Asphalt rubble)										
Fill: Brown Sandy Clay, trace Gravel and Organic Matter-Moist (Includes Wood debris)			2-SS	19		1.5		19	48.8	Strong Petroleum Odor
Fill: Dark Gray lean Clay, little Gravel-Moist (Includes Cobbles and Boulders)	5		3-SS	50/5"					5.5	Slight Petroleum Odor
Auger Refusal Boring Terminated at about 5 feet (EL. 820.5')										

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling:	BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION: 9	TEST BORING LOG	GILES ENGINEERING ASSOCIATES, INC.
SURFACE ELEVATION: 827.1 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY	
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN	
FIELD REP: JAMES BLAIR	PROJECT NO: 1G-2301011	

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
Fill: Brown Gravelly fine to medium Sand-Moist			1-SS	62				9	BDL	
Fill: Brown fine to medium Sand, trace Gravel-Moist		825	2-SS	13					BDL	
Fill: Dark Brown Gravelly fine to medium Sand, little Clay-Moist (Includes Asphalt rubble)	5		3-SS	8				32	BDL	
Fill: Brown lean Clay with Gravel-Moist (Includes Brick rubble)		820	4-SS	5				20	BDL	
	10		5-SS	50/3"					BDL	

Auger Refusal
Boring Terminated at about 10 feet (EL. 817.1')

	Water Observation Data	Remarks:
∇	Water Encountered During Drilling:	BDL = Below Detection Limit
▼	Water Level At End of Drilling:	
	Cave Depth At End of Drilling:	
▼	Water Level After Drilling:	
	Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

BORING NO. & LOCATION:	TEST BORING LOG
10	
SURFACE ELEVATION: 832.2 feet	PROPOSED ADDITIONS - CARROLL UNIVERSITY
COMPLETION DATE: 02/08/23	100 N. EAST AVENUE WAUKESHA, WISCONSIN
FIELD REP: KEITH FLOWERS	PROJECT NO: 1G-2301011

GILES ENGINEERING ASSOCIATES, INC.

MATERIAL DESCRIPTION	Depth (ft)	Elevation	Sample No. & Type	N	Q_u (tsf)	Q_p (tsf)	Q_s (tsf)	W (%)	PID	NOTES
±5" Asphalt-Concrete										
±5" Base Course										
Fill: Brown lean Clay, trace Sand and Gravel-Moist			1-SS	8				30	BDL	
		830	2-SS	6		3.3		23	BDL	
Brown fine to medium Sand, little Gravel-Moist	5		3-SS	7					BDL	
		825	4-SS	50/1"					BDL	(a)

Auger Refusal
Boring Terminated at about 8 feet (EL. 824.2')

Water Observation Data	Remarks:
Water Encountered During Drilling:	(a) Poor Sample Recovery BDL = Below Detection Limit
Water Level At End of Drilling:	
Cave Depth At End of Drilling:	
Water Level After Drilling:	
Cave Depth After Drilling:	

Changes in strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between test borings. Location of test boring is shown on the Boring Location Plan.

APPENDIX B

FIELD PROCEDURES

The field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) designation D

420 entitled "Standard Guide for Sampling Rock and Rock" and/or other relevant specifications. Soil samples were preserved and transported to *Giles'* laboratory in general accordance with the procedures recommended by ASTM designation D 4220 entitled "Standard Practice for Preserving and Transporting Soil Samples." Brief descriptions of the sampling, testing and field procedures commonly performed by *Giles* are provided herein.

GENERAL FIELD PROCEDURES

Test Boring Elevations

The ground surface elevations reported on the Test Boring Logs are referenced to the assumed benchmark shown on the Boring Location Plan (Figure 1). Unless otherwise noted, the elevations were determined with a conventional hand-level and are accurate to within about 1 foot.

Test Boring Locations

The test borings were located on-site based on the existing site features and/or apparent property lines. Dimensions illustrating the approximate boring locations are reported on the Boring Location Plan (Figure 1).

Water Level Measurement

The water levels reported on the Test Boring Logs represent the depth of “free” water encountered during drilling and/or after the drilling tools were removed from the borehole. Water levels measured within a granular (sand and gravel) soil profile are typically indicative of the water table elevation. It is usually not possible to accurately identify the water table elevation with cohesive (clayey) soils, since the rate of seepage is slow. The water table elevation within cohesive soils must therefore be determined over a period of time with groundwater observation wells.

It must be recognized that the water table may fluctuate seasonally and during periods of heavy precipitation. Depending on the subsurface conditions, water may also become perched above the water table, especially during wet periods.

Borehole Backfilling Procedures

Each borehole was backfilled upon completion of the field operations. If potential contamination was encountered, and/or if required by state or local regulations, boreholes were backfilled with an “impervious” material (such as bentonite slurry). Borings that penetrated pavements, sidewalks, etc. were “capped” with Portland Cement concrete, asphaltic concrete, or a similar surface material. It must, however, be recognized that the backfill material may settle, and the surface cap may subside, over a period of time. Further backfilling and/or re-surfacing by *Giles’* client or the property owner may be required.

FIELD SAMPLING AND TESTING PROCEDURES

Auger Sampling (AU)

Soil samples are removed from the auger flights as an auger is withdrawn above the ground surface. Such samples are used to determine general soil types and identify approximate soil stratifications. Auger samples are highly disturbed and are therefore not typically used for geotechnical strength testing.

Split-Barrel Sampling (SS) – (ASTM D-1586)

A split-barrel sampler with a 2-inch outside diameter is driven into the subsoil with a 140-pound hammer free-falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the "Standard Penetration Resistance" or N-value is an index of the relative density of granular soils and the comparative consistency of cohesive soils. A soil sample is collected from each SPT interval.

Shelby Tube Sampling (ST) – (ASTM D-1587)

A relatively undisturbed soil sample is collected by hydraulically advancing a thin-walled Shelby Tube sampler into a soil mass. Shelby Tubes have a sharp cutting edge and are commonly 2 to 5 inches in diameter.

Bulk Sample (BS)

A relatively large volume of soils is collected with a shovel or other manually-operated tool. The sample is typically transported to *Giles'* materials laboratory in a sealed bag or bucket.

Dynamic Cone Penetration Test (DC) – (ASTM STP 399)

This test is conducted by driving a 1.5-inch-diameter cone into the subsoil using a 15-pound steel ring (hammer), free-falling a vertical distance of 20 inches. The number of hammer-blows required to drive the cone 1¾ inches is an indication of the soil strength and density, and is defined as "N". The Dynamic Cone Penetration test is commonly conducted in hand auger borings, test pits and within excavated trenches.

- Continued -

Ring-Lined Barrel Sampling – (ASTM D 3550)

In this procedure, a ring-lined barrel sampler is used to collect soil samples for classification and laboratory testing. This method provides samples that fit directly into laboratory test instruments without additional handling/disturbance.

Sampling and Testing Procedures

The field testing and sampling operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the field testing (i.e. N-values) are reported on the Test Boring Logs. Explanations of the terms and symbols shown on the logs are provided on the appendix enclosure entitled “General Notes”.

APPENDIX C

LABORATORY TESTING AND CLASSIFICATION

The laboratory testing was conducted under the supervision of a geotechnical engineer in accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Brief descriptions of laboratory tests commonly performed by *Giles* are provided herein.

LABORATORY TESTING AND CLASSIFICATION

Photoionization Detector (PID)

In this procedure, soil samples are "scanned" in *Giles'* analytical laboratory using a Photoionization Detector (PID). The instrument is equipped with an 11.7 eV lamp calibrated to a Benzene Standard and is capable of detecting a minute concentration of **certain** Volatile Organic Compound (VOC) vapors, such as those commonly associated with petroleum products and some solvents. Results of the PID analysis are expressed in HNu (manufacturer's) units rather than actual concentration.

Moisture Content (w) (ASTM D 2216)

Moisture content is defined as the ratio of the weight of water contained within a soil sample to the weight of the dry solids within the sample. Moisture content is expressed as a percentage.

Unconfined Compressive Strength (qu) (ASTM D 2166)

An axial load is applied at a uniform rate to a cylindrical soil sample. The unconfined compressive strength is the maximum stress obtained or the stress when 15% axial strain is reached, whichever occurs first.

Calibrated Penetrometer Resistance (qp)

The small, cylindrical tip of a hand-held penetrometer is pressed into a soil sample to a prescribed depth to measure the soils capacity to resist penetration. This test is used to evaluate unconfined compressive strength.

Vane-Shear Strength (qs)

The blades of a vane are inserted into the flat surface of a soil sample and the vane is rotated until failure occurs. The maximum shear resistance measured immediately prior to failure is taken as the vane-shear strength.

Loss-on-Ignition (ASTM D 2974; Method C)

The Loss-on-Ignition (L.O.I.) test is used to determine the organic content of a soil sample. The procedure is conducted by heating a dry soil sample to 440°C in order to burn-off or "ash" organic matter present within the sample. The L.O.I. value is the ratio of the weight loss due to ignition compared to the initial weight of the dry sample. L.O.I. is expressed as a percentage.

Particle Size Distribution (ASTB D 421, D 422, and D 1140)

This test is performed to determine the distribution of specific particle sizes (diameters) within a soil sample. The distribution of coarse-grained soil particles (sand and gravel) is determined from a “sieve analysis,” which is conducted by passing the sample through a series of nested sieves. The distribution of fine-grained soil particles (silt and clay) is determined from a “hydrometer analysis” which is based on the sedimentation of particles suspended in water.

Consolidation Test (ASTM D 2435)

In this procedure, a series of cumulative vertical loads are applied to a small, laterally confined soil sample. During each load increment, vertical compression (consolidation) of the sample is measured over a period of time. Results of this test are used to estimate settlement and time rate of settlement.

Classification of Samples

Each soil sample was visually-manually classified, based on texture and plasticity, in general accordance with the Unified Soil Classification System (ASTM D-2488-75). The classifications are reported on the Test Boring Logs.

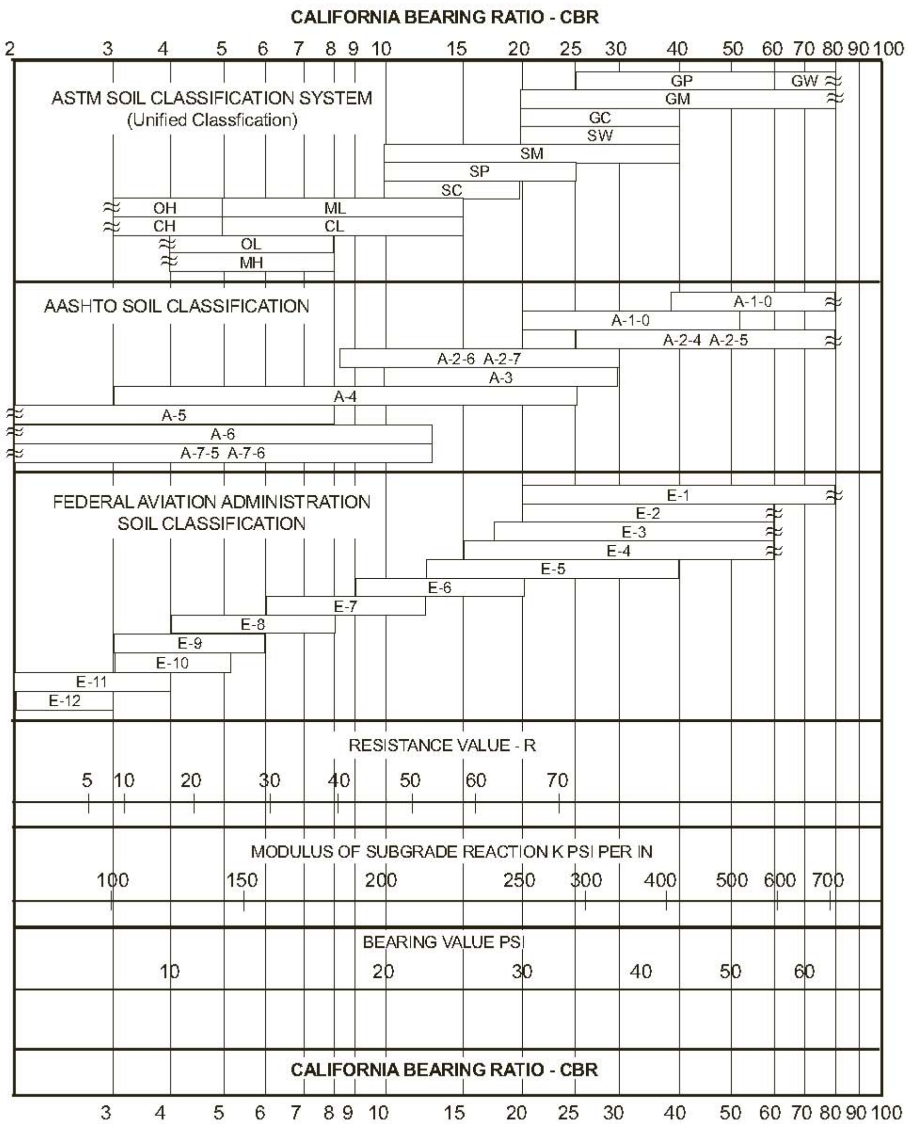
Laboratory Testing

The laboratory testing operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) and/or other relevant specifications. Results of the laboratory tests are provided on the Test Boring Logs or other appendix enclosures. Explanation of the terms and symbols used on the logs is provided on the appendix enclosure entitled “General Notes.”

California Bearing Ratio (CBR) Test ASTM D-1833

The CBR test is used for evaluation of a soil subgrade for pavement design. The test consists of measuring the force required for a 3-square-inch cylindrical piston to penetrate 0.1 or 0.2 inch into a compacted soil sample. The result is expressed as a percent of force required to penetrate a standard compacted crushed stone.

Unless a CBR test has been specifically requested by the client, the CBR is estimated from published charts, based on soil classification and strength characteristics. A typical correlation chart is below.



APPENDIX D

GENERAL INFORMATION

AND
IMPORTANT INFORMATION ABOUT
THIS GEOTECHNICAL REPORT

GENERAL COMMENTS

The soil samples obtained during the subsurface exploration will be retained for a period of thirty days. If no instructions are received, they will be disposed of at that time.

This report has been prepared exclusively for the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. Copies of this report may be provided to contractor(s), with contract documents, to disclose information relative to this project. The report, however, has not been prepared to serve as the plans and specifications for actual construction without the appropriate interpretation by the project architect, structural engineer, and/or civil engineer. Reproduction and distribution of this report must be authorized by the client and *Giles*.

This report has been based on assumed conditions/characteristics of the proposed development where specific information was not available. It is recommended that the architect, civil engineer and structural engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. The project plans and specifications may also be submitted to *Giles* for review to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted.

The analysis of this site was based on a subsoil profile interpolated from a limited subsurface exploration. If the actual conditions encountered during construction vary from those indicated by the borings, *Giles* must be contacted immediately to determine if the conditions alter the recommendations contained herein.

The conclusions and recommendations presented in this report have been promulgated in accordance with generally accepted professional engineering practices in the field of geotechnical engineering. No other warranty is either expressed or implied.

GUIDE SPECIFICATIONS FOR SUBGRADE AND GRADE PREPARATION FOR FILL, FOUNDATION, FLOOR SLAB AND PAVEMENT SUPPORT; AND SELECTION, PLACEMENT AND COMPACTION OF FILL SOILS USING STANDARD PROCTOR PROCEDURES

1. Construction monitoring and testing of subgrades and grades for fill, foundation, floor slab and pavement; and fill selection, placement and compaction shall be performed by an experienced soils engineer and/or his representatives.

2. All compaction fill, subgrades and grades shall be (a) underlain by suitable bearing material; (b) free of all organic, frozen, or other deleterious material, and (c) observed, tested and approved by qualified engineering personnel representing an experienced soils engineer. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of (a) proof-rolling to detect soil, wet yielding soils or other unstable materials that must be undercut, (b) scarifying top 6 to 8 inches, (c) moisture conditioning the soils as required, and (d) recompaction to same minimum in-situ density required for similar materials indicated under Item 5. Note: compaction requirements for pavement subgrade are higher than other areas. Weather and construction equipment may damage compacted fill surface and reworking and retesting may be necessary to assure proper performance.

3. In overexcavation and fill areas, the compacted fill must extend (a) a minimum 1 foot lateral distance beyond the exterior edge of the foundation at bearing grade or pavement subgrade and down to compacted fill subgrade on a maximum 0.5(H):1(V) slope, (b) 1 foot above footing grade outside the building, and (c) to floor subgrade inside the building. Fill shall be placed and compacted on a 5(H):1(V) slope or must be stepped or benched as required to flatten if not specifically approved by qualified personnel under the direction of an experienced soil engineer.

4. The compacted fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated", and shall be low-expansive with a maximum Liquid Limit (ASTM D-423) and Plasticity Index (ASTM D-424) of 30 and 15, respectively, unless specifically tested and found to have low expansive properties and approved by an experienced soils engineer. The top 12 inches of compacted fill should have a maximum 3-inch-particle diameter and all underlying compacted fill a maximum 6-inch-diameter unless specifically approved by an experienced soils engineer. All fill materials must be tested and approved under the direction of an experienced soils engineer prior to placement. If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per the Unified Soil Classification System (ASTM D-2487).

5. For structural fill depths less than 20 feet, the density of the structural compacted fill and scarified subgrade and grades shall not be less than 95 percent of the maximum dry density as determined by Standard Proctor (ASTM-698) with the exception of the top 12 inches of pavement subgrade which shall have a minimum in-situ density of 100 percent of maximum dry density, or 5 percent higher than underlying fill materials. Where the structural fill depth is greater than 20 feet, the portions below 20 feet should have a minimum in-place density of 100 percent of its maximum dry density of 5 percent greater than the top 20 feet. The moisture content of cohesive soil shall not vary by more than -1 to +3 percent and granular soil ±3 percent of the optimum when placed and compacted or recompacted, unless specifically recommended/approved by the soils engineer monitoring the placement and compaction. Cohesive soils with moderate to high expansion potentials (PI>15) should, however, be placed, compacted and maintained prior to construction at a moisture content 3±1 percent above optimum moisture content to limit further heave. The fill shall be placed in layers with a maximum loose thickness of 8 inches for foundations and 10 inches for floor slabs and pavement, unless specifically approved by the soils engineer taking into consideration the type of materials and compaction equipment being used. The compaction equipment should consist of suitable mechanical equipment specifically designed for soil compaction. Bulldozers or similar tracked vehicles are typically not suitable for compaction.

6. Excavation, filling, subgrade and grade preparation shall be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs and seepage water encountered shall be pumped or drained to provide a suitable working platform. Springs or water seepage encountered during grading/foundation construction must be called to the soil engineer's attention immediately for possible construction procedure revision or inclusion of an underdrain system.

7. Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below-grade walls (i.e. basement walls and retaining walls) must be properly tested and approved by an experienced soils engineer with consideration for the lateral pressure used in the wall design.

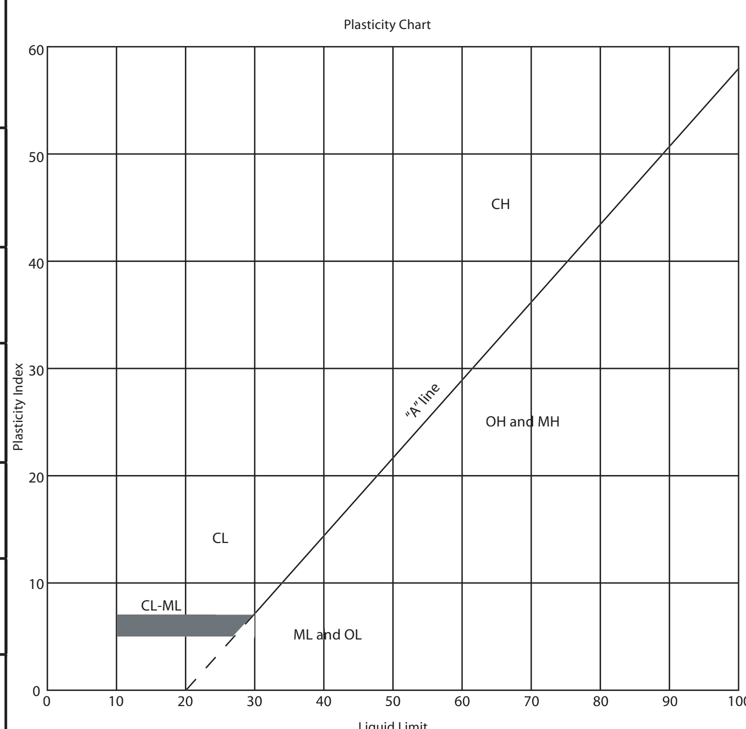
8. Whenever, in the opinion of the soils engineer or the Owner's Representatives, an unstable condition is being created either by cutting or filling, the work shall not proceed into that area until an appropriate geotechnical exploration and analysis has been performed and the grading plan revised, if found necessary.

CHARACTERISTICS AND RATINGS OF UNIFIED SOIL SYSTEM CLASSES FOR SOIL CONSTRUCTION *									
Class	Compaction Characteristics	Max. Dry Density Standard Proctor (pcf)	Compressibility and Expansion	Drainage and Permeability	Value as an Embankment Material	Value as Subgrade When Not Subject to Frost	Value as Base Course	Value as Temporary Pavement	
								With Dust Palliative	With Bituminous Treatment
GW	Good: tractor, rubber-tired, steel wheel or vibratory roller	125-135	Almost none	Good drainage, pervious	Very stable	Excellent	Good	Fair to poor	Excellent
GP	Good: tractor, rubber-tired, steel wheel or vibratory roller	115-125	Almost none	Good drainage, pervious	Reasonably stable	Excellent to good	Poor to fair	Poor	
GM	Good: rubber-tired or light sheepsfoot roller	120-135	Slight	Poor drainage, semipervious	Reasonably stable	Excellent to good	Fair to poor	Poor	Poor to fair
GC	Good to fair: rubber-tired or sheepsfoot roller	115-130	Slight	Poor drainage, impervious	Reasonably stable	Good	Good to fair **	Excellent	Excellent
SW	Good: tractor, rubber-tired or vibratory roller	110-130	Almost none	Good drainage, pervious	Very stable	Good	Fair to poor	Fair to poor	Good
SP	Good: tractor, rubber-tired or vibratory roller	100-120	Almost none	Good drainage, pervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SM	Good: rubber-tired or sheepsfoot roller	110-125	Slight	Poor drainage, impervious	Reasonably stable when dense	Good to fair	Poor	Poor	Poor to fair
SC	Good to fair: rubber-tired or sheepsfoot roller	105-125	Slight to medium	Poor drainage, impervious	Reasonably stable	Good to fair	Fair to poor	Excellent	Excellent
ML	Good to poor: rubber-tired or sheepsfoot roller	95-120	Slight to medium	Poor drainage, impervious	Poor stability, high density required	Fair to poor	Not suitable	Poor	Poor
CL	Good to fair: sheepsfoot or rubber-tired roller	95-120	Medium	No drainage, impervious	Good stability	Fair to poor	Not suitable	Poor	Poor
OL	Fair to poor: sheepsfoot or rubber-tired roller	80-100	Medium to high	Poor drainage, impervious	Unstable, should not be used	Poor	Not suitable	Not suitable	Not suitable
MH	Fair to poor: sheepsfoot or rubber-tired roller	70-95	High	Poor drainage, impervious	Poor stability, should not be used	Poor	Not suitable	Very poor	Not suitable
CH	Fair to poor: sheepsfoot roller	80-105	Very high	No drainage, impervious	Fair stability, may soften on expansion	Poor to very poor	Not suitable	Very poor	Not suitable
OH	Fair to poor: sheepsfoot roller	65-100	High	No drainage, impervious	Unstable, should not be used	Very poor	Not suitable	Not suitable	Not suitable
Pt	Not suitable		Very high	Fair to poor drainage	Should not be used	Not suitable	Not suitable	Not suitable	Not suitable

* "The Unified Classification: Appendix A - Characteristics of Soil, Groups Pertaining to Roads and Airfields, and Appendix B - Characteristics of Soil Groups Pertaining to Embankments and Foundations," Technical Memorandum 357, U.S. Waterways Ixperiment Station, Vicksburg, 1953.

** Not suitable if subject to frost.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*	
Coarse-grained soils (more than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent: GW, GP, SW, SP; More than 12 percent: GM, GC, SM, SC; 5 to 12 percent: *Borderline* cases requiring dual symbols[b]	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtrues, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4 — Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4 — Limits plotting within shaded area, above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7
Fine-grained soils (More than half material is smaller than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits, suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u is used when L.L. is greater than 28.
[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group sympols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-75)

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 inch and larger
Cobbles:	3 inch to 8 inch
Gravel:	coarse - ¾ to 3 inch
	fine – No. 4 (4.76 mm) to ¾ inch
Sand:	coarse – No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium – No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (non-plastic)
Clay:	No 200 (0.074 mm) and smaller (plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance (correlated to Unconfined Compressive Strength, tsf)
PID:	Results of vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benzene standard. Results expressed in HNU-Units. (BDL=Below Detection Limit)
N:	Penetration Resistance per 12 inch interval, or fraction thereof, for a standard 2 inch O.D. (1⅜ inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N-Values where plus sign (+) is shown.
Nc:	Penetration Resistance per 1¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.
Nr:	Penetration Resistance per 12 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube – 3 inch O.D. (except where noted)
CS:	3 inch O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	**BLOWS PER FOOT (N)**	**UNCONFINED COMPRESSIVE STRENGTH (TSF)**
Very Soft	0 - 2	0 - 0.25
Soft	3 - 4	0.25 - 0.50
Medium Stiff	5 – 8	0.50 - 1.00
Stiff	9 – 15	1.00 - 2.00
Very Stiff	16 – 30	2.00 - 4.00
Hard	31+	4.00+

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	**BLOWS PER FOOT (N)**
Very Loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	51+

DEGREE OF PLASTICITY	**PI**
None to Slight	0 - 4
Slight	5 - 10
Medium	11 - 30
High to Very High	31+

DEGREE OF EXPANSIVE POTENTIAL	**PI**
Low	0 - 15
Medium	15 - 25
High	25+

Important Information about This
Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Geotechnical, Environmental & Construction Materials Consultants

GILES
ENGINEERING ASSOCIATES, INC.

www.gilesengr.com

Wisconsin Department of Safety and Professional Services
Division of Industry Services
4822 Madison Yards Way
PO Box 7302
Madison, WI 53707

Phone: 608-266-2112
Web: http://dsps.wi.gov
Email: dsps@wisconsin.gov

Program: Plumbing
Web: https://dsps.wi.gov/Pages/Programs/Plumbing

Soil and Site Evaluation – Stormwater Infiltration

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]

Page _1_ of ____

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but is not limited to: vertical and horizontal reference point (BM); direction and percent of slope; scale or dimensions; north arrow; and BM referenced to nearest road.

PLEASE PRINT ALL INFORMATION

COUNTY

PARCEL ID

PROPERTY OWNER

PROPERTY OWNER'S MAILING ADDRESS

CITY, STATE, ZIP CODE PHONE

PROPERTY LOCATION

Govt. Lot ____, ____ ¼, ____ ¼, S ____, T ____N, R ____

Lot #, Block #, Subd. Name or CSM #: ________________

Municipality: ____________________

☐ City ☐ Village ☐ Town

Nearest Road:

Drainage area__________________ ☐sq. ft. ☐acres

Test site suitable for (check all that apply):

☐Site not suitable ☐Bioretention

☐Reuse ☐Subsurface Dispersal System

☐Irrigation ☐Other ______________________

HYDRAULIC APPLICATION TEST METHOD

☐ Morphological Evaluation

☐ Double Ring Infiltrometer

☐ Other: (specify)

____

SOIL MOISTURE

Date of soil borings:

____

USDA-NRCS WETS VALUE:

☐ Dry = 1

☐ Normal = 2

☐ Wet = 3

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation ________ ft. Elevation of Limiting Factor ________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation _________ ft. Elevation of Limiting Factor _________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation _________ ft. Elevation of Limiting Factor _________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation _________ ft. Elevation of Limiting Factor _________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation _________ ft. Elevation of Limiting Factor _________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

____ #OBS. ☐ Pit ☐ Boring Ground Surface Elevation _________ ft. Elevation of Limiting Factor _________ ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App. Rate Inches/Hr.

Comments:

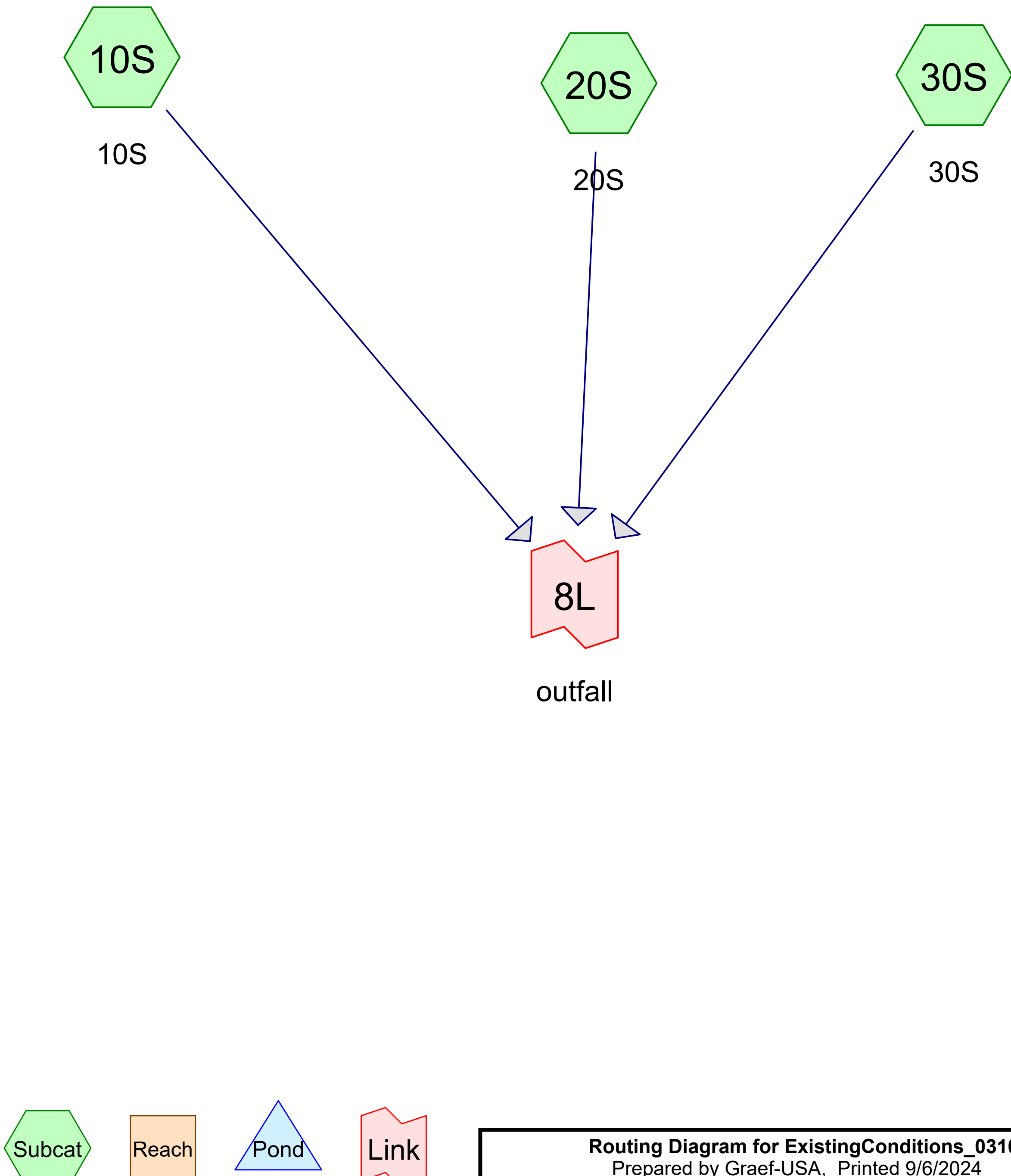
Overall Site Comments:

Name (Please Print) | Signature | Credential Number

Address | Date Evaluation Conducted | Phone Number

APPENDIX B

Pre-Development Site Hydrologic & Hydraulic Analysis



Routing Diagram for ExistingConditions_0310
Prepared by Graef-USA, Printed 9/6/2024
HydroCAD® 10.20-3g s/n 07832 © 2023 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.800	61	>75% Grass cover, Good, HSG B (10S, 20S, 30S)
3.036	98	Paved parking, HSG B (10S, 20S, 30S)
3.836	**90**	**TOTAL AREA**

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

Subcatchment 10S: 10S Runoff Area=3.787 ac 79.85% Impervious Runoff Depth>1.71"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=10.30 cfs 0.538 af

Subcatchment 20S: 20S Runoff Area=0.025 ac 24.00% Impervious Runoff Depth>0.62"
Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.001 af

Subcatchment 30S: 30S Runoff Area=0.024 ac 25.00% Impervious Runoff Depth>0.64"
Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.001 af

Link 8L: outfall Inflow=10.35 cfs 0.541 af
Primary=10.35 cfs 0.541 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.541 af Average Runoff Depth = 1.69"
20.86% Pervious = 0.800 ac 79.14% Impervious = 3.036 ac

Summary for Subcatchment 10S: 10S

Runoff = 10.30 cfs @ 12.13 hrs, Volume= 0.538 af, Depth> 1.71"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.763	61	>75% Grass cover, Good, HSG B
3.024	98	Paved parking, HSG B
3.787		Weighted Average
0.763		20.15% Pervious Area
3.024		79.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 20S: 20S

Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 0.62"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.019	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.025		Weighted Average
0.019		76.00% Pervious Area
0.006		24.00% Impervious Area

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

Summary for Subcatchment 30S: 30S

Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 0.64"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.018	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.024		Weighted Average
0.018		75.00% Pervious Area
0.006		25.00% Impervious Area

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

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 79.14% Impervious, Inflow Depth > 1.69" for 1-YR event
Inflow = 10.35 cfs @ 12.13 hrs, Volume= 0.541 af
Primary = 10.35 cfs @ 12.13 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment 10S: 10S Runoff Area=3.787 ac 79.85% Impervious Runoff Depth>1.95"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=11.74 cfs 0.616 af

Subcatchment 20S: 20S Runoff Area=0.025 ac 24.00% Impervious Runoff Depth>0.75"
Tc=6.0 min CN=WQ Runoff=0.03 cfs 0.002 af

Subcatchment 30S: 30S Runoff Area=0.024 ac 25.00% Impervious Runoff Depth>0.77"
Tc=6.0 min CN=WQ Runoff=0.03 cfs 0.002 af

Link 8L: outfall Inflow=11.79 cfs 0.619 af
Primary=11.79 cfs 0.619 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.619 af Average Runoff Depth = 1.94"
20.86% Pervious = 0.800 ac 79.14% Impervious = 3.036 ac

Summary for Subcatchment 10S: 10S

Runoff = 11.74 cfs @ 12.13 hrs, Volume= 0.616 af, Depth> 1.95"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.763	61	>75% Grass cover, Good, HSG B
3.024	98	Paved parking, HSG B
3.787		Weighted Average
0.763		20.15% Pervious Area
3.024		79.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 20S: 20S

Runoff = 0.03 cfs @ 12.14 hrs, Volume= 0.002 af, Depth> 0.75"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.019	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.025		Weighted Average
0.019		76.00% Pervious Area
0.006		24.00% Impervious Area

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

Summary for Subcatchment 30S: 30S

Runoff = 0.03 cfs @ 12.14 hrs, Volume= 0.002 af, Depth> 0.77"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.018	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.024		Weighted Average
0.018		75.00% Pervious Area
0.006		25.00% Impervious Area

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

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 79.14% Impervious, Inflow Depth > 1.94" for 2-YR event
Inflow = 11.79 cfs @ 12.13 hrs, Volume= 0.619 af
Primary = 11.79 cfs @ 12.13 hrs, Volume= 0.619 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment 10S: 10S Runoff Area=3.787 ac 79.85% Impervious Runoff Depth>2.88"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=17.31 cfs 0.910 af

Subcatchment 20S: 20S Runoff Area=0.025 ac 24.00% Impervious Runoff Depth>1.33"
Tc=6.0 min CN=WQ Runoff=0.05 cfs 0.003 af

Subcatchment 30S: 30S Runoff Area=0.024 ac 25.00% Impervious Runoff Depth>1.36"
Tc=6.0 min CN=WQ Runoff=0.05 cfs 0.003 af

Link 8L: outfall Inflow=17.41 cfs 0.916 af
Primary=17.41 cfs 0.916 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.916 af Average Runoff Depth = 2.86"
20.86% Pervious = 0.800 ac 79.14% Impervious = 3.036 ac

Summary for Subcatchment 10S: 10S

Runoff = 17.31 cfs @ 12.13 hrs, Volume= 0.910 af, Depth> 2.88"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.763	61	>75% Grass cover, Good, HSG B
3.024	98	Paved parking, HSG B
3.787		Weighted Average
0.763		20.15% Pervious Area
3.024		79.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 20S: 20S

Runoff = 0.05 cfs @ 12.14 hrs, Volume= 0.003 af, Depth> 1.33"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.019	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.025		Weighted Average
0.019		76.00% Pervious Area
0.006		24.00% Impervious Area

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

Summary for Subcatchment 30S: 30S

Runoff = 0.05 cfs @ 12.14 hrs, Volume= 0.003 af, Depth> 1.36"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.018	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.024		Weighted Average
0.018		75.00% Pervious Area
0.006		25.00% Impervious Area

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

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 79.14% Impervious, Inflow Depth > 2.86" for 10-YR event
Inflow = 17.41 cfs @ 12.13 hrs, Volume= 0.916 af
Primary = 17.41 cfs @ 12.13 hrs, Volume= 0.916 af, Atten= 0%, Lag= 0.0 min

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

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

Subcatchment 10S: 10S Runoff Area=3.787 ac 79.85% Impervious Runoff Depth>4.95"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=29.72 cfs 1.562 af

Subcatchment 20S: 20S Runoff Area=0.025 ac 24.00% Impervious Runoff Depth>2.90"
Tc=6.0 min CN=WQ Runoff=0.12 cfs 0.006 af

Subcatchment 30S: 30S Runoff Area=0.024 ac 25.00% Impervious Runoff Depth>2.93"
Tc=6.0 min CN=WQ Runoff=0.12 cfs 0.006 af

Link 8L: outfall Inflow=29.97 cfs 1.574 af
Primary=29.97 cfs 1.574 af

Total Runoff Area = 3.836 ac Runoff Volume = 1.574 af Average Runoff Depth = 4.92"
20.86% Pervious = 0.800 ac 79.14% Impervious = 3.036 ac

Summary for Subcatchment 10S: 10S

Runoff = 29.72 cfs @ 12.13 hrs, Volume= 1.562 af, Depth> 4.95"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.763	61	>75% Grass cover, Good, HSG B
3.024	98	Paved parking, HSG B
3.787		Weighted Average
0.763		20.15% Pervious Area
3.024		79.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 20S: 20S

Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.006 af, Depth> 2.90"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.019	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.025		Weighted Average
0.019		76.00% Pervious Area
0.006		24.00% Impervious Area

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

Summary for Subcatchment 30S: 30S

Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.006 af, Depth> 2.93"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.018	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.024		Weighted Average
0.018		75.00% Pervious Area
0.006		25.00% Impervious Area

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

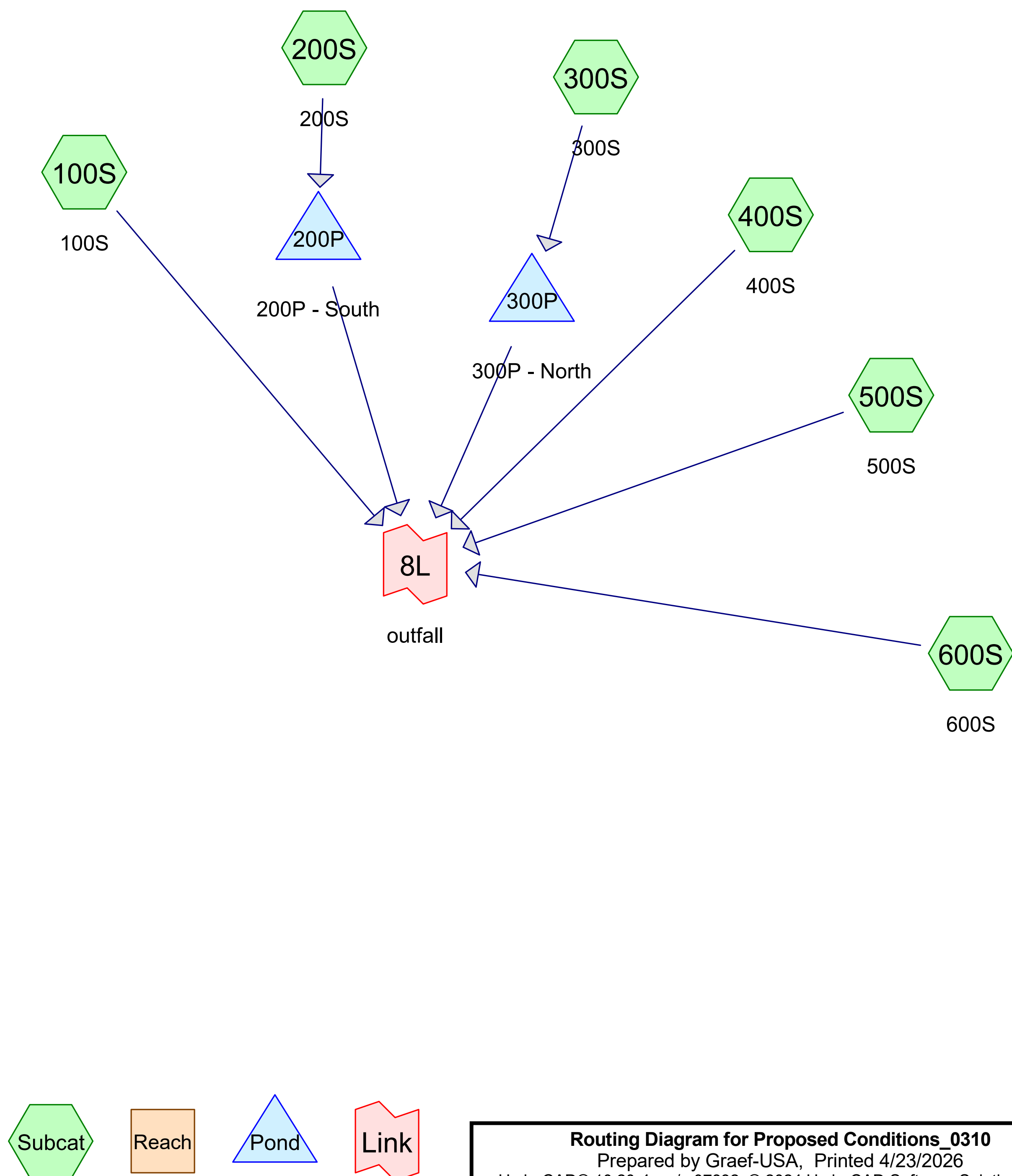
Summary for Link 8L: outfall

Inflow Area =	3.836 ac,	79.14% Impervious,	Inflow Depth > 4.92"	for 100-YR event
Inflow =	29.97 cfs @	12.13 hrs, Volume=	1.574 af	
Primary =	29.97 cfs @	12.13 hrs, Volume=	1.574 af,	Atten= 0%, Lag= 0.0 min

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

APPENDIX C

Post-Development Site Hydrologic & Hydraulic Analysis



Routing Diagram for Proposed Conditions_0310
Prepared by Graef-USA, Printed 4/23/2026

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-YR	MSE 24-hr	3	Default	24.00	1	2.40	2
2	2-YR	MSE 24-hr	3	Default	24.00	1	2.70	2
3	10-YR	MSE 24-hr	3	Default	24.00	1	3.81	2
4	100-YR	MSE 24-hr	3	Default	24.00	1	6.18	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.580	61	>75% Grass cover, Good, HSG B (100S, 200S, 300S, 400S, 500S, 600S)
1.723	98	Paved parking, HSG B (100S, 200S, 300S, 400S, 500S)
0.533	98	Roofs, HSG B (100S, 300S)
3.836	**83**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 100S: 100S Runoff Area=1.275 ac 78.67% Impervious Runoff Depth>1.74"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=3.55 cfs 0.185 af

Subcatchment 200S: 200S Runoff Area=0.580 ac 60.17% Impervious Runoff Depth>1.37"
Flow Length=300' Tc=6.2 min CN=WQ Runoff=1.23 cfs 0.066 af

Subcatchment 300S: 300S Runoff Area=1.180 ac 66.02% Impervious Runoff Depth>1.49"
Tc=6.0 min CN=WQ Runoff=2.77 cfs 0.147 af

Subcatchment 400S: 400S Runoff Area=0.015 ac 40.00% Impervious Runoff Depth>0.97"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.02 cfs 0.001 af

Subcatchment 500S: 500S Runoff Area=0.753 ac 15.80% Impervious Runoff Depth>0.48"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.46 cfs 0.030 af

Subcatchment 600S: 600S Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.17"
Flow Length=201' Tc=6.0 min CN=61 Runoff=0.00 cfs 0.000 af

Pond 200P: 200P - South Peak Elev=827.40' Storage=0.022 af Inflow=1.23 cfs 0.066 af
Outflow=1.20 cfs 0.053 af

Pond 300P: 300P - North Peak Elev=827.00' Storage=0.110 af Inflow=2.77 cfs 0.147 af
Outflow=0.11 cfs 0.064 af

Link 8L: outfall Inflow=5.20 cfs 0.334 af
Primary=5.20 cfs 0.334 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.430 af Average Runoff Depth = 1.35"
41.19% Pervious = 1.580 ac 58.81% Impervious = 2.256 ac

Summary for Subcatchment 100S: 100S

Runoff = 3.55 cfs @ 12.13 hrs, Volume= 0.185 af, Depth> 1.74"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

	Area (ac)	CN	Description
	0.272	61	>75% Grass cover, Good, HSG B
	0.485	98	Paved parking, HSG B
*	0.518	98	Roofs, HSG B
	1.275		Weighted Average
	0.272		21.33% Pervious Area
	1.003		78.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 200S: 200S

Runoff = 1.23 cfs @ 12.13 hrs, Volume= 0.066 af, Depth> 1.37"
Routed to Pond 200P : 200P - South

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.231	61	>75% Grass cover, Good, HSG B
0.349	98	Paved parking, HSG B
0.580		Weighted Average
0.231		39.83% Pervious Area
0.349		60.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0190	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.2	75	0.0140	1.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.69"
1.4	200	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	300	Total			

Summary for Subcatchment 300S: 300S

Runoff = 2.77 cfs @ 12.13 hrs, Volume= 0.147 af, Depth> 1.49"
Routed to Pond 300P : 300P - North

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.401	61	>75% Grass cover, Good, HSG B
0.764	98	Paved parking, HSG B
0.015	98	Roofs, HSG B
1.180		Weighted Average
0.401		33.98% Pervious Area
0.779		66.02% Impervious Area

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

Summary for Subcatchment 400S: 400S

Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 0.97"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.009	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.015		Weighted Average
0.009		60.00% Pervious Area
0.006		40.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 500S: 500S

Runoff = 0.46 cfs @ 12.14 hrs, Volume= 0.030 af, Depth> 0.48"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.634	61	>75% Grass cover, Good, HSG B
0.119	98	Paved parking, HSG B
0.753		Weighted Average
0.634		84.20% Pervious Area
0.119		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 600S: 600S

Runoff = 0.00 cfs @ 12.18 hrs, Volume= 0.000 af, Depth> 0.17"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (ac)	CN	Description
0.033	61	>75% Grass cover, Good, HSG B
0.033		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 200P: 200P - South

Inflow Area = 0.580 ac, 60.17% Impervious, Inflow Depth > 1.37" for 1-YR event
Inflow = 1.23 cfs @ 12.13 hrs, Volume= 0.066 af
Outflow = 1.20 cfs @ 12.15 hrs, Volume= 0.053 af, Atten= 3%, Lag= 0.9 min
Primary = 1.20 cfs @ 12.15 hrs, Volume= 0.053 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.40' @ 12.15 hrs Surf.Area= 0.018 ac Storage= 0.022 af

Plug-Flow detention time= 156.7 min calculated for 0.053 af (80% of inflow)
Center-of-Mass det. time= 95.1 min (859.3 - 764.2)

Volume	Invert	Avail.Storage	Storage Description
#1	823.49'	0.038 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
823.49	0.000	0.0	0.000	0.000
823.50	0.010	30.0	0.000	0.000
824.50	0.010	30.0	0.003	0.003
826.49	0.010	30.0	0.006	0.009
826.50	0.010	100.0	0.000	0.009
827.50	0.019	100.0	0.014	0.024
828.00	0.039	100.0	0.014	0.038

Device	Routing	Invert	Outlet Devices
#1	Primary	822.31'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.31' / 822.21' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	827.25'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.00'	**3.600 in/hr Underdrain over Surface area above 824.00'** Conductivity to Groundwater Elevation = 818.00' Excluded Surface area = 0.010 ac

Primary OutFlow Max=1.19 cfs @ 12.15 hrs HW=827.40' (Free Discharge)
└─**1=Culvert** (Passes 1.19 cfs of 8.10 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 1.16 cfs @ 1.25 fps)
  └─**3=Underdrain** (Controls 0.03 cfs)

Summary for Pond 300P: 300P - North

Inflow Area = 1.180 ac, 66.02% Impervious, Inflow Depth > 1.49" for 1-YR event
Inflow = 2.77 cfs @ 12.13 hrs, Volume= 0.147 af
Outflow = 0.11 cfs @ 13.57 hrs, Volume= 0.064 af, Atten= 96%, Lag= 86.3 min
Primary = 0.11 cfs @ 13.57 hrs, Volume= 0.064 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.00' @ 13.57 hrs Surf.Area= 0.086 ac Storage= 0.110 af

Plug-Flow detention time= 360.5 min calculated for 0.064 af (43% of inflow)
Center-of-Mass det. time= 262.0 min (1,024.4 - 762.4)

Volume	Invert	Avail.Storage	Storage Description
#1	822.49'	0.215 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
822.49	0.000	0.0	0.000	0.000
822.50	0.060	30.0	0.000	0.000
824.50	0.060	30.0	0.036	0.036
826.49	0.060	30.0	0.036	0.072
826.50	0.060	100.0	0.001	0.073
827.50	0.112	100.0	0.086	0.159
828.00	0.112	100.0	0.056	0.215

Device	Routing	Invert	Outlet Devices
#1	Primary	821.25'	**12.0" Round Culvert** L= 84.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.25' / 820.88' S= 0.0044 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	824.00'	**3.600 in/hr Underdrain over Horizontal area above 824.00'** Conductivity to Groundwater Elevation = 816.50' Excluded Horizontal area = 0.060 ac
#3	Device 1	827.00'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.10 cfs @ 13.57 hrs HW=827.00' (Free Discharge)
└─**1=Culvert** (Passes 0.10 cfs of 7.75 cfs potential flow)
  ├─**2=Underdrain** (Controls 0.10 cfs)
  └─**3=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.20 fps)

Summary for Link 8L: outfall

Inflow Area =	3.836 ac,	58.81% Impervious,	Inflow Depth > 1.04"	for 1-YR event
Inflow =	5.20 cfs @	12.13 hrs, Volume=	0.334 af	
Primary =	5.20 cfs @	12.13 hrs, Volume=	0.334 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 100S: 100S Runoff Area=1.275 ac 78.67% Impervious Runoff Depth>2.00"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=4.05 cfs 0.212 af

Subcatchment 200S: 200S Runoff Area=0.580 ac 60.17% Impervious Runoff Depth>1.59"
Flow Length=300' Tc=6.2 min CN=WQ Runoff=1.43 cfs 0.077 af

Subcatchment 300S: 300S Runoff Area=1.180 ac 66.02% Impervious Runoff Depth>1.72"
Tc=6.0 min CN=WQ Runoff=3.18 cfs 0.169 af

Subcatchment 400S: 400S Runoff Area=0.015 ac 40.00% Impervious Runoff Depth>1.14"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.03 cfs 0.001 af

Subcatchment 500S: 500S Runoff Area=0.753 ac 15.80% Impervious Runoff Depth>0.61"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.62 cfs 0.038 af

Subcatchment 600S: 600S Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.26"
Flow Length=201' Tc=6.0 min CN=61 Runoff=0.01 cfs 0.001 af

Pond 200P: 200P - South Peak Elev=827.41' Storage=0.022 af Inflow=1.43 cfs 0.077 af
Outflow=1.38 cfs 0.063 af

Pond 300P: 300P - North Peak Elev=827.04' Storage=0.113 af Inflow=3.18 cfs 0.169 af
Outflow=0.39 cfs 0.085 af

Link 8L: outfall Inflow=6.07 cfs 0.400 af
Primary=6.07 cfs 0.400 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.498 af Average Runoff Depth = 1.56"
41.19% Pervious = 1.580 ac 58.81% Impervious = 2.256 ac

Summary for Subcatchment 100S: 100S

Runoff = 4.05 cfs @ 12.13 hrs, Volume= 0.212 af, Depth> 2.00"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

	Area (ac)	CN	Description
	0.272	61	>75% Grass cover, Good, HSG B
	0.485	98	Paved parking, HSG B
*	0.518	98	Roofs, HSG B
	1.275		Weighted Average
	0.272		21.33% Pervious Area
	1.003		78.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 200S: 200S

Runoff = 1.43 cfs @ 12.13 hrs, Volume= 0.077 af, Depth> 1.59"
Routed to Pond 200P : 200P - South

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.231	61	>75% Grass cover, Good, HSG B
0.349	98	Paved parking, HSG B
0.580		Weighted Average
0.231		39.83% Pervious Area
0.349		60.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0190	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.2	75	0.0140	1.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.69"
1.4	200	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	300	Total			

Summary for Subcatchment 300S: 300S

Runoff = 3.18 cfs @ 12.13 hrs, Volume= 0.169 af, Depth> 1.72"
Routed to Pond 300P : 300P - North

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.401	61	>75% Grass cover, Good, HSG B
0.764	98	Paved parking, HSG B
0.015	98	Roofs, HSG B
1.180		Weighted Average
0.401		33.98% Pervious Area
0.779		66.02% Impervious Area

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

Summary for Subcatchment 400S: 400S

Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.001 af, Depth> 1.14"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.009	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.015		Weighted Average
0.009		60.00% Pervious Area
0.006		40.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,**
					Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow**
					Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow**
					Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 500S: 500S

Runoff = 0.62 cfs @ 12.14 hrs, Volume= 0.038 af, Depth> 0.61"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.634	61	>75% Grass cover, Good, HSG B
0.119	98	Paved parking, HSG B
0.753		Weighted Average
0.634		84.20% Pervious Area
0.119		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 600S: 600S

Runoff = 0.01 cfs @ 12.16 hrs, Volume= 0.001 af, Depth> 0.26"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (ac)	CN	Description
0.033	61	>75% Grass cover, Good, HSG B
0.033		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 200P: 200P - South

Inflow Area = 0.580 ac, 60.17% Impervious, Inflow Depth > 1.59" for 2-YR event
Inflow = 1.43 cfs @ 12.13 hrs, Volume= 0.077 af
Outflow = 1.38 cfs @ 12.15 hrs, Volume= 0.063 af, Atten= 3%, Lag= 0.9 min
Primary = 1.38 cfs @ 12.15 hrs, Volume= 0.063 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.41' @ 12.15 hrs Surf.Area= 0.018 ac Storage= 0.022 af

Plug-Flow detention time= 143.1 min calculated for 0.063 af (82% of inflow)
Center-of-Mass det. time= 84.0 min (847.4 - 763.4)

Volume	Invert	Avail.Storage	Storage Description
#1	823.49'	0.038 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
823.49	0.000	0.0	0.000	0.000
823.50	0.010	30.0	0.000	0.000
824.50	0.010	30.0	0.003	0.003
826.49	0.010	30.0	0.006	0.009
826.50	0.010	100.0	0.000	0.009
827.50	0.019	100.0	0.014	0.024
828.00	0.039	100.0	0.014	0.038

Device	Routing	Invert	Outlet Devices
#1	Primary	822.31'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.31' / 822.21' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	827.25'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.00'	**3.600 in/hr Underdrain over Surface area above 824.00'** Conductivity to Groundwater Elevation = 818.00' Excluded Surface area = 0.010 ac

Primary OutFlow Max=1.38 cfs @ 12.15 hrs HW=827.41' (Free Discharge)
└─**1=Culvert** (Passes 1.38 cfs of 8.11 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 1.35 cfs @ 1.32 fps)
  └─**3=Underdrain** (Controls 0.03 cfs)

Summary for Pond 300P: 300P - North

Inflow Area = 1.180 ac, 66.02% Impervious, Inflow Depth > 1.72" for 2-YR event
Inflow = 3.18 cfs @ 12.13 hrs, Volume= 0.169 af
Outflow = 0.39 cfs @ 12.57 hrs, Volume= 0.085 af, Atten= 88%, Lag= 26.3 min
Primary = 0.39 cfs @ 12.57 hrs, Volume= 0.085 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.04' @ 12.57 hrs Surf.Area= 0.088 ac Storage= 0.113 af

Plug-Flow detention time= 304.5 min calculated for 0.085 af (50% of inflow)
Center-of-Mass det. time= 213.7 min (975.1 - 761.4)

Volume	Invert	Avail.Storage	Storage Description
#1	822.49'	0.215 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
822.49	0.000	0.0	0.000	0.000
822.50	0.060	30.0	0.000	0.000
824.50	0.060	30.0	0.036	0.036
826.49	0.060	30.0	0.036	0.072
826.50	0.060	100.0	0.001	0.073
827.50	0.112	100.0	0.086	0.159
828.00	0.112	100.0	0.056	0.215

Device	Routing	Invert	Outlet Devices
#1	Primary	821.25'	**12.0" Round Culvert** L= 84.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.25' / 820.88' S= 0.0044 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	824.00'	**3.600 in/hr Underdrain over Horizontal area above 824.00'** Conductivity to Groundwater Elevation = 816.50' Excluded Horizontal area = 0.060 ac
#3	Device 1	827.00'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.34 cfs @ 12.57 hrs HW=827.04' (Free Discharge)
└─**1=Culvert** (Passes 0.34 cfs of 7.78 cfs potential flow)
  ├─**2=Underdrain** (Controls 0.10 cfs)
  └─**3=Orifice/Grate** (Weir Controls 0.24 cfs @ 0.65 fps)

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 58.81% Impervious, Inflow Depth > 1.25" for 2-YR event
Inflow = 6.07 cfs @ 12.14 hrs, Volume= 0.400 af
Primary = 6.07 cfs @ 12.14 hrs, Volume= 0.400 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 100S: 100S Runoff Area=1.275 ac 78.67% Impervious Runoff Depth>2.97"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=5.98 cfs 0.315 af

Subcatchment 200S: 200S Runoff Area=0.580 ac 60.17% Impervious Runoff Depth>2.44"
Flow Length=300' Tc=6.2 min CN=WQ Runoff=2.22 cfs 0.118 af

Subcatchment 300S: 300S Runoff Area=1.180 ac 66.02% Impervious Runoff Depth>2.60"
Tc=6.0 min CN=WQ Runoff=4.86 cfs 0.256 af

Subcatchment 400S: 400S Runoff Area=0.015 ac 40.00% Impervious Runoff Depth>1.86"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.04 cfs 0.002 af

Subcatchment 500S: 500S Runoff Area=0.753 ac 15.80% Impervious Runoff Depth>1.17"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=1.41 cfs 0.073 af

Subcatchment 600S: 600S Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>0.72"
Flow Length=201' Tc=6.0 min CN=61 Runoff=0.04 cfs 0.002 af

Pond 200P: 200P - South Peak Elev=827.47' Storage=0.023 af Inflow=2.22 cfs 0.118 af
Outflow=2.17 cfs 0.102 af

Pond 300P: 300P - North Peak Elev=827.20' Storage=0.128 af Inflow=4.86 cfs 0.256 af
Outflow=2.95 cfs 0.168 af

Link 8L: outfall Inflow=11.28 cfs 0.663 af
Primary=11.28 cfs 0.663 af

Total Runoff Area = 3.836 ac Runoff Volume = 0.767 af Average Runoff Depth = 2.40"
41.19% Pervious = 1.580 ac 58.81% Impervious = 2.256 ac

Summary for Subcatchment 100S: 100S

Runoff = 5.98 cfs @ 12.13 hrs, Volume= 0.315 af, Depth> 2.97"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

	Area (ac)	CN	Description
	0.272	61	>75% Grass cover, Good, HSG B
	0.485	98	Paved parking, HSG B
*	0.518	98	Roofs, HSG B
	1.275		Weighted Average
	0.272		21.33% Pervious Area
	1.003		78.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 200S: 200S

Runoff = 2.22 cfs @ 12.13 hrs, Volume= 0.118 af, Depth> 2.44"
Routed to Pond 200P : 200P - South

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.231	61	>75% Grass cover, Good, HSG B
0.349	98	Paved parking, HSG B
0.580		Weighted Average
0.231		39.83% Pervious Area
0.349		60.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0190	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.2	75	0.0140	1.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.69"
1.4	200	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	300	Total			

Summary for Subcatchment 300S: 300S

Runoff = 4.86 cfs @ 12.13 hrs, Volume= 0.256 af, Depth> 2.60"
Routed to Pond 300P : 300P - North

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.401	61	>75% Grass cover, Good, HSG B
0.764	98	Paved parking, HSG B
0.015	98	Roofs, HSG B
1.180		Weighted Average
0.401		33.98% Pervious Area
0.779		66.02% Impervious Area

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

Summary for Subcatchment 400S: 400S

Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.002 af, Depth> 1.86"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.009	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.015		Weighted Average
0.009		60.00% Pervious Area
0.006		40.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 500S: 500S

Runoff = 1.41 cfs @ 12.14 hrs, Volume= 0.073 af, Depth> 1.17"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.634	61	>75% Grass cover, Good, HSG B
0.119	98	Paved parking, HSG B
0.753		Weighted Average
0.634		84.20% Pervious Area
0.119		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 600S: 600S

Runoff = 0.04 cfs @ 12.14 hrs, Volume= 0.002 af, Depth> 0.72"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (ac)	CN	Description
0.033	61	>75% Grass cover, Good, HSG B
0.033		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 200P: 200P - South

Inflow Area = 0.580 ac, 60.17% Impervious, Inflow Depth > 2.44" for 10-YR event
Inflow = 2.22 cfs @ 12.13 hrs, Volume= 0.118 af
Outflow = 2.17 cfs @ 12.15 hrs, Volume= 0.102 af, Atten= 2%, Lag= 0.8 min
Primary = 2.17 cfs @ 12.15 hrs, Volume= 0.102 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.47' @ 12.15 hrs Surf.Area= 0.019 ac Storage= 0.023 af

Plug-Flow detention time= 109.2 min calculated for 0.102 af (87% of inflow)
Center-of-Mass det. time= 58.6 min (819.9 - 761.3)

Volume	Invert	Avail.Storage	Storage Description
#1	823.49'	0.038 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
823.49	0.000	0.0	0.000	0.000
823.50	0.010	30.0	0.000	0.000
824.50	0.010	30.0	0.003	0.003
826.49	0.010	30.0	0.006	0.009
826.50	0.010	100.0	0.000	0.009
827.50	0.019	100.0	0.014	0.024
828.00	0.039	100.0	0.014	0.038

Device	Routing	Invert	Outlet Devices
#1	Primary	822.31'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.31' / 822.21' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	827.25'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.00'	**3.600 in/hr Underdrain over Surface area above 824.00'** Conductivity to Groundwater Elevation = 818.00' Excluded Surface area = 0.010 ac

Primary OutFlow Max=2.16 cfs @ 12.15 hrs HW=827.47' (Free Discharge)
└─**1=Culvert** (Passes 2.16 cfs of 8.16 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 2.13 cfs @ 1.54 fps)
  └─**3=Underdrain** (Controls 0.03 cfs)

Summary for Pond 300P: 300P - North

Inflow Area = 1.180 ac, 66.02% Impervious, Inflow Depth > 2.60" for 10-YR event
Inflow = 4.86 cfs @ 12.13 hrs, Volume= 0.256 af
Outflow = 2.95 cfs @ 12.20 hrs, Volume= 0.168 af, Atten= 39%, Lag= 4.1 min
Primary = 2.95 cfs @ 12.20 hrs, Volume= 0.168 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.20' @ 12.20 hrs Surf.Area= 0.097 ac Storage= 0.128 af

Plug-Flow detention time= 204.8 min calculated for 0.168 af (66% of inflow)
Center-of-Mass det. time= 127.4 min (886.1 - 758.7)

Volume	Invert	Avail.Storage	Storage Description
#1	822.49'	0.215 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
822.49	0.000	0.0	0.000	0.000
822.50	0.060	30.0	0.000	0.000
824.50	0.060	30.0	0.036	0.036
826.49	0.060	30.0	0.036	0.072
826.50	0.060	100.0	0.001	0.073
827.50	0.112	100.0	0.086	0.159
828.00	0.112	100.0	0.056	0.215

Device	Routing	Invert	Outlet Devices
#1	Primary	821.25'	**12.0" Round Culvert** L= 84.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.25' / 820.88' S= 0.0044 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	824.00'	**3.600 in/hr Underdrain over Horizontal area above 824.00'** Conductivity to Groundwater Elevation = 816.50' Excluded Horizontal area = 0.060 ac
#3	Device 1	827.00'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.93 cfs @ 12.20 hrs HW=827.20' (Free Discharge)
└─**1=Culvert** (Passes 2.93 cfs of 7.90 cfs potential flow)
  ├─**2=Underdrain** (Controls 0.14 cfs)
  └─**3=Orifice/Grate** (Weir Controls 2.79 cfs @ 1.47 fps)

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 58.81% Impervious, Inflow Depth > 2.07" for 10-YR event
Inflow = 11.28 cfs @ 12.15 hrs, Volume= 0.663 af
Primary = 11.28 cfs @ 12.15 hrs, Volume= 0.663 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 100S: 100S Runoff Area=1.275 ac 78.67% Impervious Runoff Depth>5.13"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=10.31 cfs 0.545 af

Subcatchment 200S: 200S Runoff Area=0.580 ac 60.17% Impervious Runoff Depth>4.42"
Flow Length=300' Tc=6.2 min CN=WQ Runoff=4.09 cfs 0.214 af

Subcatchment 300S: 300S Runoff Area=1.180 ac 66.02% Impervious Runoff Depth>4.64"
Tc=6.0 min CN=WQ Runoff=8.75 cfs 0.457 af

Subcatchment 400S: 400S Runoff Area=0.015 ac 40.00% Impervious Runoff Depth>3.65"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=0.09 cfs 0.005 af

Subcatchment 500S: 500S Runoff Area=0.753 ac 15.80% Impervious Runoff Depth>2.73"
Flow Length=201' Tc=6.0 min CN=WQ Runoff=3.59 cfs 0.171 af

Subcatchment 600S: 600S Runoff Area=0.033 ac 0.00% Impervious Runoff Depth>2.13"
Flow Length=201' Tc=6.0 min CN=61 Runoff=0.13 cfs 0.006 af

Pond 200P: 200P - South Peak Elev=827.58' Storage=0.025 af Inflow=4.09 cfs 0.214 af
Outflow=4.01 cfs 0.196 af

Pond 300P: 300P - North Peak Elev=827.39' Storage=0.147 af Inflow=8.75 cfs 0.457 af
Outflow=7.75 cfs 0.361 af

Link 8L: outfall Inflow=25.43 cfs 1.283 af
Primary=25.43 cfs 1.283 af

Total Runoff Area = 3.836 ac Runoff Volume = 1.397 af Average Runoff Depth = 4.37"
41.19% Pervious = 1.580 ac 58.81% Impervious = 2.256 ac

Summary for Subcatchment 100S: 100S

Runoff = 10.31 cfs @ 12.13 hrs, Volume= 0.545 af, Depth> 5.13"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

	Area (ac)	CN	Description
	0.272	61	>75% Grass cover, Good, HSG B
	0.485	98	Paved parking, HSG B
*	0.518	98	Roofs, HSG B
	1.275		Weighted Average
	0.272		21.33% Pervious Area
	1.003		78.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 200S: 200S

Runoff = 4.09 cfs @ 12.13 hrs, Volume= 0.214 af, Depth> 4.42"
Routed to Pond 200P : 200P - South

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.231	61	>75% Grass cover, Good, HSG B
0.349	98	Paved parking, HSG B
0.580		Weighted Average
0.231		39.83% Pervious Area
0.349		60.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	25	0.0190	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.2	75	0.0140	1.03		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.69"
1.4	200	0.0140	2.40		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	300	Total			

Summary for Subcatchment 300S: 300S

Runoff = 8.75 cfs @ 12.13 hrs, Volume= 0.457 af, Depth> 4.64"
Routed to Pond 300P : 300P - North

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.401	61	>75% Grass cover, Good, HSG B
0.764	98	Paved parking, HSG B
0.015	98	Roofs, HSG B
1.180		Weighted Average
0.401		33.98% Pervious Area
0.779		66.02% Impervious Area

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

Summary for Subcatchment 400S: 400S

Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.005 af, Depth> 3.65"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.009	61	>75% Grass cover, Good, HSG B
0.006	98	Paved parking, HSG B
0.015		Weighted Average
0.009		60.00% Pervious Area
0.006		40.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 500S: 500S

Runoff = 3.59 cfs @ 12.14 hrs, Volume= 0.171 af, Depth> 2.73"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.634	61	>75% Grass cover, Good, HSG B
0.119	98	Paved parking, HSG B
0.753		Weighted Average
0.634		84.20% Pervious Area
0.119		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 600S: 600S

Runoff = 0.13 cfs @ 12.14 hrs, Volume= 0.006 af, Depth> 2.13"
Routed to Link 8L : outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (ac)	CN	Description
0.033	61	>75% Grass cover, Good, HSG B
0.033		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	12	0.0442	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.69"
1.0	70	0.0280	1.17		**Shallow Concentrated Flow, Grass Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.6	119	0.0235	3.11		**Shallow Concentrated Flow, Paved Shallow Concentrated Flow** Paved Kv= 20.3 fps
3.0	201	Total, Increased to minimum Tc = 6.0 min			

Summary for Pond 200P: 200P - South

Inflow Area = 0.580 ac, 60.17% Impervious, Inflow Depth > 4.42" for 100-YR event
Inflow = 4.09 cfs @ 12.13 hrs, Volume= 0.214 af
Outflow = 4.01 cfs @ 12.15 hrs, Volume= 0.196 af, Atten= 2%, Lag= 0.8 min
Primary = 4.01 cfs @ 12.15 hrs, Volume= 0.196 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.58' @ 12.15 hrs Surf.Area= 0.022 ac Storage= 0.025 af

Plug-Flow detention time= 73.1 min calculated for 0.196 af (92% of inflow)
Center-of-Mass det. time= 35.7 min (794.1 - 758.4)

Volume	Invert	Avail.Storage	Storage Description
#1	823.49'	0.038 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
823.49	0.000	0.0	0.000	0.000
823.50	0.010	30.0	0.000	0.000
824.50	0.010	30.0	0.003	0.003
826.49	0.010	30.0	0.006	0.009
826.50	0.010	100.0	0.000	0.009
827.50	0.019	100.0	0.014	0.024
828.00	0.039	100.0	0.014	0.038

Device	Routing	Invert	Outlet Devices
#1	Primary	822.31'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 822.31' / 822.21' S= 0.0100 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	827.25'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	824.00'	**3.600 in/hr Underdrain over Surface area above 824.00'** Conductivity to Groundwater Elevation = 818.00' Excluded Surface area = 0.010 ac

Primary OutFlow Max=3.99 cfs @ 12.15 hrs HW=827.58' (Free Discharge)
└─**1=Culvert** (Passes 3.99 cfs of 8.26 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 3.94 cfs @ 1.89 fps)
  └─**3=Underdrain** (Controls 0.05 cfs)

Summary for Pond 300P: 300P - North

Inflow Area = 1.180 ac, 66.02% Impervious, Inflow Depth > 4.64" for 100-YR event
Inflow = 8.75 cfs @ 12.13 hrs, Volume= 0.457 af
Outflow = 7.75 cfs @ 12.16 hrs, Volume= 0.361 af, Atten= 11%, Lag= 1.8 min
Primary = 7.75 cfs @ 12.16 hrs, Volume= 0.361 af
Routed to Link 8L : outfall

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 827.39' @ 12.16 hrs Surf.Area= 0.106 ac Storage= 0.147 af

Plug-Flow detention time= 137.9 min calculated for 0.361 af (79% of inflow)
Center-of-Mass det. time= 74.8 min (830.0 - 755.2)

Volume	Invert	Avail.Storage	Storage Description
#1	822.49'	0.215 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Voids (%)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
822.49	0.000	0.0	0.000	0.000
822.50	0.060	30.0	0.000	0.000
824.50	0.060	30.0	0.036	0.036
826.49	0.060	30.0	0.036	0.072
826.50	0.060	100.0	0.001	0.073
827.50	0.112	100.0	0.086	0.159
828.00	0.112	100.0	0.056	0.215

Device	Routing	Invert	Outlet Devices
#1	Primary	821.25'	**12.0" Round Culvert** L= 84.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.25' / 820.88' S= 0.0044 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf
#2	Device 1	824.00'	**3.600 in/hr Underdrain over Horizontal area above 824.00'** Conductivity to Groundwater Elevation = 816.50' Excluded Horizontal area = 0.060 ac
#3	Device 1	827.00'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

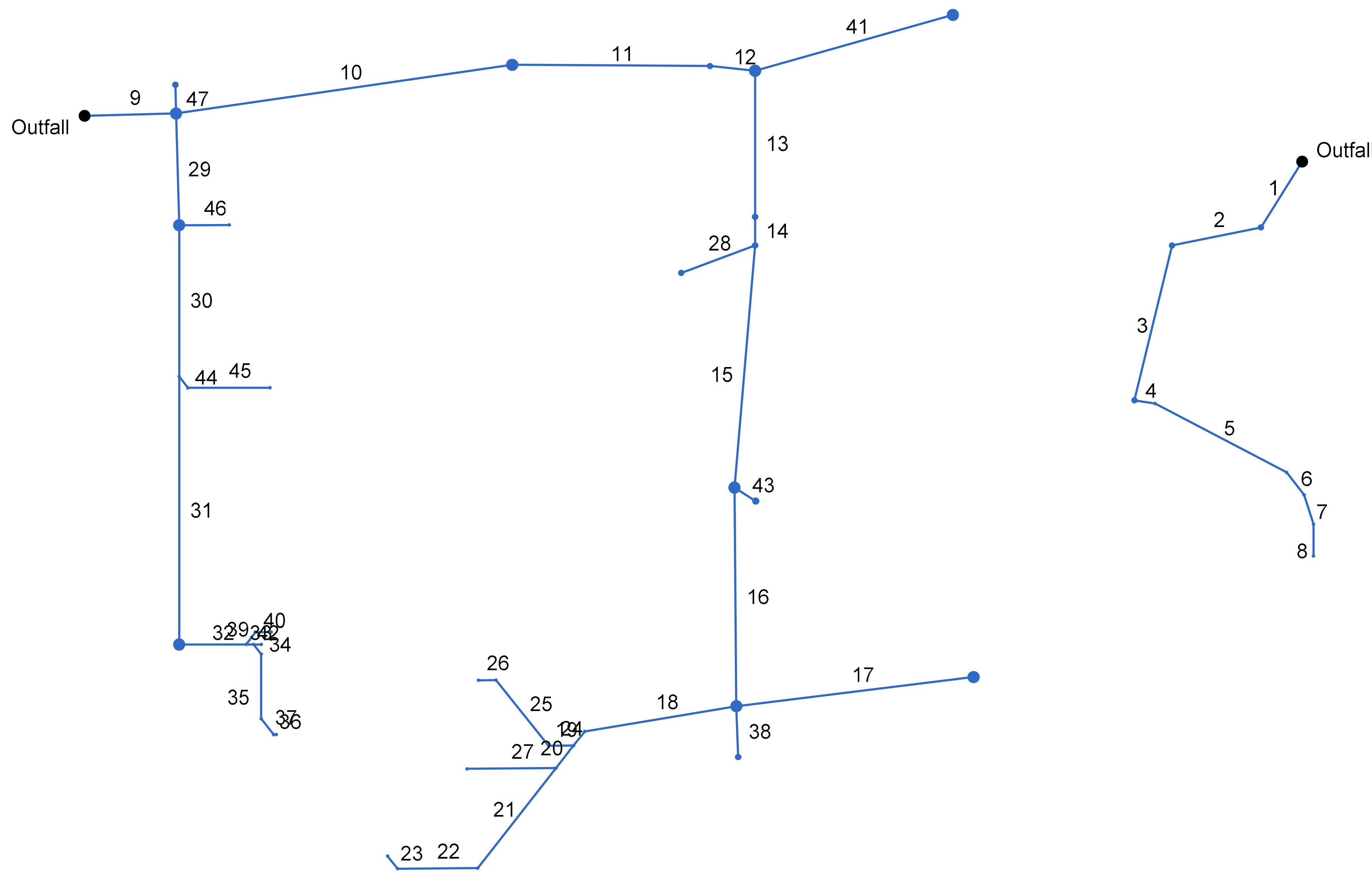
Primary OutFlow Max=7.74 cfs @ 12.16 hrs HW=827.39' (Free Discharge)
└─**1=Culvert** (Passes 7.74 cfs of 8.04 cfs potential flow)
  ├─**2=Underdrain** (Controls 0.17 cfs)
  └─**3=Orifice/Grate** (Weir Controls 7.57 cfs @ 2.05 fps)

Summary for Link 8L: outfall

Inflow Area = 3.836 ac, 58.81% Impervious, Inflow Depth > 4.01" for 100-YR event
Inflow = 25.43 cfs @ 12.14 hrs, Volume= 1.283 af
Primary = 25.43 cfs @ 12.14 hrs, Volume= 1.283 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: New.stm	Number of lines: 47	Date: 4/23/2026

Storm Sewer Tabulation

Station: Line	Station: To Line	Len (ft)	Drng Area: Incr (ac)	Drng Area: Total (ac)	Rnoff coeff (C)	Area x C: Incr	Area x C: Total	Tc: Inlet (min)	Tc: Syst (min)	Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe: Size (in)	Pipe: Slope (%)	Invert Elev: Dn (ft)	Invert Elev: Up (ft)	HGL Elev: Dn (ft)	HGL Elev: Up (ft)	Grnd / Rim Elev: Dn (ft)	Grnd / Rim Elev: Up (ft)	Line ID
1	End	26.430	0.27	0.52	0.81	0.21	0.42	9.0	9.0	5.6	2.38	3.02	4.27	12	0.61	826.68	826.84	827.34	827.52	827.80	830.19	P-45 (1)
2	1	35.950	0.09	0.25	0.84	0.07	0.21	6.0	7.2	6.2	1.30	3.02	2.63	12	0.61	826.84	827.06	827.72	827.54	830.19	829.99	P-44
3	2	51.062	0.15	0.16	0.83	0.12	0.14	6.0	6.8	6.3	0.87	3.02	2.69	12	0.61	827.06	827.38	827.54	827.77	829.99	830.37	P-46
4	3	8.416	0.00	0.02	0.00	0.00	0.01	0.0	6.8	6.3	0.09	0.48	1.85	6	0.61	827.88	827.93	828.02	828.07	830.37	830.47	P-58
5	4	56.690	0.00	0.02	0.00	0.00	0.01	0.0	6.3	6.5	0.09	0.48	1.87	6	0.61	827.93	828.28	828.08	828.42	830.47	831.24	P-59
6	5	10.000	0.00	0.02	0.00	0.00	0.01	0.0	6.2	6.6	0.09	0.48	1.87	6	0.61	828.28	828.34	828.42	828.49	831.24	831.37	P-60
7	6	10.000	0.00	0.02	0.00	0.00	0.01	0.0	6.1	6.6	0.09	0.48	1.87	6	0.61	828.34	828.40	828.49	828.55	831.37	831.47	P-61
8	7	10.000	0.02	0.02	0.90	0.01	0.01	6.0	6.0	6.6	0.09	0.48	1.87	6	0.61	828.40	828.46	828.55	828.61	831.47	831.68	P-62
9	End	36.512	0.00	4.23	0.00	0.00	3.41	0.0	16.5	4.1	17.10	24.99	5.75	24	1.04	819.25	819.63	821.25	821.32	824.84	825.18	P-105
10	9	135.120	0.00	3.64	0.00	0.00	2.89	0.0	16.1	4.2	15.06	17.67	5.97	24	0.52	820.27	820.98	821.88	822.38	825.18	826.56	P-32
11	10	78.953	0.14	3.64	0.81	0.12	2.89	6.0	15.9	4.2	15.15	17.67	6.22	24	0.52	820.98	821.39	822.47	822.80	826.56	826.56	P-31
12	11	18.089	0.00	3.50	0.00	0.00	2.77	0.0	15.8	4.2	14.67	17.67	5.91	24	0.52	821.39	821.48	822.89	822.93	826.56	827.79	P-47
13	12	45.993	0.03	3.50	0.76	0.02	2.77	6.0	15.7	4.3	11.79	17.67	4.78	24	0.52	821.53	821.77	823.50	823.00	827.79	827.99	P-38
14	13	9.000	0.11	3.47	0.88	0.10	2.75	6.0	15.7	4.3	11.70	17.67	5.78	24	0.52	821.77	821.81	823.00	823.04	827.99	827.77	P-39
15	14	76.698	0.00	3.25	0.00	0.00	2.56	0.0	15.4	4.3	11.01	17.67	5.55	24	0.52	821.81	822.21	823.04	823.40	827.77	827.71	P-43
16	15	68.860	0.00	2.69	0.00	0.00	2.14	0.0	15.2	4.3	9.24	17.67	5.03	24	0.52	822.21	822.57	823.40	823.65	827.71	828.12	P-42
17	16	95.030	1.88	1.88	0.75	1.41	1.41	15.0	15.0	4.4	6.14	12.36	7.94	15	3.12	823.32	826.29	823.94	827.29	828.12	830.50	P-43 (1)
18	16	61.214	0.00	0.05	0.00	0.00	0.05	0.0	6.9	6.3	0.31	0.62	2.93	6	1.04	824.07	824.71	824.32	824.99	828.12	828.32	P-80
19	18	6.286	0.00	0.05	0.00	0.00	0.05	0.0	6.9	6.3	0.31	0.62	2.71	6	1.04	824.71	824.77	824.99	825.05	828.32	828.38	P-79 (1)
20	19	10.001	0.00	0.04	0.00	0.00	0.03	0.0	6.8	6.3	0.20	0.62	2.08	6	1.04	824.77	824.87	825.05	825.10	828.38	828.48	P-79
21	20	44.253	0.00	0.02	0.00	0.00	0.02	0.0	6.3	6.5	0.11	0.62	1.58	6	1.04	824.87	825.33	825.10	825.49	828.48	828.83	P-78
22	21	32.167	0.00	0.02	0.00	0.00	0.02	0.0	6.0	6.6	0.11	0.62	1.97	6	1.04	825.33	825.66	825.49	825.83	828.83	828.97	P-77

Project File: New.stm | Number of lines: 47 | Run Date: 4/23/2026

NOTES:Intensity = 34.01 / (Inlet time + 4.70) ^ 0.69; Return period =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	Station To Line	Len (ft)	Drng Area Incr (ac)	Drng Area Total (ac)	Rnoff coeff (C)	Area x C Incr	Area x C Total	Tc Inlet (min)	Tc Syst (min)	Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe Size (in)	Pipe Slope (%)	Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev Dn (ft)	HGL Elev Up (ft)	Grnd / Rim Elev Dn (ft)	Grnd / Rim Elev Up (ft)	Line ID
23	22	5.649	0.02	0.02	0.90	0.02	0.02	6.0	6.0	6.6	0.11	0.62	1.96	6	1.04	825.66	825.72	825.83	825.89	828.97	828.99	P-76
24	19	10.003	0.00	0.02	0.00	0.00	0.02	0.0	6.3	6.5	0.11	0.62	1.45	6	1.04	824.77	824.88	825.05	825.04	828.38	828.51	P-91
25	24	29.396	0.00	0.02	0.00	0.00	0.02	0.0	6.1	6.6	0.11	0.62	1.97	6	1.04	824.88	825.18	825.04	825.35	828.51	828.86	P-92
26	25	6.960	0.02	0.02	0.90	0.02	0.02	6.0	6.0	6.6	0.11	0.62	1.96	6	1.04	825.18	825.25	825.35	825.42	828.86	828.98	P-93
27	20	35.334	0.02	0.02	0.90	0.02	0.02	6.0	6.0	6.6	0.11	0.62	1.58	6	1.04	824.87	825.24	825.10	825.40	828.48	828.98	P-81
28	14	30.742	0.11	0.11	0.77	0.08	0.08	6.0	6.0	6.6	0.54	4.15	3.16	12	1.16	824.45	824.81	824.70	825.12	827.77	827.63	P-40
29	9	35.228	0.00	0.48	0.00	0.00	0.44	0.0	8.0	5.9	2.57	3.83	2.13	15	0.30	820.65	820.76	821.88	821.92	825.18	825.99	P-48
30	29	47.677	0.00	0.27	0.00	0.00	0.24	0.0	7.4	6.1	1.50	3.83	1.26	15	0.30	820.76	820.90	822.00	822.01	825.99	826.64	P-35
31	30	84.326	0.00	0.24	0.00	0.00	0.21	0.0	6.6	6.4	1.36	2.11	1.83	12	0.30	821.03	821.28	822.03	822.13	826.64	826.90	P-35 (2)
32	31	26.561	0.00	0.24	0.00	0.00	0.21	0.0	6.5	6.4	1.37	1.89	5.17	8	2.08	822.12	822.67	822.54	823.22	826.90	828.43	P-36
33	32	3.000	0.00	0.22	0.00	0.00	0.20	0.0	6.5	6.4	1.26	1.89	4.15	8	2.08	822.67	822.73	823.22	823.26	828.43	828.62	P-36 (1)
34	33	4.243	0.00	0.02	0.00	0.00	0.01	0.0	6.3	6.5	0.10	0.88	0.51	6	2.08	822.73	822.82	823.26	823.26	828.62	828.74	P-72
35	34	20.377	0.00	0.02	0.00	0.00	0.01	0.0	6.1	6.6	0.10	0.88	1.22	6	2.08	822.82	823.24	823.26	823.40	828.74	828.58	P-73
36	35	7.071	0.00	0.02	0.00	0.00	0.01	0.0	6.0	6.6	0.10	0.88	1.91	6	2.08	823.24	823.39	823.40	823.54	828.58	828.95	P-74
37	36	1.079	0.02	0.02	0.90	0.01	0.01	6.0	6.0	6.6	0.10	0.88	1.91	6	2.08	823.39	823.41	823.54	823.57	828.95	829.00	P-75
38	16	15.995	0.75	0.75	0.90	0.68	0.68	6.0	6.0	6.6	4.50	7.13	4.49	15	1.04	822.57	822.74	823.65	823.60	828.12	827.00	P-42 (1)
39	32	5.487	0.00	0.02	0.00	0.00	0.02	0.0	6.1	6.6	0.12	0.88	0.62	6	2.08	822.67	822.78	823.22	823.22	828.43	828.77	P-70
40	39	6.322	0.02	0.02	0.90	0.02	0.02	6.0	6.0	6.6	0.12	0.88	1.32	6	2.08	822.78	822.92	823.23	823.09	828.77	828.97	P-71
41	12	80.963	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.95	3.93	4.48	12	1.04	822.66	823.50	823.50	824.24	827.79	827.00	P-30
42	33	3.000	0.20	0.20	0.90	0.18	0.18	6.0	6.0	6.6	1.20	1.89	4.07	8	2.08	822.73	822.79	823.26	823.31	828.62	828.80	P-36 (1) (1)
43	15	9.513	0.56	0.56	0.76	0.43	0.43	12.0	12.0	4.9	2.09	3.93	2.67	12	1.04	822.21	822.31	823.40	823.43	827.71	826.50	P-41
44	29	20.110	0.21	0.21	0.90	0.19	0.19	6.0	6.0	6.6	1.27	1.89	4.89	8	2.08	821.58	822.00	822.00	822.53	825.99	826.51	P-34

Project File: New.stm | Number of lines: 47 | Run Date: 4/23/2026

NOTES:Intensity = 34.01 / (Inlet time + 4.70) ^ 0.69; Return period =Yrs. 10 ; c = cir e = ellip b = box

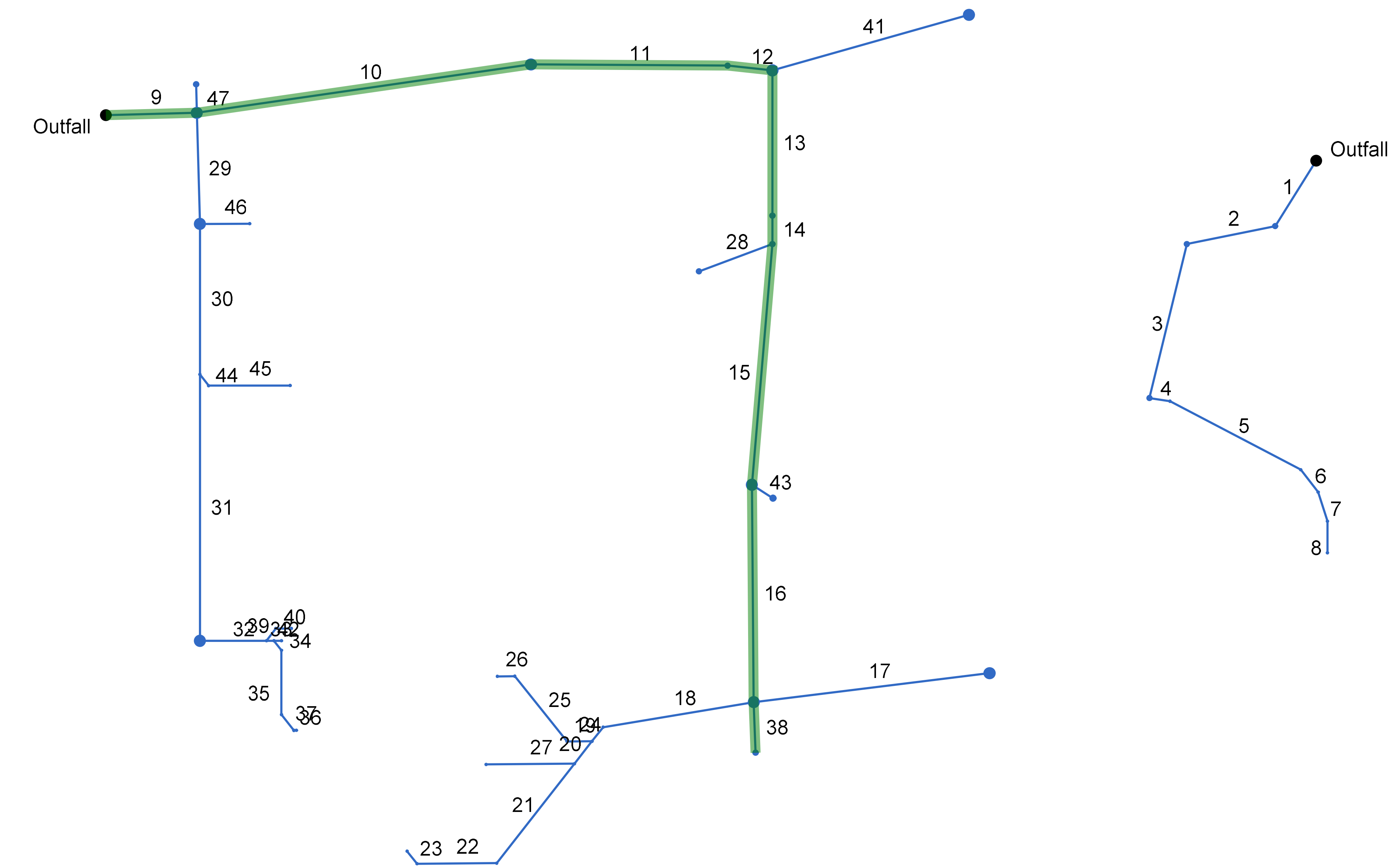
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
45	30	5.000	0.00	0.04	0.00	0.00	0.03	0.0	6.5	6.4	0.20	0.62	1.04	6	1.04	821.28	821.33	822.03	822.04	826.64	827.13	P-98
46	45	32.838	0.04	0.04	0.90	0.03	0.03	6.0	6.0	6.6	0.21	0.62	1.15	6	1.04	821.33	821.67	822.05	822.09	827.13	828.99	P-99
47	9	9.029	0.10	0.10	0.90	0.09	0.09	6.0	6.0	6.6	0.61	0.00	0.50	15	-0.99	820.47	820.38	821.88	821.89	825.18	824.90	P-48 (1)

Project File: New.stm | Number of lines: 47 | Run Date: 4/23/2026

NOTES:Intensity = 34.01 / (Inlet time + 4.70) ^ 0.69; Return period =Yrs. 10 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

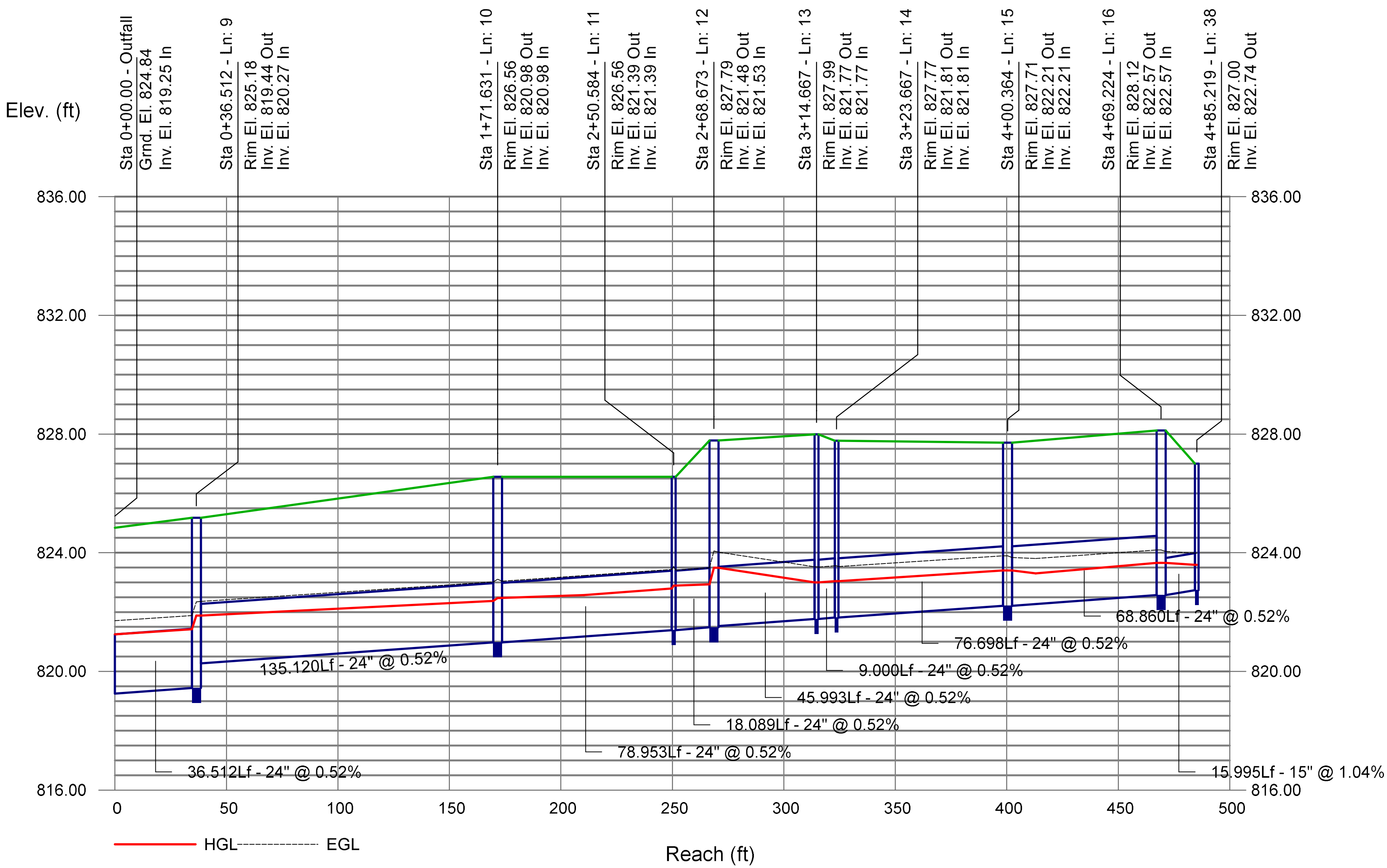


Project File: New.stm	Number of lines: 47	Date: 4/23/2026

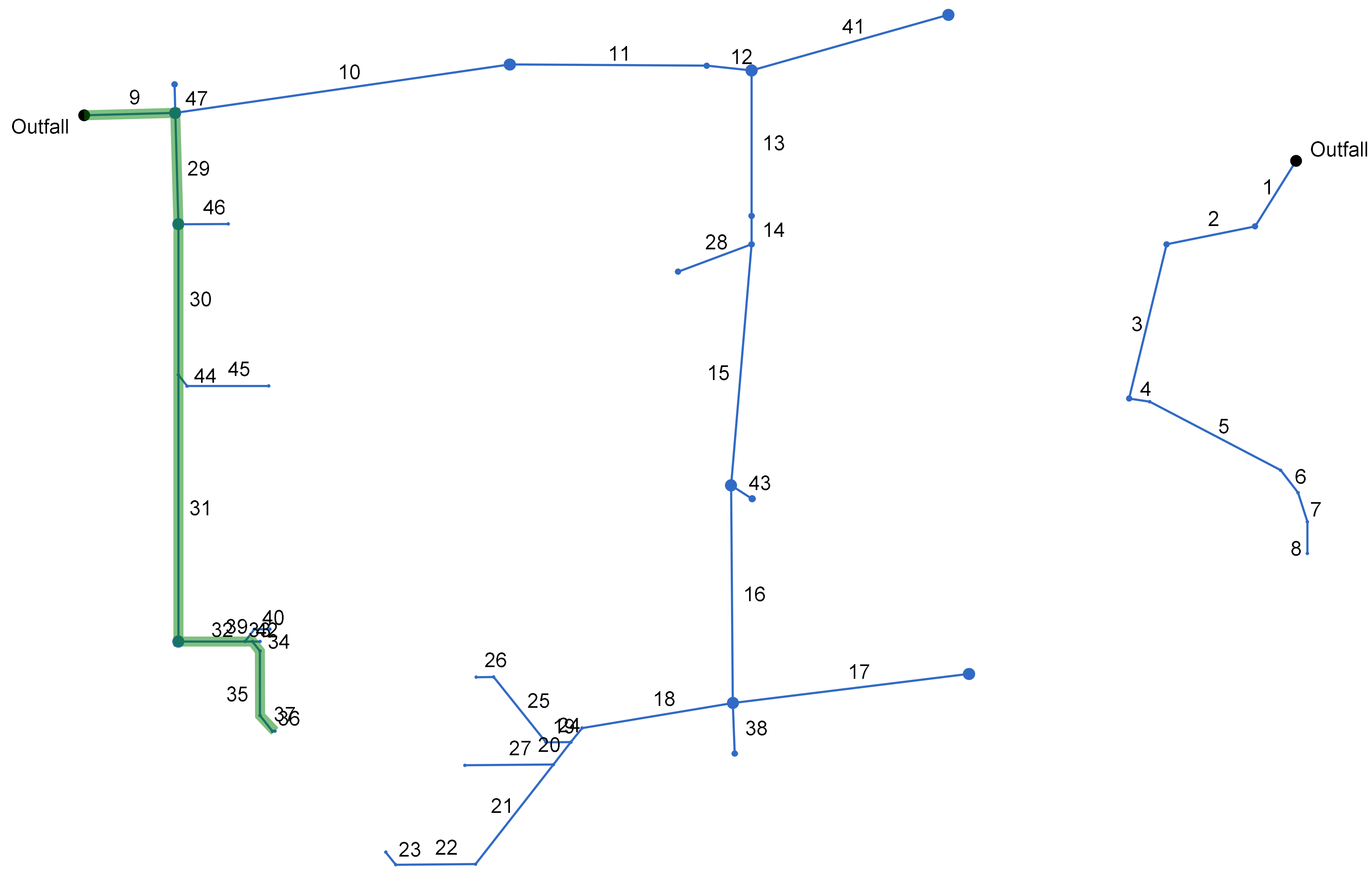
Storm Sewers v2024.00

Storm Sewer Profile

Proj. file: New.stm



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

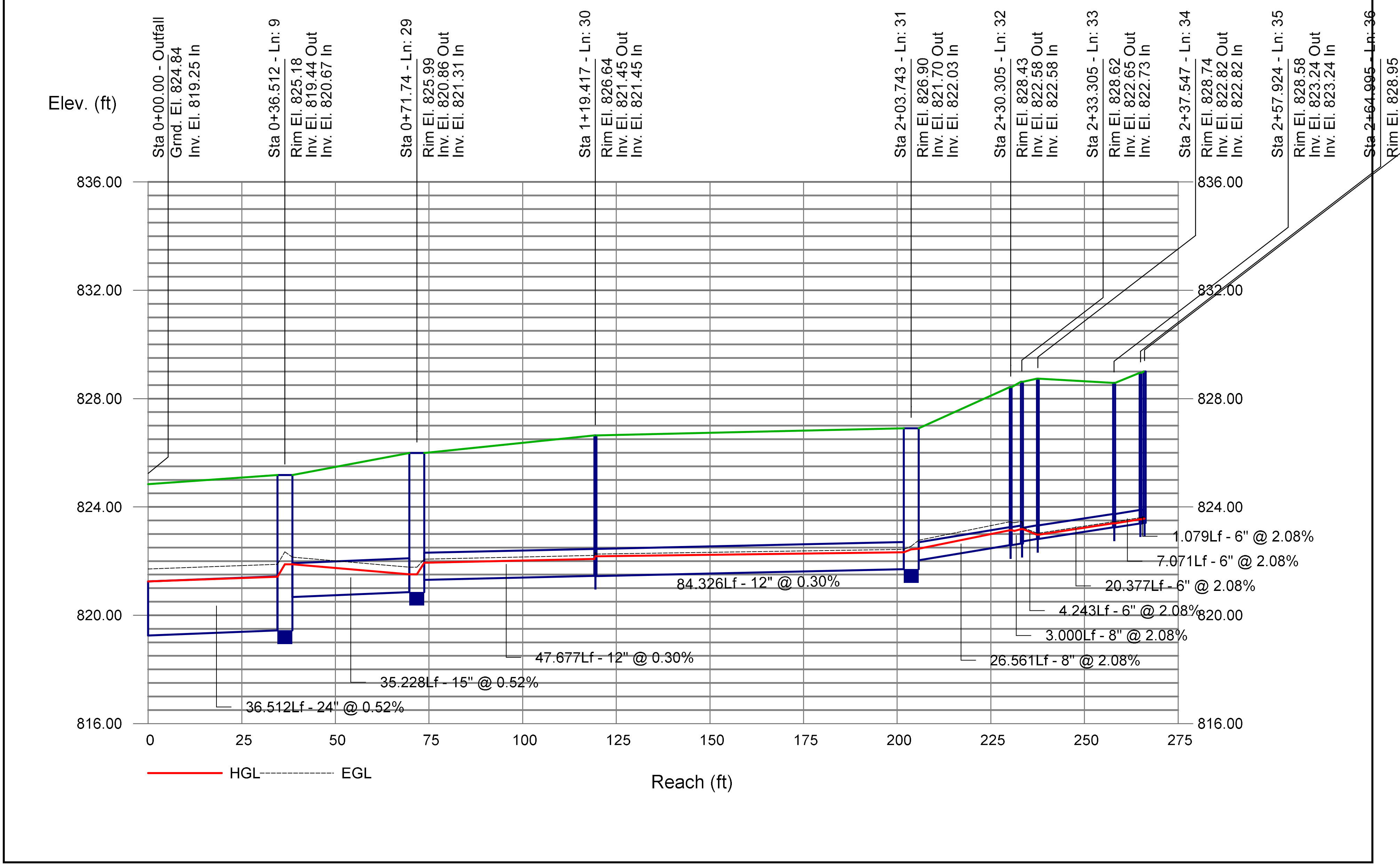


Project File: New.stm	Number of lines: 47	Date: 4/23/2026

Storm Sewers v2024.00

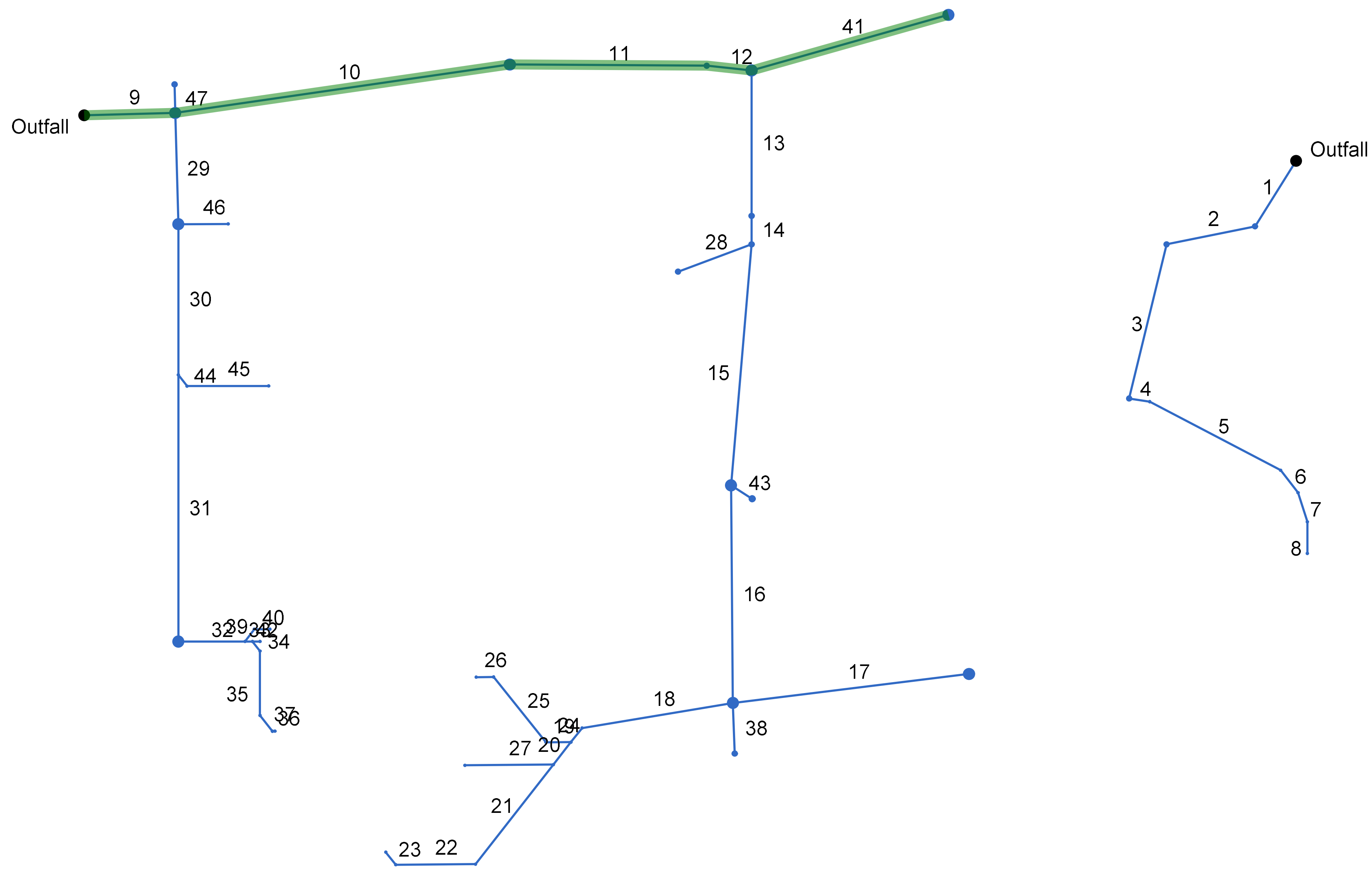
Storm Sewer Profile

Proj. file: New.stm



Storm Sewers

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

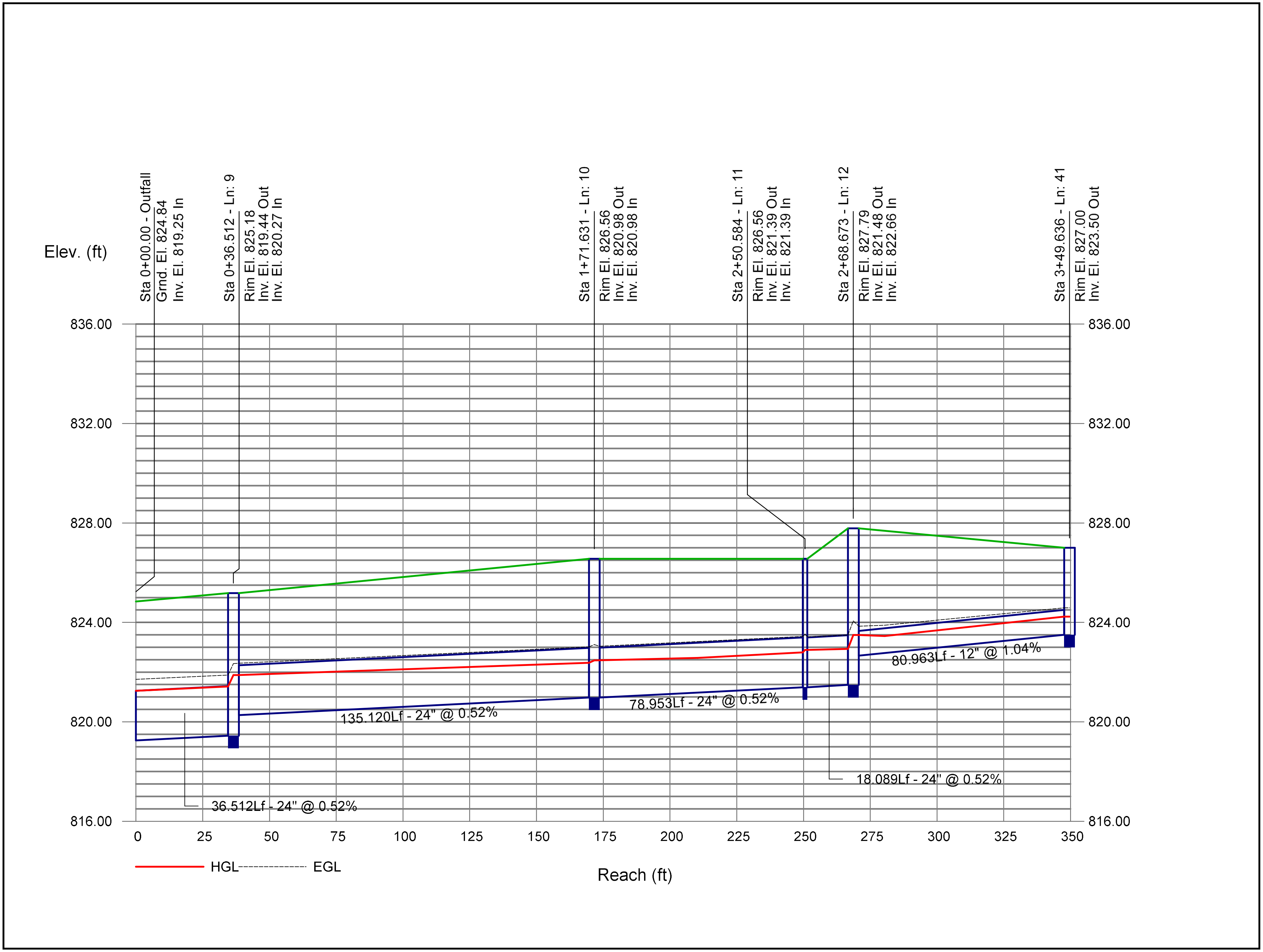


Project File: New.stm	Number of lines: 47	Date: 4/23/2026

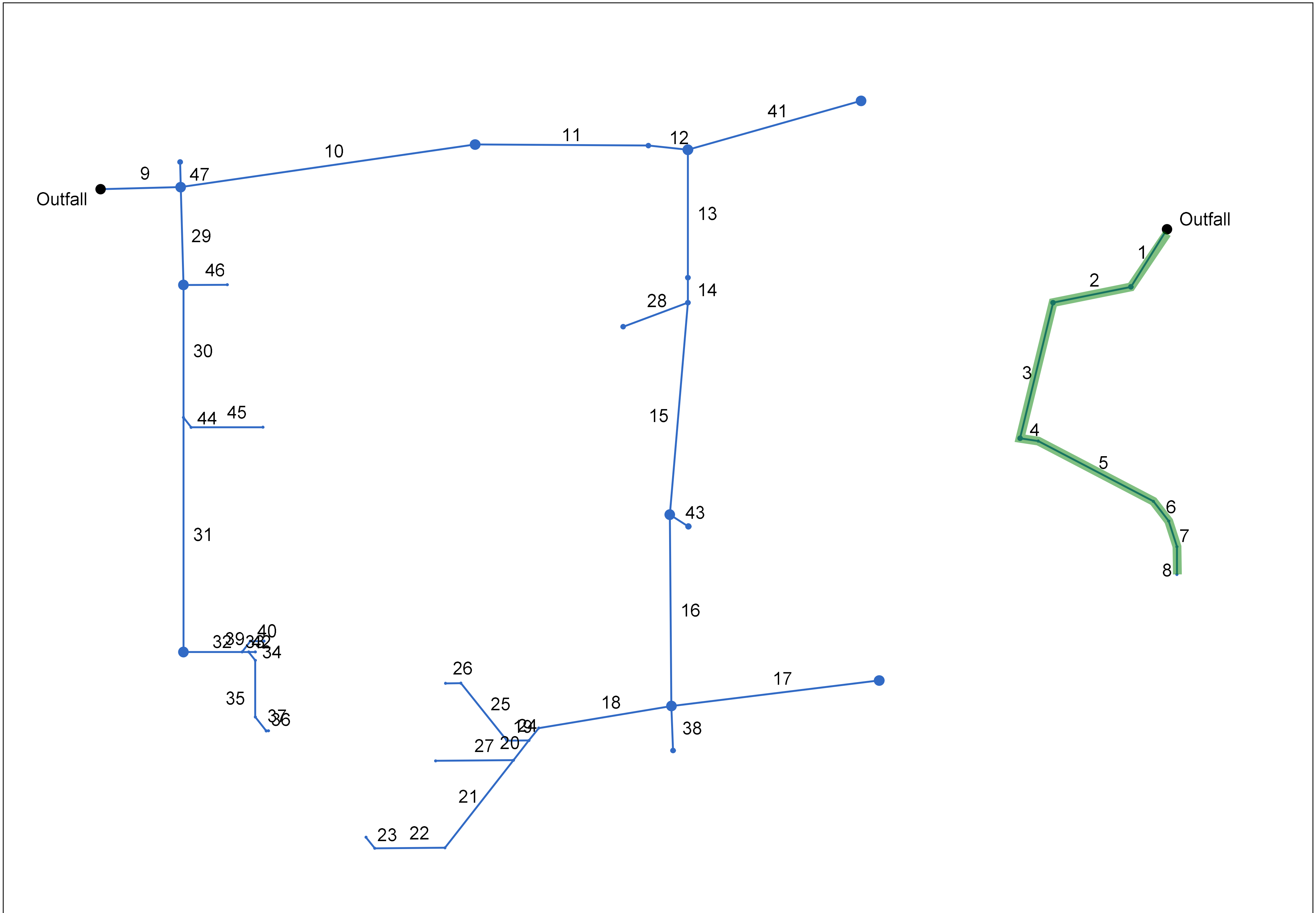
Storm Sewers v2024.00

Storm Sewer Profile

Proj. file: New.stm



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

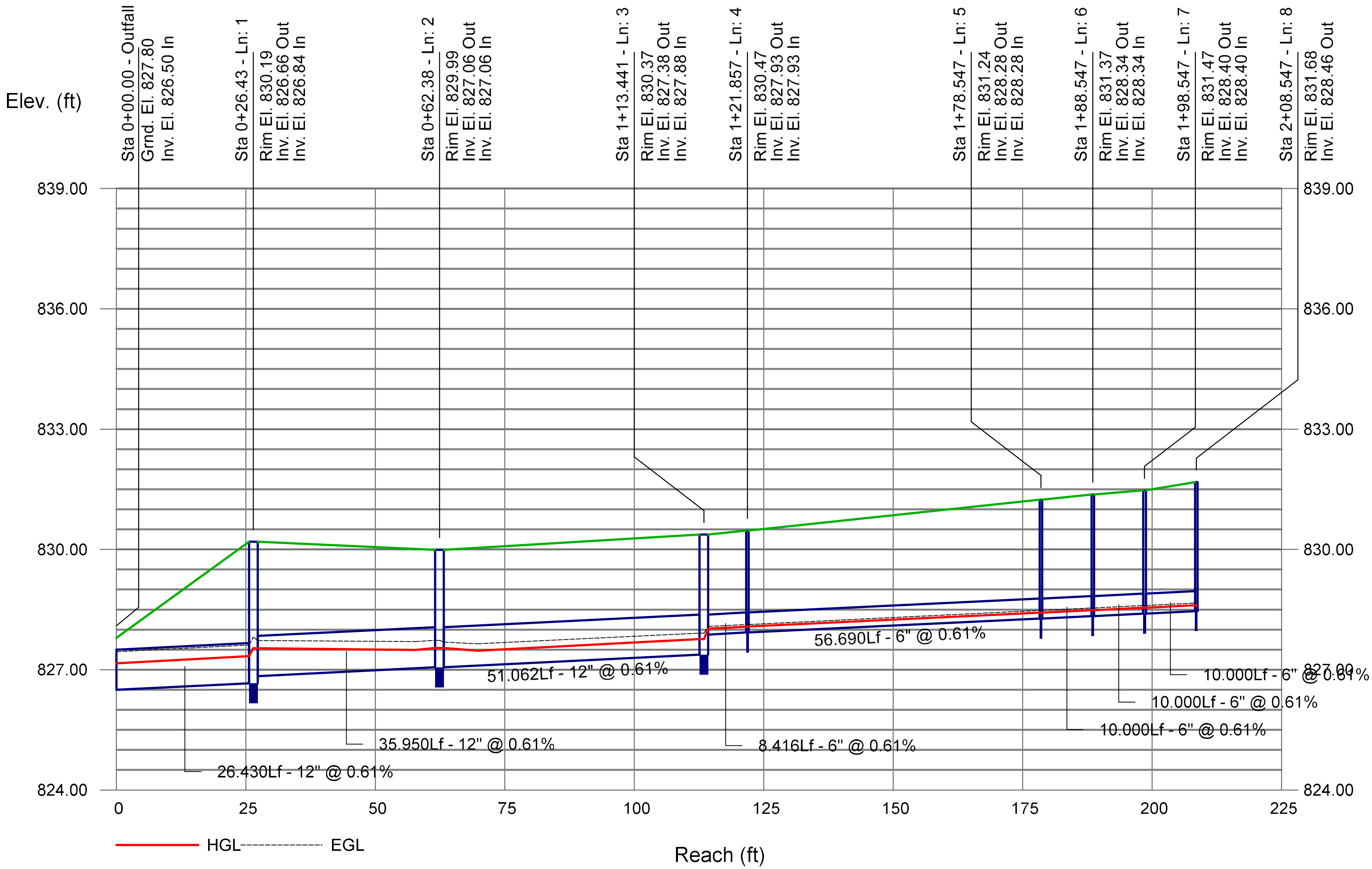


Project File: New.stm	Number of lines: 47	Date: 4/23/2026

Storm Sewers v2024.00

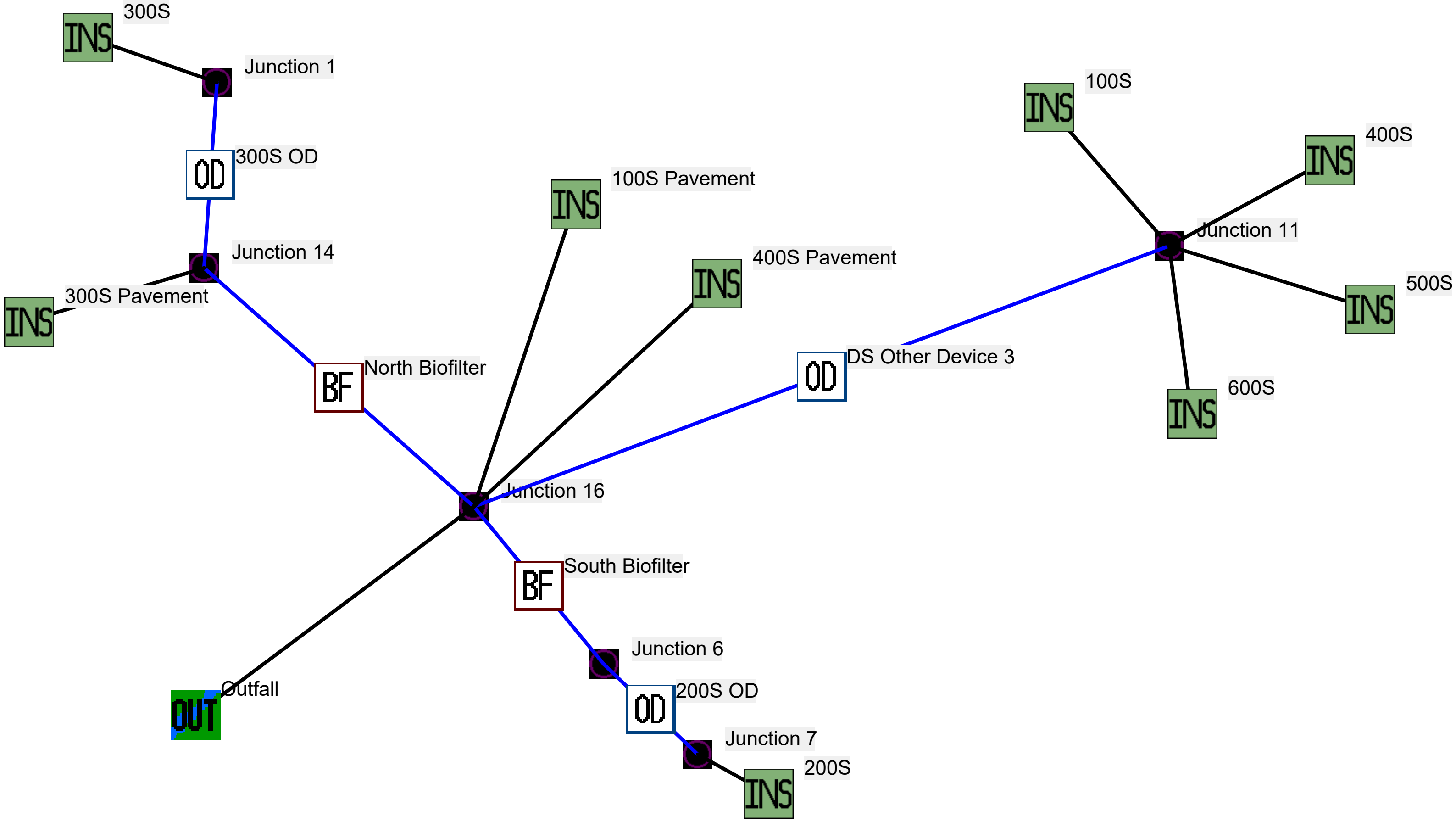
Storm Sewer Profile

Proj. file: New.stm



APPENDIX D

TSS / Water Quality


300S
INS
Junction 1
300S OD
OD
Junction 14
300S Pavement
INS
North Biofilter
BF
100S Pavement
INS
400S Pavement
INS
100S
INS
400S
INS
Junction 11
500S
INS
DS Other Device 3
OD
600S
INS
Junction 16
South Biofilter
BF
Junction 6
Outfall
OUT
200S OD
OD
Junction 7
200S
INS

Data file name: X:\ML\2022\20220310\Design\Calcs\Storm Water\WinSLAMM_0310.mdb
WinSLAMM Version 10.5.0
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/05/69   Study period ending date: 12/31/69
Start of Winter Season: 12/02   End of Winter Season: 03/12
Date: 04-23-2026   Time: 16:57:40
Site information:

LU# 1 - Institutional: 100S Pavement   Total area (ac): 0.380
13 - Paved Parking 1: 0.380 ac.   Connected   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Institutional: 400S   Total area (ac): 0.009
45 - Large Landscaped Areas 1: 0.009 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Institutional: 500S   Total area (ac): 0.753
31 - Sidewalks 1: 0.119 ac.   Disconnected   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.634 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 4 - Institutional: 600S   Total area (ac): 0.033
45 - Large Landscaped Areas 1: 0.033 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 5 - Institutional: 100S   Total area (ac): 0.895
1 - Roofs 1: 0.518 ac.   Pitched   Connected   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
25 - Driveways 1: 0.105 ac.   Disconnected   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.272 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 6 - Institutional: 300S Pavement   Total area (ac): 0.703
13 - Paved Parking 1: 0.703 ac.   Connected   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 7 - Institutional: 300S   Total area (ac): 0.477
1 - Roofs 1: 0.015 ac.   Pitched   Connected   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
31 - Sidewalks 1: 0.061 ac.   Disconnected   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.401 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 8 - Institutional: 400S Pavement   Total area (ac): 0.006
13 - Paved Parking 1: 0.006 ac.   Connected   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 9 - Institutional: 200S   Total area (ac): 0.580
31 - Sidewalks 1: 0.349 ac.   Disconnected   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.231 ac.   Normal Silty   PSD File: C:\WinSLAMM Files\NURP.cpz   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Other Device CP# 1 (DS) - 300S OD
Fraction of drainage area served by device (ac) = 1.00
Particulate Concentration reduction fraction = 1.00
Filterable Concentration reduction fraction = 1.00
Runoff volume reduction fraction = 0
Control Practice 2: Other Device CP# 2 (DS) - DS Other Device 3
Fraction of drainage area served by device (ac) = 1.00
Particulate Concentration reduction fraction = 1.00
Filterable Concentration reduction fraction = 1.00
Runoff volume reduction fraction = 0

Control Practice 3: Biofilter CP# 1 (DS) - North Biofilter

1. Top area (square feet) = 4875
2. Bottom aea (square feet) = 2625
3. Depth (ft): 5.5
4. Biofilter width (ft) - for Cost Purposes Only: 10
5. Infiltration rate (in/hr) = 0
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 0.001
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 2
10. Porosity of rock filled volume = 0.33
11. Engineered soil infiltration rate: 3.6
12. Engineered soil depth (ft) = 2
13. Engineered soil porosity = 0.27
14. Percent solids reduction due to flow through engineered soil = 80
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: Not needed - calculated by program
18. Initial water surface elevation (ft): 0

Soil Data	Soil Type Fraction in Eng. Soil
User-Defined Media Type	1.000

Saturation water content (Porosity) = 0.562
Infiltration rate (in/hr) = 3.6

Biofilter Outlet/Discharge Characteristics:

Outlet type: Broad Crested Weir
1. Weir crest length (ft): 3
2. Weir crest width (ft): 2
3. Height of datum to bottom of weir opening: 5

Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 3
2. Stand pipe height above datum (ft): 4.5

Outlet type: Drain Tile/Underdrain
1. Underdrain outlet diameter (ft): 0.5
2. Invert elevation above datum (ft): 0.08
3. Number of underdrain outlets: 1

Outlet type: Evapotranspiration

Month Number	Month	Evapotranspiration (in/day)	Evaporation (in/day)
1	January	.	.
2	February	.	.
3	March	.	.
4	April	.2	.
5	May	.4	.
6	June	.6	.
7	July	.8	.
8	August	.8	.
9	September	.6	.
10	October	.4	.
11	November	.2	.
12	December	.	.

1. Saturated Soil Moisture Content: 0.27
2. Soil Field Moisture Capacity (% of Soil Dry Weight): 0.368
3. Permanent Wilting Point (% of Soil Dry Weight): 0.07
4. Supplemental Irrigation Used= False

4a. Fraction of available capacity when irrigation starts = 0
4b. Fraction of available capacity when irrigation stops = 0
5a. First area of biofilter that is vegetated (fraction): 0.9
5b. Second area of biofilter that is vegetated (fraction): 0.1
5c. Third area of biofilter that is vegetated (fraction): 0
5d. Fourth area of biofilter that is vegetated (fraction): 0
6a. First plant type: 7
6b. Second plant type: 4
6c. Third plant type: 0
6d. Fourth plant type: 0
7a. First root depth (ft): 6
7b. Second root depth (ft): 1
7c. Third root depth (ft): 0
7d. Fourth root depth (ft): 0
8a. First ET adjustment factor for actual crop (decimal): 0.5
8b. Second ET adjustment factor for actual crop (decimal): 0.65
8c. Third ET adjustment factor for actual crop (decimal): 0
8e. Fourth ET adjustment factor for actual crop (decimal): 0

Control Practice 4: Biofilter CP# 2 (DS) - South Biofilter
1. Top area (square feet) = 1699
2. Bottom aea (square feet) = 436
3. Depth (ft): 4.5
4. Biofilter width (ft) - for Cost Purposes Only: 10
5. Infiltration rate (in/hr) = 0
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 0.001
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 1
10. Porosity of rock filled volume = 0.33
11. Engineered soil infiltration rate: 3.6
12. Engineered soil depth (ft) = 2
13. Engineered soil porosity = 0.27
14. Percent solids reduction due to flow through engineered soil = 80
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: Not needed - calculated by program
18. Initial water surface elevation (ft): 0

Soil Data	Soil Type Fraction in Eng. Soil
User-Defined Media Type	1.000

Saturation water content (Porosity) = 0.562
Infiltration rate (in/hr) = 3.6

Biofilter Outlet/Discharge Characteristics:

Outlet type: Broad Crested Weir
1. Weir crest length (ft): 3
2. Weir crest width (ft): 2
3. Height of datum to bottom of weir opening: 4.49

Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 2
2. Stand pipe height above datum (ft): 3.5

Outlet type: Drain Tile/Underdrain
1. Underdrain outlet diameter (ft): 0.5
2. Invert elevation above datum (ft): 0.08
3. Number of underdrain outlets: 1

Outlet type: Evapotranspiration

Month Number	Month	Evapotranspiration (in/day)	Evaporation (in/day)
1	January	.	.
2	February	.	.
3	March	.	.
4	April	.2	.
5	May	.4	.
6	June	.6	.
7	July	.8	.
8	August	.8	.
9	September	.6	.
10	October	.4	.
11	November	.2	.
12	December	.	.

1. Saturated Soil Moisture Content: 0.27
2. Soil Field Moisture Capacity (% of Soil Dry Weight): 0.368
3. Permanent Wilting Point (% of Soil Dry Weight): 0.07
4. Supplemental Irrigation Used= False

4a. Fraction of available capacity when irrigation starts = 0
4b. Fraction of available capacity when irrigation stops = 0
5a. First area of biofilter that is vegetated (fraction): 0.9
5b. Second area of biofilter that is vegetated (fraction): 0.1
5c. Third area of biofilter that is vegetated (fraction): 0
5d. Fourth area of biofilter that is vegetated (fraction): 0
6a. First plant type: 7
6b. Second plant type: 4
6c. Third plant type: 0
6d. Fourth plant type: 0
7a. First root depth (ft): 6
7b. Second root depth (ft): 1
7c. Third root depth (ft): 0
7d. Fourth root depth (ft): 0
8a. First ET adjustment factor for actual crop (decimal): 0.5
8b. Second ET adjustment factor for actual crop (decimal): 0.65
8c. Third ET adjustment factor for actual crop (decimal): 0
8e. Fourth ET adjustment factor for actual crop (decimal): 0

Control Practice 5: Other Device CP# 3 (DS) - 200S OD

Fraction of drainage area served by device (ac) = 1.00
Particulate Concentration reduction fraction = 1.00
Filterable Concentration reduction fraction = 1.00
Runoff volume reduction fraction = 0

Data File: X:\ML\2022\20220310\Design\Calcs\Storm Water\WinSLAMM_0310.mdb												
Rain File: WisReg - Milwaukee WI 1969.RAN												
Date: 04-23-26 Time: 4:54:08 PM												
Site Description:												
Col. #:	2	3	4	5	6	7	8	9	10	11	12	13
Control Practice No.	Control Practice Type	Control Practice Name or Location	Total Inflow Volume (cf)	Total Outflow Volume (cf)	Percent Volume Reduction	Total Influent Load (lbs)	Total Effluent Load (lbs)	Percent Load Reduction	Flow Weighted Influent Conc (mg/L)	Flow Weighted Effluent Conc (mg/L)	Percent Conc. Reduction	Influent Median Part. Size (microns)
1	Other Device	300S OD	3956	3956	0	34.84	0	100.0	141.1	0	100.000	7.80
2	Other Device	DS Other Device 3	57960	57960	0	186.4	0	100.0	51.51	0	100.000	7.80
3	Biofilter	North Biofilter	59484	54448	8.466	450.6	83.60	81.45	121.4	24.59	79.734	7.80
4	Biofilter	South Biofilter	3086	2648	14.19	0	0	0.0	0	0		0.50
5	Other Device	200S OD	3086	3086	0	26.11	0	100.0	135.5	0	100.000	7.80

Data File: X:\ML\2022\20220310													
Rain File: WisReg - Milwaukee V													
Date: 04-23-26 Time: 4:54:08 P													
Site Description:													
Col. #:	2	14	15	18	19	23	27	28	29	30	31	32	33
Control Practice No.	Control Practice Type	Effluent Median Part. Size (microns)	Notes	Maximum Stage (ft)	Hydraulic Volume Out (cf)	Treated Volume (cf)	Maximum Surface Ponding Time (hrs)	Maximum Subsurface Ponding Time (hrs)	Volume Infiltrated (cf)	Underdrain Discharge Vol. (cf)	Evapo-Transpir. Vol. (cf)	Minimum Soil Moist. (frac)	Surface Discharge Bypass Vol. (cf)
1	Other Device	7.80											
2	Other Device	7.80											
3	Biofilter	1.68	No Biofilter Overflows	4.53	55708	47489	8.3	104.00	0.00	54224	11770.92		224.74
4	Biofilter	0.50	No Biofilter Overflows	3.43	2779	1416	4.8	104.00	0.00	2648	1670.49		0.00
5	Other Device	7.80											

Data File: X:\ML\2022\20220310												
Rain File: WisReg - Milwaukee V												
Date: 04-23-26 Time: 4:54:08 P												
Site Description:												
Col. #:	2	34	35	36	39	54	61	62	63	64	65	91
Control Practice No.	Control Practice Type	Evap. Vol. (cf)	Volume Supplemtl. Irrig.(cf)	Final Surface Infiltration Rate (in/hr)	Surface Ponding Events >72 hrs (Count)	Residence Time in Media (hrs)	Ttl. Mass Trapped in Media (lbs)	Ttl. Mass Infiltrated (lbs)	Annual Allowable Clog Rate (lbs/yr)	First Year Cum. Load (lbs)	Time Until Clogging Failure (yrs)	Runoff Producing Events/ Ttl. Rains
1	Other Device											81/93
2	Other Device											93/93
3	Biofilter			3.301	0	1.96	447.02	0.00	0.205	0.170	Never	60/93
4	Biofilter			3.600	0	1.80	0.00	0.00	0.205	0.000	Never	28/93
5	Other Device											36/93

SLAMM for Windows Version 10.5.0

Data file name: X:\ML\2022\20220310\Design\Calcs\Storm Water\WinSLAMM_0310.mdb
WinSLAMM Version 10.5.0
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/05/69 Study period ending date: 12/31/69
Start of Winter Season: 12/02 End of Winter Season: 03/12
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 04-23-2026 Time of run: 16:55:43
Total Area Modeled (acres): 3.836
Years in Model Run: 0.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	151019	-	74.04	698.1	-
Outfall Total with Controls:	145545	3.62%	36.43	331.0	52.59%
Annualized Total After Outfall Controls:	147566			335.6	

Biofilter # 1: Never. Percent Solids Reduction due to Engineered Media = 80
Biofilter # 2: Never. Percent Solids Reduction due to Engineered Media = 80