Tallgrass Villas

City of Waukesha
Waukesha County, Wisconsin

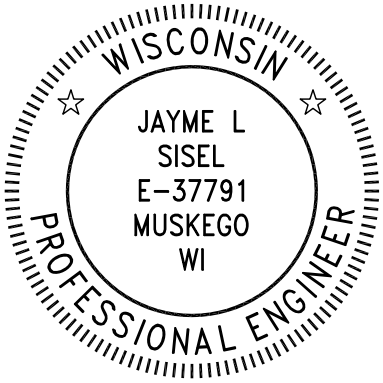
Preliminary

Storm Water Management Plan

Prepared by:

Trio Engineering LLC
4100 N. Calhoun Road
Brookfield, Wisconsin 53005
Contact: Josh Pudelko, P.E.
Telephone: (262) 790-1480
Email: info@trioeng.com

Sound Stormwater Design LLC
Contact: Jayme Sisel, P.E.
Telephone: (414) 286-4739
Email: jayme.sisel@soundstormwater.com



November 22, 2021
Revised February 21, 2022

TABLE OF CONTENTS

APPENDICES

Figures

Introduction

"Tallgrass Villas" is a proposed multifamily development comprised of twenty-four (24) 2-unit condominium units designed with private entrances, garages, and surface visitor parking. The proposed site encompasses a 16.3-acre parcel located south of Northview Road and east of Pebble Creek, in the City of Waukesha, Waukesha County, Wisconsin.

The subdivision design integrates with the existing topography, preserving trees and wetlands to the maximum extent practicable, and situates ponds and basins where runoff naturally flows, but with controlled outlets that reduce runoff rates and redirect runoff to adequate discharge points. This design approach minimizes site grading and maximizes the existing trees and wetlands that can be retained on the site.

This report documents the design computations for existing and proposed conditions and presents a plan for stormwater management that meets the requirements of the City of Waukesha and the Wisconsin Department of Natural Resources (WDNR).

Owner/ Developer

The owner, developer, and responsible entity for installation and maintenance of the stormwater management practices is:

Bielinski Homes, Inc.
1830 Meadow Lane, Suite A
Pewaukee, Wisconsin 53072
Contact: John Donovan
Phone: (262) 548-5570

Design Requirements

The following design standards have been used to develop the stormwater management plan for the "Tallgrass Villas" project:

- City of Waukesha's Stormwater Management Ordinance Chapter 32, Stormwater Management and Erosion Control
- Wisconsin Department of Natural Resources (WDNR) Technical Standards, NR151, and NR216
- Summary of design requirements:
    - Peak Discharge:
        - City of Waukesha: The peak flow discharge rates of stormwater runoff from the site under the post-development site conditions shall not exceed the rates under the pre-development conditions for the 1, 2, 10, and 100-year, 24-hour design storm event.

- Water Quality (Total Suspended Solids): Reduce to the maximum extent practicable the total suspended solids load by 80%, based on an average annual rainfall, as compared to no runoff management controls.
- Infiltration: For medium impervious developments, such as multifamily residential, one of the following shall be met:
  - Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 75% of the pre-development infiltration volume, based on an average annual rainfall.
  - No more than 2% of the project site is required as an effective infiltration area.

Analysis Overview

The Stormwater Management Plan for the "Tallgrass Villas" subdivision has been designed in accordance with the City of Waukesha's Chapter 32 requirements and all applicable state requirements. Existing and proposed stormwater runoff conditions for the site were analyzed for**:** runoff volume, peak volume, discharge, detention basin storage capacity required, outlet structure and storm sewer system requirements. The software package used for modeling and analysis was HydroCAD Version 10.10 software by HydroCAD Software Solutions. HydroCAD uses NRCS methods to generate runoff and pond routing hydrographs. The model's capabilities include modeling simple drainage basins, combining hydrographs to determine runoff and storage requirements, and detention basin and outlet structure sizing.

MSE3 rainfall distributions were used for modeling the 1, 2, 10 and 100-year, 24-hour storm events. The corresponding rainfall data used for modeling was taken from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Tables for Wisconsin Counties and is shown in the following table.

TABLE 1
Design Rainfall Values

Storm Recurrence Interval	24-hour Rainfall Depths
1-year	2.40 inches
2-year	2.70 inches
10-year	3.81 inches
100-year	6.18 inches

Soil types for the site were determined from the NRCS Soil Survey Maps for Waukesha County and from soil boring logs prepared by Midwest Engineering Services, Inc. The Soil Survey identifies the soils at the site as a mix of Type C soils (Knowles and Theresa silt loams) and Type D soils (Hochheim loam). The soil boring logs indicate the soils encountered at the site as 4 to 36-inches of silty clay, silty loam, and silty clay loam topsoil followed by gravelly loamy sand, sandy loam, and gravelly loam with cobbles and boulders extending to the maximum depths explored. The exception to this was within 4 of the 17 soil boring logs where deeper layers of silty clay and silty clay loam soils were encountered at depths ranging between 4 ½ to 6 feet and 8 to 12 ½ feet below existing grade. Based on this, a hydrologic soil group Type C was used to determine the runoff curve numbers for the site.

Pre-Development Watershed Description

The existing site encompasses a 16.3-acre parcel located south of Northview Road and east of Pebble Creek, in the City of Waukesha. The existing site is comprised of a vacant field with some areas of intermittent trees. Surface drainage is generally from east to west, towards Pebble Creek which flows south and runs the length of the west property boundary. Pebble Creek is a tributary of the Fox River.

Figure 1, Pre-Development Conditions Plan, shows the location of the project site, land cover types, drainage subareas and flow paths. The following table summarizes the results of the stormwater model for pre-development conditions. Detailed hydrological computations are included in Appendix A.

TABLE 2
Pre-Development Site Conditions

Subarea or Junction	Description	Total Area (acres)	Impervious Area (acres)	Time of Conc. (min.)	Peak Flow Rate (cfs)			
					1-year	2-year	10-year	100-year
1	Subarea	4.77	0.45	19	3.47	4.55	9.06	19.91
1D	Existing Depression	-	-	-	3.21	3.45	4.24	14.32
2	Subarea	15.38	0.40	19	6.93	9.82	22.40	54.69
99	**Total Outflow**	**20.15**	**0.85**	**-**	**10.10**	**13.09**	**26.36**	**63.04**

Post-Development Site Drainage Description

The proposed development is a multifamily residential subdivision comprised of twenty-four (24) 2-unit condominium units designed with private entrances, garages, and surface visitor parking. Stormwater management for the development will be provided by three (3) bioretention basins. The proposed development plan will disturb approximately 13 acres of area and will result in a net increase in impervious area of approximately 4.85 acres.

The following table summarizes the results of the hydrologic analysis for post-development conditions. Detailed hydrological computations are included in Appendix B.

TABLE 3
Post-Development Site Conditions

Subarea, Junction or Pond	Description	Total Area (acres)	Impervious Area (acres)	Time of Conc. (min.)	Peak Flow Rate (cfs)			
					1-year	2-year	10-year	100-year
1	Subarea	1.23	0.25	22	1.04	1.33	2.49	5.19
1B	North Basin	-	-	-	0.40	0.44	0.77	3.14
2	Subarea	4.11	2.19	9	8.16	9.81	16.09	29.69
2B	Central Basin	-	-	-	1.90	2.34	3.35	12.25
3	Subarea	2.40	1.39	9	5.23	6.21	9.88	17.72
3B	West Basin	-	-	-	0.87	1.02	3.65	14.02
4	Subarea	4.87	0.57	19	3.83	4.99	9.71	20.96
5	Subarea	0.63	0.10	15	0.52	0.68	1.36	2.97
6	Subarea	6.91	1.20	22	5.05	6.58	12.83	27.74
99	**Total Outflow**	**20.15**	**5.70**	**-**	**9.98**	**13.08**	**25.12**	**61.26**

Stormwater Detention Basin Design & Summary

The Stormwater Management Plan proposes three (3) bioretention basins as the primary means of stormwater management for the site. All basins have been designed with 4:1 side slopes on the berms, a 4-foot top of berm width, and overflow spillways set above the 100-year high water level. Additionally, all basin outfall structures discharge to energy dissipating level spreaders prior to discharging into the adjacent wetlands.

Figure 2, Post-Development Conditions Plan, shows the location of the project site, land cover types, drainage subareas, flow paths, and proposed stormwater management improvements. The following table summarizes the results of the stormwater model for post-development conditions. Detailed hydrological computations are included in Appendix B.

TABLE 4
Post-Development Site Conditions

Basin 1B (North Basin)

Basin Details:
- Bottom elevation = 95.50
- Top of engineered soil elevation = 100.50
- 10-foot spillway = 104.00
- Top of berm elevation = 105.00

Outlet Control:
- 1.63 in/hr native infiltration rate, WDNR Tech Stand 1002
- 3-inch diameter orifice at I.E. 97.50
- 3-inch diameter orifice at I.E. 101.00
- 36-inch horizontal grate at elevation 103.75
- 12-inch culvert pipe at I.E. 97.50

	1-year Storm	2-year Storm	10-year Storm	100-year Storm
Peak Inflow (cfs)	1.04	1.33	2.49	5.19
Peak Outflow (cfs)	0.40	0.44	0.77	3.14
Max Water Surface Elev.	100.55	101.02	102.30	103.92
Max Storage Volume (cf)	1,120	1,512	3,061	6,195

Basin 2B (Central Basin)

Basin Details:
- Bottom elevation = 95.00
- Top of engineered soil elevation = 100.00
- 10-foot spillway = 105.20
- Top of berm elevation = 106.20

Outlet Control:
- 1.63 in/hr native infiltration rate, WDNR Tech Stand 1002
- 3.5-inch diameter orifice at I.E. 97.00
- 8-inch diameter orifice at I.E. 100.50
- 36-inch horizontal grate at elevation 104.75
- 15-inch culvert pipe at I.E. 97.00

	1-year Storm	2-year Storm	10-year Storm	100-year Storm
Peak Inflow (cfs)	8.16	9.81	16.09	29.69
Peak Outflow (cfs)	1.90	2.34	3.35	12.25
Max Water Surface Elev.	101.38	101.79	103.24	105.16
Max Storage Volume (cf)	7,459	8,981	15,605	27,755

Basin 3B (West Basin)

System Details:
- Bottom elevation = 90.00
- Top of engineered soil elevation = 95.00
- 10-foot spillway at elevation = 100.00
- Top of berm elevation = 101.00

Outlet Control:
- 1.63 in/hr native infiltration rate, WDNR Tech Stand 1002
- 3.25-inch diameter orifice at I.E. 93.00
- 3.5-inch diameter orifice at I.E. 95.50
- 15-inch diameter orifice at I.E. 97.50
- 36-inch horizontal grate at elevation 99.67
- 18-inch culvert pipe at I.E. 93.00

	1-year Storm	2-year Storm	10-year Storm	100-year Storm
Peak Inflow (cfs)	5.86	7.44	12.55	21.56
Peak Outflow (cfs)	0.87	1.02	3.65	14.02
Max Water Surface Elev.	96.77	97.49	98.29	99.95
Max Storage Volume (cf)	10,130	13,255	17,212	27,225

Peak Discharge Summaries

The stormwater management system will maintain post-development peak discharge rates to be no greater than pre-development discharge rates for the 1, 2, 10, and 100-year, 24-hour design storms. This is in accordance with the City of Waukesha's Chapter 32 stormwater discharge criteria. The following table compares the results of the analysis from a peak discharge standpoint.

TABLE 5
Comparison of Peak Discharge

	Pre-Development		Post-Development
1-year	10.10 cfs	>	9.98 cfs
2-year	13.09 cfs	>	13.08 cfs
10-year	26.36 cfs	>	25.12 cfs
100-year	63.04 cfs	>	61.26 cfs

Water Quality

The City of Waukesha's Chapter 32 requires new development sites to be designed to remove 80 percent of TSS, based on an average annual rainfall as compared to no runoff management controls. Stormwater quality was analyzed using winSLAMM Version 10.4.1 software, developed by Robert Pitt and John Voorhees. The results of the winSLAMM analysis indicate that approximately 85.5 percent of TSS will be removed from stormwater as a result of the proposed bioretention basins. Detailed computations are included in Appendix C.

Infiltration

The City of Waukesha's Chapter 32 requires medium imperviousness developments to infiltrate sufficient runoff volume so that the post-development infiltration volume is at least 75% of the pre-development infiltration volume, based on an average annual rainfall. However, no more than 2% of the project site is required as an effective infiltration area.

Three (3) bioretention basins were incorporated into the development plan to meet infiltration performance standards for the proposed subdivision. Design infiltration rates for the site were taken from Table 2 of WDNR Technical Standard 1002, Site Evaluation for Stormwater Infiltration. Static infiltrations rates for the in-situ soils at each basin were based on the least permeable soil horizon within 5 feet below the native soil interface. Infiltration was analyzed using winSLAMM to determine runoff volumes for both pre-development and post-development conditions. The results of the winSLAMM analysis indicate that the site will infiltrate approximately 95 percent of the pre-development infiltration volume. Detailed computations are included in Appendix D.

Conclusion

The proposed development will maintain compliance with the City of Waukesha and the WDNR's requirements for control of stormwater quantity, quality, and infiltration. We request, on behalf of

Bielinski Homes, approval of this Stormwater Management Plan to allow for construction of the Tallgrass Villas subdivision development.

Prepared by:

SOUND STORMWATER DESIGN LLC

Jayme Sisel, P.E.

FIGURES

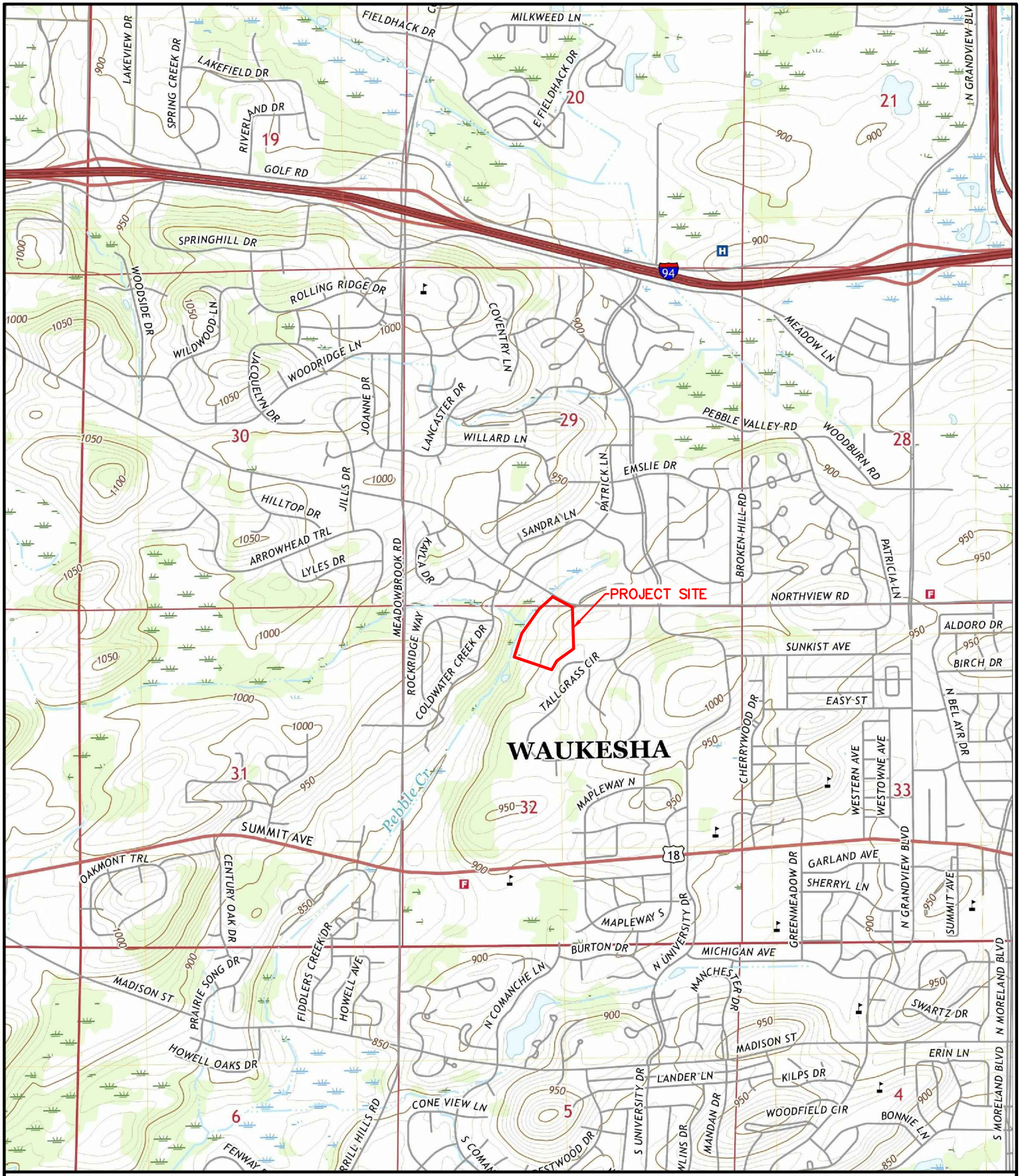


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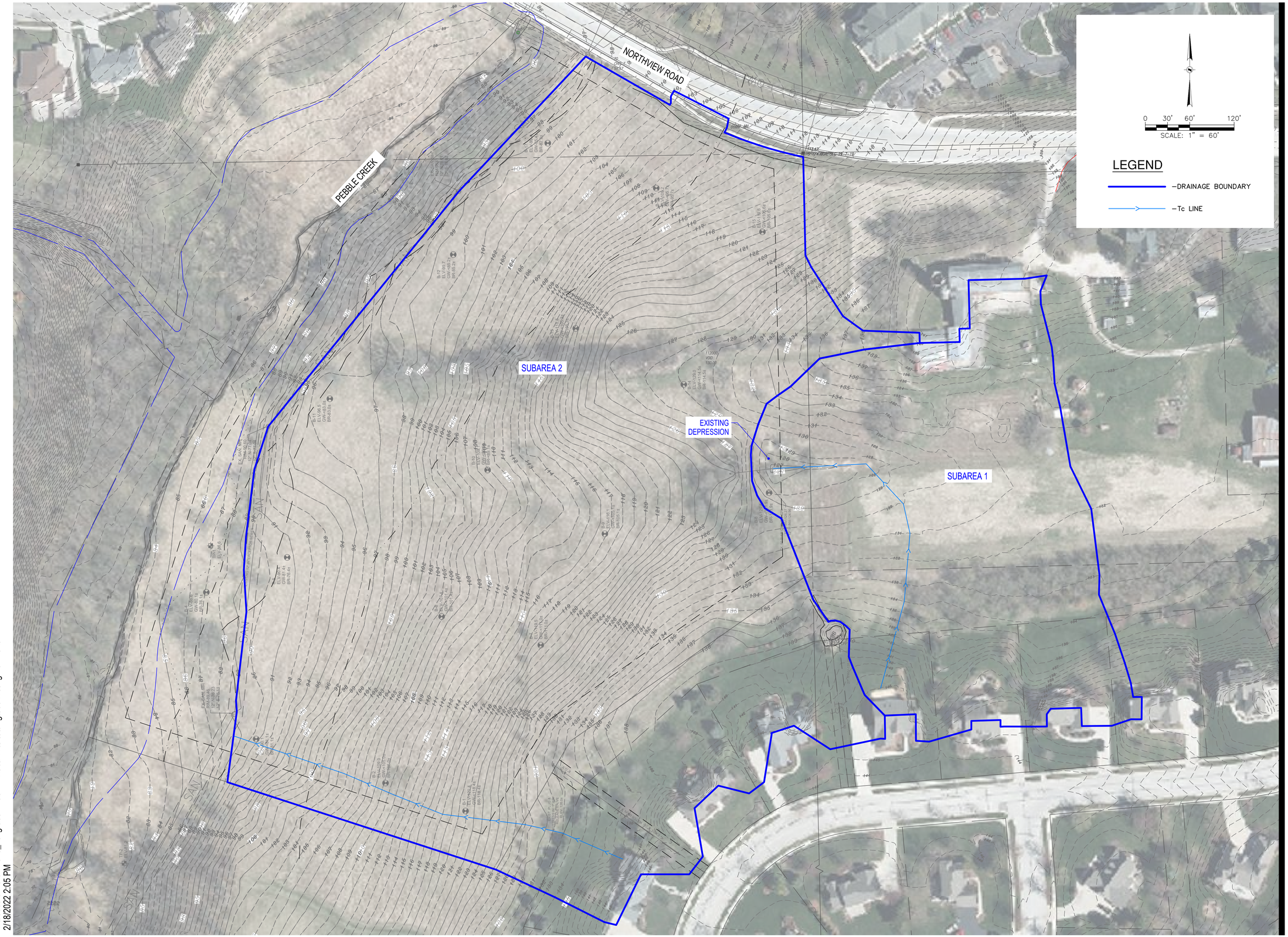
FIGURE 1

SITE LOCATION MAP

TALLGRASS VILLAS
NORTHVIEW ROAD
WAUKESHA, WISCONSIN

SOUND STORMWATER DESIGN



SOUND STORMWATER DESIGN

Copper Oaks Ct.
Muskego, WI 53150
414.286.4739
jayme.sisel@soundstormwater.com

CLIENT:

BIELINSKI COMMERCIAL, LLC.
1830 MEADOW LANE, SUITE A
PEWAUKEE, WISCONSIN 53072

PROJECT TITLE:

TALLGRASS VILLAS

NORTHVIEW ROAD
CITY OF WAUKESHA, WISCONSIN

DATE: 11-22-21

JOB NO: 2021-018

SHEET TITLE:

PRE-DEVELOPMENT CONDITIONS PLAN

FIGURE:

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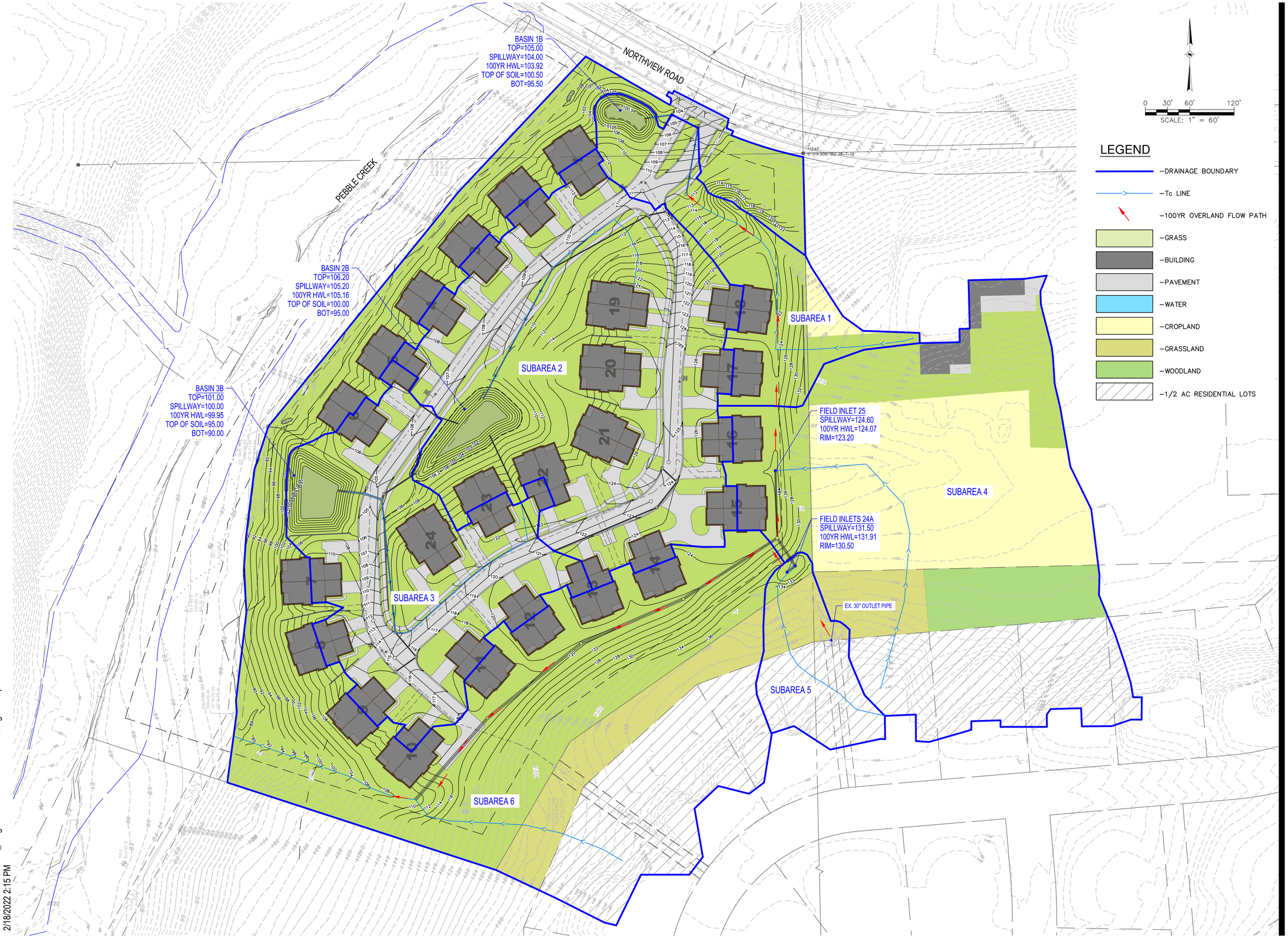

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jayme.sisel@soundstormwater.com

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SHEET TITLE:
POST-DEVELOPMENT CONDITIONS PLAN

FIGURE:
3

BIORETENTION BASIN (1B)
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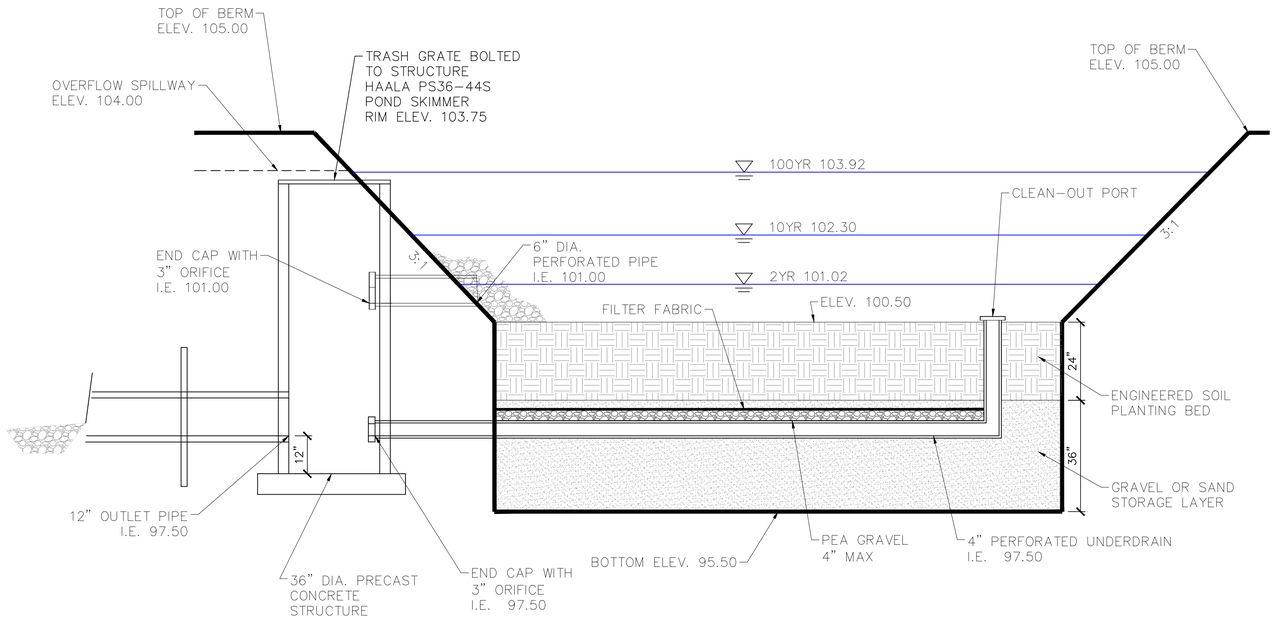

OUTLET CONTROL STRUCTURE
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BIORETENTION BASIN (2B)
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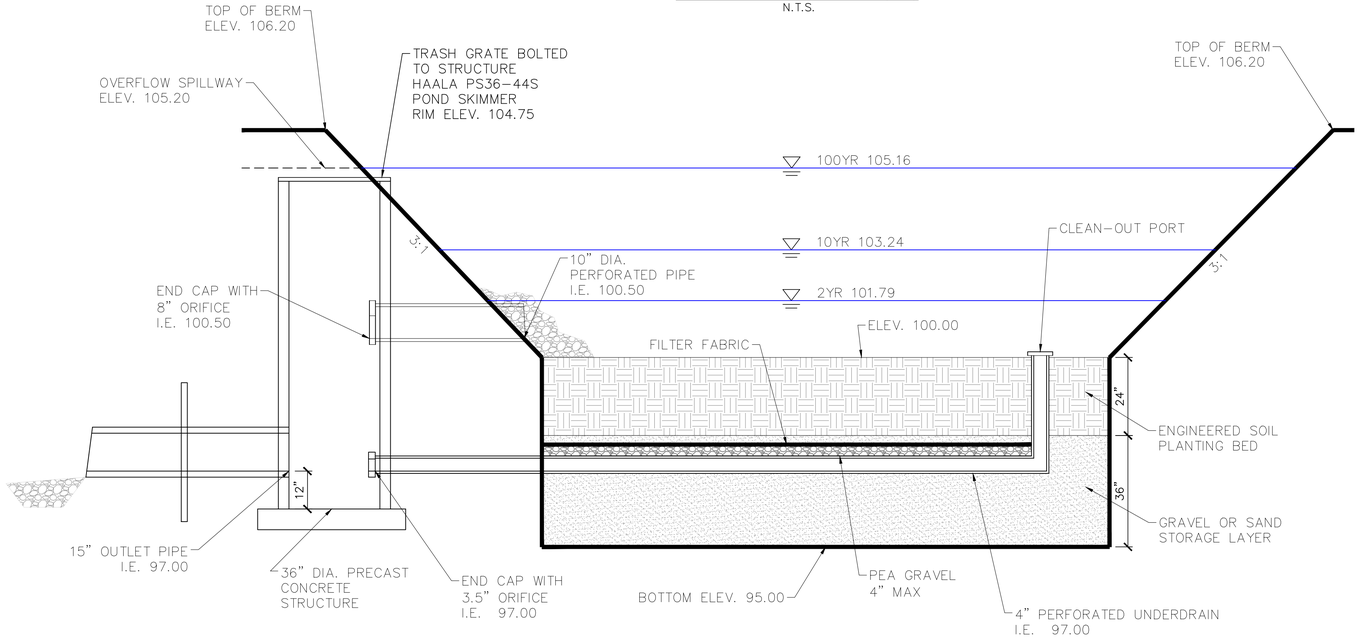

OUTLET CONTROL STRUCTURE
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OVERFLOW SPILLWAY
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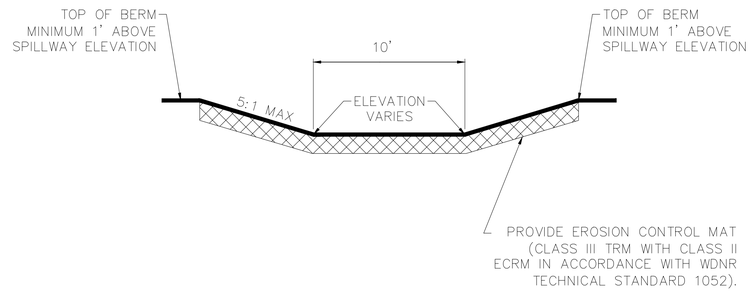

BIORETENTION BASIN NOTES

ENGINEERED SOIL COMPOSITION:
PLANTING MIXTURE SHALL CONSIST OF A MIXTURE OF 70 TO 85% SAND AND 15 TO 30% COMPOST IN ACCORDANCE WITH WDNR TECHNICAL STANDARD 1004, BIORETENTION FOR INFILTRATION. THE PERCENTAGES ARE BASED ON VOLUME. SPECIAL ATTENTION SHOULD BE GIVEN TO PLANT SELECTION WHEN THE PERCENTAGE OF SAND EXCEEDS 75%.

THE SAND COMPONENT SHALL BE USDA COARSE SAND (0.02 TO 0.04 INCH DIAMETER), PRE-WASHED TO REMOVE CLAY AND SILT PARTICLES, AND WELL-DRAINED OR DRY PRIOR TO MIXING. SAND CONSISTING OF DOLOMITE OR CALCIUM CARBONATE MAY ALSO BE USED.

THE COMPOST COMPONENT SHALL MEET THE REQUIREMENTS OF WDNR SPECIFICATION S100, COMPOST.

STORAGE LAYER:
THE GRAVEL SHALL MEET THE COARSE AGGREGATE #2 AND OTHER SPECIFICATIONS OF WISCONSIN STANDARDS AND SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION, SECTION 501.2.5, 2003 EDITION, OR AN EQUIVALENT AS APPROVED BY THE ADMINISTERING AUTHORITY. GRAVEL SHALL BE DOUBLE-WASHED.

A LAYER OF SAND MAY BE USED IN LIEU OF GRAVEL TO FORM THE STORAGE LAYER. SEE SAND SPECIFICATION NOTED UNDER ENGINEERED SOIL COMPOSITION.

UNDERDRAIN PIPE PROTECTION:
THE UNDERDRAIN PIPE SHALL BE PROTECTED FROM CLOGGING BY USE OF FILTER FABRIC OR A FILTER SOCK. IF THE STORAGE LAYER IS SAND, A FILTER SOCK SHALL BE USED. A COVER OF PEA GRAVEL MAY ALSO BE USED.

PEA GRAVEL – IF USED, THE PEA GRAVEL LAYER SHALL BE AT LEAST 4 INCHES THICK. PEA GRAVEL SHALL BE WASHED. PEA GRAVEL SHALL BE LARGE ENOUGH TO PREVENT ITS FALLING THROUGH THE PERFORATIONS OF THE UNDERDRAIN PIPE.

FILTER FABRIC – FILTER FABRIC SHALL COVER THE UNDERDRAIN PIPE AND SHALL NOT EXTEND LATERALLY FROM EITHER SIDE OF THE PIPE MORE THAN TWO FEET. THE FABRIC SHALL MEET THE SPECIFICATIONS OF WISCONSIN STANDARDS AND SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION, SECTION 645.2.4, SCHEDULE TEST B, 2003 EDITION, OR AN EQUIVALENT APPROVED BY THE ADMINISTRATING AUTHORITY.

FILTER SOCK – THE OPENINGS IN THE FILTER SHALL BE SMALL ENOUGH TO PREVENT SAND PARTICLES FROM ENTERING THE UNDERDRAIN PIPE. THE FLOW RATE OF THE FABRIC SHALL BE CAPABLE OF PASSING WATER AT A RATE EQUAL TO OR GREATER THAN THE FLOW RATE CAPACITY OF THE TOTAL COMBINED PERFORATIONS IN THE UNDERDRAIN PIPE. IN ADDITION, THE FABRIC SHALL MEET THE OTHER REQUIREMENTS OF WISCONSIN STANDARDS AND SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION, SECTION 612.2.8(1-3), 2003 EDITION, OR AN EQUIVALENT APPROVED BY THE ADMINISTERING AUTHORITY.

SOUND STORMWATER DESIGN

Copper Oaks Ct.
Muskego, WI 53150
414.286.4739
jayme.sisel@soundstormwater.com

CLIENT:
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1830 MEADOW LANE, SUITE A
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SHEET TITLE:
STORMWATER DETAILS

FIGURE:
4

BIORETENTION BASIN (3B)

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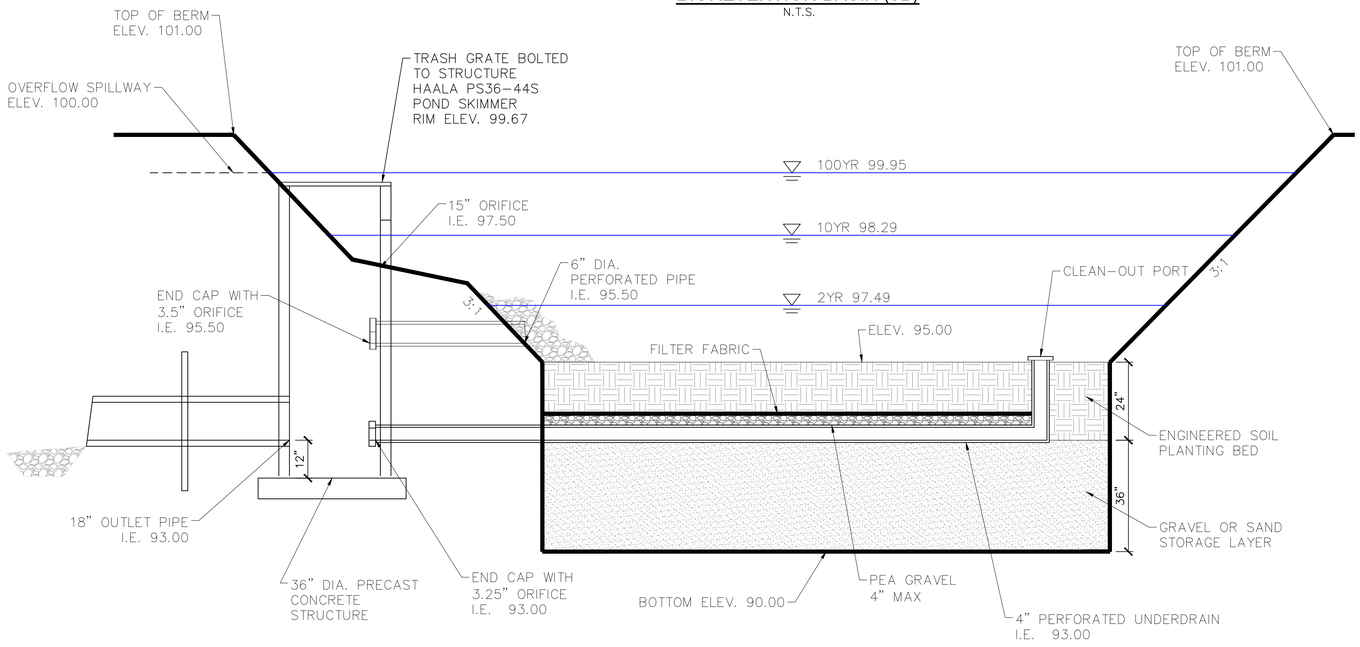

OUTLET CONTROL STRUCTURE

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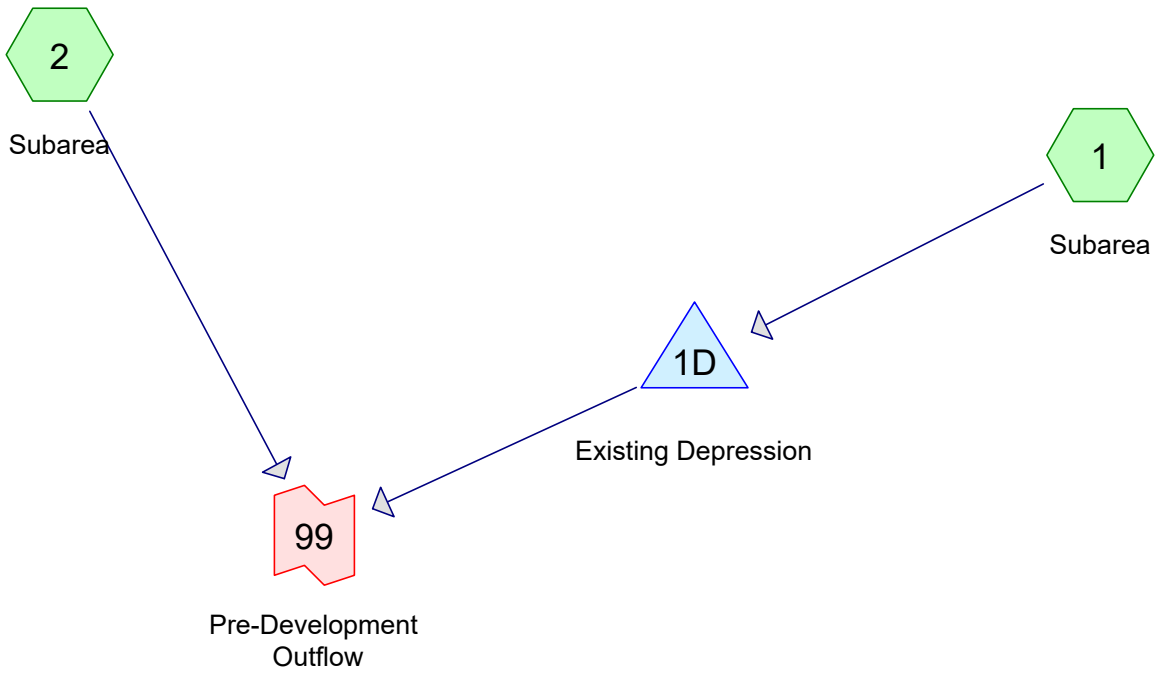
STORMWATER DETAILS

FIGURE:
5

APPENDIX A

Pre-Development Hydrologic Analysis



Subcat Reach Pond Link

Routing Diagram for Existing_Tallgrass
Prepared by HP Inc., Printed 11/19/2021

Rainfall Events Listing (selected events)

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)
13.220	71	grassland - C soils (1, 2)
2.690	80	offsite 1/2 ac residential lots @ 25% imp - C soils (1, 2)
1.930	78	offsite cropland - C soiils (1, 2)
0.710	74	offsite grass - C soils (1, 2)
1.000	71	offsite grassland - C soils (1, 2)
0.180	98	offsite impervious (1)
0.420	70	offsite woodland - C soils (1)
20.150	**73**	**TOTAL AREA**

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

Subcatchment1: Subarea Runoff Area=4.770 ac 9.43% Impervious Runoff Depth>0.68"
Flow Length=455' Tc=18.8 min CN=77 Runoff=3.47 cfs 0.269 af

Subcatchment2: Subarea Runoff Area=15.380 ac 2.62% Impervious Runoff Depth>0.48"
Flow Length=555' Tc=19.4 min CN=72 Runoff=6.93 cfs 0.611 af

Pond 1D: Existing Depression Peak Elev=127.50' Storage=355 cf Inflow=3.47 cfs 0.269 af
Outflow=3.21 cfs 0.269 af

Link 99: Pre-DevelopmentOutflow Inflow=10.10 cfs 0.880 af
Primary=10.10 cfs 0.880 af

Total Runoff Area = 20.150 ac Runoff Volume = 0.880 af Average Runoff Depth = 0.52"
95.77% Pervious = 19.297 ac 4.23% Impervious = 0.852 ac

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

Subcatchment1: Subarea Runoff Area=4.770 ac 9.43% Impervious Runoff Depth>0.87"
Flow Length=455' Tc=18.8 min CN=77 Runoff=4.55 cfs 0.345 af

Subcatchment2: Subarea Runoff Area=15.380 ac 2.62% Impervious Runoff Depth>0.63"
Flow Length=555' Tc=19.4 min CN=72 Runoff=9.82 cfs 0.813 af

Pond 1D: Existing Depression Peak Elev=128.01' Storage=971 cf Inflow=4.55 cfs 0.345 af
Outflow=3.45 cfs 0.345 af

Link 99: Pre-DevelopmentOutflow Inflow=13.09 cfs 1.158 af
Primary=13.09 cfs 1.158 af

Total Runoff Area = 20.150 ac Runoff Volume = 1.158 af Average Runoff Depth = 0.69"
95.77% Pervious = 19.297 ac 4.23% Impervious = 0.852 ac

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

Subcatchment1: Subarea Runoff Area=4.770 ac 9.43% Impervious Runoff Depth>1.66"
Flow Length=455' Tc=18.8 min CN=77 Runoff=9.06 cfs 0.661 af

Subcatchment2: Subarea Runoff Area=15.380 ac 2.62% Impervious Runoff Depth>1.33"
Flow Length=555' Tc=19.4 min CN=72 Runoff=22.40 cfs 1.700 af

Pond 1D: Existing Depression Peak Elev=129.06' Storage=5,280 cf Inflow=9.06 cfs 0.661 af
Outflow=4.24 cfs 0.661 af

Link 99: Pre-DevelopmentOutflow Inflow=26.36 cfs 2.361 af
Primary=26.36 cfs 2.361 af

Total Runoff Area = 20.150 ac Runoff Volume = 2.361 af Average Runoff Depth = 1.41"
95.77% Pervious = 19.297 ac 4.23% Impervious = 0.852 ac

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

Subcatchment1: Subarea Runoff Area=4.770 ac 9.43% Impervious Runoff Depth>3.63"
Flow Length=455' Tc=18.8 min CN=77 Runoff=19.91 cfs 1.444 af

Subcatchment2: Subarea Runoff Area=15.380 ac 2.62% Impervious Runoff Depth>3.14"
Flow Length=555' Tc=19.4 min CN=72 Runoff=54.69 cfs 4.021 af

Pond 1D: Existing Depression Peak Elev=129.82' Storage=13,048 cf Inflow=19.91 cfs 1.444 af
Outflow=14.32 cfs 1.444 af

Link 99: Pre-DevelopmentOutflow Inflow=63.04 cfs 5.464 af
Primary=63.04 cfs 5.464 af

Total Runoff Area = 20.150 ac Runoff Volume = 5.464 af Average Runoff Depth = 3.25"
95.77% Pervious = 19.297 ac 4.23% Impervious = 0.852 ac

Summary for Subcatchment 1: Subarea

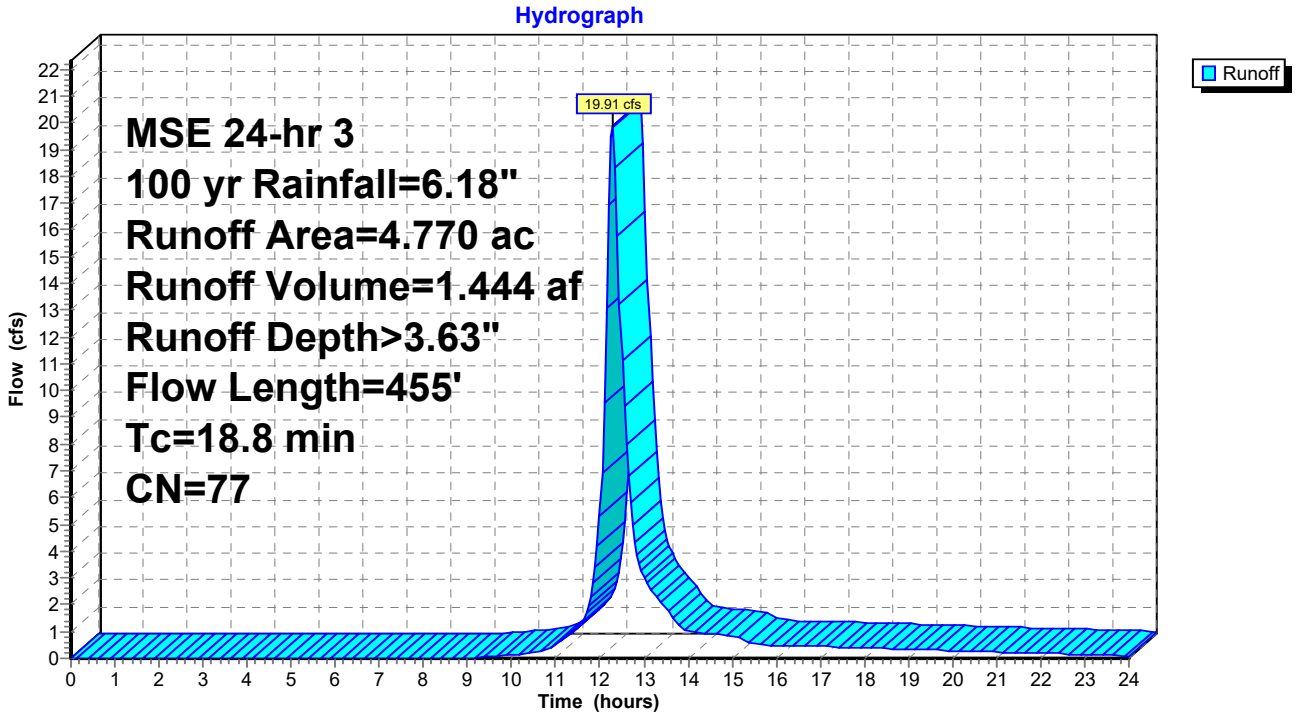
Runoff = 19.91 cfs @ 12.28 hrs, Volume= 1.444 af, Depth> 3.63"
Routed to Pond 1D : Existing Depression

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.330	71	grassland - C soils
*	1.850	78	offsite cropland - C soiils
*	0.420	70	offsite woodland - C soils
*	0.630	74	offsite grass - C soils
*	0.280	71	offsite grassland - C soils
*	0.180	98	offsite impervious
*	1.080	80	offsite 1/2 ac residential lots @ 25% imp - C soils
	4.770	77	Weighted Average
	4.320		90.57% Pervious Area
	0.450		9.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	165	0.0800	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
4.0	90	0.0300	0.37		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.70"
1.5	200	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.8	455	Total			

Subcatchment 1: Subarea



Summary for Subcatchment 2: Subarea

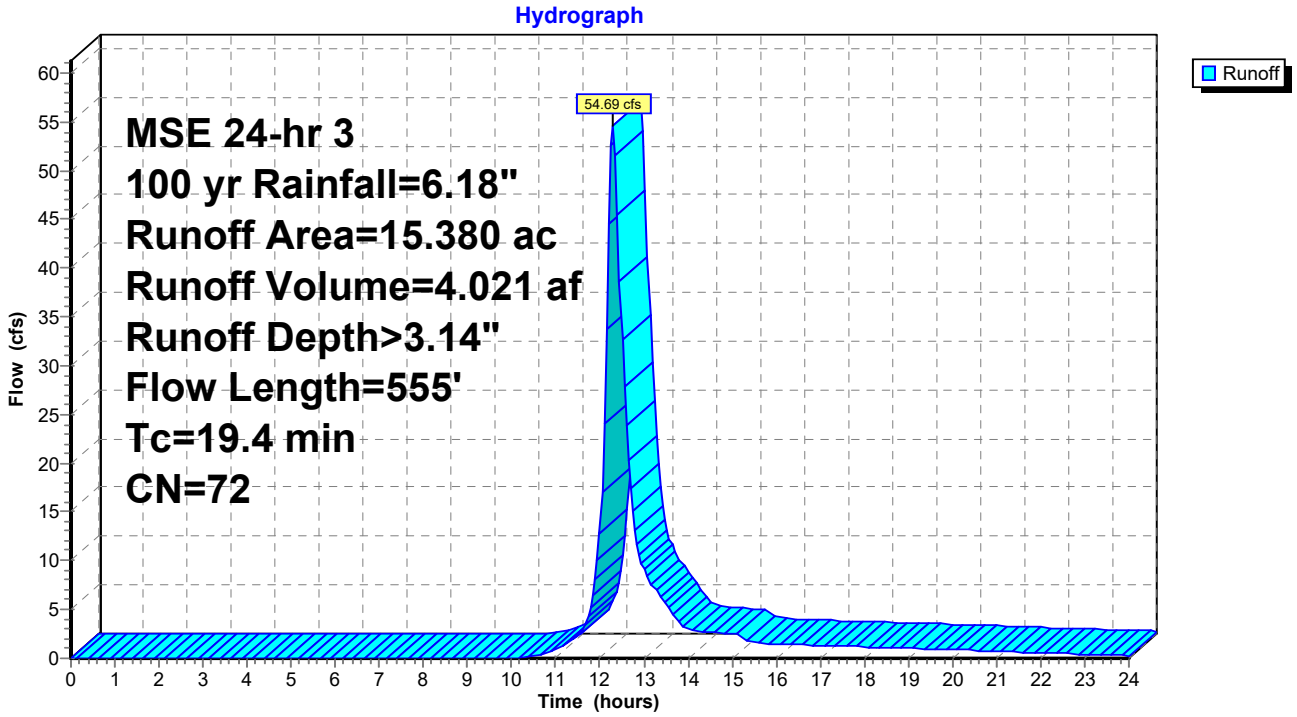
Runoff = 54.69 cfs @ 12.30 hrs, Volume= 4.021 af, Depth> 3.14"
Routed to Link 99 : Pre-Development Outflow

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	12.890	71	grassland - C soils
*	0.080	78	offsite cropland - C soiils
*	0.080	74	offsite grass - C soils
*	0.720	71	offsite grassland - C soils
*	1.610	80	offsite 1/2 ac residential lots @ 25% imp - C soils
	15.380	72	Weighted Average
	14.977		97.38% Pervious Area
	0.403		2.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	145	0.0900	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
7.1	155	0.1000	0.36		**Sheet Flow,** Range n= 0.130 P2= 2.70"
0.8	255	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
19.4	555	Total			

Subcatchment 2: Subarea



Summary for Pond 1D: Existing Depression

Inflow Area = 4.770 ac, 9.43% Impervious, Inflow Depth > 3.63" for 100 yr event
Inflow = 19.91 cfs @ 12.28 hrs, Volume= 1.444 af
Outflow = 14.32 cfs @ 12.43 hrs, Volume= 1.444 af, Atten= 28%, Lag= 9.1 min
Primary = 14.32 cfs @ 12.43 hrs, Volume= 1.444 af
Routed to Link 99 : Pre-Development Outflow

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 129.82' @ 12.43 hrs Surf.Area= 13,754 sf Storage= 13,048 cf

Plug-Flow detention time= 14.2 min calculated for 1.444 af (100% of inflow)
Center-of-Mass det. time= 14.1 min (823.7 - 809.6)

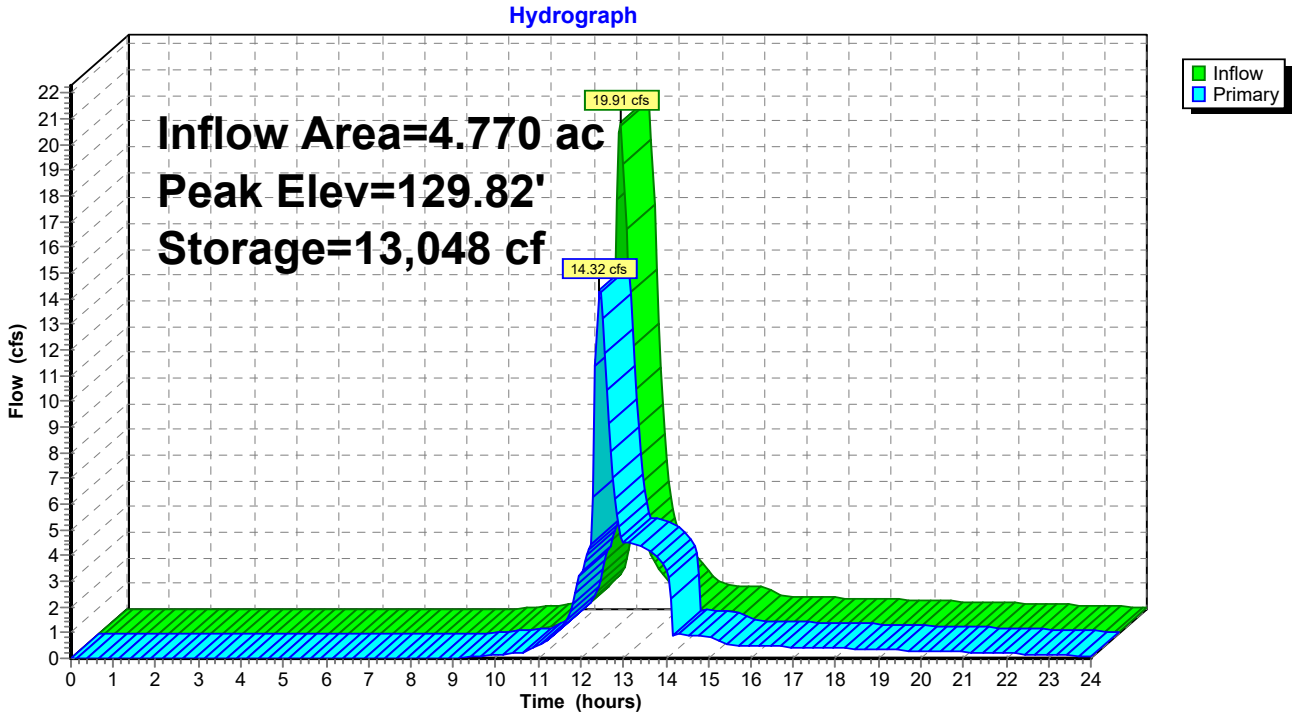
Volume	Invert	Avail.Storage	Storage Description
#1	126.00'	15,749 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
126.00	0	0	0	0
127.00	286	95	95	288
128.00	1,599	854	949	1,604
129.00	6,773	3,888	4,837	6,783
130.00	15,664	10,912	15,749	15,682

Device	Routing	Invert	Outlet Devices
#1	Primary	126.27'	**12.0" Round Culvert** L= 50.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 126.27' / 124.96' S= 0.0262 '/' Cc= 0.900 n= 0.024, Flow Area= 0.79 sf
#2	Primary	129.50'	**20.0' long + 5.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=14.16 cfs @ 12.43 hrs HW=129.81' (Free Discharge)
1=Culvert (Barrel Controls 4.73 cfs @ 6.02 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 9.44 cfs @ 1.40 fps)

Pond 1D: Existing Depression

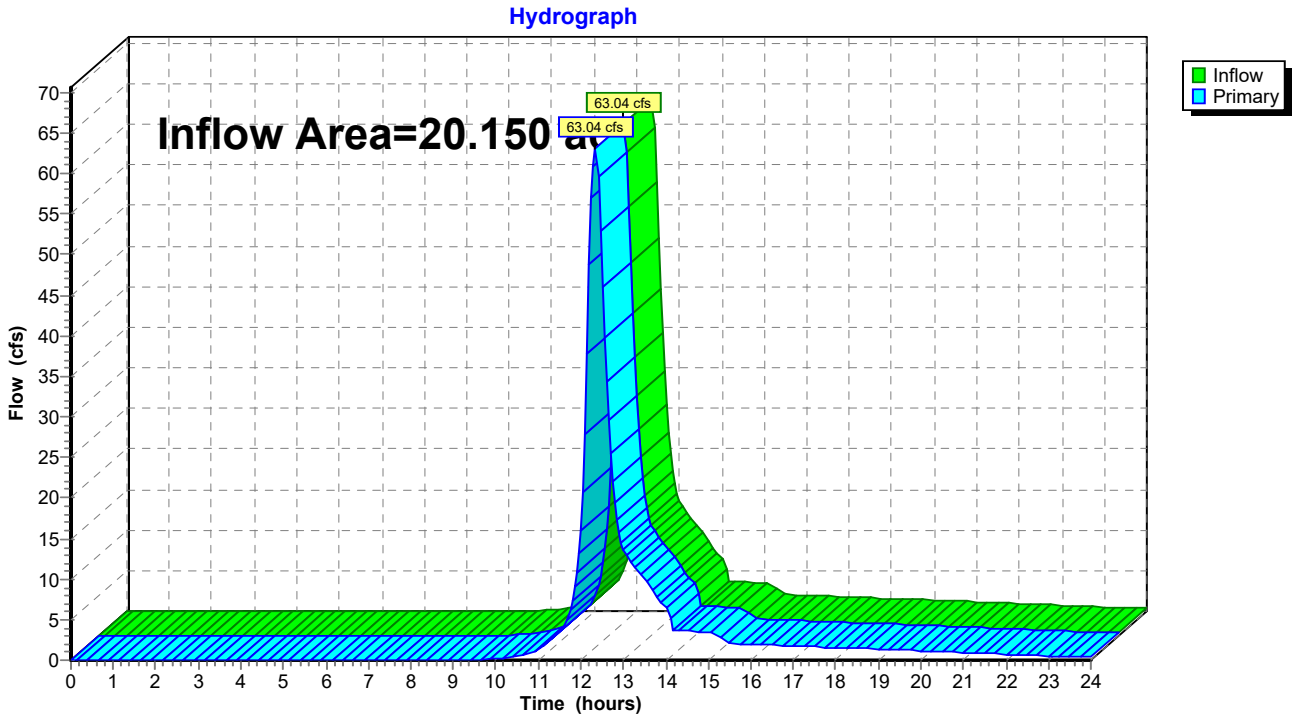


Summary for Link 99: Pre-Development Outflow

Inflow Area = 20.150 ac, 4.23% Impervious, Inflow Depth > 3.25" for 100 yr event
Inflow = 63.04 cfs @ 12.34 hrs, Volume= 5.464 af
Primary = 63.04 cfs @ 12.34 hrs, Volume= 5.464 af, Atten= 0%, Lag= 0.0 min

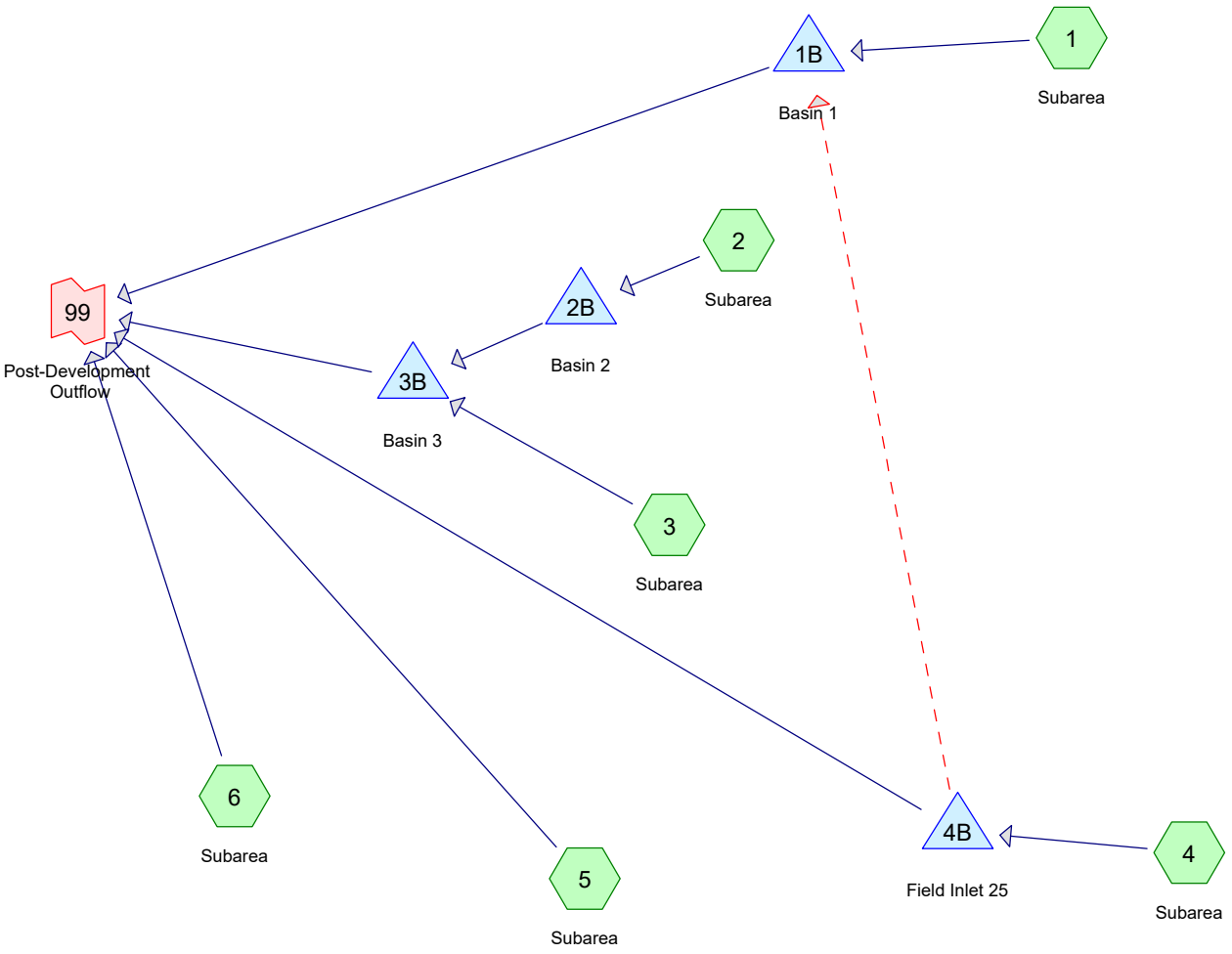
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 99: Pre-Development Outflow



APPENDIX B

Post-Development Hydrologic Analysis



Subcat Reach Pond Link

Routing Diagram for Proposed_Tallgrass
Prepared by HP Inc., Printed 2/18/2022

Rainfall Events Listing (selected events)

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)
8.240	74	grass - C soils (1, 2, 3, 4, 5, 6)
4.850	98	impervious (1, 2, 3, 4, 6)
0.080	100	infiltration area (1, 3)
0.050	98	infiltration area (2)
2.690	80	offsite 1/2 ac residential lots - C soils (4, 5, 6)
1.930	78	offsite cropland - C soiils (1, 4)
0.710	74	offsite grass - C soils (1, 4)
1.000	71	offsite grassland - C soils (4, 5, 6)
0.180	98	offsite impervious (4)
0.420	70	offsite woodland - C soils (4)
20.150	**81**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subarea Runoff Area=1.230 ac 21.95% Impervious Runoff Depth>0.82"
Flow Length=775' Tc=21.5 min CN=80 Runoff=1.04 cfs 0.084 af

Subcatchment2: Subarea Runoff Area=4.110 ac 54.50% Impervious Runoff Depth>1.23"
Flow Length=405' Tc=8.9 min CN=87 Runoff=8.16 cfs 0.420 af

Subcatchment3: Subarea Runoff Area=2.400 ac 60.42% Impervious Runoff Depth>1.37"
Flow Length=505' Tc=9.1 min CN=89 Runoff=5.23 cfs 0.273 af

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>0.72"
Flow Length=455' Tc=18.8 min CN=78 Runoff=3.83 cfs 0.293 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>0.68"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=0.52 cfs 0.036 af

Subcatchment6: Subarea Runoff Area=6.910 ac 13.02% Impervious Runoff Depth>0.72"
Flow Length=560' Tc=21.5 min CN=78 Runoff=5.05 cfs 0.416 af

Pond 1B: Basin 1 Peak Elev=100.55' Storage=1,120 cf Inflow=1.04 cfs 0.084 af
Discarded=0.04 cfs 0.034 af Primary=0.40 cfs 0.047 af Outflow=0.45 cfs 0.081 af

Pond 2B: Basin 2 Peak Elev=101.38' Storage=7,459 cf Inflow=8.16 cfs 0.420 af
Discarded=0.23 cfs 0.144 af Primary=1.90 cfs 0.263 af Outflow=2.13 cfs 0.408 af

Pond 3B: Basin 3 Peak Elev=96.77' Storage=10,130 cf Inflow=5.86 cfs 0.537 af
Discarded=0.30 cfs 0.212 af Primary=0.87 cfs 0.311 af Outflow=1.17 cfs 0.523 af

Pond 4B: Field Inlet 25 Peak Elev=123.48' Storage=10 cf Inflow=3.83 cfs 0.293 af
Primary=3.83 cfs 0.293 af Secondary=0.00 cfs 0.000 af Outflow=3.83 cfs 0.293 af

Link 99: Post-DevelopmentOutflow Inflow=9.98 cfs 1.102 af
Primary=9.98 cfs 1.102 af

Total Runoff Area = 20.150 ac Runoff Volume = 1.523 af Average Runoff Depth = 0.91"
74.39% Pervious = 14.990 ac 25.61% Impervious = 5.160 ac

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subarea Runoff Area=1.230 ac 21.95% Impervious Runoff Depth>1.03"
Flow Length=775' Tc=21.5 min CN=80 Runoff=1.33 cfs 0.105 af

Subcatchment2: Subarea Runoff Area=4.110 ac 54.50% Impervious Runoff Depth>1.48"
Flow Length=405' Tc=8.9 min CN=87 Runoff=9.81 cfs 0.507 af

Subcatchment3: Subarea Runoff Area=2.400 ac 60.42% Impervious Runoff Depth>1.63"
Flow Length=505' Tc=9.1 min CN=89 Runoff=6.21 cfs 0.326 af

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>0.92"
Flow Length=455' Tc=18.8 min CN=78 Runoff=4.99 cfs 0.373 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>0.87"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=0.68 cfs 0.046 af

Subcatchment6: Subarea Runoff Area=6.910 ac 13.02% Impervious Runoff Depth>0.92"
Flow Length=560' Tc=21.5 min CN=78 Runoff=6.58 cfs 0.529 af

Pond 1B: Basin 1 Peak Elev=101.02' Storage=1,512 cf Inflow=1.33 cfs 0.105 af
Discarded=0.05 cfs 0.036 af Primary=0.44 cfs 0.065 af Outflow=0.49 cfs 0.101 af

Pond 2B: Basin 2 Peak Elev=101.79' Storage=8,981 cf Inflow=9.81 cfs 0.507 af
Discarded=0.25 cfs 0.152 af Primary=2.34 cfs 0.338 af Outflow=2.59 cfs 0.490 af

Pond 3B: Basin 3 Peak Elev=97.49' Storage=13,255 cf Inflow=7.44 cfs 0.664 af
Discarded=0.34 cfs 0.236 af Primary=1.02 cfs 0.408 af Outflow=1.35 cfs 0.644 af

Pond 4B: Field Inlet 25 Peak Elev=123.53' Storage=16 cf Inflow=4.99 cfs 0.373 af
Primary=4.98 cfs 0.373 af Secondary=0.00 cfs 0.000 af Outflow=4.98 cfs 0.373 af

Link 99: Post-DevelopmentOutflow Inflow=13.08 cfs 1.421 af
Primary=13.08 cfs 1.421 af

Total Runoff Area = 20.150 ac Runoff Volume = 1.886 af Average Runoff Depth = 1.12"
74.39% Pervious = 14.990 ac 25.61% Impervious = 5.160 ac

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subarea Runoff Area=1.230 ac 21.95% Impervious Runoff Depth>1.88"
Flow Length=775' Tc=21.5 min CN=80 Runoff=2.49 cfs 0.193 af

Subcatchment2: Subarea Runoff Area=4.110 ac 54.50% Impervious Runoff Depth>2.46"
Flow Length=405' Tc=8.9 min CN=87 Runoff=16.09 cfs 0.843 af

Subcatchment3: Subarea Runoff Area=2.400 ac 60.42% Impervious Runoff Depth>2.64"
Flow Length=505' Tc=9.1 min CN=89 Runoff=9.88 cfs 0.529 af

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>1.73"
Flow Length=455' Tc=18.8 min CN=78 Runoff=9.71 cfs 0.704 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>1.66"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=1.36 cfs 0.087 af

Subcatchment6: Subarea Runoff Area=6.910 ac 13.02% Impervious Runoff Depth>1.73"
Flow Length=560' Tc=21.5 min CN=78 Runoff=12.83 cfs 0.998 af

Pond 1B: Basin 1 Peak Elev=102.30' Storage=3,061 cf Inflow=2.49 cfs 0.193 af
Discarded=0.08 cfs 0.043 af Primary=0.77 cfs 0.143 af Outflow=0.85 cfs 0.185 af

Pond 2B: Basin 2 Peak Elev=103.24' Storage=15,605 cf Inflow=16.09 cfs 0.843 af
Discarded=0.33 cfs 0.183 af Primary=3.35 cfs 0.635 af Outflow=3.69 cfs 0.818 af

Pond 3B: Basin 3 Peak Elev=98.29' Storage=17,212 cf Inflow=12.55 cfs 1.164 af
Discarded=0.39 cfs 0.282 af Primary=3.65 cfs 0.848 af Outflow=4.03 cfs 1.130 af

Pond 4B: Field Inlet 25 Peak Elev=123.72' Storage=62 cf Inflow=9.71 cfs 0.704 af
Primary=9.71 cfs 0.704 af Secondary=0.00 cfs 0.000 af Outflow=9.71 cfs 0.704 af

Link 99: Post-DevelopmentOutflow Inflow=25.12 cfs 2.780 af
Primary=25.12 cfs 2.780 af

Total Runoff Area = 20.150 ac Runoff Volume = 3.355 af Average Runoff Depth = 2.00"
74.39% Pervious = 14.990 ac 25.61% Impervious = 5.160 ac

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subarea Runoff Area=1.230 ac 21.95% Impervious Runoff Depth>3.94"
Flow Length=775' Tc=21.5 min CN=80 Runoff=5.19 cfs 0.404 af

Subcatchment2: Subarea Runoff Area=4.110 ac 54.50% Impervious Runoff Depth>4.69"
Flow Length=405' Tc=8.9 min CN=87 Runoff=29.69 cfs 1.606 af

Subcatchment3: Subarea Runoff Area=2.400 ac 60.42% Impervious Runoff Depth>4.91"
Flow Length=505' Tc=9.1 min CN=89 Runoff=17.72 cfs 0.982 af

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>3.73"
Flow Length=455' Tc=18.8 min CN=78 Runoff=20.96 cfs 1.515 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>3.63"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=2.97 cfs 0.191 af

Subcatchment6: Subarea Runoff Area=6.910 ac 13.02% Impervious Runoff Depth>3.73"
Flow Length=560' Tc=21.5 min CN=78 Runoff=27.74 cfs 2.150 af

Pond 1B: Basin 1 Peak Elev=103.92' Storage=6,195 cf Inflow=5.19 cfs 0.404 af
Discarded=0.12 cfs 0.058 af Primary=3.14 cfs 0.336 af Outflow=3.26 cfs 0.394 af

Pond 2B: Basin 2 Peak Elev=105.16' Storage=27,755 cf Inflow=29.69 cfs 1.606 af
Discarded=0.46 cfs 0.243 af Primary=12.25 cfs 1.332 af Outflow=12.71 cfs 1.574 af

Pond 3B: Basin 3 Peak Elev=99.95' Storage=27,225 cf Inflow=21.56 cfs 2.313 af
Discarded=0.49 cfs 0.349 af Primary=14.02 cfs 1.912 af Outflow=14.52 cfs 2.261 af

Pond 4B: Field Inlet 25 Peak Elev=124.07' Storage=286 cf Inflow=20.96 cfs 1.515 af
Primary=20.96 cfs 1.515 af Secondary=0.00 cfs 0.000 af Outflow=20.96 cfs 1.515 af

Link 99: Post-DevelopmentOutflow Inflow=61.26 cfs 6.104 af
Primary=61.26 cfs 6.104 af

Total Runoff Area = 20.150 ac Runoff Volume = 6.847 af Average Runoff Depth = 4.08"
74.39% Pervious = 14.990 ac 25.61% Impervious = 5.160 ac

Summary for Subcatchment 1: Subarea

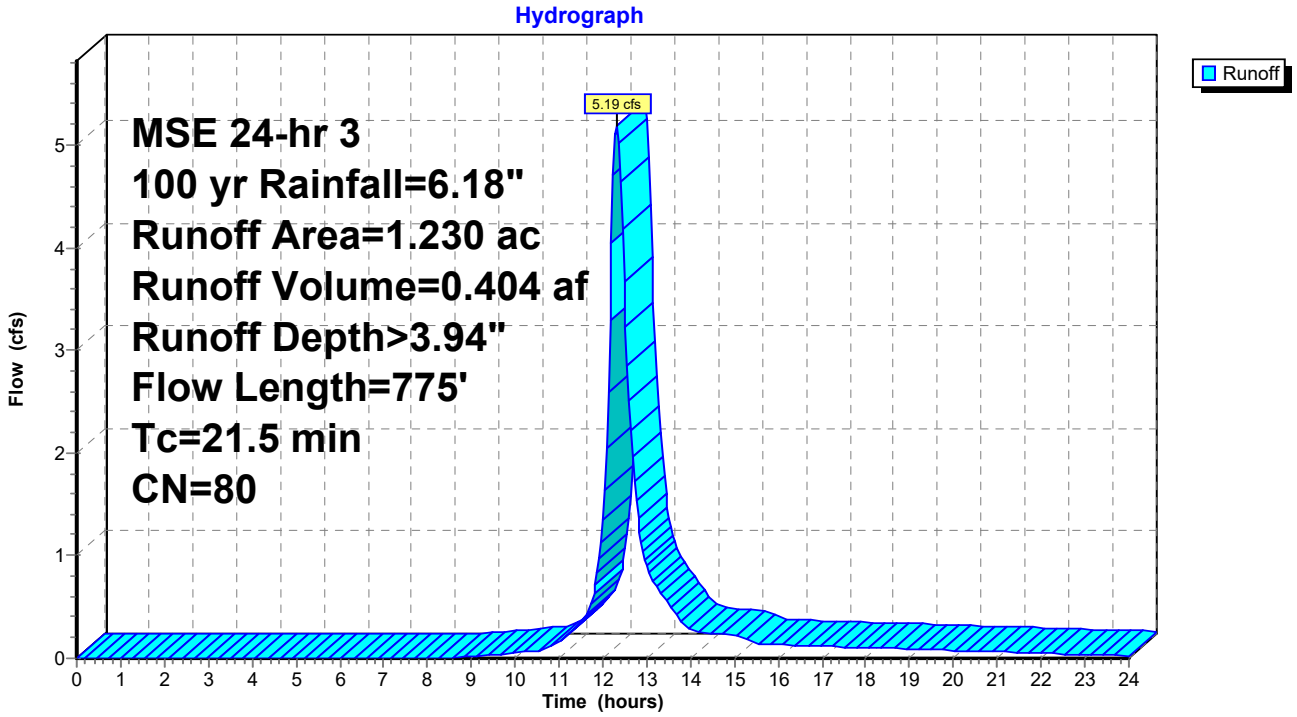
Runoff = 5.19 cfs @ 12.31 hrs, Volume= 0.404 af, Depth> 3.94"
Routed to Pond 1B : Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.780	74	grass - C soils
*	0.250	98	impervious
*	0.020	100	infiltration area
*	0.080	78	offsite cropland - C soiils
*	0.100	74	offsite grass - C soils
	1.230	80	Weighted Average
	0.960		78.05% Pervious Area
	0.270		21.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	150	0.0300	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
0.1	40	0.2300	7.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	150	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.0	275	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.5	160		5.00		**Direct Entry, Pipe Flow**
21.5	775	Total			

Subcatchment 1: Subarea



Summary for Subcatchment 2: Subarea

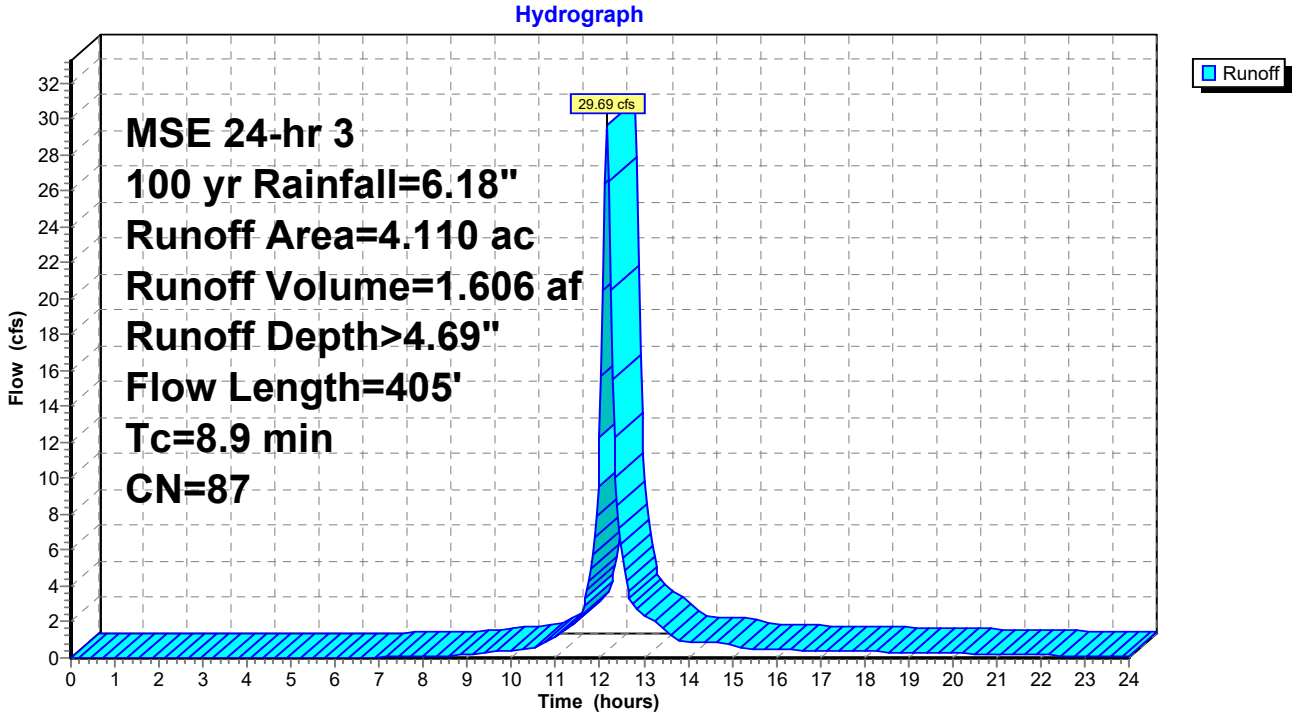
Runoff = 29.69 cfs @ 12.16 hrs, Volume= 1.606 af, Depth> 4.69"
Routed to Pond 2B : Basin 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	1.870	74	grass - C soils
*	2.190	98	impervious
*	0.050	98	infiltration area
	4.110	87	Weighted Average
	1.870		45.50% Pervious Area
	2.240		54.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.1300	0.23		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
0.9	105	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	200		5.00		**Direct Entry, Pipe Flow**
8.9	405	Total			

Subcatchment 2: Subarea



Summary for Subcatchment 3: Subarea

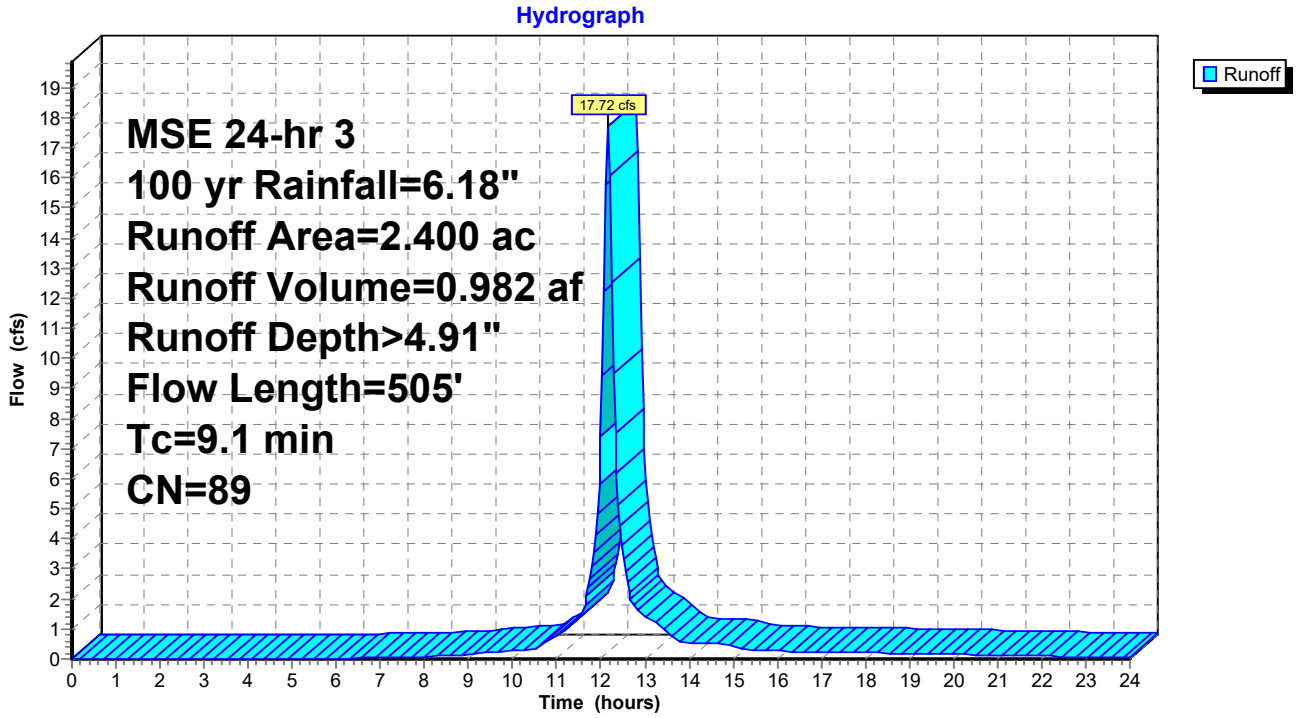
Runoff = 17.72 cfs @ 12.16 hrs, Volume= 0.982 af, Depth> 4.91"
Routed to Pond 3B : Basin 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.950	74	grass - C soils
*	1.390	98	impervious
*	0.060	100	infiltration area
	2.400	89	Weighted Average
	0.950		39.58% Pervious Area
	1.450		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	45	0.0300	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
0.0	10	0.0500	4.54		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.3	220	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.8	230		5.00		**Direct Entry, Pipe Flow**
9.1	505	Total			

Subcatchment 3: Subarea



Summary for Subcatchment 4: Subarea

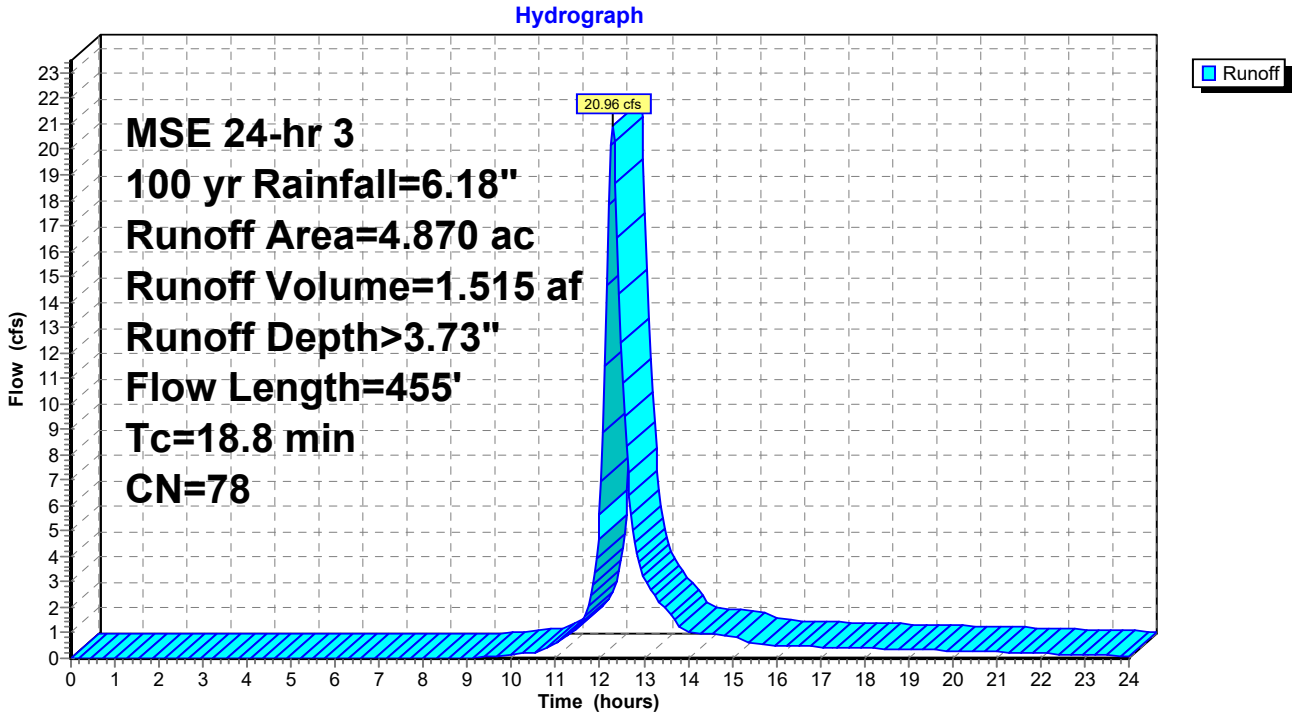
Runoff = 20.96 cfs @ 12.28 hrs, Volume= 1.515 af, Depth> 3.73"
Routed to Pond 4B : Field Inlet 25

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.340	74	grass - C soils
*	0.120	98	impervious
*	1.850	78	offsite cropland - C soiils
*	0.420	70	offsite woodland - C soils
*	0.610	74	offsite grass - C soils
*	0.270	71	offsite grassland - C soils
*	0.180	98	offsite impervious
*	1.080	80	offsite 1/2 ac residential lots - C soils
	4.870	78	Weighted Average
	4.570		93.84% Pervious Area
	0.300		6.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	165	0.0800	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
4.0	90	0.0300	0.37		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.70"
1.5	200	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.8	455	Total			

Subcatchment 4: Subarea



Summary for Subcatchment 5: Subarea

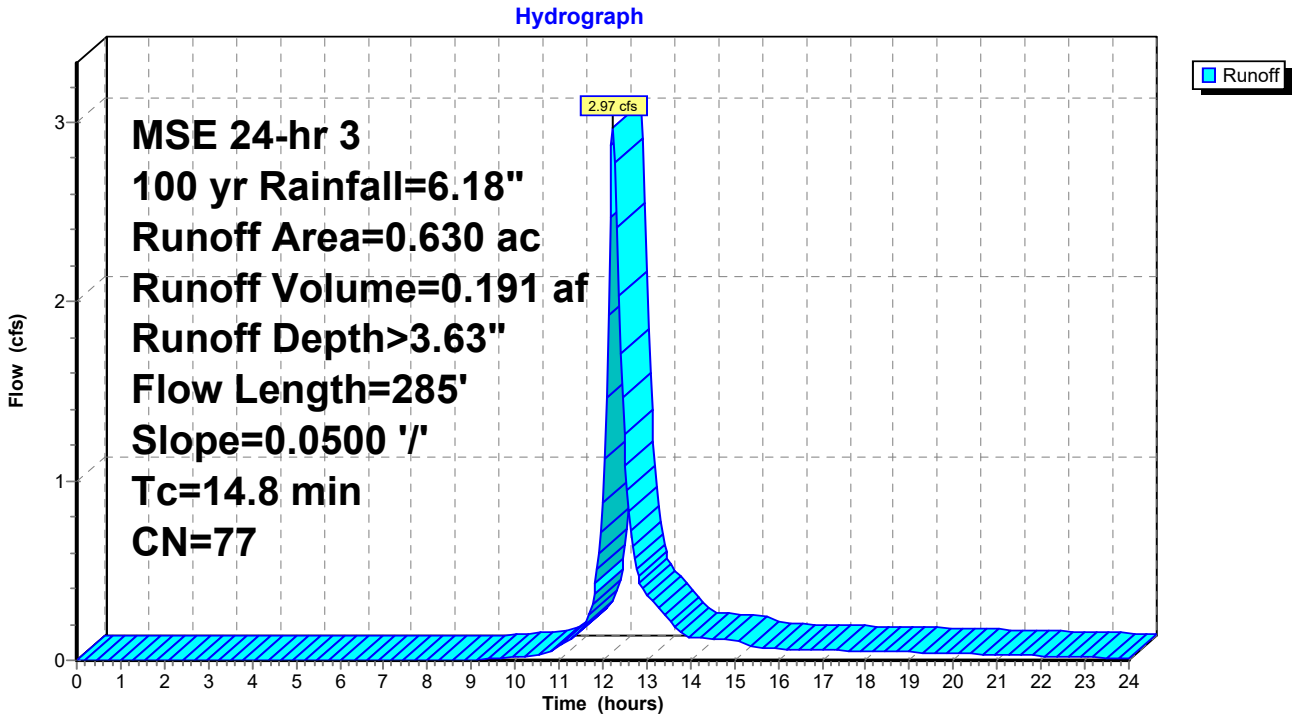
Runoff = 2.97 cfs @ 12.23 hrs, Volume= 0.191 af, Depth> 3.63"
Routed to Link 99 : Post-Development Outflow

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.050	74	grass - C soils
*	0.170	71	offsite grassland - C soils
*	0.410	80	offsite 1/2 ac residential lots - C soils
	0.630	77	Weighted Average
	0.630		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	140	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
0.7	145	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.8	285	Total			

Subcatchment 5: Subarea



Summary for Subcatchment 6: Subarea

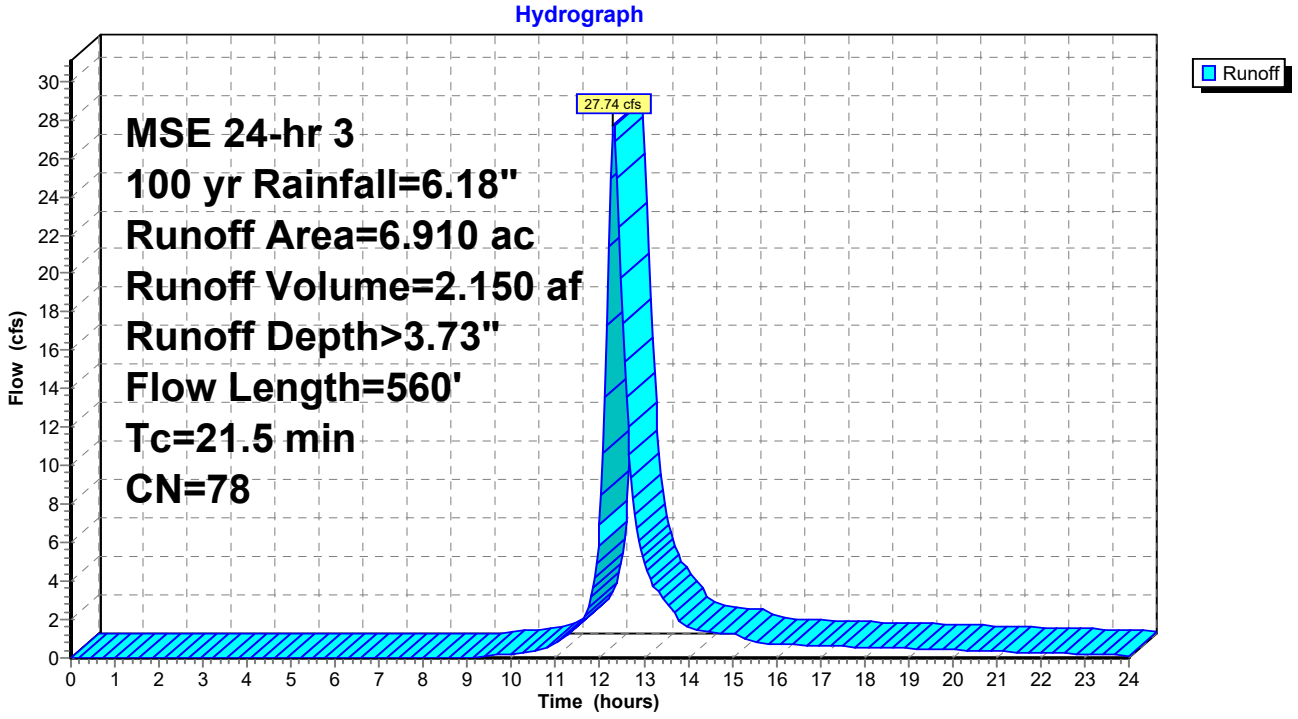
Runoff = 27.74 cfs @ 12.32 hrs, Volume= 2.150 af, Depth> 3.73"
Routed to Link 99 : Post-Development Outflow

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	4.250	74	grass - C soils
*	0.900	98	impervious
*	0.560	71	offsite grassland - C soils
*	1.200	80	offsite 1/2 ac residential lots - C soils
	6.910	78	Weighted Average
	6.010		86.98% Pervious Area
	0.900		13.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	300	0.0900	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
1.0	260	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
21.5	560	Total			

Subcatchment 6: Subarea



Summary for Pond 1B: Basin 1

Inflow Area = 1.230 ac, 21.95% Impervious, Inflow Depth > 3.94" for 100 yr event
Inflow = 5.19 cfs @ 12.31 hrs, Volume= 0.404 af
Outflow = 3.26 cfs @ 12.53 hrs, Volume= 0.394 af, Atten= 37%, Lag= 13.1 min
Discarded = 0.12 cfs @ 12.53 hrs, Volume= 0.058 af
Primary = 3.14 cfs @ 12.53 hrs, Volume= 0.336 af
Routed to Link 99 : Post-Development Outflow

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 103.92' @ 12.53 hrs Surf.Area= 2,378 sf Storage= 6,195 cf

Plug-Flow detention time= 62.4 min calculated for 0.393 af (97% of inflow)
Center-of-Mass det. time= 49.2 min (856.0 - 806.8)

Volume	Invert	Avail.Storage	Storage Description
#1	95.50'	9,170 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

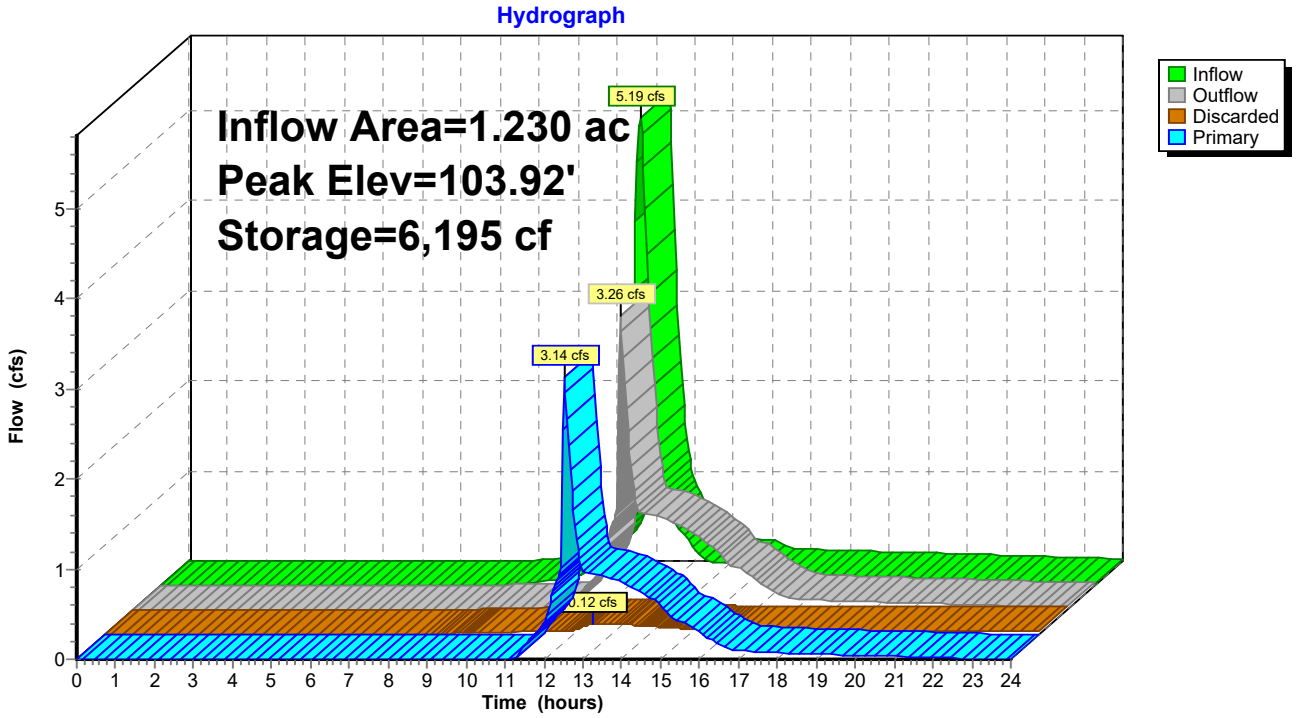
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
95.50	724	0.0	0	0	724
96.50	724	30.0	217	217	819
97.50	724	30.0	217	434	915
98.50	724	30.0	217	652	1,010
99.50	724	30.0	217	869	1,106
100.50	724	30.0	217	1,086	1,201
101.50	1,139	100.0	924	2,010	1,630
102.50	1,611	100.0	1,368	3,378	2,119
103.50	2,141	100.0	1,870	5,248	2,671
104.50	2,726	100.0	2,428	7,675	3,282
105.00	3,259	100.0	1,494	9,170	3,823

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.50'	**1.630 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 87.00' Phase-In= 0.01'
#2	Primary	97.50'	**12.00" Round Culvert** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.50' / 97.50' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	97.50'	**3.00" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	101.00'	**3.00" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Primary	103.75'	**36.00" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Primary	104.00'	**10.0' long + 5.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.12 cfs @ 12.53 hrs HW=103.92' (Free Discharge)
└**1=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=3.06 cfs @ 12.53 hrs HW=103.92' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.99 cfs of 8.84 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.59 cfs @ 12.08 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.39 cfs @ 8.04 fps)
└**5=Orifice/Grate** (Weir Controls 2.08 cfs @ 1.33 fps)
└**6=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 1B: Basin 1



Summary for Pond 2B: Basin 2

Inflow Area = 4.110 ac, 54.50% Impervious, Inflow Depth > 4.69" for 100 yr event
Inflow = 29.69 cfs @ 12.16 hrs, Volume= 1.606 af
Outflow = 12.71 cfs @ 12.32 hrs, Volume= 1.574 af, Atten= 57%, Lag= 9.7 min
Discarded = 0.46 cfs @ 12.32 hrs, Volume= 0.243 af
Primary = 12.25 cfs @ 12.32 hrs, Volume= 1.332 af
Routed to Pond 3B : Basin 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 105.16' @ 12.32 hrs Surf.Area= 7,444 sf Storage= 27,755 cf

Plug-Flow detention time= 72.0 min calculated for 1.574 af (98% of inflow)
Center-of-Mass det. time= 60.9 min (842.9 - 782.0)

Volume	Invert	Avail.Storage	Storage Description
#1	95.00'	34,464 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

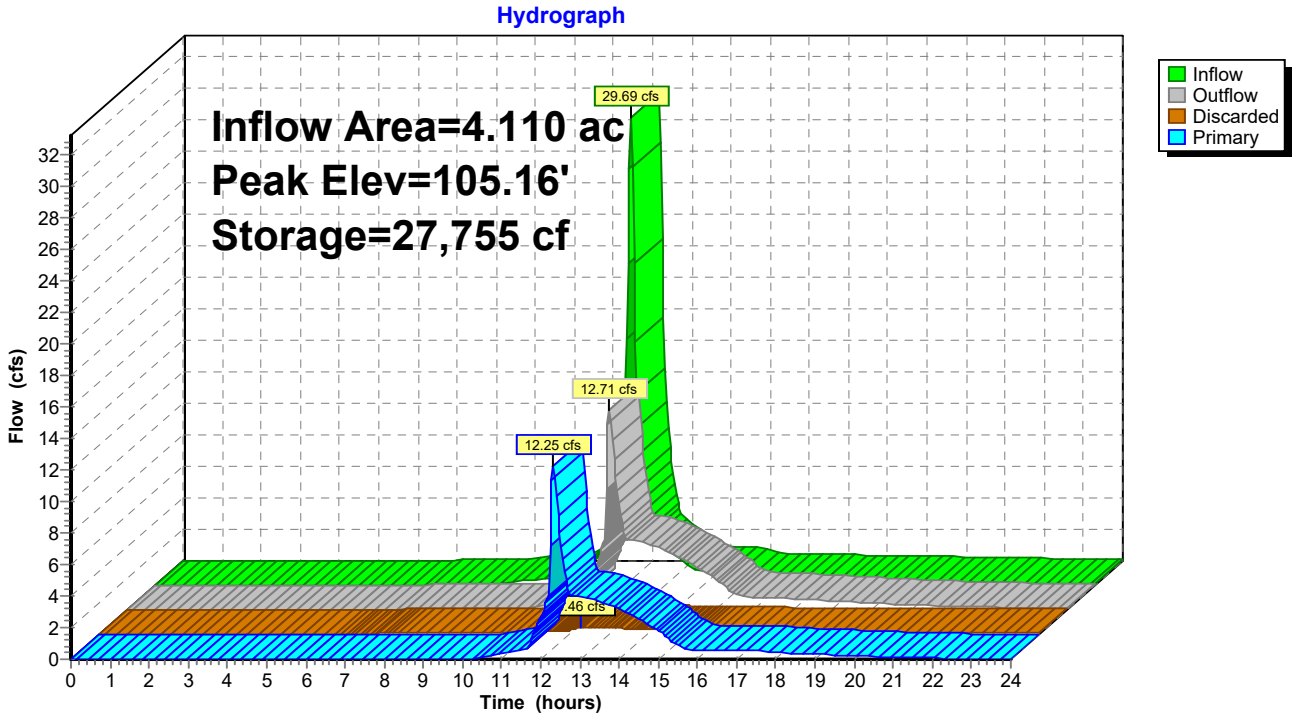
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
95.00	2,325	0.0	0	0	2,325
96.00	2,325	30.0	698	698	2,496
97.00	2,325	30.0	698	1,395	2,667
98.00	2,325	30.0	698	2,093	2,838
99.00	2,325	30.0	698	2,790	3,009
100.00	2,325	30.0	698	3,488	3,180
101.00	3,141	100.0	2,723	6,210	4,016
102.00	4,050	100.0	3,586	9,796	4,950
103.00	5,051	100.0	4,541	14,337	5,979
104.00	6,128	100.0	5,581	19,918	7,088
105.00	7,261	100.0	6,686	26,605	8,257
106.00	8,472	100.0	7,859	34,464	9,508

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.00'	**1.630 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 89.00' Phase-In= 0.01'
#2	Primary	97.00'	**15.00" Round Culvert** L= 53.3' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.00' / 95.76' S= 0.0233 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	97.00'	**3.50" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	100.50'	**8.00" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	104.75'	**36.00" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Primary	105.20'	**10.0' long + 5.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.46 cfs @ 12.32 hrs HW=105.15' (Free Discharge)
└**1=Exfiltration** (Controls 0.46 cfs)

Primary OutFlow Max=12.18 cfs @ 12.32 hrs HW=105.15' TW=99.73' (Dynamic Tailwater)
└**2=Culvert** (Passes 12.18 cfs of 13.76 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.75 cfs @ 11.21 fps)
  └**4=Orifice/Grate** (Orifice Controls 3.49 cfs @ 10.01 fps)
  └**5=Orifice/Grate** (Weir Controls 7.94 cfs @ 2.08 fps)
└**6=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 2B: Basin 2



Summary for Pond 3B: Basin 3

Inflow Area = 6.510 ac, 56.68% Impervious, Inflow Depth > 4.26" for 100 yr event
Inflow = 21.56 cfs @ 12.16 hrs, Volume= 2.313 af
Outflow = 14.52 cfs @ 12.42 hrs, Volume= 2.261 af, Atten= 33%, Lag= 15.5 min
Discarded = 0.49 cfs @ 12.42 hrs, Volume= 0.349 af
Primary = 14.02 cfs @ 12.42 hrs, Volume= 1.912 af
Routed to Link 99 : Post-Development Outflow

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 99.95' @ 12.42 hrs Surf.Area= 6,809 sf Storage= 27,225 cf

Plug-Flow detention time= 78.7 min calculated for 2.257 af (98% of inflow)
Center-of-Mass det. time= 67.8 min (876.2 - 808.4)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	34,891 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

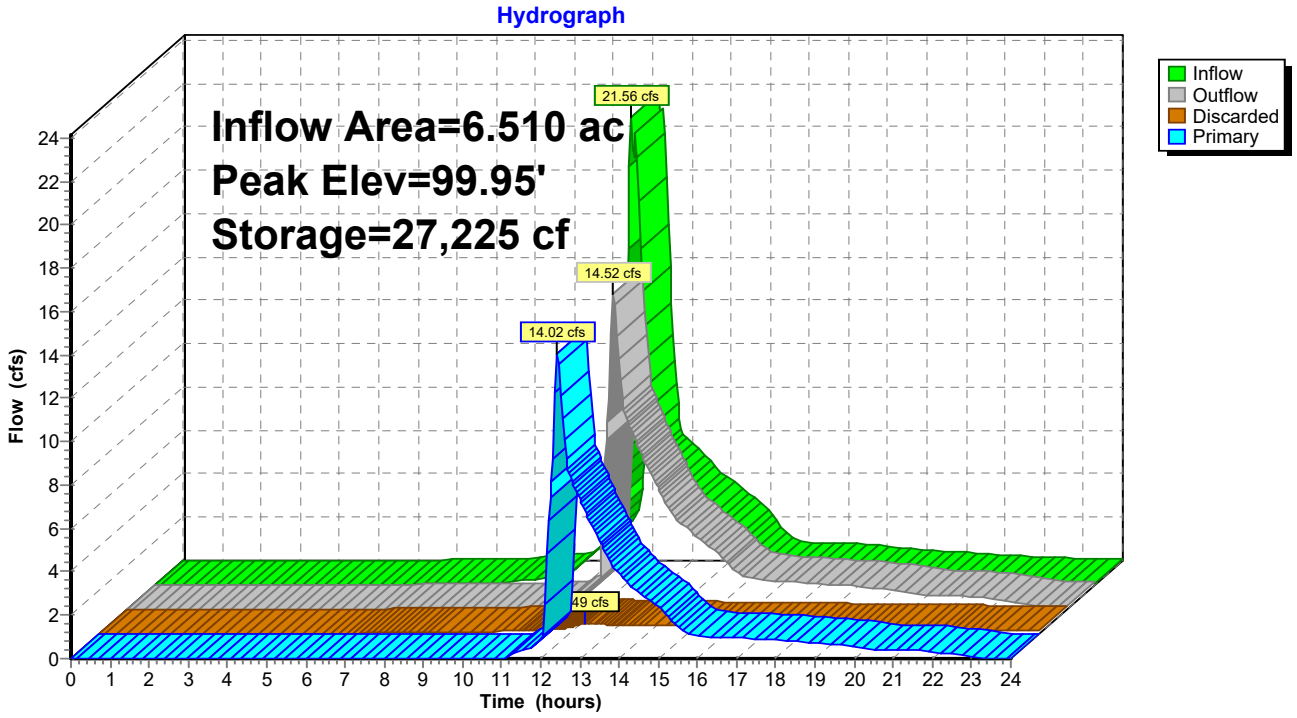
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
90.00	2,770	0.0	0	0	2,770
91.00	2,770	30.0	831	831	2,957
92.00	2,770	30.0	831	1,662	3,143
93.00	2,770	30.0	831	2,493	3,330
94.00	2,770	30.0	831	3,324	3,516
95.00	2,770	30.0	831	4,155	3,703
96.00	3,452	100.0	3,105	7,260	4,413
97.00	4,208	100.0	3,824	11,084	5,200
98.00	5,033	100.0	4,614	15,698	6,059
99.00	5,915	100.0	5,468	21,166	6,979
100.00	6,854	100.0	6,379	27,545	7,960
101.00	7,850	100.0	7,346	34,891	9,002

Device	Routing	Invert	Outlet Devices
#1	Discarded	90.00'	**1.630 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 85.00' Phase-In= 0.01'
#2	Primary	93.00'	**18.00" Round Culvert** L= 50.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 93.00' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 2	93.00'	**3.25" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	95.50'	**3.50" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	97.50'	**15.00" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 2	99.67'	**36.00" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Primary	100.00'	**10.0' long + 5.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.49 cfs @ 12.42 hrs HW=99.95' (Free Discharge)
└**1=Exfiltration** (Controls 0.49 cfs)

Primary OutFlow Max=13.92 cfs @ 12.42 hrs HW=99.95' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 13.92 cfs of 21.19 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.72 cfs @ 12.57 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.67 cfs @ 9.99 fps)
  └**5=Orifice/Grate** (Orifice Controls 7.98 cfs @ 6.50 fps)
  └**6=Orifice/Grate** (Weir Controls 4.55 cfs @ 1.73 fps)
└**7=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond 3B: Basin 3



Summary for Pond 4B: Field Inlet 25

Inflow Area = 4.870 ac, 6.16% Impervious, Inflow Depth > 3.73" for 100 yr event
Inflow = 20.96 cfs @ 12.28 hrs, Volume= 1.515 af
Outflow = 20.96 cfs @ 12.29 hrs, Volume= 1.515 af, Atten= 0%, Lag= 0.4 min
Primary = 20.96 cfs @ 12.29 hrs, Volume= 1.515 af
Routed to Link 99 : Post-Development Outflow
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 1B : Basin 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 124.07' @ 12.29 hrs Surf.Area= 897 sf Storage= 286 cf

Plug-Flow detention time= 0.1 min calculated for 1.513 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (808.0 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	123.20'	1,534 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

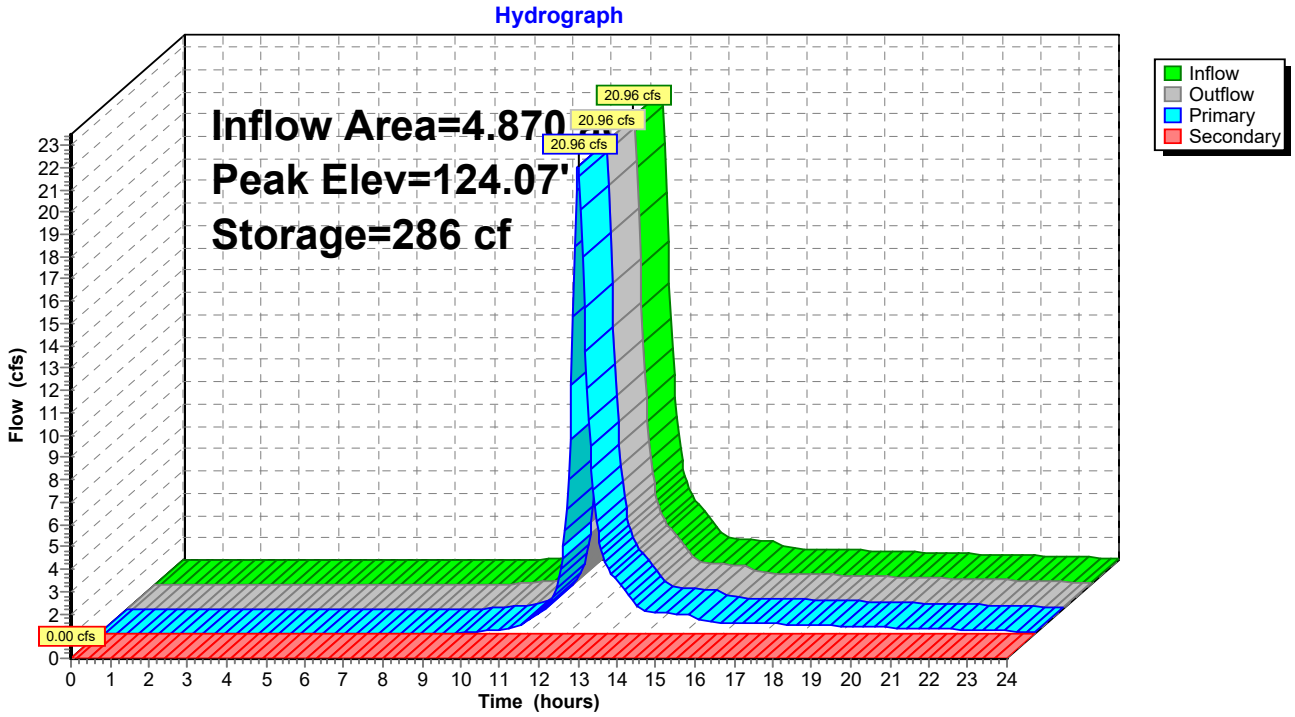
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
123.20	0	0	0	0
124.00	836	223	223	837
125.00	1,852	1,311	1,534	1,861

Device	Routing	Invert	Outlet Devices
#1	Primary	118.70'	**21.00" Round Culvert** L= 91.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 118.70' / 117.79' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 2.41 sf
#2	Device 1	123.20'	**30.00" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	124.60'	**6.0' long + 4.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=20.83 cfs @ 12.29 hrs HW=124.07' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 20.83 cfs of 24.31 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 20.83 cfs @ 3.05 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.20' TW=95.50' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4B: Field Inlet 25

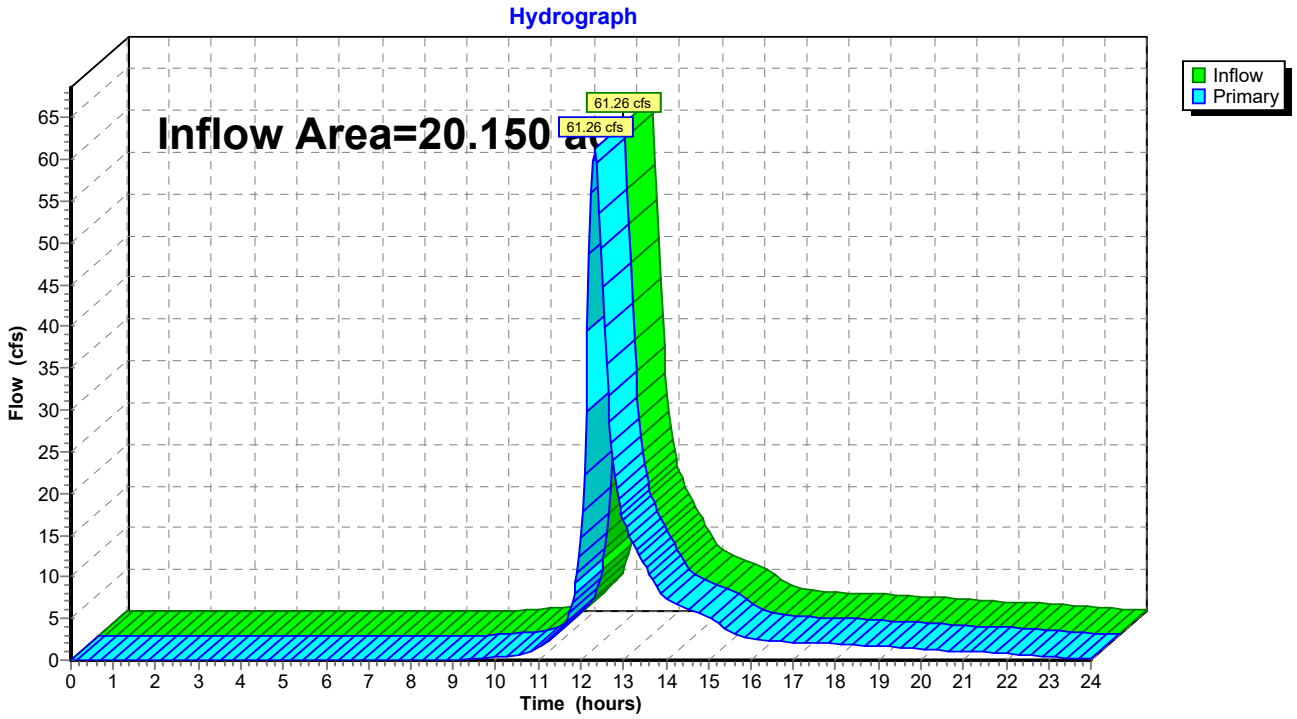


Summary for Link 99: Post-Development Outflow

Inflow Area = 20.150 ac, 25.61% Impervious, Inflow Depth > 3.63" for 100 yr event
Inflow = 61.26 cfs @ 12.34 hrs, Volume= 6.104 af
Primary = 61.26 cfs @ 12.34 hrs, Volume= 6.104 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

Link 99: Post-Development Outflow



APPENDIX C

Treatment Analysis

WinSLAMM - Treatment Analysis

WinSLAMM v 10 Data File: [D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Treatment_018.mdb] - [Land Use Model]

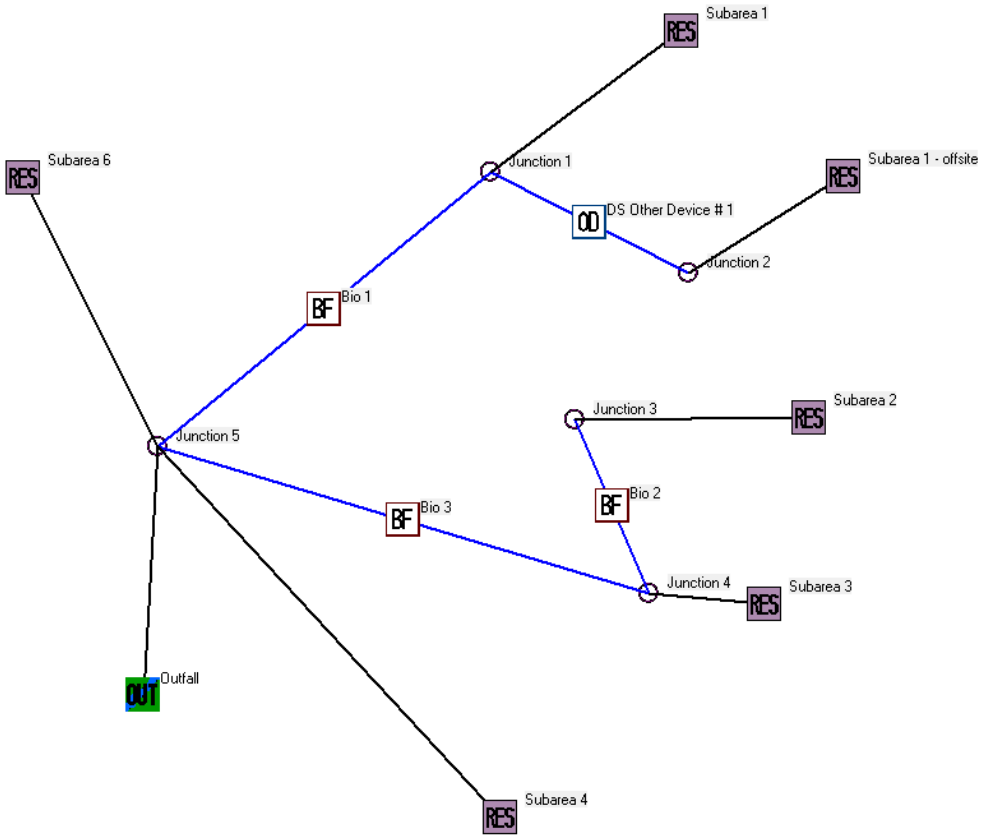
File Current File Data Pollutants Tools Run Utilities Help

RES INS COM IND OU FRE GS CB WP BF PP HD OD FS SF UF IR

Control Practice:

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Residential	Subarea 1	1.050
2	Residential	Subarea 1 - offsite	0.180
3	Residential	Subarea 2	4.110
4	Residential	Subarea 3	2.400
5	Residential	Subarea 4	0.120
6	Residential	Subarea 6	0.900

CP #	Control Practice Type	Control Practice Name or Location
1	Other Device	DS Other Device # 1
2	Biofilter	Bio 1
3	**Biofilter**	**Bio 2**
4	Biofilter	Bio 3



SLAMM for Windows Version 10.4.1

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Treatment_018.mdb
Data file description:
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
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 02-17-2022 Time of run: 20:21:57
Total Area Modeled (acres): 8.760
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:	478244	-	105.2	3141	-
Outfall Total with Controls:	133190	72.15%	54.91	456.5	85.47%
Annualized Total After Outfall Controls:	135040			462.9	

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Treatment_018.mdb
WinSLAMM Version 10.4.1
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: 12/06 End of Winter Season: 03/28
Date: 02-17-2022 Time: 20:22:03
Site information:

LU# 1 - Residential: Subarea 1 Total area (ac): 1.050
  1 - Roofs 1: 0.110 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  31 - Sidewalks 1: 0.010 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  37 - Streets 1: 0.130 ac. Smooth Street Length = 0.079 curb-mi Street Width (assuming two curb-mi per street mile) = 27.1519 ft
    Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  51 - Small Landscaped Areas 1: 0.780 ac. Normal Clayey Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  70 - Water Body Areas: 0.020 ac. Source Area PSD File:
LU# 2 - Residential: Subarea 1 - offsite Total area (ac): 0.180
  51 - Small Landscaped Areas 1: 0.100 ac. Normal Clayey Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  57 - Undeveloped Areas 1: 0.080 ac. Normal Clayey Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Residential: Subarea 2   Total area (ac): 4.110
     1 - Roofs 1: 0.930 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     25 - Driveways 1: 0.510 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1: 0.140 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     37 - Streets 1: 0.610 ac.   Smooth   Street Length = 0.373 curb-mi   Street Width (assuming two curb-mi per street mile) = 26.98392 ft
           Default St. Dirt Accum.   Annual Winter Load = 2500 lbs   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     51 - Small Landscaped Areas 1: 1.870 ac.   Normal Clayey   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     70 - Water Body Areas: 0.050 ac.   Source Area PSD File:
LU# 4 - Residential: Subarea 3   Total area (ac): 2.400
     1 - Roofs 1: 0.540 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     25 - Driveways 1: 0.310 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1: 0.080 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     37 - Streets 1: 0.460 ac.   Smooth   Street Length = 0.281 curb-mi   Street Width (assuming two curb-mi per street mile) = 27.01068 ft
           Default St. Dirt Accum.   Annual Winter Load = 2500 lbs   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     51 - Small Landscaped Areas 1: 0.950 ac.   Normal Clayey   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     70 - Water Body Areas: 0.060 ac.   Source Area PSD File:
LU# 5 - Residential: Subarea 4   Total area (ac): 0.120
     1 - Roofs 1: 0.110 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1: 0.010 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
LU# 6 - Residential: Subarea 6   Total area (ac): 0.900
     1 - Roofs 1: 0.790 ac.   Pitched   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     25 - Driveways 1: 0.050 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1: 0.010 ac.   Connected   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     37 - Streets 1: 0.050 ac.   Smooth   Street Length = 0.031 curb-mi   Street Width (assuming two curb-mi per street mile) = 26.6129 ft
           Default St. Dirt Accum.   Annual Winter Load = 2500 lbs   Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

      Control Practice 1: Other Device CP# 1 (DS) - DS Other Device # 1
         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:  Biofilter CP# 1 (DS) - Bio 1
   1.  Top area (square feet) =  3259
   2.  Bottom aea (square feet) =  724
   3.  Depth (ft):   9.5
   4.  Biofilter width (ft) - for Cost Purposes Only:   10
   5.  Infiltration rate (in/hr) =  1.63
   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) 3
   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 Soil Type         1.000
        Saturation water content percent (Porosity) =   0
        Field capacity (%) =   0
        Permanent Wilting Point (%) =   0
        Infiltration rate (in/hr) =   3.6
   Biofilter Outlet/Discharge Characteristics:
       Outlet type:  Broad Crested Weir
               1.  Weir crest length (ft):   10
               2.  Weir crest width (ft):   10
               3.  Height of datum to bottom of weir opening:   8.5
       Outlet type:  Vertical Stand Pipe
               1.  Stand pipe diameter (ft):   3
               2.  Stand pipe height above datum (ft):   8.25
       Outlet type:  Surface Discharge Pipe
               1.  Surface discharge pipe outlet diameter (ft):   0.25
               2.  Pipe invert elevation above datum (ft):   5.5
```

```
               3.  Number of surface pipe outlets:   1
        Outlet type:  Drain Tile/Underdrain
               1.  Underdrain outlet diameter (ft):   0.25
               2.  Invert elevation above datum (ft):   2
               3.  Number of underdrain outlets:   1

Control Practice 3:  Biofilter CP# 2 (DS) - Bio 2
   1.  Top area (square feet) =  8472
   2.  Bottom aea (square feet) =  2325
   3.  Depth (ft):   11
   4.  Biofilter width (ft) - for Cost Purposes Only:   11
   5.  Infiltration rate (in/hr) =  1.63
   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) 3
   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 Soil Type           1.000
        Saturation water content percent (Porosity) =   0
        Field capacity (%) =   0
        Permanent Wilting Point (%) =   0
        Infiltration rate (in/hr) =   3.6
   Biofilter Outlet/Discharge Characteristics:
       Outlet type:  Broad Crested Weir
               1.  Weir crest length (ft):   10
               2.  Weir crest width (ft):   10
               3.  Height of datum to bottom of weir opening:   10.2
       Outlet type:  Vertical Stand Pipe
               1.  Stand pipe diameter (ft):   3
```

```
            2.  Stand pipe height above datum (ft):   9.75
        Outlet type:  Surface Discharge Pipe
            1.  Surface discharge pipe outlet diameter (ft):   0.67
            2.  Pipe invert elevation above datum (ft):   5.5
            3.  Number of surface pipe outlets:   1
        Outlet type:  Drain Tile/Underdrain
            1.  Underdrain outlet diameter (ft):   0.29
            2.  Invert elevation above datum (ft):   2
            3.  Number of underdrain outlets:   1

Control Practice 4:  Biofilter CP# 3 (DS) - Bio 3
   1.  Top area (square feet) =  7850
   2.  Bottom aea (square feet) =  2770
   3.  Depth (ft):   11
   4.  Biofilter width (ft) - for Cost Purposes Only:   10
   5.  Infiltration rate (in/hr) =  1.63
   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) 3
   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 Soil Type         1.000
        Saturation water content percent (Porosity) =   0
        Field capacity (%) =   0
        Permanent Wilting Point (%) =   0
        Infiltration rate (in/hr) =   3.6
   Biofilter Outlet/Discharge Characteristics:
       Outlet type:  Broad Crested Weir
            1.  Weir crest length (ft):   10
```

```
        2.  Weir crest width (ft):   10
        3.  Height of datum to bottom of weir opening:   10
Outlet type:  Vertical Stand Pipe
        1.  Stand pipe diameter (ft):   3
        2.  Stand pipe height above datum (ft):   9.67
Outlet type:  Surface Discharge Pipe
        1.  Surface discharge pipe outlet diameter (ft):   0.27
        2.  Pipe invert elevation above datum (ft):   5.5
        3.  Number of surface pipe outlets:   1
Outlet type:  Drain Tile/Underdrain
        1.  Underdrain outlet diameter (ft):   0.27
        2.  Invert elevation above datum (ft):   3
        3.  Number of underdrain outlets:   1
```

APPENDIX D

Infiltration Analysis

Infiltration Analysis Results

FOR: Tallgrass Villas
LOCATION: Waukesha, Wisconsin

Pre-Development					
Disturbed Area	13.22	acres	=	575,863	sq-ft
Average Annual Rainfall	29.02	inches	=	2.42	feet
Total Rainfall Volume	1,392,629	cu-ft			
Total Runoff (from SLAMM Output)	99,494	cu-ft			
Total Pre-Development Infiltration Volume	1,293,135	cu-ft			

Post-Development		
Total Runoff (from SLAMM Output)	167,439	cu-ft
Total Post-Development Infiltration Volume	1,225,190	cu-ft

Percent Infiltrated	
Post Infiltration Vol / Pre Infiltration Vol	94.7%

SLAMM for Windows Version 10.4.1

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Infiltration_Pre_018.mdb
Data file description:
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
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 11-19-2021 Time of run: 15:06:11
Total Area Modeled (acres): 13.220
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:	99493	-	227.0	1410	-
Outfall Total with Controls:	99494	0.00%	227.0	1410	0.00%
Annualized Total After Outfall Controls:	100876			1430	

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Infiltration_Pre_018.mdb
WinSLAMM Version 10.4.1
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: 12/06 End of Winter Season: 03/28
Date: 11-19-2021 Time: 15:06:22
Site information:

Pre-Development Area Description	Pre-Development Area (ac)	Pre-Development CN
	13.220	71
Total Area (ac)/Composite CN	13.220	71

LU# 1 - Residential: Subarea 1 Total area (ac): 13.220
51 - Small Landscaped Areas 1: 13.220 ac. Normal Clayey Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

WinSLAMM - Infiltration Analysis

WinSLAMM v 10 Data File: [D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Infiltration_Post_018.mdb] - [Land Use Model]

File Current File Data Pollutants Tools Run Utilities Help

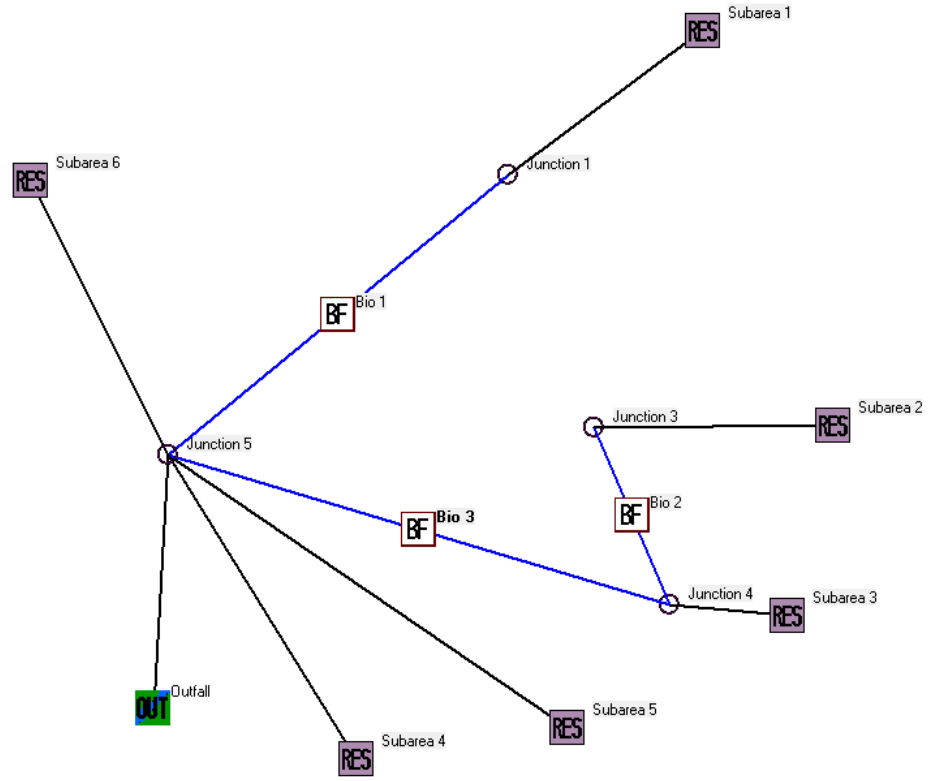
RES INS COM IND OU FRE GS CB WP BF PP HD OD FS SF UF IR

Control Practice:

Bio 3

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Residential	Subarea 1	1.050
2	Residential	Subarea 2	4.110
3	Residential	Subarea 3	2.400
4	Residential	Subarea 4	0.460
5	Residential	Subarea 6	5.150
6	Residential	Subarea 5	0.050

CP #	Control Practice Type	Control Practice Name or Location
1	Biofilter	Bio 1
2	Biofilter	Bio 2
3	**Biofilter**	**Bio 3**



SLAMM for Windows Version 10.4.1

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Infiltration_Post_018.mdb
Data file description:
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
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 02-17-2022 Time of run: 20:17:28
Total Area Modeled (acres): 13.220
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:	511810	-	113.8	3636	-
Outfall Total with Controls:	167439	67.28%	90.81	949.2	73.89%
Annualized Total After Outfall Controls:	169764			962.4	

Data file name: D:\Jobs\2021\2021-018_Tallgrass Villas - TRIO\Project_Information\Calcs\SLAMM\Infiltration_Post_018.mdb
WinSLAMM Version 10.4.1
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: 12/06 End of Winter Season: 03/28
Date: 02-17-2022 Time: 20:17:36
Site information:

LU# 1 - Residential: Subarea 1 Total area (ac): 1.050
  1 - Roofs 1: 0.110 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  31 - Sidewalks 1: 0.010 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  37 - Streets 1: 0.130 ac. Smooth Street Length = 0.079 curb-mi Street Width (assuming two curb-mi per street mile) = 27.1519 ft
    Default St. Dirt Accum. Annual Winter Load = 2500 lbs Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  51 - Small Landscaped Areas 1: 0.780 ac. Normal Clayey Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  70 - Water Body Areas: 0.020 ac. Source Area PSD File:
LU# 2 - Residential: Subarea 2 Total area (ac): 4.110
  1 - Roofs 1: 0.930 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  25 - Driveways 1: 0.510 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  31 - Sidewalks 1: 0.140 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

```
     37 - Streets 1:  0.610 ac.    Smooth    Street Length = 0.373 curb-mi    Street Width (assuming two curb-
mi per street mile) = 26.98392 ft
           Default St. Dirt Accum.    Annual Winter Load = 2500 lbs    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     51 - Small Landscaped Areas 1:  1.870 ac.    Normal Clayey    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     70 - Water Body Areas:  0.050 ac.    Source Area PSD File:
LU# 3 - Residential:  Subarea 3     Total area (ac):  2.400
     1 - Roofs 1:  0.540 ac.    Pitched    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     25 - Driveways 1:  0.310 ac.    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1:  0.080 ac.    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     37 - Streets 1:  0.460 ac.    Smooth    Street Length = 0.281 curb-mi    Street Width (assuming two curb-
mi per street mile) = 27.01068 ft
           Default St. Dirt Accum.    Annual Winter Load = 2500 lbs    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     51 - Small Landscaped Areas 1:  0.950 ac.    Normal Clayey    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     70 - Water Body Areas:  0.060 ac.    Source Area PSD File:
LU# 4 - Residential:  Subarea 4     Total area (ac):  0.460
     1 - Roofs 1:  0.110 ac.    Pitched    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1:  0.010 ac.    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     51 - Small Landscaped Areas 1:  0.340 ac.    Normal Clayey    Low Density    Source Area PSD File:
C:\WinSLAMM Files\NURP.cpz
LU# 5 - Residential:  Subarea 6     Total area (ac):  5.150
     1 - Roofs 1:  0.790 ac.    Pitched    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     25 - Driveways 1:  0.050 ac.    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     31 - Sidewalks 1:  0.010 ac.    Connected    Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
     37 - Streets 1:  0.050 ac.    Smooth    Street Length = 0.031 curb-mi    Street Width (assuming two curb-
mi per street mile) = 26.6129 ft
           Default St. Dirt Accum.    Annual Winter Load = 2500 lbs    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     51 - Small Landscaped Areas 1:  4.250 ac.    Normal Clayey    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
LU# 6 - Residential:  Subarea 5     Total area (ac):  0.050
     51 - Small Landscaped Areas 1:  0.050 ac.    Normal Clayey    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz

      Control Practice 1:  Biofilter CP# 1 (DS) - Bio 1
```

```
1.  Top area (square feet) =  3259
2.  Bottom aea (square feet) =  724
3.  Depth (ft):   9.5
4.  Biofilter width (ft) - for Cost Purposes Only:   10
5.  Infiltration rate (in/hr) =  1.63
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) 3
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 Soil Type           1.000
     Saturation water content percent (Porosity) =   0
     Field capacity (%) =   0
     Permanent Wilting Point (%) =   0
     Infiltration rate (in/hr) =   3.6
Biofilter Outlet/Discharge Characteristics:
    Outlet type:  Broad Crested Weir
            1.  Weir crest length (ft):   10
            2.  Weir crest width (ft):   10
            3.  Height of datum to bottom of weir opening:   8.5
    Outlet type:  Vertical Stand Pipe
            1.  Stand pipe diameter (ft):   3
            2.  Stand pipe height above datum (ft):   8.25
    Outlet type:  Surface Discharge Pipe
            1.  Surface discharge pipe outlet diameter (ft):   0.25
            2.  Pipe invert elevation above datum (ft):   5.5
            3.  Number of surface pipe outlets:   1
    Outlet type:  Drain Tile/Underdrain
            1.  Underdrain outlet diameter (ft):   0.25
```

```
              2.  Invert elevation above datum (ft):   2
              3.  Number of underdrain outlets:   1

Control Practice 2:  Biofilter CP# 2 (DS) - Bio 2
   1.  Top area (square feet) =  8472
   2.  Bottom aea (square feet) =  2325
   3.  Depth (ft):   11
   4.  Biofilter width (ft) - for Cost Purposes Only:   11
   5.  Infiltration rate (in/hr) =  1.63
   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) 3
   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 Soil Type         1.000
        Saturation water content percent (Porosity) =   0
        Field capacity (%) =   0
        Permanent Wilting Point (%) =   0
        Infiltration rate (in/hr) =   3.6
   Biofilter Outlet/Discharge Characteristics:
       Outlet type:  Broad Crested Weir
              1.  Weir crest length (ft):   10
              2.  Weir crest width (ft):   10
              3.  Height of datum to bottom of weir opening:   10.2
       Outlet type:  Vertical Stand Pipe
              1.  Stand pipe diameter (ft):   3
              2.  Stand pipe height above datum (ft):   9.75
       Outlet type:  Surface Discharge Pipe
              1.  Surface discharge pipe outlet diameter (ft):   0.67
```

```
               2.  Pipe invert elevation above datum (ft):   5.5
               3.  Number of surface pipe outlets:   1
        Outlet type:  Drain Tile/Underdrain
               1.  Underdrain outlet diameter (ft):   0.29
               2.  Invert elevation above datum (ft):   2
               3.  Number of underdrain outlets:   1

Control Practice 3:  Biofilter CP# 3 (DS) - Bio 3
   1.  Top area (square feet) =  7850
   2.  Bottom aea (square feet) =  2770
   3.  Depth (ft):   11
   4.  Biofilter width (ft) - for Cost Purposes Only:   10
   5.  Infiltration rate (in/hr) =  1.63
   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) 3
   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 Soil Type           1.000
        Saturation water content percent (Porosity) =   0
        Field capacity (%) =   0
        Permanent Wilting Point (%) =   0
        Infiltration rate (in/hr) =   3.6
   Biofilter Outlet/Discharge Characteristics:
       Outlet type:  Broad Crested Weir
               1.  Weir crest length (ft):   10
               2.  Weir crest width (ft):   10
               3.  Height of datum to bottom of weir opening:   10
       Outlet type:  Vertical Stand Pipe
```

1. Stand pipe diameter (ft): 3
2. Stand pipe height above datum (ft): 9.67

Outlet type: Surface Discharge Pipe

1. Surface discharge pipe outlet diameter (ft): 0.27
2. Pipe invert elevation above datum (ft): 5.5
3. Number of surface pipe outlets: 1

Outlet type: Drain Tile/Underdrain

1. Underdrain outlet diameter (ft): 0.27
2. Invert elevation above datum (ft): 3
3. Number of underdrain outlets: 1

APPENDIX E

Soil Survey
and
Soil Boring Logs

Map Scale: 1:2,330 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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 Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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 17, Sep 10, 2021

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

Date(s) aerial images were photographed: May 20, 2020—Aug 20, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HmC2	Hochheim loam, 6 to 12 percent slopes, eroded	D	2.0	11.6%
HmD2	Hochheim loam, 12 to 20 percent slopes, eroded	D	7.9	46.6%
KwB	Knowles silt loam, 2 to 6 percent slopes	C	4.2	25.0%
Ph	Pella silt loam, 0 to 2 percent slopes	B/D	0.5	3.0%
Pm	Pella silt loam, bedrock substratum, 0 to 2 percent slopes	C/D	1.2	7.2%
ThB	Theresa silt loam, 2 to 6 percent slopes	C	1.1	6.6%
Totals for Area of Interest			**16.9**	**100.0%**

midwest engineering services, inc.

geotechnical • environmental • materials engineers

205 Wilmont Drive
Waukesha, WI 53189-7959
262-521-2125
FAX 262-521-2471
www.midwesteng.com

July 21, 2005

Mr. John Siepmann
Siepmann Realty Corporation
W240 N1221 Pewaukee Road
Waukesha, WI 53188

Subject: Subsurface Exploration and Infiltration Evaluation
Tallgrass Condominiums
Northview Road
Waukesha, Wisconsin
MES Project No. 7-53102

Dear Mr. Siepmann,

In accordance with your request, Midwest Engineering Services, Inc. (MES) performed a subsurface exploration to provide a preliminary evaluation of the soil and groundwater conditions for proposed stormwater infiltration basins at the above referenced site. Two (2) copies of this report are provided herein. In addition, two (2) copies have been forwarded to Mr. Tony Zanon with Jahnke & Jahnke Associates, Inc. The work was performed for Siepmann Realty Corporation, at the request of Mr. John Siepmann. The scope of services was performed in accordance with a signed agreement (MES Proposal No. 7-5219, dated May 9, 2005), between Midwest Engineering Services, Inc. (MES) and Siepmann Realty Corporation.

The purpose of the subsurface exploration was to evaluate the soil and groundwater conditions encountered and provide subsurface information for preliminary design planning for the stormwater infiltration basins associated with the proposed condominium development. The field and laboratory work for classification of the subgrade soils was performed to provide information for use by the basin design personnel when considering requirements of Chapter NR151 of the Wisconsin Administrative Code, and of WDNR Technical Standard 1002 "Site Evaluation for Stormwater Infiltration" guidelines. The design of the proposed basins was beyond the scope of services for this project. Additionally, field infiltration testing was not requested or performed.

SITE AND PROJECT DESCRIPTION

The proposed condominium development site is located on the south side of Northview Road, immediately east of Pebble Creek, in the City of Waukesha, Wisconsin. The property is currently vacant and consists of an agricultural field. The site topography is hilly and the site slopes from the east property line (approximately El 135) down to the west to Pebble Creek (approximately El. 85). An existing 12-inch interceptor sewer extends through the western portion of the property from north to south. Neighboring properties consist of residences to the north and west (across Pebble Creek), a wooded area to the south and a farm to the east.

From the information provided by the client, it is understood that storm water infiltration basins are planned for the property; however, their location and elevation design information was not known at the time of this report. The subsurface exploration was performed to allow a general evaluation of subsurface conditions across the property to assist in placement and design of the infiltration basins.

SOIL SURVEY MAP REVIEW

The USDA Soil Conservation Survey for Milwaukee & Waukesha Counties Wisconsin indicated the near surface soils in the vicinity of the site consist of Hochheim Loam (HmC2 and HmD2), Knowles Silt Loam (KwB), Theresa Silt Loam (ThB) and the Pella Silt Loam (Pm), along Pebble Creek. The Hochheim, Knowles and Theresa soils reportedly can have a seasonal high water table at greater than 5 feet below the ground surface, while the Pella soils can reportedly have a seasonal high water table from 0 to 1 foot below the ground surface. Dolomite bedrock was indicated to be present within the Knowles and Pella soil areas at a depth ranging from 27 to 60 inches below the ground surface.

FIELD EXPLORATION AND LABORATORY TESTING

Seventeen (17) soil borings were drilled for this project. The borings were performed in an approximate grid pattern across the property to allow for a general evaluation of subsurface conditions. The test borings were planned to be extended to a depth of about 20 feet below existing grade. However, all of the borings, with the exception of Boring B-10, were terminated at depths ranging from 2 to 17½ feet below existing grade due to auger refusal on probable cobbles and boulders or bedrock. Jahnke & Jahnke Associates, Inc. determined the approximate boring locations and MES personnel staked the boring locations in the field relative to existing site features. Upon completion of the borings, Jahnke & Jahnke Associates, Inc. determined the actual boring locations and ground surface elevations. The soil borings were performed with truck-mounted drill rigs, utilizing continuous flight hollow stem

augers to advance the test holes. Soil samples were obtained using split-barrel samplers with continuous 2-foot sampling intervals to the boring termination depths. The locations of the borings and the ground surface elevations are indicated on the Boring Location Plan, Figure 1, enclosed with this report.

The soils encountered in the borings were classified in general accordance with USDA National Resources Conservation Service textural soil classification procedures. Standard laboratory testing was also performed on representative soils collected from the boring locations in order to further estimate the soil characteristics.

A description of the subgrade conditions encountered at each boring location is shown on the attached Soil Boring Logs. The soil descriptions are considered representative for the specific boring locations; however, variations may occur between and beyond the test locations. A summary of the major soil profile components at the boring locations is described in the following paragraphs. Upon completion of drilling operations and water level observations, the borings were backfilled to ground surface with bentonite chips.

SUBSURFACE CONDITIONS

The surficial soils at the boring locations generally consisted of about 4 to 36 inches of silty clay, silty loam and silty clay loam topsoil. The underlying natural soils then generally consisted of dense to hard relative density gravelly loamy sand, sandy loam, and gravelly loam with cobbles and boulders extending to the maximum depths explored, ranging from 2 to 20 feet (El. 76.1 to El. 114.5) below existing grade. Exceptions to these soils were encountered at Borings B-2, B-5, B-9 and B-12 where silty clay and silty clay loam soils were encountered below the surficial topsoil to depths ranging from 4½ to 6 feet (El. 76.4 to El. 105.1) below existing grade, and within Boring B-16, where a silty clay layer was encountered between a depth of 8 to 12½ feet (El. 101.2 to El. 96.7) below existing grade.

Auger refusal on probable cobbles and boulders or dolomitic limestone bedrock was encountered at depths ranging from 2 to 17½ feet (El. 76.1 to El. 114.5) below existing grade.

Groundwater was encountered within Borings B-4, B-5 and B-17 at depths ranging from 6½ to 14 feet (El. 80.1 to El. 85.4) during auger advancement. No groundwater was encountered during auger advancement or upon completion of in the remaining boring locations. Based on the sample coloration and moisture content of the collected samples, the apparent static water level in the vicinity of the Borings B-4, B-5 and B-17, which were performed in the western portion of the property along Pebble Creek, was considered to be at depths ranging from 6.5 to 14 feet (El. 80.1 to El. 85.4) at the time of the subsurface exploration. The static water level in the remainder of the site was considered to be at depths greater than 2 to 20 feet (below El. 81.1 to below El. 118.4) below existing grade. The shallow water levels encountered within Borings B-4, B-5 and B-17 may represent perched water conditions within the gravelly sandy

loam and loam soils underlain by bedrock. It must also be recognized that groundwater levels fluctuate with time due to variations in seasonal precipitation, lateral drainage conditions, and soil permeability characteristics.

The soil classifications for the subsurface materials encountered at other depths and locations are provided on the soil boring logs enclosed with this report.

CONCLUSIONS

The subgrade soils encountered in the borings have been classified in general accordance with the USDA textural soil classification system. Estimated infiltration rates for various soil types, are shown. Table 2 of the Site Evaluation for Stormwater Infiltration (1002) document, which is published by the Wisconsin Department of Natural Resources Conservation Practice Standards, is shown below.

Soil Texture[1]	Design Infiltration Rate Without Measurement Inches/hour
Coarse sand or coarser (COS)	3.60
Loamy coarse sand (LCOS)	3.60
Sand (S)	3.60
Loamy sand (LS)	1.63
Sandy loam (SL)	0.50
Loam (L)	0.24
Silt loam (Si, L)	0.13
Sandy clay loam (SCL)	0.11
Clay loam (CL)	0.03
Silty Clay loam (Si, CL)	0.04
Sandy clay (SC)	0.04
Silty clay (Si, C)	0.07
Clay (C)	0.07

[1]Use sandy loam design infiltration for fine sand, loamy fine sand, very fine sand, and loamy fine sand soil textures.

NR-151 guidelines indicate infiltration rates shall be based on the least permeable soil horizon within 5 feet of the bottom elevation of the proposed infiltration system.

The soils encountered in the majority of the borings consisted of gravelly loamy sand, and gravelly loam with cobbles and boulders extending to depths ranging from 2 to at least 20 feet below existing grade. Based upon the aforementioned Table 2, these soils are estimated to have infiltration rates of about 1.63 to 3.60 inches per hour. These rates are greater than 0.6 inches per hour, and such soils are generally not exempt from the infiltration requirements of NR151.12(5)(c) under NR151.12(5)(c)6a. However, areas of the site may be excluded under

other provisions, such as NR151.12(5)(c)5e or NR151.12(5)(c)5i, due to shallow groundwater or bedrock, or the lack of suitable fine soil strata, respectively.

The intermixed layers of silty clay and silty clay loam soils encountered within Borings B-2, B-5, B-9, B-12 and B-16 are anticipated to have infiltration rates ranging from about 0.04 to about 0.07 inches per hour. Such soils are generally considered to be exempt from the infiltration requirements of NR151.12(5)(c) under NR151.12(5)(c)6a. Where sandy loam soils are present, with an estimated infiltration rate of 0.5 inches per hour, it is understood that the WDNR has indicated that field verification testing of the actual in-situ infiltration rate for these materials may be required under Step C of the Site Evaluation for Stormwater Infiltration document to confirm they are exempt [under NR151.12(5)(c)6a].

The preceding infiltration rate estimates and groundwater elevations are based on the subgrade conditions encountered in the test borings, and soil characterization in accordance with the USDA Classification System and NR-151 guidelines. However, considering the presence of silty clay and silty clay loam soils, the relatively shallow bedrock across the property and the dense to hard relative density characteristics of the soils, it is recommended that the basin bottoms be observed by qualified geotechnical engineering personnel at the time of construction to verify the soil types. In-situ testing with a double ring infiltrometer, along with additional test pits or soil borings in the final infiltration basin areas, is also recommended to better classify the soils, further evaluate subsurface, groundwater, and/or bedrock conditions, and provide more representative infiltration rates for the basin designs.

The preceding infiltration rate estimates are intended only for use in preliminary planning. It must be recognized that actual infiltration rates will be somewhat variable depending upon the uniformity, in-place density and/or grading of the subsoils below the individual basin or trench footprint. It should also be recognized the performance of these basins could be affected by other factors such as soil densification by construction equipment and sedimentation. A maintenance program must be developed to address the removal of sedimentation and or organic materials should they develop. Additionally, it is recommended that an experienced civil engineering firm perform the pond design.

GENERAL COMMENTS

The limited evaluation has been prepared on the basis of the subsurface conditions encountered in the soil borings discussed above. Preliminary recommendations presented herein are based on available soil information and test data collected. This study has been conducted in the manner consistent with that level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings and opinions contained herein have been promulgated in accordance with general accepted practices in the fields of soil mechanics and engineering geology. No other representations, expressed or applied, and no warranty or guarantee is included or intended in this report.

After you have had the opportunity of reading this report, please call at any time with any questions or comments you may have. MES appreciates the opportunity to be of service on this project.

Sincerely yours,

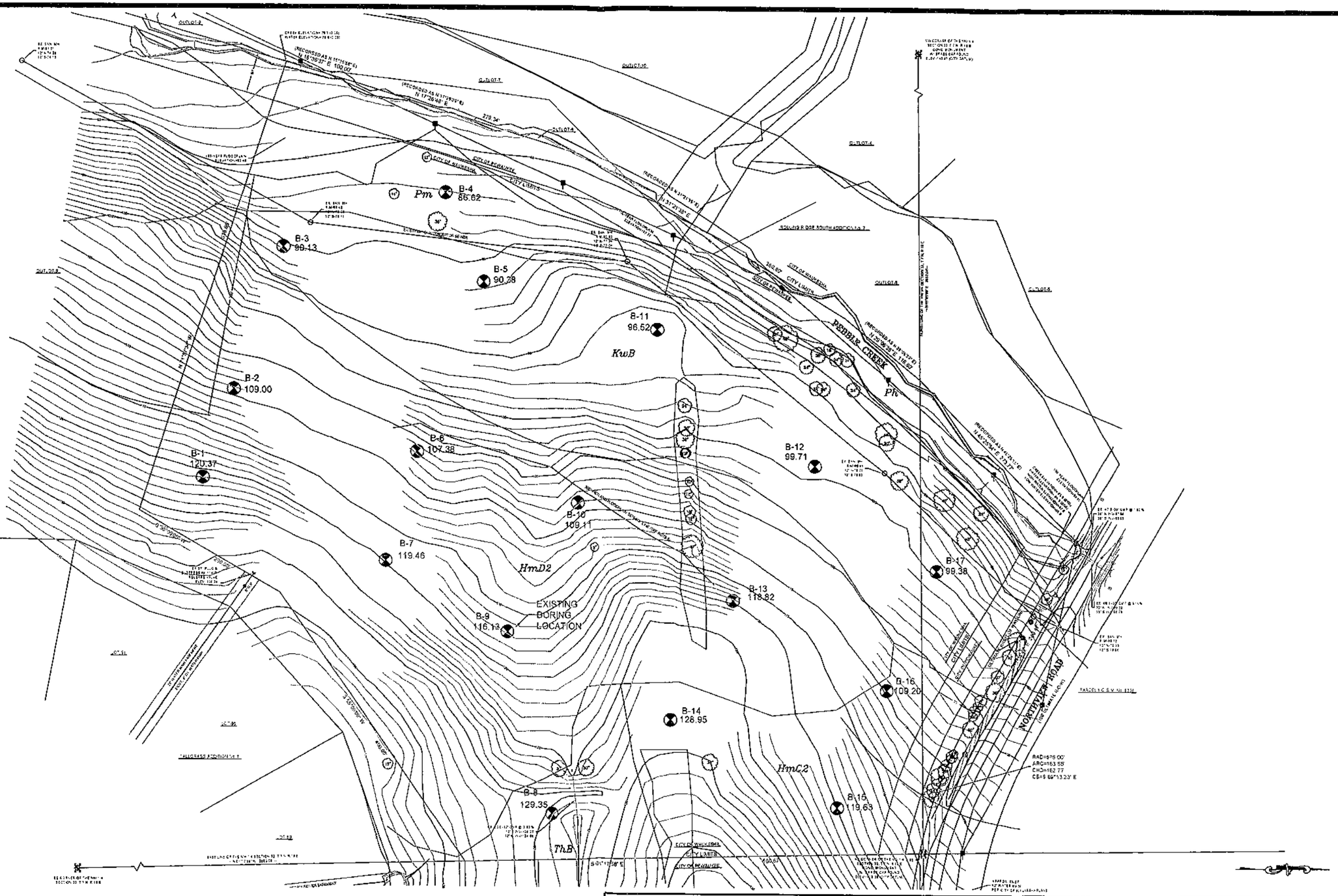
MIDWEST ENGINEERING SERVICES, INC.

Paul J. Giese (JL)
Paul J. Giese, P.E.
Department Manager
Geotechnical Services

James M. Becco, P.E.
Region Manager

Enclosures: Boring Location Plan, Figure 1
Soil Boring Logs (17)
General Notes

cc: Jahnke & Jahnke Associates, Inc., Attn.: Mr. Tony Zanon (2 copies)



Notes

1) Boring locations and elevations provided by Jahnke & Jahnke Associates, Inc.

midwest engineering services, inc.

Boring Location Plan

Tallgrass Condominiums
Northview Road
Waukesha, Wisconsin

Scale: 1" = 120' +/-

Project Number: 7-53102

Date: 7/19/05

Drawn By:

site dwg\ mes

TABLE 1
Estimated Topsoil, Groundwater and Auger Refusal Depths and Elevations
Proposed Tallgrass Condominiums
Waukesha, Wisconsin
MES Project No. 7-53102

Boring No. (c)	Boring Elevation (a)	Topsoil Depth (Inches) (b)	Estimated Groundwater Table Depth (feet) (b)	Estimated Groundwater Table Elevation (a)	Auger Refusal Depth (feet) (b)	Estimated Auger Refusal Elevation (a)
B-1	EL. 120.4	12±	>2±	< EL. 118.4±	2±	EL. 118.4±
B-2	EL. 109.0	24±	>4	<EL. 105±	4±	EL. 105±
B-3	EL. 90.1	36±	>9±	<EL. 81.1±	9±	EL. 81.1±
B-4	EL. 86.6	36±	6.5± (c)	EL. 80.1±	10.5±	EL. 76.1±
B-5	EL. 90.4	24±	9± (c)	EL. 81.4±	14±	EL. 76.4±
B-6	EL. 107.4	12±	>6±	<EL. 101.4±	6±	EL. 101.4±
B-7	EL. 119.5	4±	>8.5±	<EL. 111±	8.5±	EL. 111±
B-8	EL. 129.4	6±	>17.5±	<EL. 111.9±	17.5±	EL. 111.9±
B-9	EL. 116.1	24±	>11±	<EL. 105.1±	11±	EL. 105.1
B-10	EL. 109.1	24±	>20±	<EL. 89.1±	>20±	<EL. 89.1±
B-11	EL. 96.5	24±	>13.5±	<EL. 83±	13.5±	EL. 83±
B-12	EL. 99.7	24±	>14.5±	<EL. 85.2±	14.5±	EL. 85.2±
B-13	EL. 118.8	6±	>13.5±	<EL. 105.3±	13.5±	EL. 105.3±
B-14	EL. 129..0	24±	>14.5±	<EL. 114.5±	14.5±	EL. 114.5±
B-15	EL. 119.6	30±	>14±	<EL. 105.6±	14±	EL. 105.6±
B-16	EL. 109.2	24±	>13.5±	<EL. 95.7±	13.5±	EL. 95.7±
B-17	EL. 99.4	36±	14± (c)	EL. 85.4±	16.5±	EL. 82.9±

a) Ground surface elevations provided by Jahnke & Jahnke Associates, Inc..
b) Depth below existing grade.
c) Possible perched groundwater.

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SOIL BORING LOG: B-1

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 120.4	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 119.4	12"+/- 10YR 3/6 Dark Yellowish Brown Silty Clay LOAM, 0, mfr, Damp, (Topsoil)	1-SS	53/8"*			10		Note A
2 / 118.4	10YR 8/2 Very Pale Brown, Very Gravelly SAND, probable Cobbles and Boulders, 0, mvfi, Damp	2-SS	50/3"*			1		

End of Boring: 2' due to auger refusal on possible cobbles and boulders or bedrock

Notes:

Note A: Boring offset 5' north of original location and auger refusal encountered at 3½ feet

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 1.3 ± ft (El. 119.1±)

Additional Comments:

*N value may be elevate due to cobbles and boulders or bedrock

Lines of demarcation represent approximate boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.

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SOIL BORING LOG: B-2

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 8, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 109.0	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 108.0	24"+/- 10YR 3/3 Dark Brown Silty CLAY, few Roots, 0, mvfi, Damp, (Topsoil)	1-SS	7	3.5		18		
		2-SS	8					
2 / 107.0		3-SS	6					
3 / 106.0	10YR 3/6 Dark Yellowish Brown Silty CLAY, 0, mvfi, Moist	4-SS	50/½"*	2.5		20		
4 / 105.0								

End of Boring: 4' due to auger refusal on possible cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 2.7 ± ft (El. 106.3±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

midwest engineering services, inc.

SOIL BORING LOG: B-3

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 8, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 90.1	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 89.1	10YR 3/3 Dark Brown Silty Clay LOAM, 0, mvfr, Moist, (Topsoil)	1-SS	8	2.50		27		
		2-SS	14					
2 / 88.1		3-SS	20			4		
3 / 87.1		4-SS	47*					
4 / 86.1	10YR 5/4 Yellow Brown Very Gravelly Loamy SAND, probable Cobbles and Boulders, 0, mvfi, Damp	5-SS	18			4		
5 / 85.1		6-SS	37*					
6 / 84.1		7-SS	49*			4		
7 / 83.1	10YR 7/3 Very Pale Brown Gravelly Loamy SAND, probable Cobbles and Boulders, 0, mefi, Damp, (Probable Weathered Bedrock)	8-SS	43*					
8 / 82.1		9-SS	--			10		
9 / 81.1								

End of Boring: 9' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 4.1 ± ft (El. 86±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-4

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 8, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 86.6	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 — 85.6	10YR 3/2 Dark Brown Silty LOAM, 0, mfr, Moist, (Topsoil)	1-SS	4			23		
		2-SS	5					
2 — 84.6		3-SS	9			11		
3 — 83.6		4-SS	33*					
4 — 82.6	10YR 6/6 Brownish Yellow Gravelly Sand LOAM, probable Cobbles and Boulders, 0, mvfr, Damp	5-SS	16			8		
5 — 81.6		6-SS	17					
6 — 80.6		7-SS	20			5		▽
7 — 79.6		8-SS	27					
8 — 78.6	10YR 4/4 Dark Yellowish Brown Gravelly Sand LOAM, probable Cobbles and Boulders, mvfr, Very Moist to Wet	9-SS	45*			7		
9 — 77.6		10-SS	50/5½"					
10 — 76.6		11-SS	50/1"*			10		

End of Boring: 10½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: 6.5 ± ft (El. 80.1±) ▽

Water Level $_{\text{Upon Completion}}$: Dry

Caved at $_{\text{Upon Completion}}$: 4.5 ± ft (El. 82.1±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-5

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 8, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 90.4	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 89.40	24"+/- 10YR 2/2 Very Dark Brown Silt LOAM, few Roots, 0, mfr, Moist, (Topsoil)	1-SS	6	2.0		19		
		2-SS	6					
2 / 88.40	10YR 3/4 Dark Yellowish Brown Silty Clay LOAM, 0, mvfr, Moist	3-SS	8	2.75	2.80	29		
3 / 87.40		4-SS	11					
4 / 86.40		5-SS	5			13		
5 / 85.40	10YR 4/6 Dark Yellowish Brown Loamy SAND, 0, mfr, Damp to Moist	6-SS	8					
6 / 84.40	10YR 4/4 Dark Yellowish Brown Gravelly Sandy LOAM, probable Cobbles and Boulders, 0, mfr, Damp	7-SS	18			7		
7 / 83.40		8-SS	36*					
8 / 82.40		9-SS	25			8		V
9 / 81.40		10-SS	89/7"*					
10 / 80.40	10YR 4/6 Dark Yellowish Brown Gravelly Sandy LOAM, with Cobbles and Boulders, 0, mvfr, Wet	11-SS	50/2½"			13		
11 / 79.40								
12 / 78.40		12-SS	50/2"*			--		
13 / 77.40								
14 / 76.40								

End of Boring: 14' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level During Drilling: 9 ± ft (El. 81.4±) V
Water Level Upon Completion: Dry
Caved at Upon Completion: 8.5 ± ft (El. 81.9±)

Additional Comments:

Lines of demarcation represent approximate boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.

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SOIL BORING LOG: B-6

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 8, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 107.4	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
	12"+/- 10YR 3/6 Dark Yellow Brown Silty LOAM, few Roots, 0, mfr, Damp, (Topsoil)	1-SS	13					
1 / 106.4						10		
		2-SS	20					
2 / 105.4								
		3-SS	29					
3 / 104.4						2		
	10YR 6/3 Pale Brown Gravelly Loamy SAND, with Cobbles and Boulders, 0, mvfr, Damp	4-SS	48*					
4 / 103.4								
		5-SS	45*					
5 / 102.4						2		
		6-SS	50/5½"					
6 / 101.4								

End of Boring: 6' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 1.7 ± ft (El. 105.7±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-7

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 119.5	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
	Note A	1-SS	50/4"*			12		
1 / 118.5								
2 / 117.5	10YR 5/4 Yellowish Brown Gravelly SAND, 0, mvfr, Damp	2-SS	28			4		
3 / 116.5		3-SS	25					
4 / 115.5		4-SS	57*			4		
5 / 114.5	10YR 7/3 Very Pale Brown Gravelly SAND, 0, mvfr, Damp	5-SS	45*					
6 / 113.5		6-SS	31*			7		
7 / 112.5	10YR 5/6 Yellowish Brown Sandy LOAM, 0, mfr, Moist	7-SS	58/7"*					
8 / 111.5		8-SS	50/3"*			2		

End of Boring: 8½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Note A: 4"+/- 10YR 4/6 Dark Yellowish Brown Silty LOAM, few Roots, 0, mfr, Damp, (Topsoil)

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 4.3 ± ft (El. 115.2±)

Additional Comments:

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-8

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Joe Black
Logged by: Ryan Bartingale

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 129.4	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
	Note A	1-SS	23			12		
1 — 128.4		2-SS	16					
2 — 127.4		3-SS	13			4		
3 — 126.4		4-SS	21					
4 — 125.4		5-SS	16			11		
5 — 124.4	10YR 6/4 Light Yellowish Brown Very Gravelly SAND, probable Cobbles and Boulders, 0, mvfr, Damp	6-SS	34*					
6 — 123.4		7-SS	50/5"*			5		
7 — 122.4								
8 — 121.4		8-SS	36*			9		
9 — 120.4	10YR 4/6 Dark Yellowish Brown Very Gravelly Loamy SAND, probable Cobbles and Boulders, 0, mvfr, Damp	9-SS	41*					
10 — 119.4		10-SS	33*			7		
11 — 118.4		11-SS	42*					
12 — 117.4		12-SS	55*			5		
13 — 116.4	10YR 7/4 Very Pale Brown Very Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp	13-SS	74/10"*					
14 — 115.4		14-SS	98/9"*			4		
15 — 114.4								
16 — 113.4		15-SS	50/1"*			14		
17 — 112.4	10YR 6/4 Light Yellowish Brown Sandy LOAM, with Cobbles and Boulders, 0, mvfr, Damp to Moist							

End of Boring: 17½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Note A: 6"+/- 10YR 3/3 Dark Brown Silty LOAM, Common Roots, 0, mfr, Damp, (Moist)

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 8.3 ± ft (El. -8.3±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.*

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SOIL BORING LOG: B-9

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 116.1	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 115.1	24"+/- 10YR 2/2 Very Dark Brown Silty LOAM, few Roots, 0, mfr, Moist, (Topsoil)	1-SS	5			19		
		2-SS	4					
2 / 114.1	10YR 3/4 Dark Yellowish Brown Silty CLAY, 0, mvfr, Moist	3-SS	4	2.5	2.79	21		
3 / 113.1		4-SS	5					
4 / 112.1		5-SS	3			21		
5 / 111.1		6-SS	4					
6 / 110.1	10YR 3/3 Dark Brown Gravelly Silty Clay LOAM, probable Cobbles and Boulders, 0, mfr, Moist	7-SS	7			15		
7 / 109.1		8-SS	6					
8 / 108.1		9-SS	52/9½"			8		
9 / 107.1								
10 / 106.1	10YR 7/3 Very Pale Brown Very Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp	10-SS	69/10"			4		
11 / 105.1								

End of Boring: 11' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 5 ± ft (El. 111.1±)

Additional Comments:

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-10

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 109.1	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 — 108.1	24"+/- 10YR 2/2 Very Dark Silty Clay LOAM, few Roots, 0, mfr, Damp, (Topsoil)	1-SS	11			8		
2 — 107.1		2-SS	15					
3 — 106.1	10YR 5/6 Yellowish Brownish Loamy SAND, 0, mfr, Damp	3-SS	12			3		
4 — 105.1		4-SS	18					
5 — 104.1	10YR 4/4 Dark Yellowish Brown Loamy SAND, probable Cobbles and Boulders, 0, mfr, Damp	5-SS	50/5½"*			4		
6 — 103.1								
7 — 102.1	10YR 7/4 Very Pale Brown Very Gravelly SAND, with Cobbles and Boulders, 0, mvfr, Damp	6-SS	37			8		
8 — 101.1		7-SS	46					
9 — 100.1		8-SS	41			3		
10 — 99.1		9-SS	50/6"*					
11 — 98.1		10-SS	50/5½"*			1		
12 — 97.1								
13 — 96.1		11-SS	42*			3		
14 — 95.1		12-SS	11*					
15 — 94.1		13-SS	34*			1		
16 — 93.1		14-SS	9					
17 — 92.1	10YR 5/4 Yellowish Brown Very Gravelly SAND, with Cobbles and Boulders, 0, mvfr, Damp	15-SS	9			7		
18 — 91.1		16-SS	8					
19 — 90.1		17-SS	17			2		
20 — 89.1		18-SS	28					

End of Boring: 20'

Notes:

Water Level / Caving Observations:
Water Level $_{\text{During Drilling:}}$ Dry
Water Level $_{\text{Upon Completion:}}$ Dry
Caved at $_{\text{Upon Completion:}}$ 12.4 ± ft (El. 96.7±)

Additional Comments:
*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.*

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SOIL BORING LOG: B-11

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 7, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 96.5	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 95.5	24"+/- 10YR 3/3 Dark Brown Silty CLAY, 0, mvfr, Damp, (Topsoil)	1-SS	10	3.5	3.5	15		
		2-SS	10					
2 / 94.5	10YR 5/4 Yellowish Brown Gravelly Loamy SAND, 0, mfr, Damp	3-SS	13			12		
3 / 93.5		4-SS	31*					
4 / 92.5		5-SS	22			8		
5 / 91.5		6-SS	73/10"					
6 / 90.5	10YR 6/4 Light Yellowish Brown Gravelly Loamy SAND, with Cobbles and Boulders, 0, mvfr, Damp	7-SS	54*			4		
7 / 89.5		8-SS	59*					
8 / 88.5		9-SS	61*			6		
9 / 87.5		10-SS	97/10"*					
10 / 86.5	10YR 5/6 Yellowish Brown LOAM, with Cobbles and Boulders, 0, mvfr, Damp	11-SS	65*			8		
11 / 85.5		12-SS	50/2"*					
12 / 84.5		13-SS	63/10"*			3		
13 / 83.5								

End of Boring: 13½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:
Water Level During Drilling: Dry
Water Level Upon Completion: Dry
Caved at Upon Completion: 6 ± ft (El. 90.5±)

Additional Comments:
*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil zone transitions.*

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SOIL BORING LOG: B-12

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 7, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 99.7	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 — 98.70	24"+/- 10YR 2/2 Very Dark Brown Silt LOAM, few Roots, 0, mfr, Damp, (Topsoil)	1-SS	6			21		
		2-SS	9					
2 — 97.70		3-SS	8			21		
3 — 96.70	10YR 3/4 Dark Yellow Brown Gravelly Silty CLAY, 0, mvfr, Moist	4-SS	19					
4 — 95.70		5-SS	24			4		
5 — 94.70		6-SS	29					
6 — 93.70		7-SS	44*			5		
7 — 92.70		8-SS	41*					
8 — 91.70		9-SS	44*			6		
9 — 90.70	10YR 5/4 Yellowish Brown Gravelly Loamy SAND with Cobbles and Boulders, 0, mvfr, Damp	10-SS	54*					
10 — 89.70		11-SS	46*			5		
11 — 88.70		12-SS	53*					
12 — 87.70		13-SS	53*			7		
13 — 86.70		14-SS	69*					
14 — 85.70								

End of Boring: 14½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 5 ± ft (El. 94.7±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-13

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Joe Black
Logged by: Ryan Bartingale

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 118.8	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
	Note A	1-SS	18			8		
1 — 117.80	10YR 7/3 Very Pale Brown Very Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp	2-SS	50/4"*					
2 — 116.80		3-SS	31*			8		
3 — 115.80		4-SS	45*					
4 — 114.80	10YR 6/4 Light Yellowish Brown Gravelly Loamy SAND with Cobbles and Boulders, 0, mvfr, Damp	5-SS	47*			8		
5 — 113.80		6-SS	30*					
6 — 112.80		7-SS	18			9		
7 — 111.80	10YR 5/6 Yellowish Brown Gravelly Loamy SAND, 0, mvfr, Damp	8-SS	15					
8 — 110.80		9-SS	17			1		
9 — 109.80		10-SS	42*					
10 — 108.80	10YR 7/1 Light Gray Very Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp	11-SS	36*			3		
11 — 107.80		12-SS	22*					
12 — 106.80		13-SS	32*			7		
13 — 105.80	10YR 5/6 Yellowish Brown Gravelly LOAM with Cobbles and Boulders, 0, mvfr, Moist	14-SS	50/6"*					

End of Boring: 13½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Note A: 6"+/- 10YR 3/3 Dark Brown Silty LOAM, Common Roots, 0, mfr, Damp, (Topsoil)

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 5.5 ± ft (El. 113.3±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-14

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Joe Black
Logged by: Ryan Bartingale

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 129.0	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 — 128.00	24"+/- 10YR 3/4 Dark Yellowish Brown Silty LOAM, Common Roots, 0, mfr, Damp, (Topsoil)	1-SS	16			12		
		2-SS	61*					
2 — 127.00		3-SS	29			6		
3 — 126.00		4-SS	18					
4 — 125.00	10YR 4/4 Dark Yellowish Brown Loamy SAND, 0, mfr, Damp	5-SS	22			6		
5 — 124.00		6-SS	28					
6 — 123.00		7-SS	25			8		
7 — 122.00		8-SS	29					
8 — 121.00		9-SS	12			8		
9 — 120.00	10YR 5/6 Yellowish Brown Gravelly LOAM with Cobbles and Boulders, 0, mfr, Moist	10-SS	54*					
10 — 119.00		11-SS	50*			9		
11 — 118.00		12-SS	40*					
12 — 117.00		13-SS	95/10"*			--		
13 — 116.00	10YR 7/3 Very Pale Brown Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp							
14 — 115.00		14-SS	50/1"*			--		

End of Boring: 14½' due to auger refusal on probable cobbles and boulder or bedrock

Notes:

Water Level / Caving Observations:
Water Level During Drilling: Dry
Water Level Upon Completion: Dry
Caved at Upon Completion: 6.8 ± ft (El. 122.2±)

Additional Comments:
*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-15

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Joe Black
Logged by: Ryan Bartingale

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 119.6	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 118.60	30"+/- 10YR 3/3 Dark Brown Silty LOAM, few Roots, 0, mfr, Damp, (Topsoil)	1-SS	6			12		
		2-SS	9					
2 / 117.60		3-SS	9			6		
3 / 116.60		4-SS	20					
4 / 115.60		5-SS	21			5		
5 / 114.60	10YR 5/6 Yellowish Brown Gravelly Loamy SAND, 0, mvfr, Damp	6-SS	25					
6 / 113.60		7-SS	67*			3		
7 / 112.60		8-SS	50/3"*					
8 / 111.60		9-SS	50/4"*			2		
9 / 110.60								
10 / 109.60	10YR 7/3 Very Pale Brown Gravelly SAND with Cobbles and Boulders, 0, mvfr, Damp	10-SS	50/2"*			2		
11 / 108.60								
12 / 107.60		11-SS	50/1"*			3		
13 / 106.60		12-SS	50/2"*			--		
14 / 105.60								

End of Boring: 14' due to auger refusal on probable cobbles and boulder or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 6.8 ± ft (El. 112.8±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

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SOIL BORING LOG: B-16

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 9, 2005
Drilled by: Joe Black
Logged by: Ryan Bartingale

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 109.2	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 / 108.20	24"+/- 10YR 4/3 Brown Silty LOAM, few Roots, 0, mfr, Damp, (Topsoil)	1-SS	7			15		
		2-SS	18					
2 / 107.20		3-SS	13			13		
3 / 106.20		4-SS	15					
4 / 105.20		5-SS	17			5		
5 / 104.20	10YR 5/6 Yellowish Brown Very Gravelly Loamy SAND, with Cobbles and Boulders, 0, mvfr, Damp	6-SS	40*					
6 / 103.20		7-SS	24			5		
7 / 102.20		8-SS	23					
8 / 101.20		9-SS	14	2.0		24		
9 / 100.20		10-SS	38*					
10 / 99.20	7.5YR 6/4 Dark Brown Silty CLAY, with 10YR 6/2 Light Gray Brown, m, 2, p Mottle Streaks, 0, mvfr, Moist	11-SS	62/10"*	4.25		17		
11 / 98.20		12-SS	50/1"*					
12 / 97.20						8		
13 / 96.20	10YR 8/2 Very Pale Brown Weathered Limestone BEDROCK, Damp	13-SS	50/½"*					

End of Boring: 13½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: Dry
Water Level $_{\text{Upon Completion}}$: Dry
Caved at $_{\text{Upon Completion}}$: 6.1 ± ft (El. 103.1±)

Additional Comments:

*N vaue may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

midwest engineering services, inc.

SOIL BORING LOG: B-17

Project: Tallgrass Condominiums

Location: Northview Road
Waukesha, Wisconsin

Project No.: 7-53102
Drill Date: June 7, 2005
Drilled by: Pete Rotaru
Logged by: Warren Fillinger

Depth Below Surface/Elev. (ft)	VISUAL SOIL CLASSIFICATION Ground Surface Elevation: 99.4	Sample No.	N (bpf)	Qp (tsf)	Qu (tsf)	MC (%)	PID (ppm)	Remarks
1 — 98.40	10YR 4/3 Brown Clayey LOAM, few Roots, 0, mvfr, Damp, (Topsoil)	1-SS	10	2.25		14		
		2-SS	12					
2 — 97.40		3-SS	13			16		
3 — 96.40		4-SS	23					
4 — 95.40		5-SS	18			6		
5 — 94.40		6-SS	25					
6 — 93.40	10YR 5/6 Yellowish Brown Gravelly Loamy SAND, probable Cobbles and Boulders, 0, mvfr, Damp to Moist	7-SS	48*			5		
7 — 92.40		8-SS	34*					
8 — 91.40		9-SS	16			9		
9 — 90.40		10-SS	27					
10 — 89.40		11-SS	15			13		
11 — 88.40	10YR 5/6 Yellowish Brown Loamy SAND, 0, mfr, Very Moist	12-SS	37*					
12 — 87.40		13-SS	40*			6		
13 — 86.40	10YR 5/6 Yellowish Brown Very Gravelly Loamy SAND, with Cobbles and Boulders, 0, mfr, Moist	14-SS	50*					▽
14 — 85.40		15-SS	86/10"*			--		
15 — 84.40	10YR 6/4 Light Yellowish Brown Very Gravelly LOAM with Cobbles and Boulders, 0, mfr, Wet							
16 — 83.40		17-SS	55*			10		

End of Boring: 16½' due to auger refusal on probable cobbles and boulders or bedrock

Notes:

Water Level / Caving Observations:

Water Level $_{\text{During Drilling}}$: 14 ± ft (El. 85.4±) ▽

Water Level $_{\text{Upon Completion}}$: Dry

Caved at $_{\text{Upon Completion}}$: 9.3 ± ft (El. 90.1±)

Additional Comments:

*N value may be elevated due to cobbles and boulders

*Lines of demarcation represent **approximate** boundaries between soil types. Variations may occur between sampling intervals and between boring locations, and the transition may be gradual. Dashed lines are indicative of potentially erratic or unknown changes, such as fill-to-natural soil transitions.*

GENERAL NOTES

SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the Unified Soil Classification System on the basis of textural and particle size categorization, and various soil behavior characteristics. Visual classifications should be substantiated by appropriate laboratory testing when a more exact soil identification is required to satisfy specific project applications criteria.

PARTICLE SIZE ±

Boulders: 8 inches Cobbles: 3 to 8 inches Gravel: 5 mm to 3 inches	Coarse Sand: 2mm to 4mm Medium Sand: 0.42mm to 2mm Fine Sand: 0.074 to 0.42mm	Silt: 0.005mm to 0.074mm Clay: -0.005mm

DRILLING & SAMPLING SYMBOLS

SS: Split-spoon, 2" O.D. by 1 3/8" I.D.
ST: Shelby Tube, 2" O.D. or 3" O.D., as noted in text
AU: Auger Sample
DB: Diamond Bit
CB: Carbide Bit
RB: Roller Bit
WS: Wash Sample
BS: Bag Sample
HA: Hand Auger

SOIL PROPERTY SYMBOLS

N: Standard penetration count, indicating number of blows of a 140 lb. hammer with a 30 inch drop, required to advance a split-spoon sampler one foot.
Qu: Unconfined compressive strength, tons per square foot (tsf)
Qp: Calibrated hand penetrometer resistance, tsf
MC: moisture content, %
LL: Liquid Limit PL: Plastic Limit PI: Plasticity Index
Dd: Dry Density, pounds per cubic foot (pcf)
PID: Photoionization Detector (Hnu meter) volatile vapor level, ppm

SOIL RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

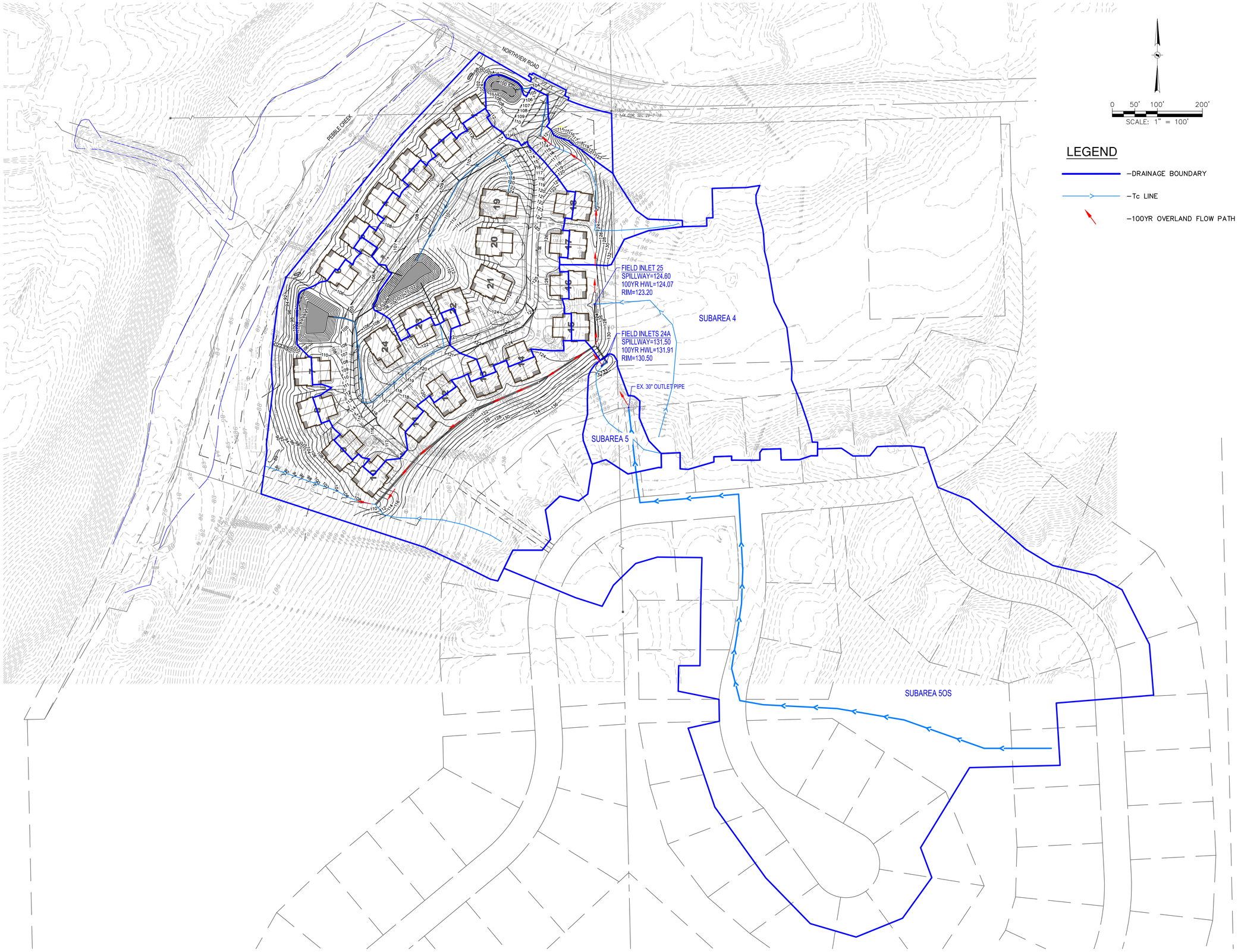
NON-COHESIVE SOILS		COHESIVE SOILS		
Classifier	N-Value Range	Classifier	Qu Range (tsf)	N-Value Range
very loose	0 - 3	very soft	0 - 0.25	0 - 2
loose	3 - 7	soft	0.25 - 0.5	2 - 5
medium dense	7 - 15	medium stiff	0.5 - 1.0	5 - 10
dense	15 - 38	stiff	1.0 - 2.0	10 - 14
very dense	38 +	very stiff	2.0 - 4.0	14 - 32
		hard	4.0 +	32+

GROUNDWATER

▼ : Approximate Groundwater level at time noted on soil boring log, measured in open bore hole unless otherwise noted. Groundwater levels often vary with time, and are affected by soil permeability characteristics, weather conditions, & lateral drainage conditions.

APPENDIX F

Backyard Inlet
Ponding Analysis



SOUND STORMWATER DESIGN

Copper Oaks Ct.
Muskego, WI 53150
414.286.4739
jayme.sisel@soundstormwater.com

CLIENT:
BIELINSKI COMMERCIAL, LLC.
1830 MEADOW LANE, SUITE A
PEWAUKEE, WISCONSIN 53072

PROJECT TITLE:
TALLGRASS VILLAS
NORTHVIEW ROAD
CITY OF WAUKESHA, WISCONSIN

DATE: 11-22-21

JOB NO: 2021-018

SHEET TITLE:
INLET ANALYSIS

FIGURE:
1.0

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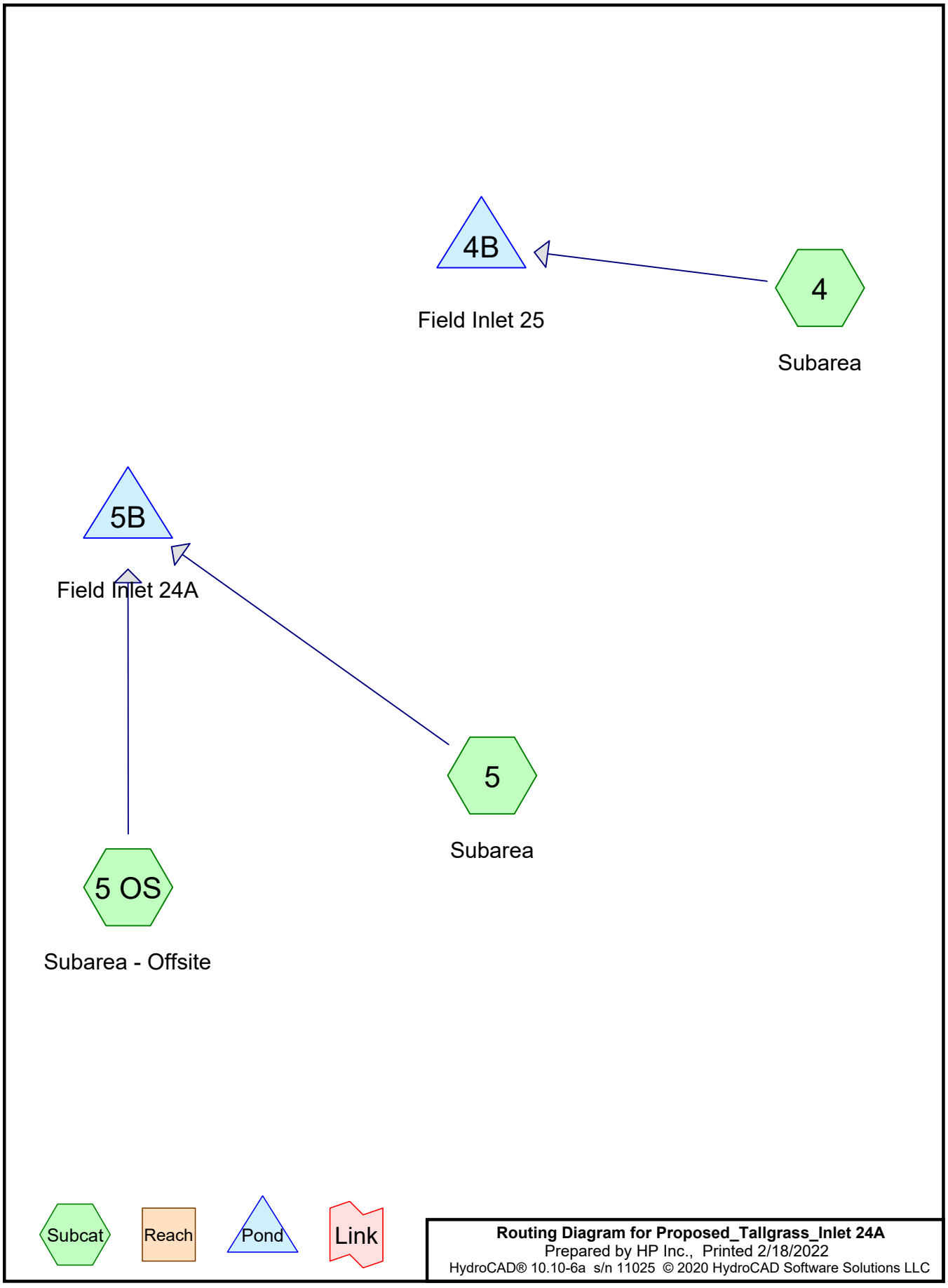
2/18/2022 2:44 PM



Routing Diagram for Proposed_Tallgrass_Inlet 24A
Prepared by HP Inc., Printed 2/18/2022

Rainfall Events Listing (selected events)

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

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.390	74	grass - C soils (4, 5)
0.120	98	impervious (4)
13.100	80	offsite 1/2 ac residential lots - C soils (4, 5, 5 OS)
0.690	74	offsite ROW grass - C soils (5 OS)
3.170	98	offsite ROW impervious (5 OS)
1.850	78	offsite cropland - C soiils (4)
0.610	74	offsite grass - C soils (4)
3.100	71	offsite grassland - C soils (4, 5, 5 OS)
0.180	98	offsite impervious (4)
0.420	70	offsite woodland - C soils (4)
23.630	**81**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>1.73"
Flow Length=455' Tc=18.8 min CN=78 Runoff=9.71 cfs 0.704 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>1.66"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=1.36 cfs 0.087 af

Subcatchment5 OS: Subarea - Offsite Runoff Area=18.130 ac 17.48% Impervious Runoff Depth>2.04"
Flow Length=1,595' Tc=34.1 min CN=82 Runoff=30.77 cfs 3.077 af

Pond 4B: Field Inlet 25 Peak Elev=123.72' Storage=62 cf Inflow=9.71 cfs 0.704 af
Primary=9.71 cfs 0.704 af Secondary=0.00 cfs 0.000 af Outflow=9.71 cfs 0.704 af

Pond 5B: Field Inlet 24A Peak Elev=131.22' Storage=3 cf Inflow=31.38 cfs 3.164 af
Primary=31.37 cfs 3.164 af Secondary=0.00 cfs 0.000 af Outflow=31.37 cfs 3.164 af

Total Runoff Area = 23.630 ac Runoff Volume = 3.868 af Average Runoff Depth = 1.96"
85.32% Pervious = 20.160 ac 14.68% Impervious = 3.470 ac

Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment4: Subarea Runoff Area=4.870 ac 6.16% Impervious Runoff Depth>3.73"
Flow Length=455' Tc=18.8 min CN=78 Runoff=20.96 cfs 1.515 af

Subcatchment5: Subarea Runoff Area=0.630 ac 0.00% Impervious Runoff Depth>3.63"
Flow Length=285' Slope=0.0500 '/' Tc=14.8 min CN=77 Runoff=2.97 cfs 0.191 af

Subcatchment5 OS: Subarea - Offsite Runoff Area=18.130 ac 17.48% Impervious Runoff Depth>4.14"
Flow Length=1,595' Tc=34.1 min CN=82 Runoff=62.28 cfs 6.261 af

Pond 4B: Field Inlet 25 Peak Elev=124.07' Storage=286 cf Inflow=20.96 cfs 1.515 af
Primary=20.96 cfs 1.515 af Secondary=0.00 cfs 0.000 af Outflow=20.96 cfs 1.515 af

Pond 5B: Field Inlet 24A Peak Elev=131.91' Storage=195 cf Inflow=63.59 cfs 6.451 af
Primary=56.08 cfs 6.304 af Secondary=7.48 cfs 0.147 af Outflow=63.56 cfs 6.451 af

Total Runoff Area = 23.630 ac Runoff Volume = 7.967 af Average Runoff Depth = 4.05"
85.32% Pervious = 20.160 ac 14.68% Impervious = 3.470 ac

Summary for Subcatchment 4: Subarea

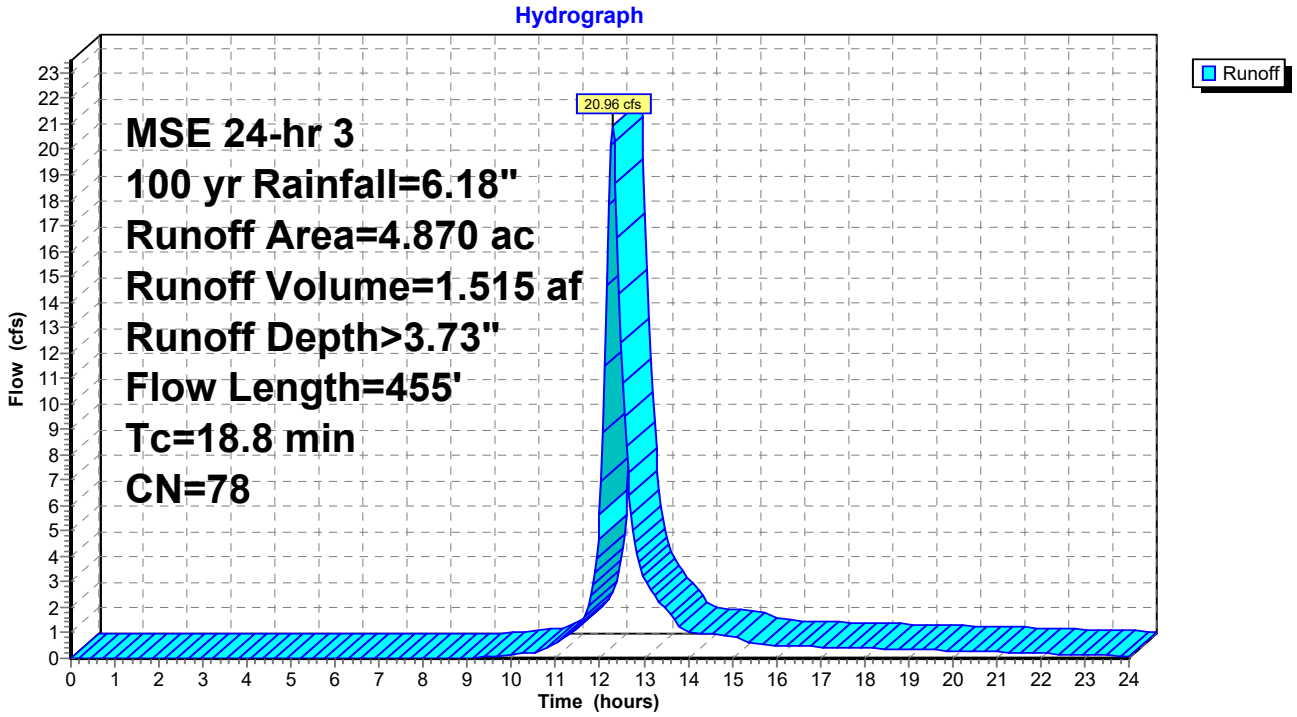
Runoff = 20.96 cfs @ 12.28 hrs, Volume= 1.515 af, Depth> 3.73"
Routed to Pond 4B : Field Inlet 25

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.340	74	grass - C soils
*	0.120	98	impervious
*	1.850	78	offsite cropland - C soiils
*	0.420	70	offsite woodland - C soils
*	0.610	74	offsite grass - C soils
*	0.270	71	offsite grassland - C soils
*	0.180	98	offsite impervious
*	1.080	80	offsite 1/2 ac residential lots - C soils
	4.870	78	Weighted Average
	4.570		93.84% Pervious Area
	0.300		6.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	165	0.0800	0.21		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
4.0	90	0.0300	0.37		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.70"
1.5	200	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.8	455	Total			

Subcatchment 4: Subarea



Summary for Subcatchment 5: Subarea

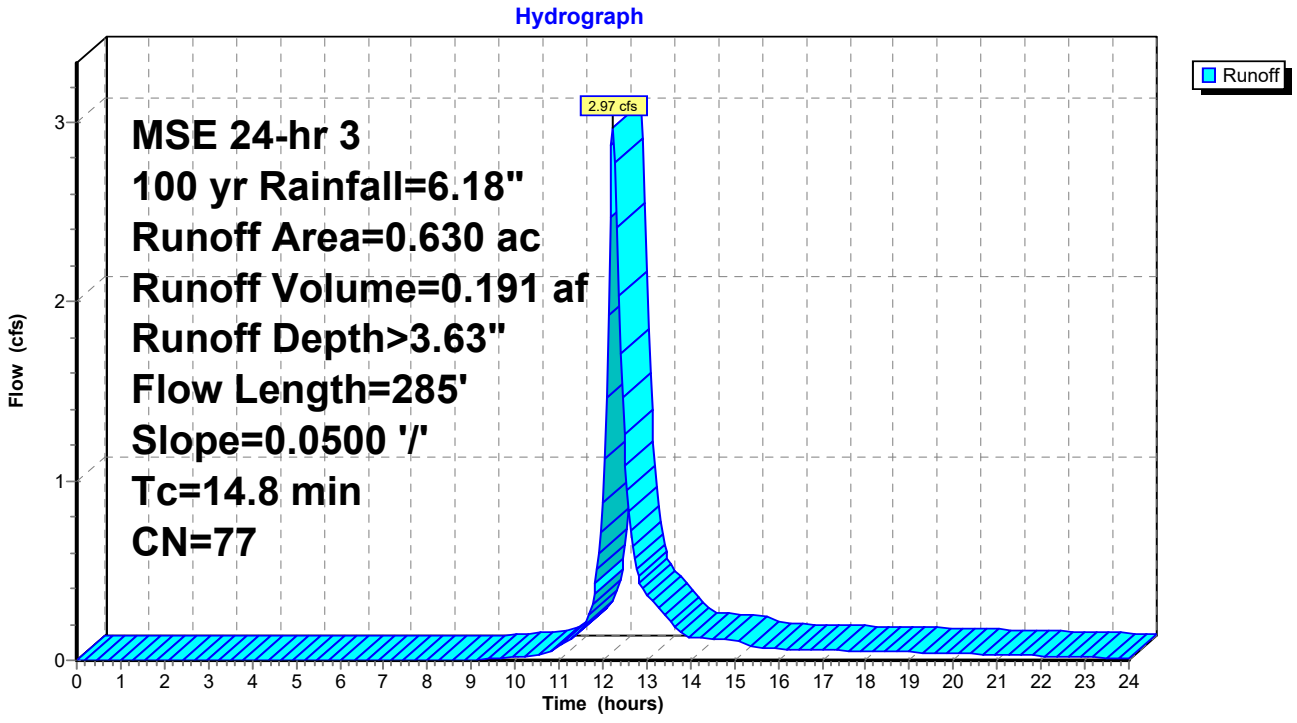
Runoff = 2.97 cfs @ 12.23 hrs, Volume= 0.191 af, Depth> 3.63"
Routed to Pond 5B : Field Inlet 24A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.050	74	grass - C soils
*	0.170	71	offsite grassland - C soils
*	0.410	80	offsite 1/2 ac residential lots - C soils
	0.630	77	Weighted Average
	0.630		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	140	0.0500	0.17		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
0.7	145	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.8	285	Total			

Subcatchment 5: Subarea



Summary for Subcatchment 5 OS: Subarea - Offsite

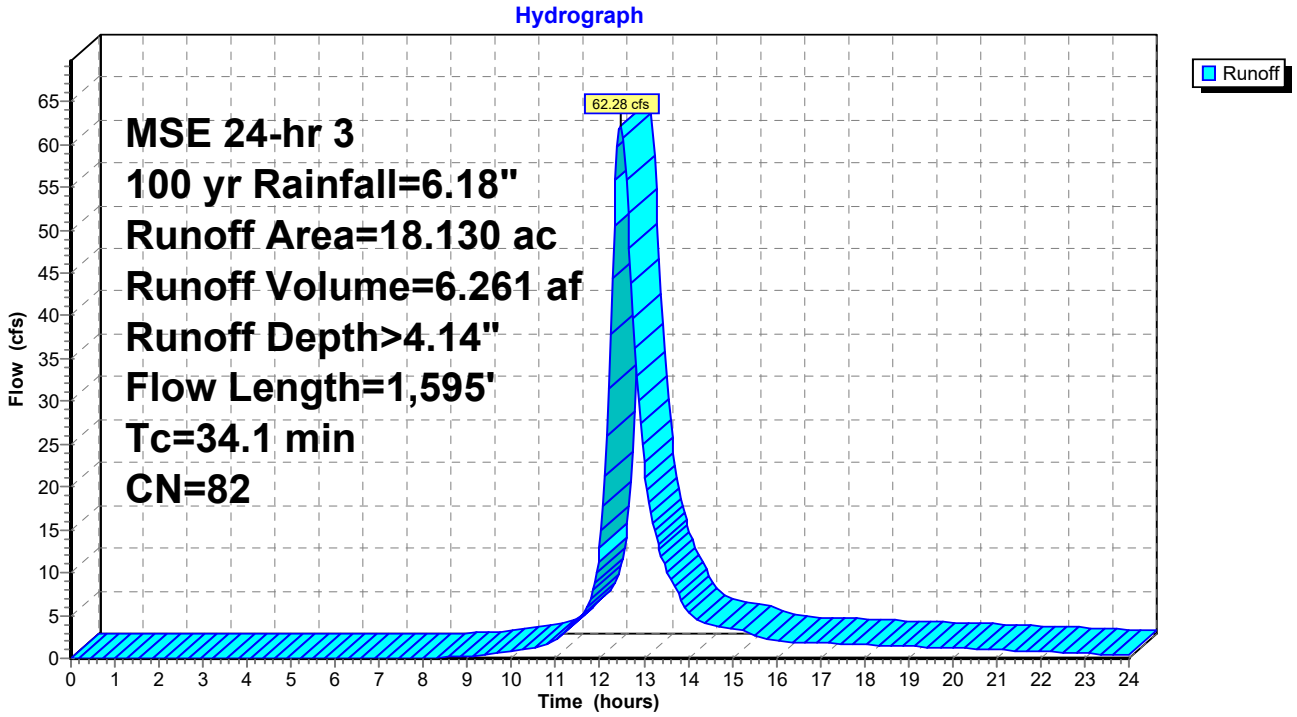
Runoff = 62.28 cfs @ 12.47 hrs, Volume= 6.261 af, Depth> 4.14"
Routed to Pond 5B : Field Inlet 24A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
MSE 24-hr 3 100 yr Rainfall=6.18"

	Area (ac)	CN	Description
*	0.690	74	offsite ROW grass - C soils
*	3.170	98	offsite ROW impervious
*	2.660	71	offsite grassland - C soils
*	11.610	80	offsite 1/2 ac residential lots - C soils
	18.130	82	Weighted Average
	14.960		82.52% Pervious Area
	3.170		17.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	70	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
19.5	230	0.0600	0.20		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
1.7	405	0.0600	3.94		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.4	405	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	485		5.00		**Direct Entry, Pipe**
34.1	1,595	Total			

Subcatchment 5 OS: Subarea - Offsite



Summary for Pond 4B: Field Inlet 25

Inflow Area = 4.870 ac, 6.16% Impervious, Inflow Depth > 3.73" for 100 yr event
Inflow = 20.96 cfs @ 12.28 hrs, Volume= 1.515 af
Outflow = 20.96 cfs @ 12.29 hrs, Volume= 1.515 af, Atten= 0%, Lag= 0.4 min
Primary = 20.96 cfs @ 12.29 hrs, Volume= 1.515 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node 1B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 124.07' @ 12.29 hrs Surf.Area= 897 sf Storage= 286 cf

Plug-Flow detention time= 0.1 min calculated for 1.513 af (100% of inflow)
Center-of-Mass det. time= 0.1 min (808.0 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	123.20'	1,534 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

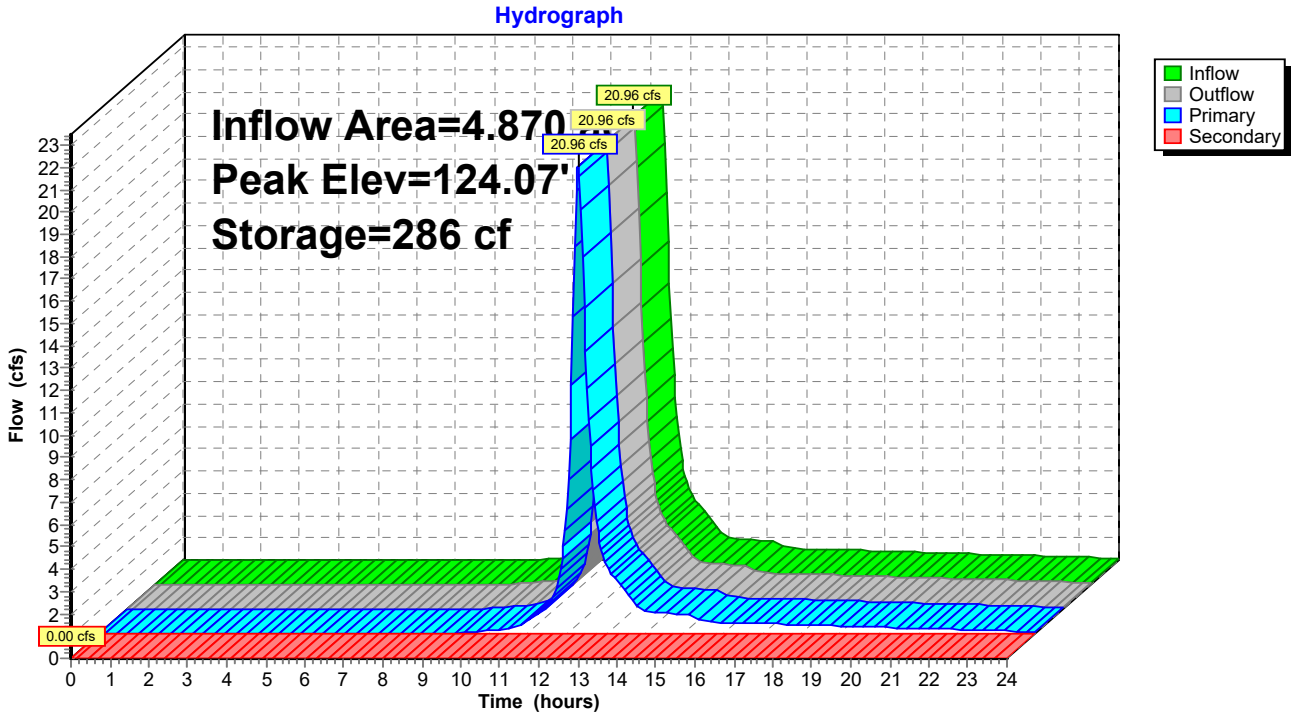
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
123.20	0	0	0	0
124.00	836	223	223	837
125.00	1,852	1,311	1,534	1,861

Device	Routing	Invert	Outlet Devices
#1	Primary	118.70'	**21.00" Round Culvert** L= 91.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 118.70' / 117.79' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 2.41 sf
#2	Device 1	123.20'	**30.00" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	124.60'	**6.0' long + 4.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=20.83 cfs @ 12.29 hrs HW=124.07' (Free Discharge)
└**1=Culvert** (Passes 20.83 cfs of 24.31 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 20.83 cfs @ 3.05 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.20' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4B: Field Inlet 25



Summary for Pond 5B: Field Inlet 24A

Inflow Area = 18.760 ac, 16.90% Impervious, Inflow Depth > 4.13" for 100 yr event
Inflow = 63.59 cfs @ 12.47 hrs, Volume= 6.451 af
Outflow = 63.56 cfs @ 12.47 hrs, Volume= 6.451 af, Atten= 0%, Lag= 0.1 min
Primary = 56.08 cfs @ 12.47 hrs, Volume= 6.304 af
Secondary = 7.48 cfs @ 12.47 hrs, Volume= 0.147 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 131.91' @ 12.47 hrs Surf.Area= 644 sf Storage= 195 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (814.1 - 814.1)

Volume	Invert	Avail.Storage	Storage Description
#1	131.00'	1,280 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
131.00	0	0	0	0
132.00	782	261	261	784
133.00	1,277	1,019	1,280	1,291

Device	Routing	Invert	Outlet Devices
#1	Primary	125.00'	**30.00" Round Culvert** L= 44.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 125.00' / 120.00' S= 0.1121 '/' Cc= 0.900 n= 0.013, Flow Area= 4.91 sf
#2	Device 1	130.50'	**30.00" Horiz. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads
#3	Secondary	131.50'	**10.0' long + 4.0 '/' SideZ x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=56.03 cfs @ 12.47 hrs HW=131.90' (Free Discharge)
└**1=Culvert** (Passes 56.03 cfs of 56.20 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 56.03 cfs @ 5.71 fps)

Secondary OutFlow Max=7.40 cfs @ 12.47 hrs HW=131.90' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 7.40 cfs @ 1.57 fps)

Pond 5B: Field Inlet 24A