



STORMWATER MANAGEMENT PLAN
FOR
VALLEY WEST SHOPPING CENTER
10520 FRANCE AVE S
BLOOMINGTON, MN

PREPARED BY:
JESSICA ANDERSEN
BRADY BUSSELMAN, PE

PROJECT INTRODUCTION

The proposed project is a 0.95 acre redevelopment located at the Valley West Shopping Center located northwest of the intersection of W Old Shakopee Rd and France Ave S in Bloomington, MN. The project is located within the Lower Minnesota River Watershed District. Stormwater management onsite has been designed to meet the rate control and volume retention requirements of the City and Watershed. The City of Bloomington is the LGU.

EXISTING CONDITIONS

The existing project area is a building and parking lot. The project area to be disturbed is 97% impervious with 0.92 acres of hard surface. Geotechnical borings prepared by Braun Intertec show underlying soils to be poorly graded sands, which may be classified as Hydrologic Soil Group type A soils and are highly suitable for infiltration. The site drains into the adjacent storm sewer which travels north. There is currently no stormwater management system in place.

PROPOSED CONDITIONS

The proposed project will reconstruct the building and parking lot areas, with a reduced impervious percentage of 89 percent, generating 0.85 acres of new and reconstructed impervious surfaces. In order to provide stormwater management onsite, an underground infiltration system is proposed beneath the parking lot. The system will discharge to the existing storm sewer to the east.

RATE CONTROL

The City of Bloomington requires that the redevelopment must achieve a net reduction of pre-project discharge rates for the 2-, 10-, and 100-year 24-hour Atlas 14 rainfall events. Rate control is achieved onsite through the reduction of onsite impervious surface, reducing the weighted curve number for the site from 96 to 92. The runoff rate control analysis was performed in HydroCAD using the MSE 3 rainfall distribution. The results of the analysis follow with additional information available in the appendices.

Maximum Rate of Runoff (cfs)		
Storm Event	Total Existing	Total Proposed
<i>2-year</i>	3.79	3.37
<i>10-year</i>	5.84	5.48
<i>100-year</i>	10.52	10.26

VOLUME REDUCTION

The City of Bloomington requires onsite retention of the first 1.1 inches of runoff from new and reconstructed impervious surfaces. The proposed storm sewer onsite drains to an underground infiltration system which captures the first 1.1 inches of rainfall and bypasses the larger storm events. The system consists of 6 inches of bottom rock, a 30 inch chamber, and another 6 inches of top rock, for a total depth of 3.75 feet. The rock within the system has 40% voids, reducing the equivalent depth of the system to 2.9 feet. Based on the underlying HSG type A soils, an infiltration rate of 0.8 in/hr and maximum infiltration depth of 3.2 feet are used for the design. The results of the volume retention calculations are provided below.

$$\text{Required Infiltration Volume}(ft^3) = V_{inf} = 1(in) * \frac{1 ft}{12 in} * \text{New Impervious Area}(ft^2)$$

$$V_{inf}(ft^3) = 1.1(in) * \frac{1 ft}{12 in} * 37,166(ft^2) = 3,407 ft^3$$

Volume Control Analysis

New Impervious Surface	36,982	sf
Design Infiltration/Filtration Rainfall Event	1.1	in
Required Infiltration/Filtration Volume	3,407	cf
Maximum Allowable Infiltration Rate	0.80	in/hr
Required Drawdown Time	48	hrs
Maximum Live Storage Depth	3.2	ft
Provided Volume Below Outlet	3,564	cf

STORMWATER SYSTEM OPERATIONS & MAINTENANCE

If required by the LGU, an operations & maintenance agreement will be prepared for the project.

SUMMARY

The proposed Valley West Shopping Center project will meet the requirements of the City of Bloomington, Lower Minnesota River Watershed District, and MPCA through construction of of an underground infiltration system. This BMP will provide the required rate control and volume reduction improvements prior to discharging stormwater runoff from the site to downstream receiving waters.

If you have any questions, comments, or additional information regarding this report, please contact me at jandersen@sambatek.com or 763-259-6679.



Engineering | Surveying | Planning | Environmental

APPENDIX A – DRAINAGE MAPS

Client

**KRAUS
ANDERSON**

**Project
VALLEY WEST**

**Location
BLOOMINGTON,
MN**

Certification

Summary

Approved: BB Drawn: AJR

Revision History

No. Date By Submittal / Rev.

**Sheet Title
EXISTING
DRAINAGE MAP**

Sheet No. Revision

1/2

Project No. 21618

LEGEND



LINK



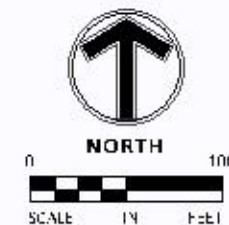
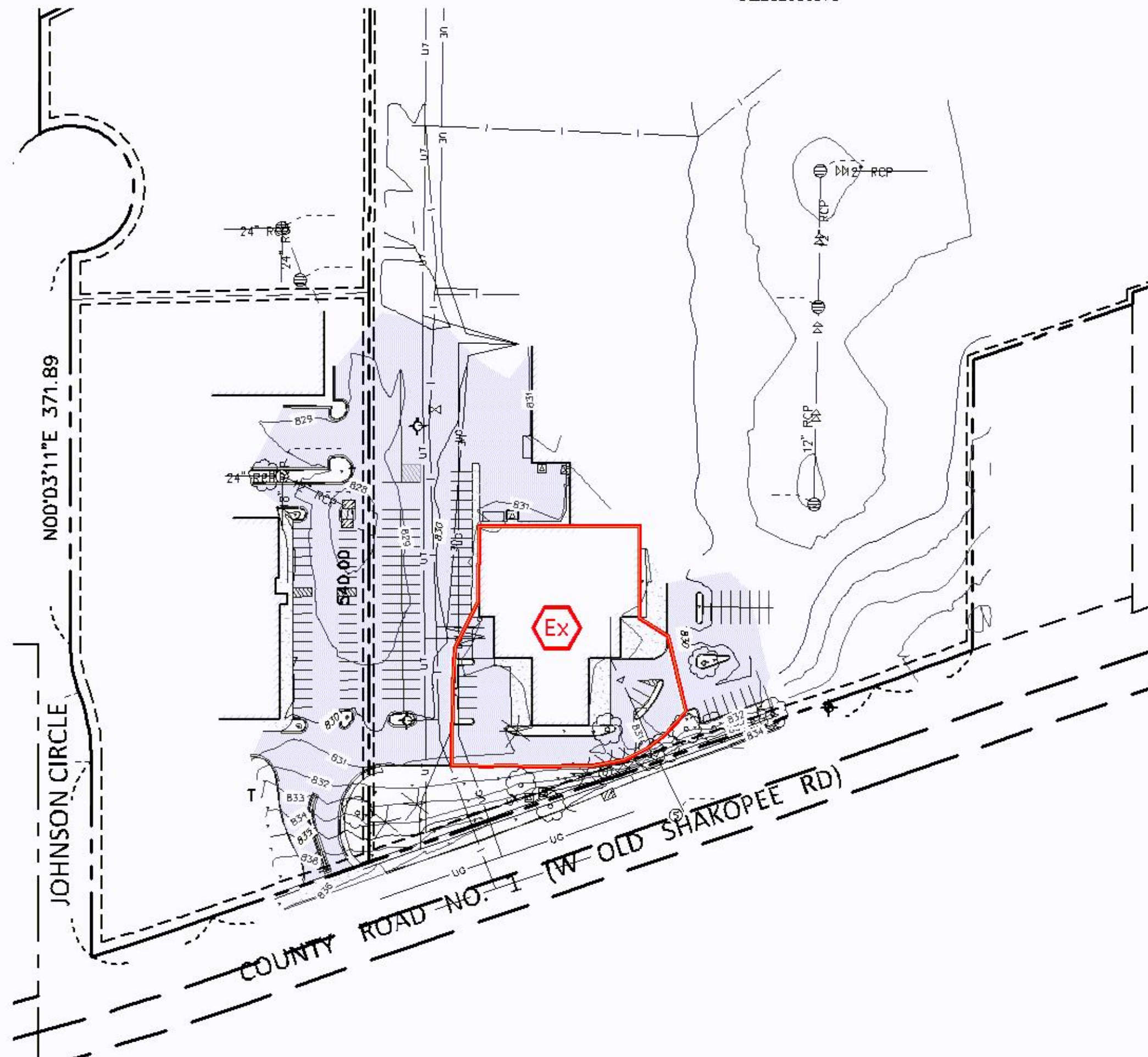
POND

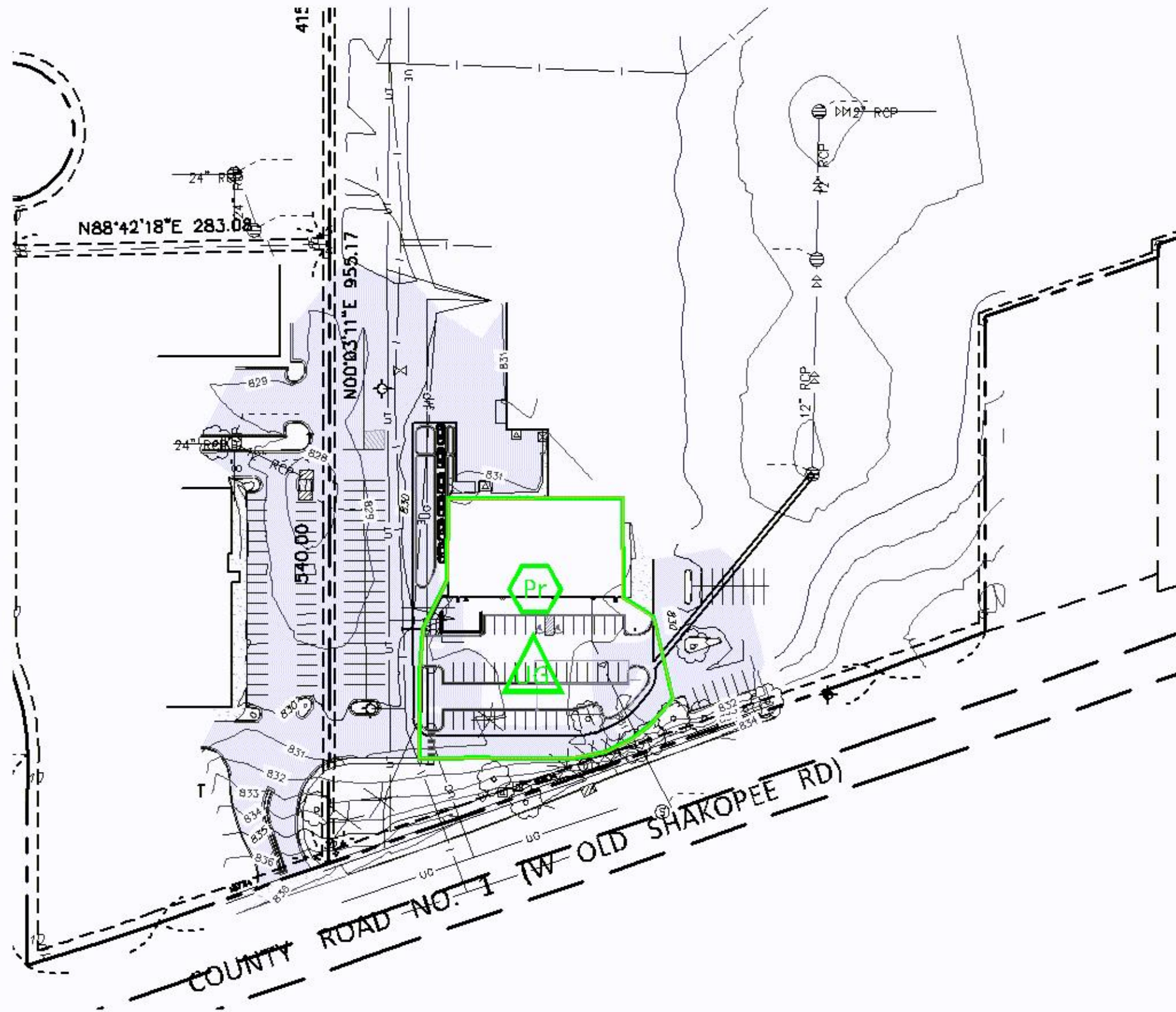


REACH



SUB-CATCHMENT





LEGEND

-  LINK
-  POND
-  REACH
-  SUB-CATCHMENT

Client

**KRAUS
ANDERSON**

**Project
VALLEY WEST**

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Approved: BB Drawn: AJR

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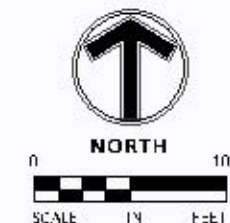
No. Date By Submittal / Rev.

**Sheet Title
PROPOSED
DRAINAGE MAP**

Sheet No. Revision

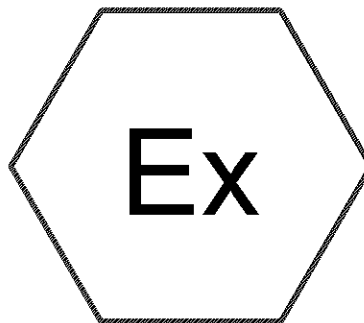
2/2

Project No. 21618

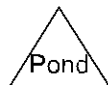
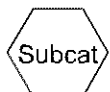


APPENDIX B – HYDROCAD CALCULATIONS

Ex 0.95 AC



Existing Area to be
Disturbed



Routing Diagram for 21618 - HydroCAD - 080619

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21618 - HydroCAD - 080619

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.033	39	>75% Grass cover, Good, HSG A (Ex)
0.915	98	Paved parking, HSG A (Ex)
0.948	96	TOTAL AREA

21618 - HydroCAD - 080619*MSE 24-hr 3 2-Year Rainfall=2.83"*

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEx: Existing Area to be

Runoff Area=0.948 ac 96.52% Impervious Runoff Depth=2.38"

Tc=5.0 min CN=96 Runoff=3.79 cfs 0.188 af

Total Runoff Area = 0.948 ac Runoff Volume = 0.188 af Average Runoff Depth = 2.38"**3.48% Pervious = 0.033 ac 96.52% Impervious = 0.915 ac**

21618 - HydroCAD - 080619

MSE 24-hr 3 2-Year Rainfall=2.83"

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Summary for Subcatchment Ex: Existing Area to be Distrurbed[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 3.79 cfs @ 12.11 hrs, Volume= 0.188 af, Depth= 2.38"

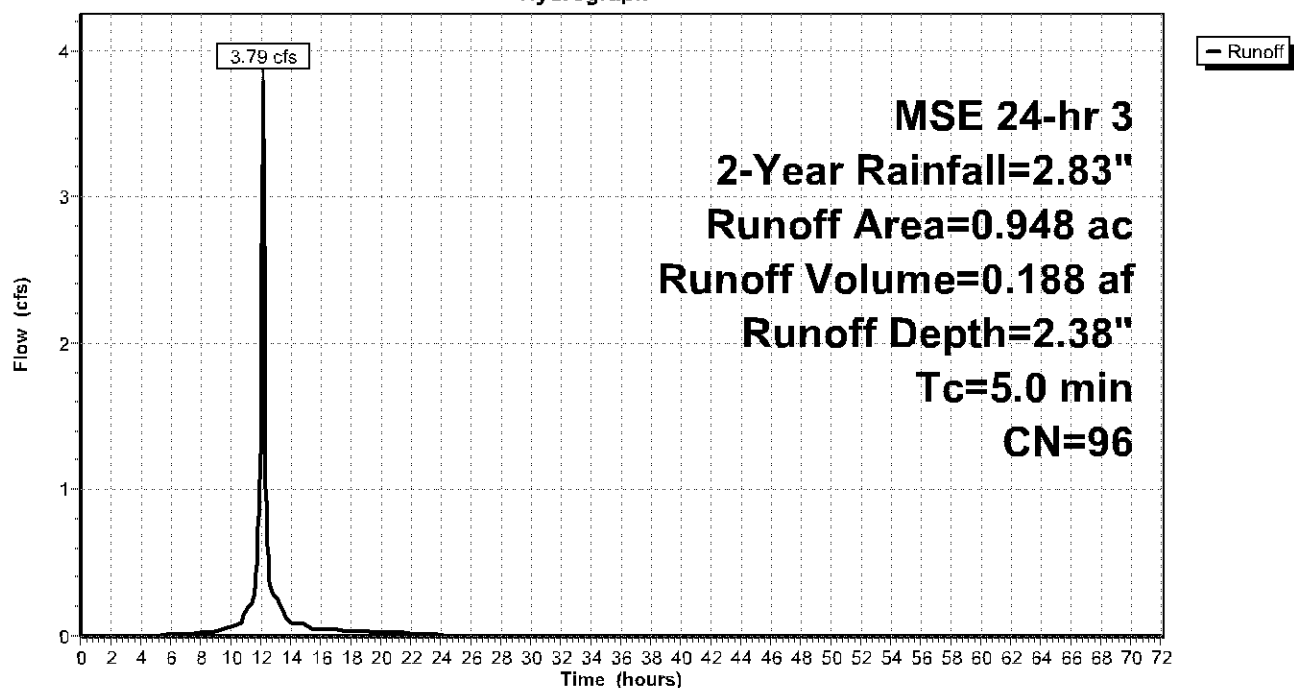
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
MSE 24-hr 3 2-Year Rainfall=2.83"

Area (ac)	CN	Description
0.915	98	Paved parking, HSG A
0.033	39	>75% Grass cover, Good, HSG A
0.948	96	Weighted Average
0.033		3.48% Pervious Area
0.915		96.52% Impervious Area

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

Subcatchment Ex: Existing Area to be Distrurbed

Hydrograph



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MSE 24-hr 3 10-Year Rainfall=4.24"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEx: Existing Area to be

Runoff Area=0.948 ac 96.52% Impervious Runoff Depth=3.78"

Tc=5.0 min CN=96 Runoff=5.84 cfs 0.298 af

Total Runoff Area = 0.948 ac Runoff Volume = 0.298 af Average Runoff Depth = 3.78"**3.48% Pervious = 0.033 ac 96.52% Impervious = 0.915 ac**

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MSE 24-hr 3 10-Year Rainfall=4.24"

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Summary for Subcatchment Ex: Existing Area to be Distrurbed[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 5.84 cfs @ 12.11 hrs, Volume= 0.298 af, Depth= 3.78"

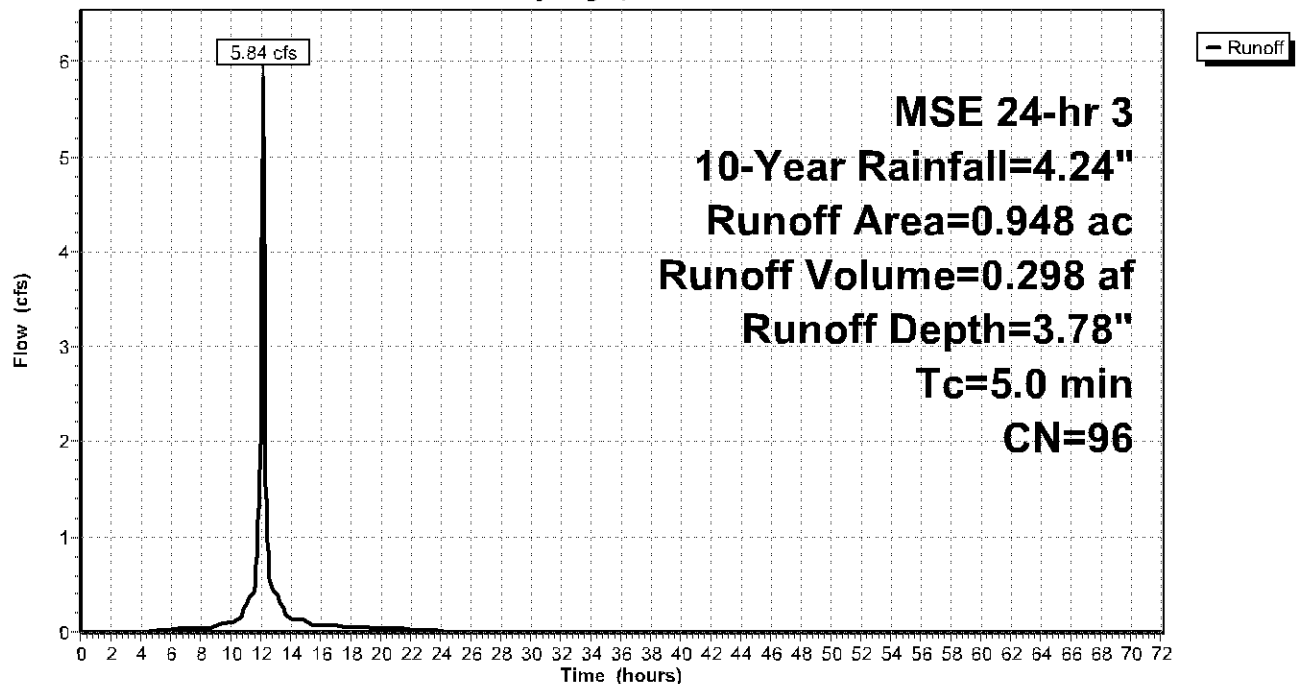
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
MSE 24-hr 3 10-Year Rainfall=4.24"

Area (ac)	CN	Description
0.915	98	Paved parking, HSG A
0.033	39	>75% Grass cover, Good, HSG A
0.948	96	Weighted Average
0.033		3.48% Pervious Area
0.915		96.52% Impervious Area

T_c (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment Ex: Existing Area to be Distrurbed

Hydrograph



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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEx: Existing Area to be

Runoff Area=0.948 ac 96.52% Impervious Runoff Depth=7.02"

Tc=5.0 min CN=96 Runoff=10.52 cfs 0.555 af

Total Runoff Area = 0.948 ac Runoff Volume = 0.555 af Average Runoff Depth = 7.02"**3.48% Pervious = 0.033 ac 96.52% Impervious = 0.915 ac**

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MSE 24-hr 3 100-Year Rainfall=7.50"

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Summary for Subcatchment Ex: Existing Area to be Distrurbed[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.52 cfs @ 12.11 hrs, Volume= 0.555 af, Depth= 7.02"

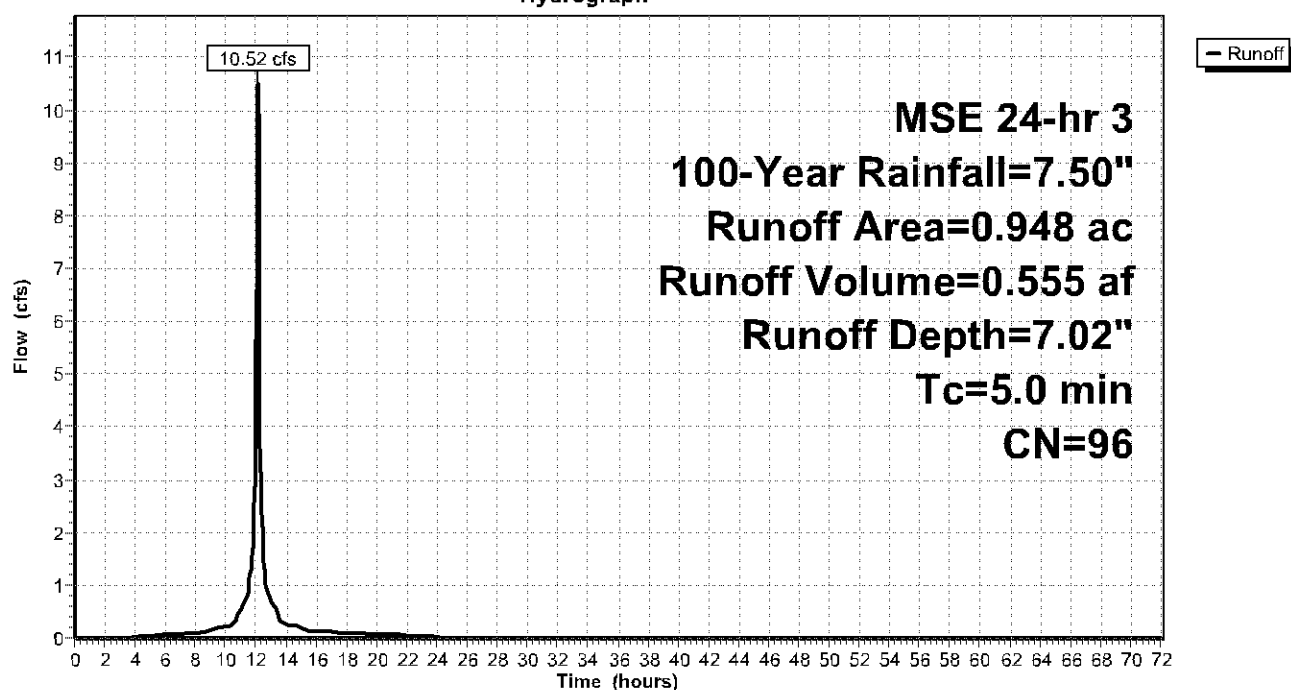
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
MSE 24-hr 3 100-Year Rainfall=7.50"

Area (ac)	CN	Description
0.915	98	Paved parking, HSG A
0.033	39	>75% Grass cover, Good, HSG A
0.948	96	Weighted Average
0.033		3.48% Pervious Area
0.915		96.52% Impervious Area

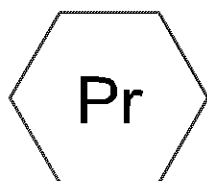
T_c (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment Ex: Existing Area to be Distrurbed

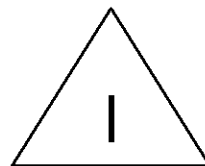
Hydrograph



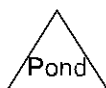
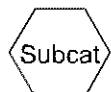
Prop Redevelopment



Proposed Area to be
Redeveloped



ADS System



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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.101	39	>75% Grass cover, Good, HSG A (Pr)
0.849	98	Paved parking, HSG C (Pr)
0.950	92	TOTAL AREA

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPr: Proposed Area to be

Runoff Area=41,382 sf 89.37% Impervious Runoff Depth=2.00"

Tc=5.0 min CN=92 Runoff=3.37 cfs 0.158 af

Pond I: ADS System

Peak Elev=0.00' Storage=0 cf

Total Runoff Area = 0.950 ac Runoff Volume = 0.158 af Average Runoff Depth = 2.00"
10.63% Pervious = 0.101 ac 89.37% Impervious = 0.849 ac

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Summary for Subcatchment Pr: Proposed Area to be Redeveloped[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 3.37 cfs @ 12.11 hrs, Volume= 0.158 af, Depth= 2.00"

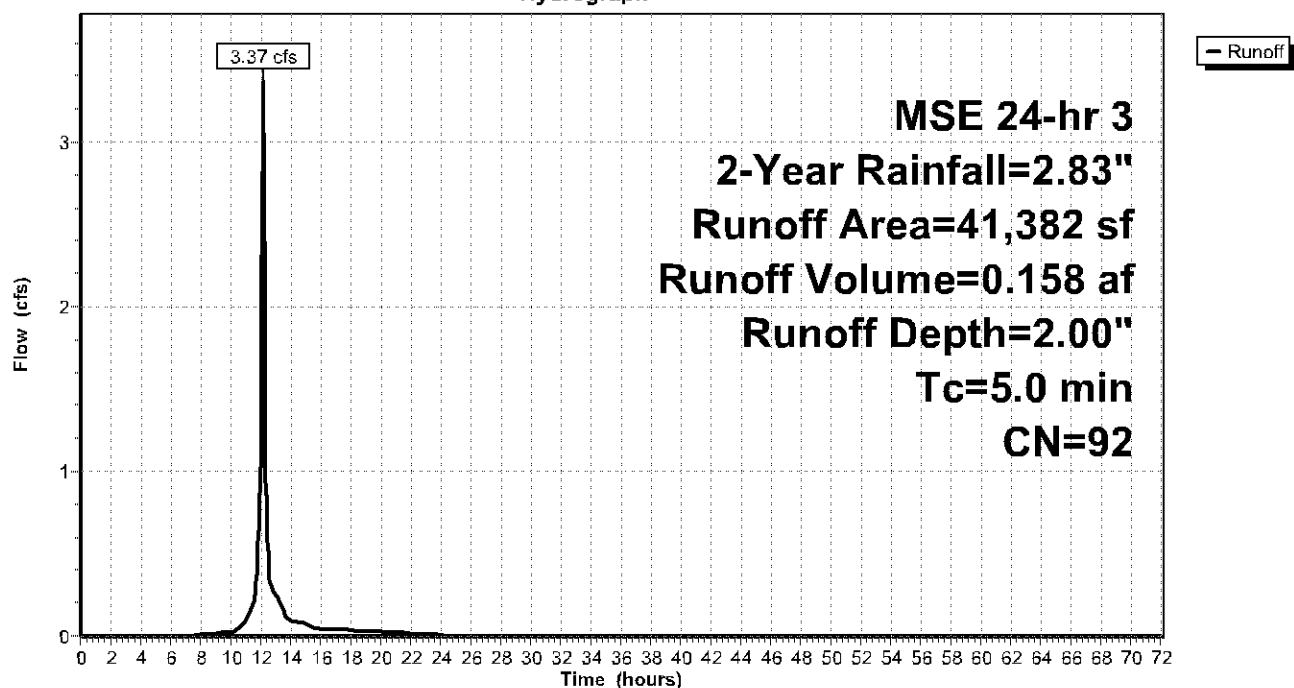
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
MSE 24-hr 3 2-Year Rainfall=2.83"

Area (sf)	CN	Description
36,982	98	Paved parking, HSG C
4,400	39	>75% Grass cover, Good, HSG A
41,382	92	Weighted Average
4,400		10.63% Pervious Area
36,982		89.37% Impervious Area

T_c (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment Pr: Proposed Area to be Redeveloped

Hydrograph



21618 - HydroCAD - 080619*MSE 24-hr 3 2-Year Rainfall=2.83"*

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Summary for Pond I: ADS System

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.30'	1,543 cf	20.50'W x 81.94'L x 3.50'H Field A 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	822.80'	2,021 cf	ADS_StormTech SC-740 +Cap x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 11 Chambers
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

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MSE 24-hr 3 2-Year Rainfall=2.83"

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Pond I: ADS System - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740+Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

11 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 79.94' Row Length +12.0" End Stone x 2 = 81.94' Base Length

4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

44 Chambers x 45.9 cf = 2,021.4 cf Chamber Storage

5,879.0 cf Field - 2,021.4 cf Chambers = 3,857.6 cf Stone x 40.0% Voids = 1,543.0 cf Stone Storage

Chamber Storage + Stone Storage = 3,564.4 cf = 0.082 af

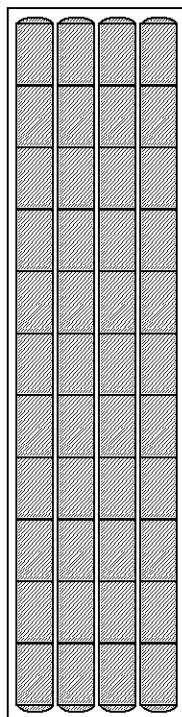
Overall Storage Efficiency = 60.6%

Overall System Size = 81.94' x 20.50' x 3.50'

44 Chambers

217.7 cy Field

142.9 cy Stone



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Stage-Area-Storage for Pond I: ADS System

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
822.30	0	824.90	2,913
822.35	34	824.95	2,960
822.40	67	825.00	3,004
822.45	101	825.05	3,046
822.50	134	825.10	3,085
822.55	168	825.15	3,123
822.60	202	825.20	3,159
822.65	235	825.25	3,194
822.70	269	825.30	3,228
822.75	302	825.35	3,262
822.80	336	825.40	3,296
822.85	404	825.45	3,329
822.90	473	825.50	3,363
822.95	541	825.55	3,396
823.00	610	825.60	3,430
823.05	678	825.65	3,464
823.10	745	825.70	3,497
823.15	813	825.75	3,531
823.20	880	825.80	3,564
823.25	947		
823.30	1,014		
823.35	1,081		
823.40	1,147		
823.45	1,213		
823.50	1,279		
823.55	1,344		
823.60	1,409		
823.65	1,473		
823.70	1,538		
823.75	1,602		
823.80	1,665		
823.85	1,728		
823.90	1,791		
823.95	1,853		
824.00	1,915		
824.05	1,976		
824.10	2,037		
824.15	2,097		
824.20	2,156		
824.25	2,215		
824.30	2,274		
824.35	2,332		
824.40	2,389		
824.45	2,445		
824.50	2,501		
824.55	2,556		
824.60	2,610		
824.65	2,663		
824.70	2,715		
824.75	2,766		
824.80	2,817		
824.85	2,866		

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MSE 24-hr 3 10-Year Rainfall=4.24"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPr: Proposed Area to be

Runoff Area=41,382 sf 89.37% Impervious Runoff Depth=3.35"

Tc=5.0 min CN=92 Runoff=5.48 cfs 0.265 af

Pond I: ADS System

Peak Elev=0.00' Storage=0 cf

Total Runoff Area = 0.950 ac Runoff Volume = 0.265 af Average Runoff Depth = 3.35"
10.63% Pervious = 0.101 ac 89.37% Impervious = 0.849 ac

21618 - HydroCAD - 080619

MSE 24-hr 3 10-Year Rainfall=4.24"

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Summary for Subcatchment Pr: Proposed Area to be Redeveloped[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 5.48 cfs @ 12.11 hrs, Volume= 0.265 af, Depth= 3.35"

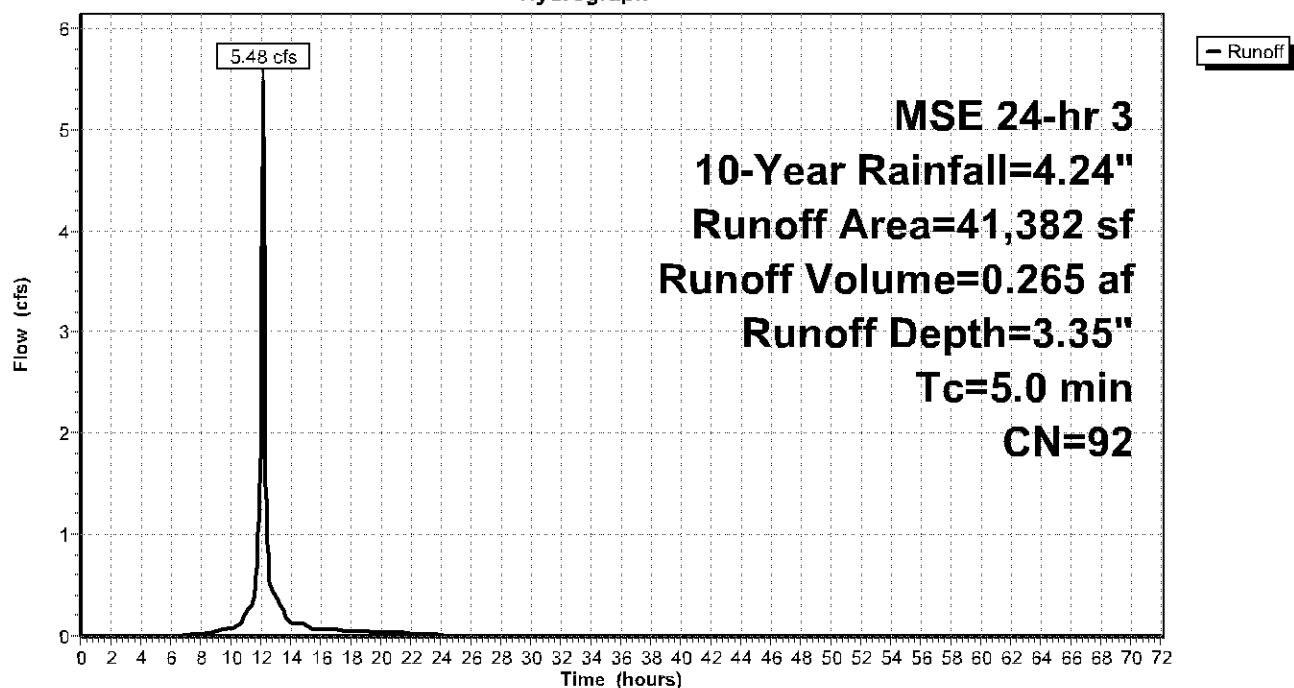
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MSE 24-hr 3 10-Year Rainfall=4.24"

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41,382	92	Weighted Average
4,400		10.63% Pervious Area
36,982		89.37% Impervious Area

T_c (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment Pr: Proposed Area to be Redeveloped

Hydrograph



21618 - HydroCAD - 080619

MSE 24-hr 3 10-Year Rainfall=4.24"

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Summary for Pond I: ADS System

[43] Hint: Has no inflow (Outflow=Zero)

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#2A	822.80'	2,021 cf	ADS_StormTech SC-740 +Cap x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 11 Chambers
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

21618 - HydroCAD - 080619

MSE 24-hr 3 10-Year Rainfall=4.24"

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Pond I: ADS System - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740+Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

11 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 79.94' Row Length +12.0" End Stone x 2 = 81.94' Base Length

4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

44 Chambers x 45.9 cf = 2,021.4 cf Chamber Storage

5,879.0 cf Field - 2,021.4 cf Chambers = 3,857.6 cf Stone x 40.0% Voids = 1,543.0 cf Stone Storage

Chamber Storage + Stone Storage = 3,564.4 cf = 0.082 af

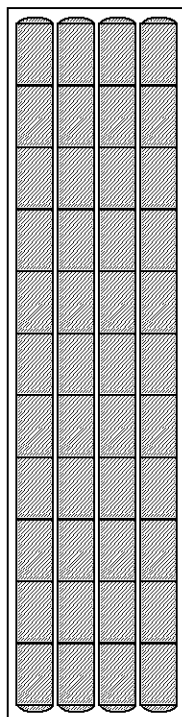
Overall Storage Efficiency = 60.6%

Overall System Size = 81.94' x 20.50' x 3.50'

44 Chambers

217.7 cy Field

142.9 cy Stone



21618 - HydroCAD - 080619

MSE 24-hr 3 10-Year Rainfall=4.24"

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Stage-Area-Storage for Pond I: ADS System

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
822.30	0	824.90	2,913
822.35	34	824.95	2,960
822.40	67	825.00	3,004
822.45	101	825.05	3,046
822.50	134	825.10	3,085
822.55	168	825.15	3,123
822.60	202	825.20	3,159
822.65	235	825.25	3,194
822.70	269	825.30	3,228
822.75	302	825.35	3,262
822.80	336	825.40	3,296
822.85	404	825.45	3,329
822.90	473	825.50	3,363
822.95	541	825.55	3,396
823.00	610	825.60	3,430
823.05	678	825.65	3,464
823.10	745	825.70	3,497
823.15	813	825.75	3,531
823.20	880	825.80	3,564
823.25	947		
823.30	1,014		
823.35	1,081		
823.40	1,147		
823.45	1,213		
823.50	1,279		
823.55	1,344		
823.60	1,409		
823.65	1,473		
823.70	1,538		
823.75	1,602		
823.80	1,665		
823.85	1,728		
823.90	1,791		
823.95	1,853		
824.00	1,915		
824.05	1,976		
824.10	2,037		
824.15	2,097		
824.20	2,156		
824.25	2,215		
824.30	2,274		
824.35	2,332		
824.40	2,389		
824.45	2,445		
824.50	2,501		
824.55	2,556		
824.60	2,610		
824.65	2,663		
824.70	2,715		
824.75	2,766		
824.80	2,817		
824.85	2,866		

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPr: Proposed Area to be

Runoff Area=41,382 sf 89.37% Impervious Runoff Depth=6.55"

Tc=5.0 min CN=92 Runoff=10.26 cfs 0.518 af

Pond I: ADS System

Peak Elev=0.00' Storage=0 cf

Total Runoff Area = 0.950 ac Runoff Volume = 0.518 af Average Runoff Depth = 6.55"
10.63% Pervious = 0.101 ac 89.37% Impervious = 0.849 ac

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MSE 24-hr 3 100-Year Rainfall=7.50"

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Summary for Subcatchment Pr: Proposed Area to be Redeveloped[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.26 cfs @ 12.11 hrs, Volume= 0.518 af, Depth= 6.55"

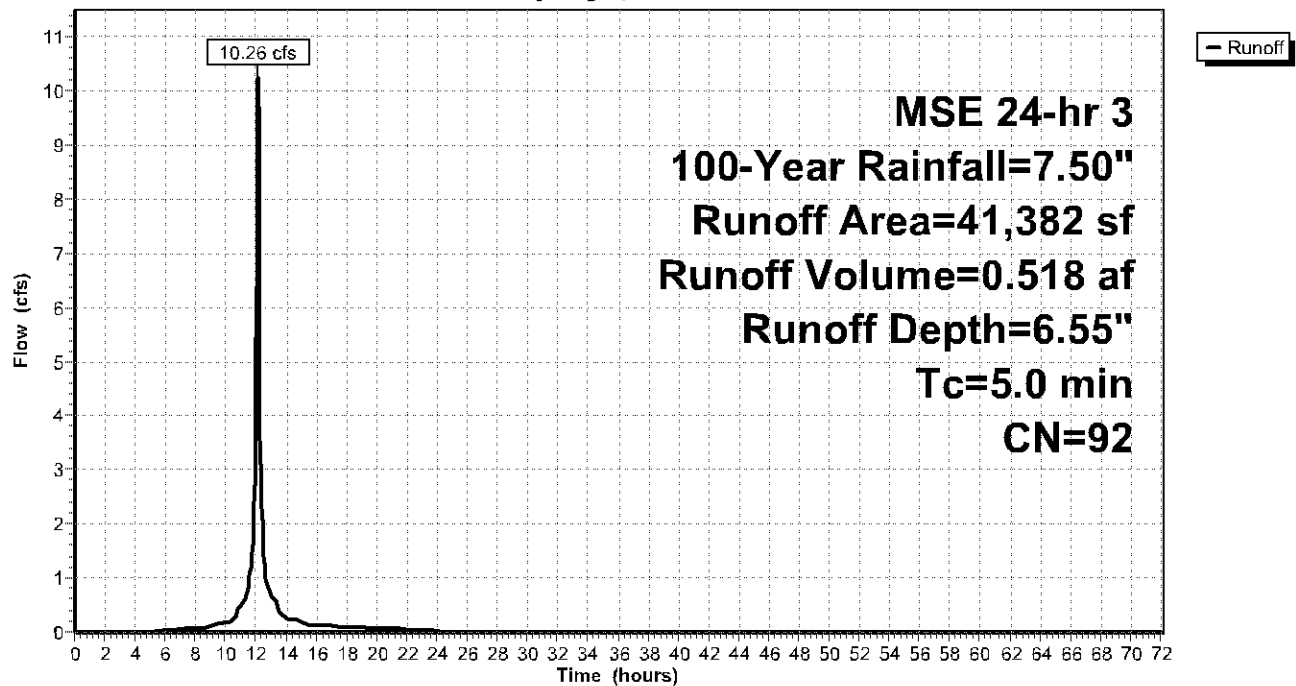
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, $dt=0.05$ hrs
MSE 24-hr 3 100-Year Rainfall=7.50"

Area (sf)	CN	Description
36,982	98	Paved parking, HSG C
4,400	39	>75% Grass cover, Good, HSG A
41,382	92	Weighted Average
4,400		10.63% Pervious Area
36,982		89.37% Impervious Area

T_c (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry,

Subcatchment Pr: Proposed Area to be Redeveloped

Hydrograph



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MSE 24-hr 3 100-Year Rainfall=7.50"

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Summary for Pond I: ADS System

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.30'	1,543 cf	20.50'W x 81.94'L x 3.50'H Field A 5,879 cf Overall - 2,021 cf Embedded = 3,858 cf x 40.0% Voids
#2A	822.80'	2,021 cf	ADS_StormTech SC-740 +Cap x 44 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 4 Rows of 11 Chambers
		3,564 cf	Total Available Storage

Storage Group A created with Chamber Wizard

21618 - HydroCAD - 080619

MSE 24-hr 3 100-Year Rainfall=7.50"

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Pond I: ADS System - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740+Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

11 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 79.94' Row Length +12.0" End Stone x 2 = 81.94' Base Length

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Chamber Storage + Stone Storage = 3,564.4 cf = 0.082 af

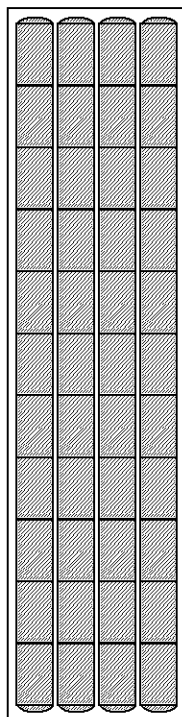
Overall Storage Efficiency = 60.6%

Overall System Size = 81.94' x 20.50' x 3.50'

44 Chambers

217.7 cy Field

142.9 cy Stone



21618 - HydroCAD - 080619*MSE 24-hr 3 100-Year Rainfall=7.50"*

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Stage-Area-Storage for Pond I: ADS System

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
822.30	0	824.90	2,913
822.35	34	824.95	2,960
822.40	67	825.00	3,004
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822.60	202	825.20	3,159
822.65	235	825.25	3,194
822.70	269	825.30	3,228
822.75	302	825.35	3,262
822.80	336	825.40	3,296
822.85	404	825.45	3,329
822.90	473	825.50	3,363
822.95	541	825.55	3,396
823.00	610	825.60	3,430
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823.10	745	825.70	3,497
823.15	813	825.75	3,531
823.20	880	825.80	3,564
823.25	947		
823.30	1,014		
823.35	1,081		
823.40	1,147		
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824.15	2,097		
824.20	2,156		
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824.35	2,332		
824.40	2,389		
824.45	2,445		
824.50	2,501		
824.55	2,556		
824.60	2,610		
824.65	2,663		
824.70	2,715		
824.75	2,766		
824.80	2,817		
824.85	2,866		

APPENDIX C – DRAFT BORING LOGS



**DENOTES APPROXIMATE LOCATION OF
STANDARD PENETRATION TEST BORING**



20' 0 40'

SCALE 1" = 40'

DRAFT
Subject to Change

**BRAUN
INTERTEC**
The Railroad Tie Build Co.

11001 Hampshire Avenue S.
Minneapolis, MN 55438
650-993-2000
braunintertec.com

Project No:
31304035

Drawing No:
31304035

Drawn By: JWS
Date Drawn: 5-8-19
Checked By: RJM
Last Modified: 5-9-19

West Stormwater System
10605 Vance Avenue S.
Bloomington, Minnesota

**Soil Boring
Location Sketch**

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1904635 Geotechnical Evaluation Valley West Stormwater System 10606 France Avenue South Bloomington, Minnesota					BORING: ST-1		
					LOCATION: See attached sketch		
					NORTHING:		EASTING:
DRILLER: M. Barber		LOGGED BY: R. Fritz		START DATE: 05/15/19	END DATE: 05/15/19		
SURFACE ELEVATION:		RIG: GP-1	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Sunny		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
0.8		PAVEMENT, 5 inches bituminous over 4 inches aggregate base.					
		POORLY GRADED SAND (SP), fine to medium sand, brown, moist, loose to medium dense (TERRACE DEPOSIT)					
			5	5-5-4 (9) 168"			
				2-2-3 (5) 144"			
			10	4-3-4 (7) 144"			
				5-5-6 (11) 168"			
14.5				7-7-8-10/0" (REF) 204"			
		END OF BORING	15				
		Boring immediately backfilled					
			20				
			25				
			30				

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1904635 Geotechnical Evaluation Valley West Stormwater System 10606 France Avenue South Bloomington, Minnesota					BORING: ST-2		
					LOCATION: See attached sketch		
					NORTHING:		EASTING:
DRILLER: M. Barber		LOGGED BY: R. Fritz		START DATE: 05/15/19	END DATE: 05/15/19		
SURFACE ELEVATION:		RIG: GP-1	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Sunny		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
0.8		PAVEMENT, 5 inches bituminous over 3 1/2 inches aggregate base.					
		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium sand, brown, moist					
4.0		POORLY GRADED SAND (SP), fine to medium sand, brown, moist, loose to medium dense (TERRACE DEPOSIT)	5	4-4-3 (7) 156"			
				1-1-1 (2) 144"			
			10	3-3-3 (6) 156"			
				5-3-3 (6) 168"			
14.5				7-7-6-5/0" (REF) 216"			
		END OF BORING	15				
		Boring immediately backfilled					
			20				
			25				
			30				