QUAM ENGINEERING, LLC
Residential and Commercial Site Design Consultants

February 4, 2020

City of Milton
Attn: Howard Robinson
710 S. Janesville St
Milton, WI 53563

Re: Arthur Drive Mini Warehouses

Enclosed are the following documents for the above referenced project:

1.) Existing Site Plan;
2.) Site Plan;
3.) Grading and Erosion Control Plan;
4.) Drainage Map;
5.) Universal Soil Loss Equation (USLE) Worksheet;
6.) Storm Sewer Rational Method Worksheet;
7.) Rip Rap Sizing Calculations;
8.) Pre- and Post-Development HydroCAD Reports;
9.) Sediment Control and Infiltration Calculations;
10.) Erosion Mat and Swale Velocity Calculations;
11.) Cost Estimate;
12.) Soils Information;
13.) Stormwater Maintenance Plan

The documents are being submitted to address erosion control and stormwater management requirements for the proposed development and will meet the following performance standards as defined in the City of Milton Ordinance and Wisconsin NR 151 standards as follows:

Erosion Control
The proposed construction shall include erosion control measures to prevent gully and bank erosion and limit total off-site erosion to less than 5.0 tons per acre per year.

All runoff during construction shall be directed to flow through erosion control measures as shown on the Grading and Erosion Control Plan. The USLE calculation worksheet is included and indicates that soil loss will be less than 5.0 tons per acre per year.

Sediment Control
For new development, BMP's shall be designed to reduce to the maximum extent practicable, the total suspended solids load by 80%, based on average annual rainfall, as compared to no management controls.

The proposed bioretention basin will provide sediment control for the site as shown in the attached sediment control calculations.

Runoff Rate Control

BMP's shall be designed to maintain or reduce, to the maximum extent practicable, as compared to pre-development conditionally the 2-year, 24-hour design storm applicable to the post-construction site. In addition, the DNR standard states BMP's shall be employed to maintain or reduce the 1-year, 24-hour post-construction peak runoff discharge rate to the 1-year, 24-hour pre-development peak runoff discharge rate.

The proposed bioretention basin will provide rate runoff control for the entire site as shown in the attached HydroCAD calculations. The following results table includes pre and post development runoff rates.

Storm Event (Year)	Total Existing Flow Rate (cfs)	Total Proposed Flow Rate Without Bio Basin (cfs)	Total Proposed Flow Rate With Bio Basin (cfs)
1	3.16	15.33	2.13
2	4.89	18.27	2.96
10	11.85	28.31	7.69
100	28.11	47.94	23.55

Infiltration

For non-residential development, infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on average annual rainfall. Alternatively, infiltrate 10% of the runoff from the 2-year, 24-hour design storm with a type II distribution. No more than 2% of the project site is required as an effective infiltration area. In addition, the DNR standard states for high imperviousness (development with more than 80% connected imperviousness), infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on average annual rainfall. No more than 2% of the post-construction site is required as an effective infiltration area.

The proposed bioretention basin will infiltrate 60% of the pre-development infiltration volume for the site as shown in the attached infiltration calculations.

Protective Areas

A protective area shall be established as measured horizontally from the top of the channel or delineated wetland boundary to the closest impervious surface.

The project is located outside the protective area specified in the Ordinance. Therefore, the protective area standard does not apply.

Fueling and Vehicle Maintenance Areas

Fueling and vehicle maintenance areas shall, to the maximum extent practicable, have BMP's designed to reduce petroleum within runoff, such that runoff that enters waters of the state contains no visible petroleum sheen.

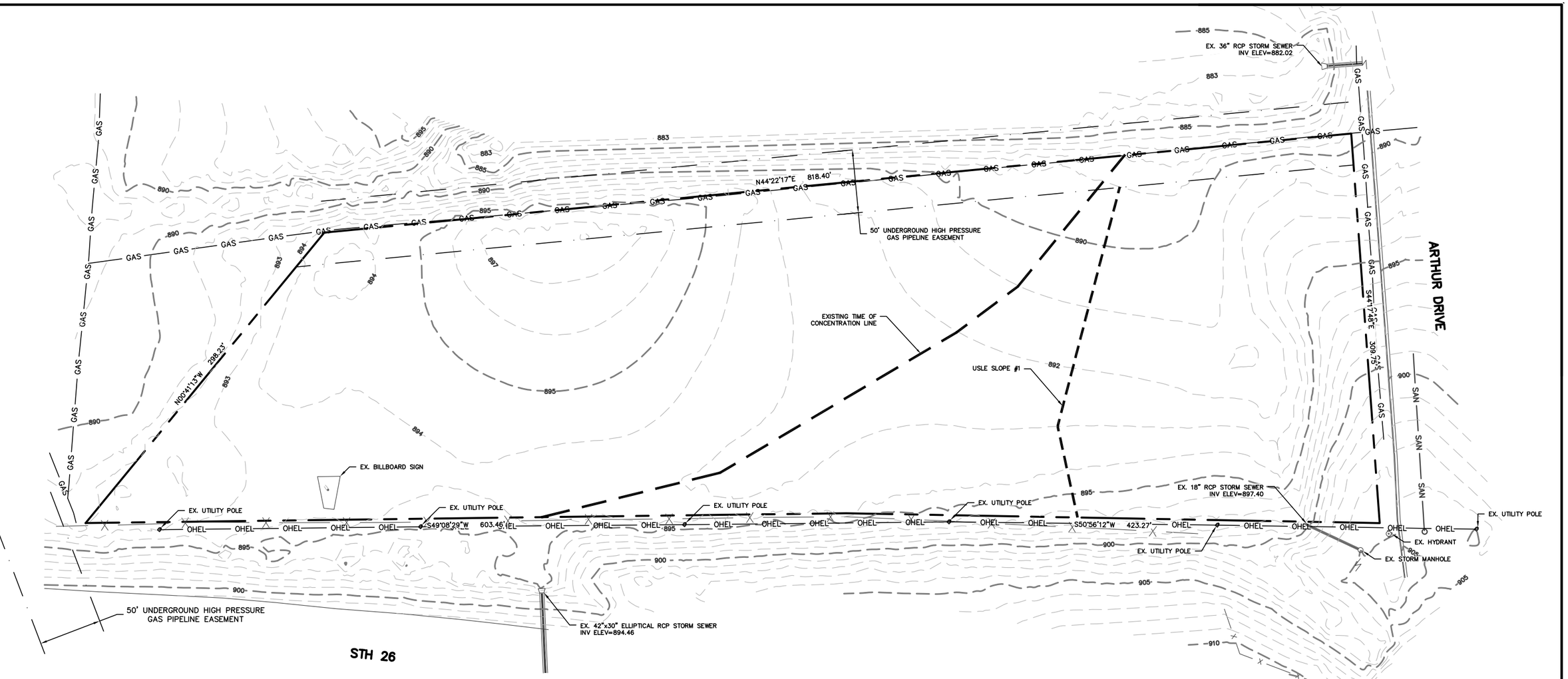
The project does not contain a fueling or vehicle maintenance area. Therefore, the fueling and vehicle maintenance standard does not apply.

If the documents are satisfactory, please provide the erosion control and storm water management approval. If you have any questions or comments, please feel free to contact me.
Sincerely,

Aaron Falkosky, P.E.

CC: Marie Chesebro w/ enc. via email

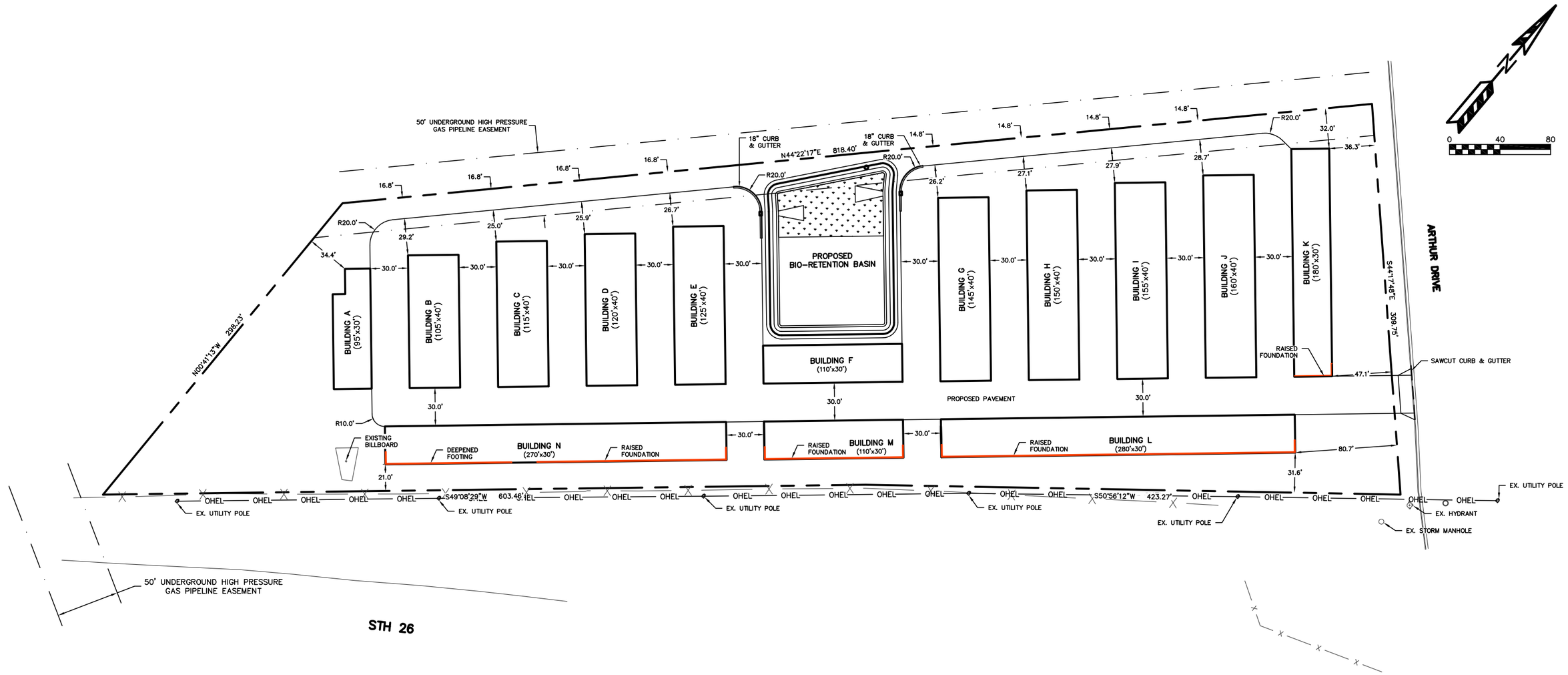
FN: LS-04-20

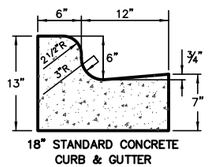


ARTHUR DRIVE MINI-WAREHOUSES – CITY OF MILTON
EXISTING SITE PLAN

EXHIBIT #1
DATED: FEBRUARY 4, 2020

QUAM ENGINEERING, LLC
Residential and Commercial Site Design Consultants
www.quamengineering.com
4604 Siggelkow Road, Suite A – McFarland, Wisconsin 53558
Phone (608) 838-7750; Fax (608) 838-7752





18" STANDARD CONCRETE CURB & GUTTER

ARTHUR DRIVE MINI–WAREHOUSES – CITY OF MILTON

SITE PLAN

EXHIBIT #2

DATED: FEBRUARY 4, 2020

QUAM ENGINEERING, LLC
Residential and Commercial Site Design Consultants
www.quamengineering.com
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Phone (608) 838–7750; Fax (608) 838–7752

QUAM ENGINEERING, LLC 4604 Siggelkow Road, Suite A – McFarland, WI 53558 (608) 838-7750 \LS-04-19\LS04BASE.DWG

CAUTION GAS CROSSING
CONTRACTOR TO FIELD DETERMINE THE GAS PIPELINE ELEVATION AND EMAIL THE ELEVATION TO RQUAM@QUAMENGINEERING.COM. QUAM ENGINEERING, LLC WILL THEN VERIFY THE OUTFALL STRUCTURE DESIGN TO AVOID PIPE CONFLICTS AND PROVIDE THE FINAL DESIGN TO THE CONTRACTOR FOR CONSTRUCTION.

PROPOSED BIO-RETENTION BASIN ELEV=887.50

BUILDING A (95'x30')
BUILDING B (105'x40')
BUILDING C (115'x40')
BUILDING D (120'x40')
BUILDING E (125'x40')
BUILDING F (110'x30')
BUILDING G (145'x40')
BUILDING H (150'x40')
BUILDING I (155'x40')
BUILDING J (160'x40')
BUILDING K (180'x30')
BUILDING L (280'x30')
BUILDING M (110'x30')
BUILDING N (270'x30')

ARTHUR DRIVE

EX. 36" RCP STORM SEWER ELEV=882.02
EX. 18" RCP STORM SEWER INV. ELEV=897.40
EX. 42"x30" ELLIPTICAL RCP STORM SEWER INV ELEV=894.46
EX. UTILITY POLE
EX. HYDRANT
EX. STORM MANHOLE
EXISTING BILLBOARD

18'x11'x1.5' MEDIUM RIP RAP w/ FABRIC
51'-15" HDPE @ 4.00%
OUTLET STRUCTURE #3 3' PRECAST CONC. STANDPIPE
14'-15" HDPE @ 2.00%
INLET #1 2'X3' PRECAST CONC. w/ NEENAH R-3067 TC=891.55 IE=887.80
15'-15" HDPE STORM SEWER @ 2.00%
INLET #2 2'X3' PRECAST CONC. w/ NEENAH R-3067 TC=891.45; IE=887.80
10' WIDE OVERFLOW WEIR EL=890.50
22'x13'x1.5' MEDIUM RIP RAP w/ FABRIC
ENGINEERED SOIL FOR 2,509 SQFT
20'x12'x1.5' MEDIUM RIP RAP w/ FABRIC

LIMITS OF DISTURBANCE (235,600 SQFT)
SILT FENCE/SOCK (SEE DETAIL)
USLE SLOPE #2
DEEPENED FOOTING
RAISED FOUNDATION
2.5' DEEP x 4' WIDE SWALE
2' DEEP x 4' WIDE SWALE
ROCK CHECK DAM (TYP) (SEE DETAIL)
STONE CONSTRUCTION ENTRANCE (SEE DETAIL)

N03°41'13"W 298.23'
S49°08'29"W 603.46'
S44°17'48"E 309.75'
N44°22'17"E 818.40'
S50°56'12"W 423.27'

0 40 80

EROSION NOTES:

THE STONE CONSTRUCTION ENTRANCE SHALL BE INSTALLED PRIOR TO ANY CONSTRUCTION. THE TRACKING PAD IS TO BE MAINTAINED BY THE CONTRACTOR IN A CONDITION, WHICH WILL PREVENT THE TRACK OF MUD OR DRY SEDIMENT ONTO THE ADJACENT PUBLIC STREETS. SEDIMENT REACHING THE PUBLIC ROAD SHALL BE REMOVED BY STREET CLEANING (NOT HYDRAULIC FLUSHING) BEFORE THE END OF EACH WORKDAY.

EROSION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO GRADING OPERATIONS AND SHALL BE PROPERLY MAINTAINED FOR MAXIMUM EFFECTIVENESS UNTIL VEGETATION IS ESTABLISHED. ALL EROSION CONTROL MEASURES AND STRUCTURES SERVING THE SITE MUST BE INSPECTED AT LEAST WEEKLY OR WITHIN 24 HOURS OF A 0.5 INCH RAIN EVENT. ALL MAINTENANCE WILL FOLLOW AN INSPECTION WITHIN 24 HOURS.

CUT AND FILL SLOPES SHALL BE NO GREATER THAN 3:1.

EROSION CONTROL IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ACCEPTANCE OF THIS PROJECT. EROSION CONTROL MEASURES AS SHOWN SHALL BE THE MINIMUM PRECAUTIONS THAT WILL BE ALLOWED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RECOGNIZING AND CORRECTING ALL EROSION CONTROL PROBLEMS THAT ARE A RESULT OF CONSTRUCTION ACTIVITIES. ADDITIONAL EROSION CONTROL MEASURES, AS REQUESTED IN WRITING BY THE STATE OR LOCAL INSPECTORS, OR THE DEVELOPER'S ENGINEER, SHALL BE INSTALLED WITHIN 24 HOURS.

TIME SCHEDULE:

MAY 1, 2020	INSTALL INITIAL EROSION CONTROL DEVICES.
MAY 1, 2020 – OCTOBER 01, 2020	CONSTRUCT BUILDINGS & DRIVEWAYS AND RESTORE PERVIOUS DISTURBED AREAS.

RESTORATION NOTES:

ALL PERVIOUS DISTURBED AREAS SHALL RECEIVE A MINIMUM OF FOUR (4) INCHES OF TOPSOIL, SEED AND MULCH. ALL PERVIOUS DISTURBED AREAS SHALL RECEIVE FERTILIZER EXCEPT NATIVE PLANTING AREAS. RESTORATION WILL OCCUR AS SOON AFTER THE DISTURBANCE AS PRACTICAL. SEED MIXTURE 40 SHALL BE USED ON ALL OTHER DISTURBED AREAS. MIXTURES SHALL BE IN ACCORDANCE WITH SECTION 630 OF D.O.T. SPECIFICATIONS. AN EQUAL AMOUNT OF ANNUAL RYEGRASS SHALL BE ADDED TO THE MIX.

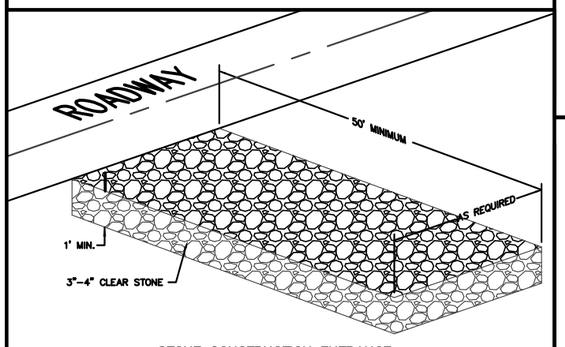
SEED MIXTURES SHALL BE APPLIED AT THE RATE OF FOUR (4) POUNDS PER 1,000 SQUARE FEET. FERTILIZER SHALL BE APPLIED AT THE RATE OF FOUR (4) POUNDS PER 1,000 SQUARE FEET. MULCH SHALL CONSIST OF HAY OR STRAW APPLIED AT THE RATE OF 2 TONS PER ACRE.

FERTILIZER SHALL MEET THE MINIMUM REQUIREMENTS THAT FOLLOW: NITROGEN, NOT LESS THAN 16%; PHOSPHORIC ACID, NOT LESS THAN 8%; POTASH, NOT LESS THAN 8%.

OWNER:
B&J STORAGE
ATTN: LARRY SCHULZ
4704 DROTT DRIVE
JANESVILLE, WI 53346

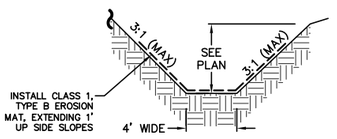
ENGINEER:
QUAM ENGINEERING, LLC
ATTN: RYAN QUAM
4604 SIGGELKOW ROAD, SUITE A
MCFARLAND, WI 53558

TO OBTAIN LOCATION OF PARTICIPANTS' UNDERGROUND FACILITIES BEFORE YOU DIG IN WISCONSIN
CALL DIGGERS HOTLINE 1-800-242-8511 TOLL FREE
TDD(FOR THE HEARING IMPAIRED)(800)542-2289
WIS. STATUTE 182.0175 (1974) REQUIRES MIN. OF 3 WORK DAYS NOTICE BEFORE YOU EXCAVATE



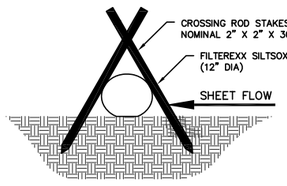
STONE CONSTRUCTION ENTRANCE

– INSTALL FLEXSTORM CATCH-IT INLET PROTECTION.
– INSTALL WISDOT CLASS 1 TYPE B EROSION MATTING.



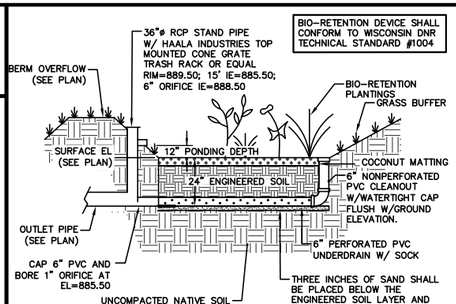
SWALE CROSS SECTION

MAINTAIN SILT SOCKS UNTIL VEGETATION IS ESTABLISHED.



SILT SOCK DETAIL

BIO-RETENTION DEVICE SHALL CONFORM TO WISCONSIN DNR TECHNICAL STANDARD #1004



SEE PLAN VIEW FOR ELEVATIONS AND OTHER INFORMATION.

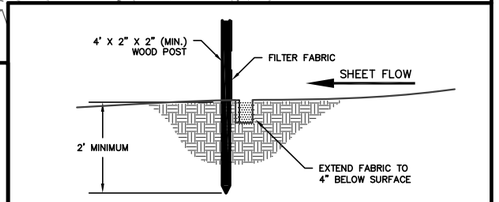
ENGINEERED SOIL SHALL CONSIST OF THE FOLLOWING:
70% SILICA SAND; 30% COMPOST W/ PH 5.5-6.5
COMPOST SHALL MEET WDNR SPECIFICATION S100.
STORAGE/INTERFACE LAYER SHALL CONSIST OF SAND AS FOLLOWS:
SAND: WASHED QUARTZ OR SILICA 0.02 – 0.04 INCHES IN DIA.

BIORETENTION PLANTINGS TO BE PLANTED AT ONE PLUG PER SQUARE FOOT. PLUGS TO BE PLANT STOCK NAMED IN THE WET PRAIRIE MIX FROM AGRECOL CORPORATION OR APPROVED EQUIVALENT. A MINIMUM OF 10 DIFFERENT PLANT STOCK NAMES TO BE PLANTED.

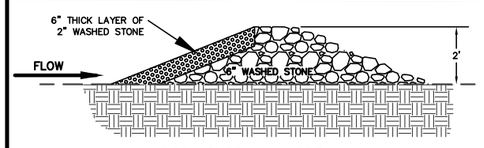
TO PREVENT COMPACTION OF ENGINEERED SOIL AND SUBSOILS, CONTRACTOR SHALL PROTECT AGAINST MACHINERY ENTERING OR COMPACTING THE BIO-RETENTION AREA.

CONTRACTOR SHALL PROVIDE COPY OF DELIVERY TICKET OR INVOICE FOR ENGINGEERED SOIL & SAND STORAGE LAYER FOR AS-BUILT CERTIFICATION PURPOSES.

BIO-RETENTION BASIN DETAIL



SILT FENCE CONSTRUCTION (SHEET FLOW)



ROCK CHECK DAM DETAIL

ARTHUR DRIVE MINI-WAREHOUSES – CITY OF MILTON

GRADING AND EROSION CONTROL PLAN
EXHIBIT #3
DATED: FEBRUARY 4, 2020

QUAM ENGINEERING, LLC
Residential and Commercial Site Design Consultants
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N

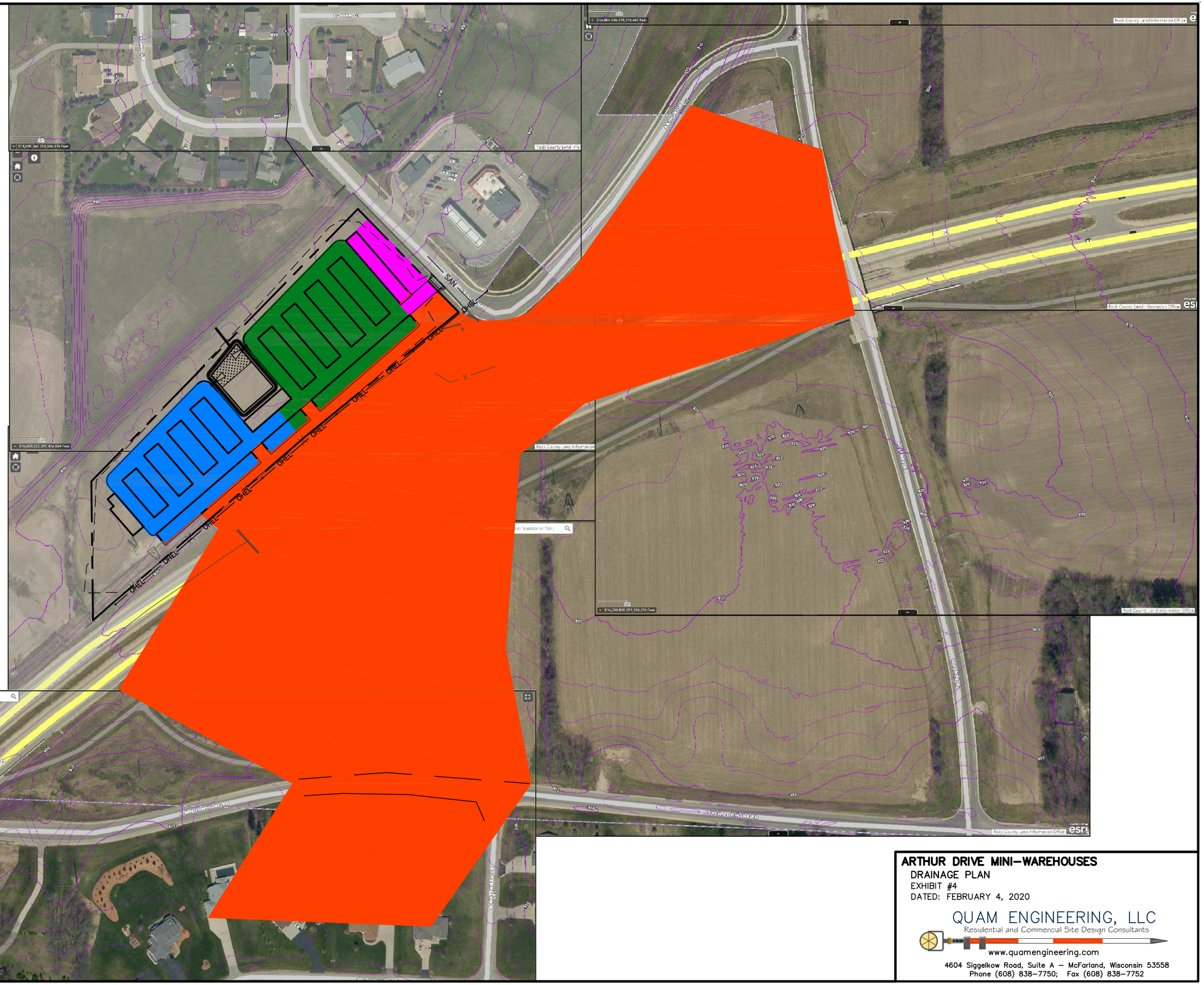
0 100 200

AREA TO INLET #1
(AND BIO BASIN)

AREA TO INLET #2
(AND BIO BASIN)

AREA TO SOUTH
DRAINAGE SWALE

AREA TO NORTH
DRAINAGE SWALE



ARTHUR DRIVE MINI–WAREHOUSES
DRAINAGE PLAN
EXHIBIT #4
DATED: FEBRUARY 4, 2020

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Residential and Commercial Site Design Consultants
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Soil Loss & Sediment Discharge Calculation Tool

for use on Construction Sites in the State of Wisconsin

WDNR Version 2.0 (06-29-2017)

YEAR 1

Developer: B&J Storage

Project: Arthur Drive Mini Warehouses - City of Milton

Date: 02/04/20

County: Rock

Version 1.0

Activity (1)	Begin Date (2)	End Date (3)	Period % R (4)	Annual R Factor (5)	Sub Soil Texture (6)	Soil Erodibility K Factor (7)	Slope (%) (8)	Slope Length (ft) (9)	LS Factor (10)	Land Cover C Factor (11)	Soil loss A (tons/acre) (12)	SDF (13)	Sediment Control Practice (14)	Sediment Discharge (t/ac) (15)
Bare Ground	05/01/20	05/14/20	4.6%	150	Silt Loam	0.43	1.0%	260	0.17	1.00	0.5	0.745	Silt Fence	0.2
Bare Ground	05/14/20	10/01/20	77.2%	150	Silt Loam	0.43	2.0%	40	0.15	1.00	7.6	0.982	Silt Fence	4.5
Seed with Mulch or Er	10/01/20	12/01/20	7.9%	150	Silt Loam	0.43	2.0%	40	0.15	0.10	0.1	0.982	Silt Fence	0.0
End	12/01/20	-----	-----	-----	-------	-----			-----	------	-----	0.000		0.0
		-----	-----	-----	-------	-----			-----	-----	-----	0.000		0.0
		-----	-----	-----	-------	-----			-----	-----	-----	0.000		0.0
										TOTAL	**8.2**		**TOTAL**	**4.8**
													% Reduction Required	**NONE**

Notes:

See Help Page for further descriptions of variables and items in drop-down boxes.
The last land disturbing activity on each sheet must be 'End'. This is either 12 months from the start of construction or final stabilization.
For periods of construction that exceed 12 months, please demonstrate that 5 tons/acre/year is not exceeded in any given 12 month period.

NOTE: THIS TOOL ONLY ADDRESSED SOIL EROSION DUE TO SHEET FLOW. MEASURES TO CONTROL CHANNEL EROSION MAY ALSO BE REQUIRED TO MEET SEDIMENT DISCHARGE REQUIREMENTS.

Recommended Permanent Seeding Dates:

4/1-5/15	and	8/7-8/29	Turf, introduced grasses and legumes
Thaw-6/30			Native Grasses, forbs, and legumes

Designed By:	MAF
Date	2/4/2020

Rational Method Worksheet

PROJECT: Arthur Drive Mini-Warehouses - City of Milton
DATE: 2/4/2020

Computed by: BMM
Checked by: AFF

LOCATION		BASIN		RAINFALL - RUNOFF						SEWER			
Upstream Structure	**Downstream Structure**	**Runoff Coefficient** (C)	**Area** (acres)	**Design Storm** (Yr)	**Time of Concentration** (min)	**Rain Intensity** (in/hr)	**Direct Runoff** (cfs)	**Other Runoff** (cfs)	**Design Runoff** (cfs)	**Sewer Size** (in)	**Slope of Sewer** (ft/ft)	**Manning's Number**	**Capacity Flowing Full** (cfs)
		C	A		T_c	I	Q=C*I*A					n	
Inlet #1	Outfall #1	0.72	1.521	10	5	7.20	7.89	0.00	7.89	15	0.020	0.012	9.90
Inlet #2	Outfall #2	0.72	1.751	10	5	7.20	9.08	0.00	9.08	15	0.020	0.012	9.90

C_{10}=0.72; Commercial, HSG B, 2-6% slopes; from FDM Procedure 13-10-5, Figure 2

I = rainfall intensity for City of Milton, Wisconsin NOAA Atlas 14.

Capacity flowing full was determined using Manning's Equation

RIP RAP SIZING CALCULATION

W.D.O.T. FACILITIES DEVELOPMENT MANUAL

RIPRAP BLANKET DESIGN

Given:	Outfall #1	
Storm Sewer Diameter (D_O)	1.25	feet
Discharge (Q_{10})	7.89	cfs
Discharge full pipe flow (Qfull)	9.90	cfs
Q/Qfull	0.80	
Partially full pipe from Figure 1 (y/D)	0.78	
Tailwater Depth (TW) based on partially full pipe	0.98	feet

Stone Size:

$d_{50} = D_O(0.020\ (D_O/TW)(Q/D_O^{5/2})^{4/3}) =$	0.2393	feet
Use average stone size of:	3	inches

Length of Stone Protection:

$L_{sp} = D_O(1.7(Q/D_O^{5/2})+8) =$	19.60	feet
Use length of:	20	feet

Width of Stone Protection (at outlet):

$W_{sp} = 3 * D_O$	3.75	feet
Use width of:	4	feet

Width of Stone Protection (at end of blanket):

W_{sp} (max. TW) $= 2(1.5\ D_O + 0.2\ L_{sp})$	11.59	feet
Use width of:	12	feet

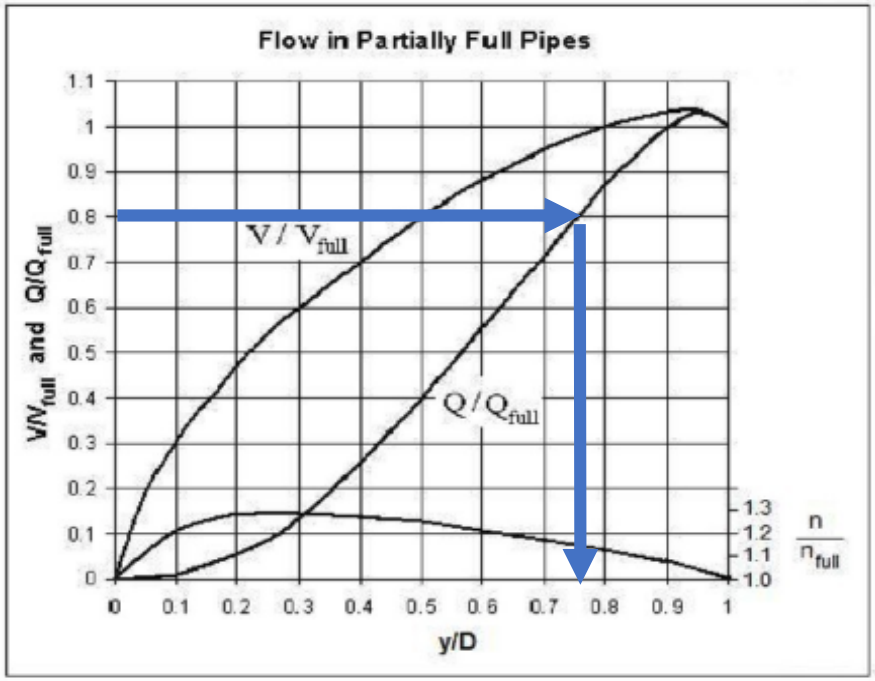


Figure 1

RIP RAP SIZING CALCULATION

W.D.O.T. FACILITIES DEVELOPMENT MANUAL

RIPRAP BLANKET DESIGN

Given:	Outfall #2	
Storm Sewer Diameter (D_O)	1.25	feet
Discharge (Q_{10})	9.08	cfs
Discharge full pipe flow (Qfull)	9.90	cfs
Q/Qfull	0.92	
Partially full pipe from Figure 1 (y/D)	0.85	
Tailwater Depth (TW) based on partially full pipe	1.06	feet

Stone Size:

$d_{50} = D_O(0.020\ (D_O/TW)(Q/D_O^{5/2})^{4/3}) =$	0.2648	feet
Use average stone size of:	4	inches

Length of Stone Protection:

$L_{sp} = D_O(1.7(Q/D_O^{5/2})+8) =$	21.05	feet
Use length of:	22	feet

Width of Stone Protection (at outlet):

$W_{sp} = 3 * D_O$	3.75	feet
Use width of:	4	feet

Width of Stone Protection (at end of blanket):

W_{sp} (max. TW) $= 2(1.5\ D_O + 0.2\ L_{sp})$	12.17	feet
Use width of:	13	feet

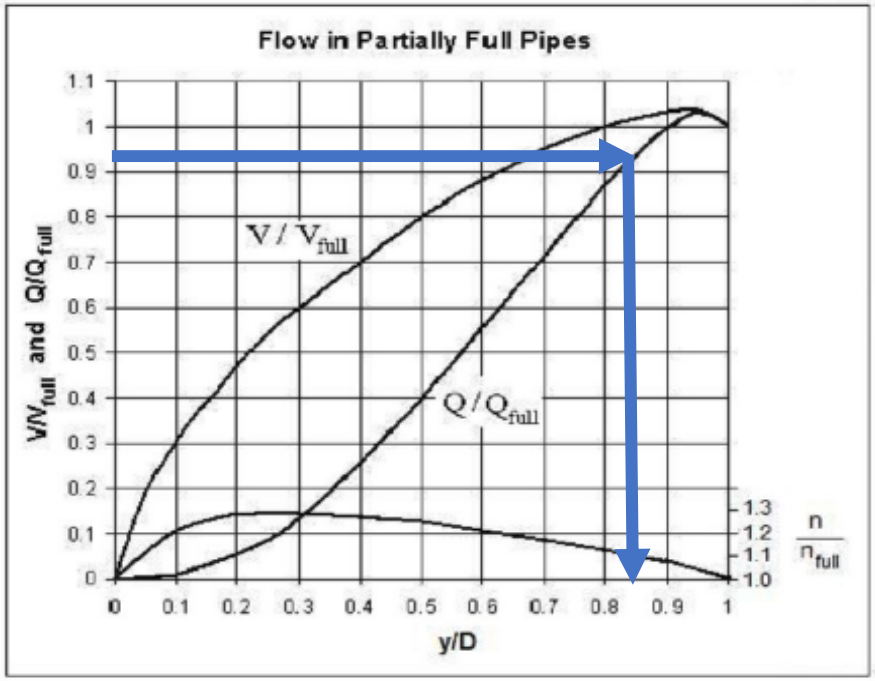


Figure 1

RIP RAP SIZING CALCULATION

W.D.O.T. FACILITIES DEVELOPMENT MANUAL

RIPRAP BLANKET DESIGN

Given:	Pond Outfall	
Storm Sewer Diameter (D_O)	1.25	feet
Discharge (Q_{10})	5.80	cfs
Discharge full pipe flow (Qfull)	9.92	cfs
Q/Qfull	0.58	
Partially full pipe from Figure 1 (y/D)	0.62	
Tailwater Depth (TW) based on partially full pipe	0.78	feet

Stone Size:

$d_{50} = D_O(0.020\ (D_O/TW)(Q/D_O^{5/2})^{4/3}) =$	0.1997	feet
Use average stone size of:	3	inches

Length of Stone Protection:

$L_{sp} = D_O(1.7(Q/D_O^{5/2})+8) =$	17.06	feet
Use length of:	18	feet

Width of Stone Protection (at outlet):

$W_{sp} = 3 * D_O$	3.75	feet
Use width of:	4	feet

Width of Stone Protection (at end of blanket):

W_{sp} (max. TW) $= 2(1.5\ D_O + 0.2\ L_{sp})$	10.57	feet
Use width of:	11	feet

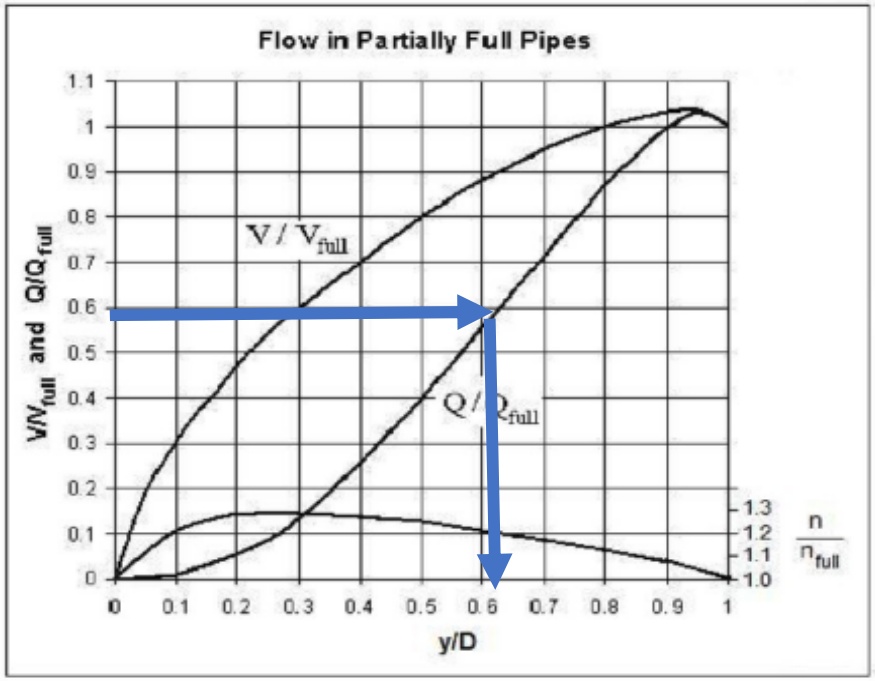
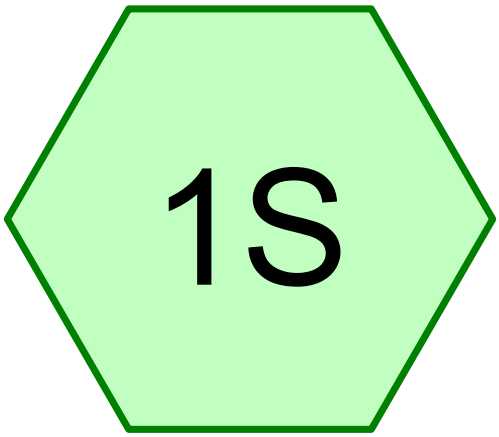


Figure 1



Existing Area

Subcat Reach Pond Link

Routing Diagram for LS04 PRE
Prepared by Quam Engineering, Printed 2/3/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.530	70	Cropland, HSG B (1S)
5.530	**70**	**TOTAL AREA**

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment 1S: Existing Area Runoff Area=5.530 ac 0.00% Impervious Runoff Depth=0.44"
Flow Length=500' Slope=0.0100 '/' Tc=9.3 min CN=70 Runoff=3.16 cfs 0.203 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.203 af Average Runoff Depth = 0.44"
100.00% Pervious = 5.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Area

Runoff = 3.16 cfs @ 12.19 hrs, Volume= 0.203 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.47"

	Area (ac)	CN	Description
*	5.530	70	Cropland, HSG B
	5.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	500	0.0100	0.90		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment 1S: Existing Area Runoff Area=5.530 ac 0.00% Impervious Runoff Depth=0.63"
Flow Length=500' Slope=0.0100 '/' Tc=9.3 min CN=70 Runoff=4.89 cfs 0.291 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.291 af Average Runoff Depth = 0.63"
100.00% Pervious = 5.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Area

Runoff = 4.89 cfs @ 12.19 hrs, Volume= 0.291 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (ac)	CN	Description
*	5.530	70	Cropland, HSG B
	5.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	500	0.0100	0.90		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment 1S: Existing Area Runoff Area=5.530 ac 0.00% Impervious Runoff Depth=1.41"
Flow Length=500' Slope=0.0100 '/' Tc=9.3 min CN=70 Runoff=11.85 cfs 0.650 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.650 af Average Runoff Depth = 1.41"
100.00% Pervious = 5.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Area

Runoff = 11.85 cfs @ 12.18 hrs, Volume= 0.650 af, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.12"

	Area (ac)	CN	Description
*	5.530	70	Cropland, HSG B
	5.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	500	0.0100	0.90		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment 1S: Existing Area Runoff Area=5.530 ac 0.00% Impervious Runoff Depth=3.25"
Flow Length=500' Slope=0.0100 '/' Tc=9.3 min CN=70 Runoff=28.11 cfs 1.497 af

Total Runoff Area = 5.530 ac Runoff Volume = 1.497 af Average Runoff Depth = 3.25"
100.00% Pervious = 5.530 ac 0.00% Impervious = 0.000 ac

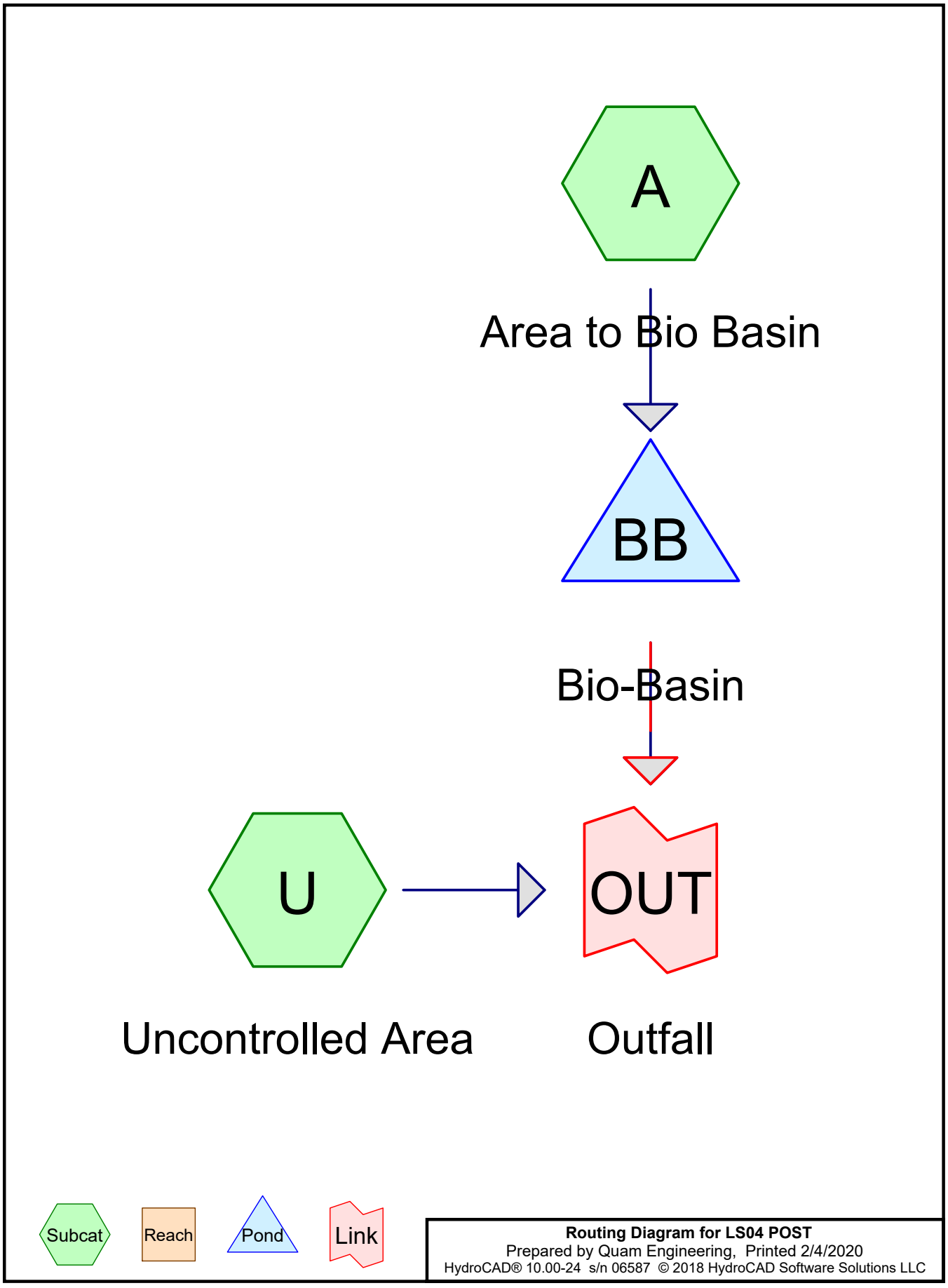
Summary for Subcatchment 1S: Existing Area

Runoff = 28.11 cfs @ 12.17 hrs, Volume= 1.497 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year Rainfall=6.55"

	Area (ac)	CN	Description
*	5.530	70	Cropland, HSG B
	5.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	500	0.0100	0.90		**Shallow Concentrated Flow, Shallow Flow** Cultivated Straight Rows Kv= 9.0 fps



Routing Diagram for LS04 POST
Prepared by Quam Engineering, Printed 2/4/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.680	74	>75% Grass cover, Good, HSG C (A, U)
3.430	98	Impervious Areas (A)
0.190	98	Impervious Roof (U)
0.230	100	Water (A)
5.530	**91**	**TOTAL AREA**

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment A: Area to Bio Basin Runoff Area=3.880 ac 94.33% Impervious Runoff Depth=2.13"
Tc=6.0 min CN=97 Runoff=13.27 cfs 0.690 af

Subcatchment U: Uncontrolled Area Runoff Area=1.650 ac 11.52% Impervious Runoff Depth=0.72"
Tc=6.0 min CN=77 Runoff=2.09 cfs 0.099 af

Pond BB: Bio-Basin Peak Elev=889.03' Storage=17,325 cf Inflow=13.27 cfs 0.690 af
Discarded=0.25 cfs 0.487 af Primary=0.55 cfs 0.203 af Secondary=0.00 cfs 0.000 af Outflow=0.79 cfs 0.690 af

Link OUT: Outfall Inflow=2.13 cfs 0.302 af
Primary=2.13 cfs 0.302 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.789 af Average Runoff Depth = 1.71"
30.38% Pervious = 1.680 ac 69.62% Impervious = 3.850 ac

Summary for Subcatchment A: Area to Bio Basin

Runoff = 13.27 cfs @ 12.13 hrs, Volume= 0.690 af, Depth= 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.47"

	Area (ac)	CN	Description
*	3.430	98	Impervious Areas
	0.220	74	>75% Grass cover, Good, HSG C
*	0.230	100	Water
	3.880	97	Weighted Average
	0.220		5.67% Pervious Area
	3.660		94.33% Impervious Area

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

Summary for Subcatchment U: Uncontrolled Area

Runoff = 2.09 cfs @ 12.14 hrs, Volume= 0.099 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-Year Rainfall=2.47"

	Area (ac)	CN	Description
*	0.190	98	Impervious Roof
	1.460	74	>75% Grass cover, Good, HSG C
	1.650	77	Weighted Average
	1.460		88.48% Pervious Area
	0.190		11.52% Impervious Area

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

Summary for Pond BB: Bio-Basin

Inflow Area = 3.880 ac, 94.33% Impervious, Inflow Depth = 2.13" for 1-Year event
Inflow = 13.27 cfs @ 12.13 hrs, Volume= 0.690 af
Outflow = 0.79 cfs @ 13.20 hrs, Volume= 0.690 af, Atten= 94%, Lag= 64.4 min
Discarded = 0.25 cfs @ 10.55 hrs, Volume= 0.487 af
Primary = 0.55 cfs @ 13.20 hrs, Volume= 0.203 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
Peak Elev= 889.03' @ 13.20 hrs Surf.Area= 2,950 sf Storage= 17,325 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 372.6 min (1,137.2 - 764.5)

Volume	Invert	Avail.Storage	Storage Description
#1	885.50'	1,593 cf	**Engineered Soil (Prismatic)**Listed below (Recalc) 5,900 cf Overall x 27.0% Voids
#2	887.50'	40,499 cf	**Bio Basin (Prismatic)**Listed below (Recalc) -Impervious
		42,092 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
885.50	2,950	0	0
887.50	2,950	5,900	5,900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
887.50	9,342	0	0
891.00	13,800	40,499	40,499

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**15.0" Round HDPE_Round 15"** L= 51.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 885.50' / 883.46' S= 0.0400 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	885.50'	**1.0" Vert. Underdrain** C= 0.600
#3	Device 1	888.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	889.50'	**36.0" Horiz. 36" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	890.50'	**10.0' long 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
#6	Discarded	885.50'	**3.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 10.55 hrs HW=885.56' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.55 cfs @ 13.20 hrs HW=889.03' TW=0.00' (Dynamic Tailwater)
└**1=HDPE_Round 15"** (Passes 0.55 cfs of 10.06 cfs potential flow)
  ├**2=Underdrain** (Orifice Controls 0.05 cfs @ 8.99 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.50 cfs @ 2.53 fps)
  └**4=36" Standpipe** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=885.50' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link OUT: Outfall

Inflow Area = 5.530 ac, 69.62% Impervious, Inflow Depth = 0.66" for 1-Year event
Inflow = 2.13 cfs @ 12.14 hrs, Volume= 0.302 af
Primary = 2.13 cfs @ 12.14 hrs, Volume= 0.302 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment A: Area to Bio Basin Runoff Area=3.880 ac 94.33% Impervious Runoff Depth=2.51"
Tc=6.0 min CN=97 Runoff=15.45 cfs 0.811 af

Subcatchment U: Uncontrolled Area Runoff Area=1.650 ac 11.52% Impervious Runoff Depth=0.97"
Tc=6.0 min CN=77 Runoff=2.84 cfs 0.133 af

Pond BB: Bio-Basin Peak Elev=889.28' Storage=20,296 cf Inflow=15.45 cfs 0.811 af
Discarded=0.25 cfs 0.514 af Primary=0.74 cfs 0.297 af Secondary=0.00 cfs 0.000 af Outflow=0.99 cfs 0.812 af

Link OUT: Outfall Inflow=2.96 cfs 0.430 af
Primary=2.96 cfs 0.430 af

Total Runoff Area = 5.530 ac Runoff Volume = 0.945 af Average Runoff Depth = 2.05"
30.38% Pervious = 1.680 ac 69.62% Impervious = 3.850 ac

Summary for Subcatchment A: Area to Bio Basin

Runoff = 15.45 cfs @ 12.13 hrs, Volume= 0.811 af, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (ac)	CN	Description
*	3.430	98	Impervious Areas
	0.220	74	>75% Grass cover, Good, HSG C
*	0.230	100	Water
	3.880	97	Weighted Average
	0.220		5.67% Pervious Area
	3.660		94.33% Impervious Area

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

Summary for Subcatchment U: Uncontrolled Area

Runoff = 2.84 cfs @ 12.14 hrs, Volume= 0.133 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-Year Rainfall=2.85"

	Area (ac)	CN	Description
*	0.190	98	Impervious Roof
	1.460	74	>75% Grass cover, Good, HSG C
	1.650	77	Weighted Average
	1.460		88.48% Pervious Area
	0.190		11.52% Impervious Area

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

Summary for Pond BB: Bio-Basin

Inflow Area = 3.880 ac, 94.33% Impervious, Inflow Depth = 2.51" for 2-Year event
Inflow = 15.45 cfs @ 12.13 hrs, Volume= 0.811 af
Outflow = 0.99 cfs @ 13.11 hrs, Volume= 0.812 af, Atten= 94%, Lag= 59.2 min
Discarded = 0.25 cfs @ 9.75 hrs, Volume= 0.514 af
Primary = 0.74 cfs @ 13.11 hrs, Volume= 0.297 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
Peak Elev= 889.28' @ 13.11 hrs Surf.Area= 2,950 sf Storage= 20,296 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 359.4 min (1,120.9 - 761.6)

Volume	Invert	Avail.Storage	Storage Description
#1	885.50'	1,593 cf	**Engineered Soil (Prismatic)**Listed below (Recalc) 5,900 cf Overall x 27.0% Voids
#2	887.50'	40,499 cf	**Bio Basin (Prismatic)**Listed below (Recalc) -Impervious
		42,092 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
885.50	2,950	0	0
887.50	2,950	5,900	5,900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
887.50	9,342	0	0
891.00	13,800	40,499	40,499

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**15.0" Round HDPE_Round 15"** L= 51.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 885.50' / 883.46' S= 0.0400 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	885.50'	**1.0" Vert. Underdrain** C= 0.600
#3	Device 1	888.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	889.50'	**36.0" Horiz. 36" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	890.50'	**10.0' long 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
#6	Discarded	885.50'	**3.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 9.75 hrs HW=885.56' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.74 cfs @ 13.11 hrs HW=889.28' TW=0.00' (Dynamic Tailwater)
└**1=HDPE_Round 15"** (Passes 0.74 cfs of 10.50 cfs potential flow)
  ├**2=Underdrain** (Orifice Controls 0.05 cfs @ 9.32 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.69 cfs @ 3.52 fps)
  └**4=36" Standpipe** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=885.50' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link OUT: Outfall

Inflow Area = 5.530 ac, 69.62% Impervious, Inflow Depth = 0.93" for 2-Year event
Inflow = 2.96 cfs @ 12.15 hrs, Volume= 0.430 af
Primary = 2.96 cfs @ 12.15 hrs, Volume= 0.430 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment A: Area to Bio Basin Runoff Area=3.880 ac 94.33% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=97 Runoff=22.68 cfs 1.219 af

Subcatchment U: Uncontrolled Area Runoff Area=1.650 ac 11.52% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=77 Runoff=5.65 cfs 0.262 af

Pond BB: Bio-Basin Peak Elev=889.79' Storage=26,330 cf Inflow=22.68 cfs 1.219 af
Discarded=0.25 cfs 0.574 af Primary=5.84 cfs 0.645 af Secondary=0.00 cfs 0.000 af Outflow=6.08 cfs 1.219 af

Link OUT: Outfall Inflow=7.69 cfs 0.907 af
Primary=7.69 cfs 0.907 af

Total Runoff Area = 5.530 ac Runoff Volume = 1.481 af Average Runoff Depth = 3.21"
30.38% Pervious = 1.680 ac 69.62% Impervious = 3.850 ac

Summary for Subcatchment A: Area to Bio Basin

Runoff = 22.68 cfs @ 12.13 hrs, Volume= 1.219 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.12"

	Area (ac)	CN	Description
*	3.430	98	Impervious Areas
	0.220	74	>75% Grass cover, Good, HSG C
*	0.230	100	Water
	3.880	97	Weighted Average
	0.220		5.67% Pervious Area
	3.660		94.33% Impervious Area

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

Summary for Subcatchment U: Uncontrolled Area

Runoff = 5.65 cfs @ 12.14 hrs, Volume= 0.262 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-Year Rainfall=4.12"

	Area (ac)	CN	Description
*	0.190	98	Impervious Roof
	1.460	74	>75% Grass cover, Good, HSG C
	1.650	77	Weighted Average
	1.460		88.48% Pervious Area
	0.190		11.52% Impervious Area

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

Summary for Pond BB: Bio-Basin

Inflow Area = 3.880 ac, 94.33% Impervious, Inflow Depth = 3.77" for 10-Year event
Inflow = 22.68 cfs @ 12.13 hrs, Volume= 1.219 af
Outflow = 6.08 cfs @ 12.33 hrs, Volume= 1.219 af, Atten= 73%, Lag= 12.3 min
Discarded = 0.25 cfs @ 9.15 hrs, Volume= 0.574 af
Primary = 5.84 cfs @ 12.33 hrs, Volume= 0.645 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
Peak Elev= 889.79' @ 12.33 hrs Surf.Area= 2,950 sf Storage= 26,330 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 290.2 min (1,044.9 - 754.6)

Volume	Invert	Avail.Storage	Storage Description
#1	885.50'	1,593 cf	**Engineered Soil (Prismatic)**Listed below (Recalc) 5,900 cf Overall x 27.0% Voids
#2	887.50'	40,499 cf	**Bio Basin (Prismatic)**Listed below (Recalc) -Impervious
		42,092 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
885.50	2,950	0	0
887.50	2,950	5,900	5,900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
887.50	9,342	0	0
891.00	13,800	40,499	40,499

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**15.0" Round HDPE_Round 15"** L= 51.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 885.50' / 883.46' S= 0.0400 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	885.50'	**1.0" Vert. Underdrain** C= 0.600
#3	Device 1	888.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	889.50'	**36.0" Horiz. 36" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	890.50'	**10.0' long 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
#6	Discarded	885.50'	**3.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 9.15 hrs HW=885.56' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=5.80 cfs @ 12.33 hrs HW=889.79' TW=0.00' (Dynamic Tailwater)
└**1=HDPE_Round 15"** (Passes 5.80 cfs of 11.31 cfs potential flow)
  ├**2=Underdrain** (Orifice Controls 0.05 cfs @ 9.92 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.96 cfs @ 4.91 fps)
  └**4=36" Standpipe** (Weir Controls 4.78 cfs @ 1.76 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=885.50' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link OUT: Outfall

Inflow Area = 5.530 ac, 69.62% Impervious, Inflow Depth = 1.97" for 10-Year event
Inflow = 7.69 cfs @ 12.30 hrs, Volume= 0.907 af
Primary = 7.69 cfs @ 12.30 hrs, Volume= 0.907 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs

Time span=0.00-240.00 hrs, dt=0.05 hrs, 4801 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

Subcatchment A: Area to Bio Basin Runoff Area=3.880 ac 94.33% Impervious Runoff Depth=6.19"
Tc=6.0 min CN=97 Runoff=36.41 cfs 2.002 af

Subcatchment U: Uncontrolled Area Runoff Area=1.650 ac 11.52% Impervious Runoff Depth=3.96"
Tc=6.0 min CN=77 Runoff=11.55 cfs 0.545 af

Pond BB: Bio-Basin Peak Elev=890.67' Storage=37,633 cf Inflow=36.41 cfs 2.002 af
Discarded=0.25 cfs 0.640 af Primary=12.60 cfs 1.343 af Secondary=1.77 cfs 0.020 af Outflow=14.61 cfs 2.003 af

Link OUT: Outfall Inflow=23.55 cfs 1.908 af
Primary=23.55 cfs 1.908 af

Total Runoff Area = 5.530 ac Runoff Volume = 2.547 af Average Runoff Depth = 5.53"
30.38% Pervious = 1.680 ac 69.62% Impervious = 3.850 ac

Summary for Subcatchment A: Area to Bio Basin

Runoff = 36.41 cfs @ 12.13 hrs, Volume= 2.002 af, Depth= 6.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year Rainfall=6.55"

	Area (ac)	CN	Description
*	3.430	98	Impervious Areas
	0.220	74	>75% Grass cover, Good, HSG C
*	0.230	100	Water
	3.880	97	Weighted Average
	0.220		5.67% Pervious Area
	3.660		94.33% Impervious Area

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

Summary for Subcatchment U: Uncontrolled Area

Runoff = 11.55 cfs @ 12.13 hrs, Volume= 0.545 af, Depth= 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-Year Rainfall=6.55"

	Area (ac)	CN	Description
*	0.190	98	Impervious Roof
	1.460	74	>75% Grass cover, Good, HSG C
	1.650	77	Weighted Average
	1.460		88.48% Pervious Area
	0.190		11.52% Impervious Area

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

Summary for Pond BB: Bio-Basin

Inflow Area = 3.880 ac, 94.33% Impervious, Inflow Depth = 6.19" for 100-Year event
Inflow = 36.41 cfs @ 12.13 hrs, Volume= 2.002 af
Outflow = 14.61 cfs @ 12.26 hrs, Volume= 2.003 af, Atten= 60%, Lag= 8.1 min
Discarded = 0.25 cfs @ 6.45 hrs, Volume= 0.640 af
Primary = 12.60 cfs @ 12.26 hrs, Volume= 1.343 af
Secondary = 1.77 cfs @ 12.26 hrs, Volume= 0.020 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs
Peak Elev= 890.67' @ 12.26 hrs Surf.Area= 2,950 sf Storage= 37,633 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 211.3 min (958.5 - 747.2)

Volume	Invert	Avail.Storage	Storage Description
#1	885.50'	1,593 cf	**Engineered Soil (Prismatic)**Listed below (Recalc) 5,900 cf Overall x 27.0% Voids
#2	887.50'	40,499 cf	**Bio Basin (Prismatic)**Listed below (Recalc) -Impervious
		42,092 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
885.50	2,950	0	0
887.50	2,950	5,900	5,900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
887.50	9,342	0	0
891.00	13,800	40,499	40,499

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**15.0" Round HDPE_Round 15"** L= 51.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 885.50' / 883.46' S= 0.0400 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	885.50'	**1.0" Vert. Underdrain** C= 0.600
#3	Device 1	888.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	889.50'	**36.0" Horiz. 36" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	890.50'	**10.0' long 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
#6	Discarded	885.50'	**3.600 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 6.45 hrs HW=885.56' (Free Discharge)
└**6=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=12.59 cfs @ 12.26 hrs HW=890.66' TW=0.00' (Dynamic Tailwater)
└**1=HDPE_Round 15"** (Inlet Controls 12.59 cfs @ 10.26 fps)
  ├**2=Underdrain** (Passes < 0.06 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 1.31 cfs potential flow)
  └**4=36" Standpipe** (Passes < 36.73 cfs potential flow)

Secondary OutFlow Max=1.66 cfs @ 12.26 hrs HW=890.66' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 1.66 cfs @ 1.01 fps)

Summary for Link OUT: Outfall

Inflow Area = 5.530 ac, 69.62% Impervious, Inflow Depth = 4.14" for 100-Year event
Inflow = 23.55 cfs @ 12.14 hrs, Volume= 1.908 af
Primary = 23.55 cfs @ 12.14 hrs, Volume= 1.908 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-240.00 hrs, dt= 0.05 hrs

INFILTRATION & SEDIMENT CONTROL CALCULATIONS

Infiltration:

The following calculations using the WinSLAMM output indicates that the proposed development will infiltrate greater than 60% of the pre-development infiltration volume for the site area suitable for infiltration.

Pre-development Infiltration results:

Development	Area (Acres)	SLAMM Soil Type	Average Annual Rainfall Volume (cuft)	Pre-Development Runoff Volume (cuft)	Pre-Development Infiltration Volume (cuft)
Non-Residential	5.530	Silty	578,329[1]	21,355	556,974

1: Total Rainfall x Drainage Area = Avg. Annual Rainfall Volume
28.81 in (1 ft/12 in) x 5.530 acres (43,560 sq ft/ 1 acre) = 578,329 cuft

Minimum required post-development infiltration volume: 556,974 cuft x 0.60 = **334,184 cuft**

Post-Development Infiltration results:

Description	Area (Acres)	SLAMM Soil Type	Average Annual Rainfall Volume (cuft)	Post-Development Runoff Volume (cuft)	Post-Development Infiltration Volume (cuft)
Non-Residential	5.530	Silty	578,329[1]	77,515	**500,814**

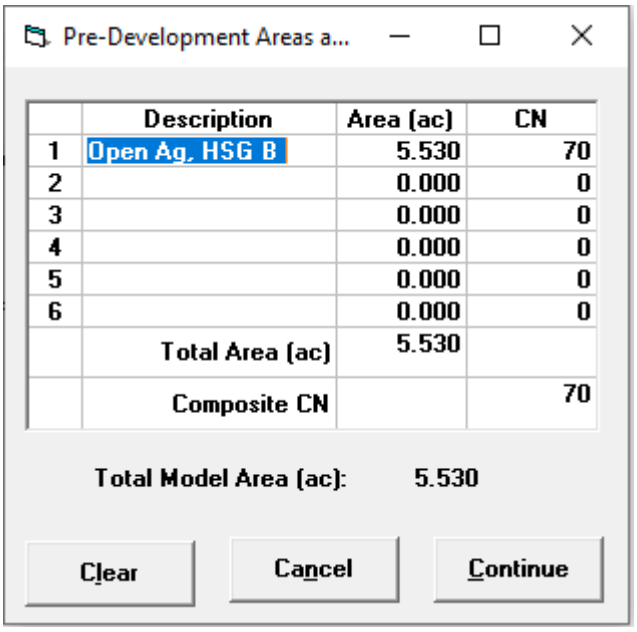
Infiltration Summary
500,814 cu ft (Post-Development) > 334,184 cu ft (60% Pre-Development)

Sediment Control:

The following calculations using the WinSLAMM output indicates that the proposed development will remove 80% of total suspended solids (TSS).

WinSLAMM Model Summary:

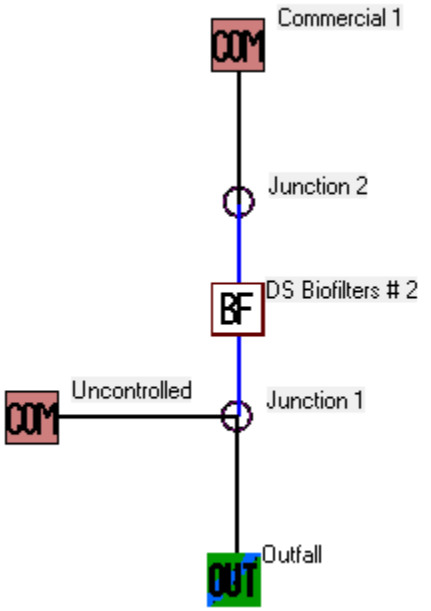
Pre-Development:



Rain Number	Start Date	Rain Total (in)	Outfall Total (cf)	Rv	Total Losses (in.)	Calculated CN*	Event Peak Flow (cfs)	Pre-Dev Runoff Vol.
Minimum:		0.00	0	0.002	0.01	72.3	0.000	0.0
Maximum:		2.59	23533	0.453	1.53	99.6	1.700	10015.0
Average:		0.26	711.1	0.035	0.23	83.4	0.715	237.3
Total:		28.81	77515		25.02			21355.00

INFILTRATION & SEDIMENT CONTROL CALCULATIONS

Post-Development



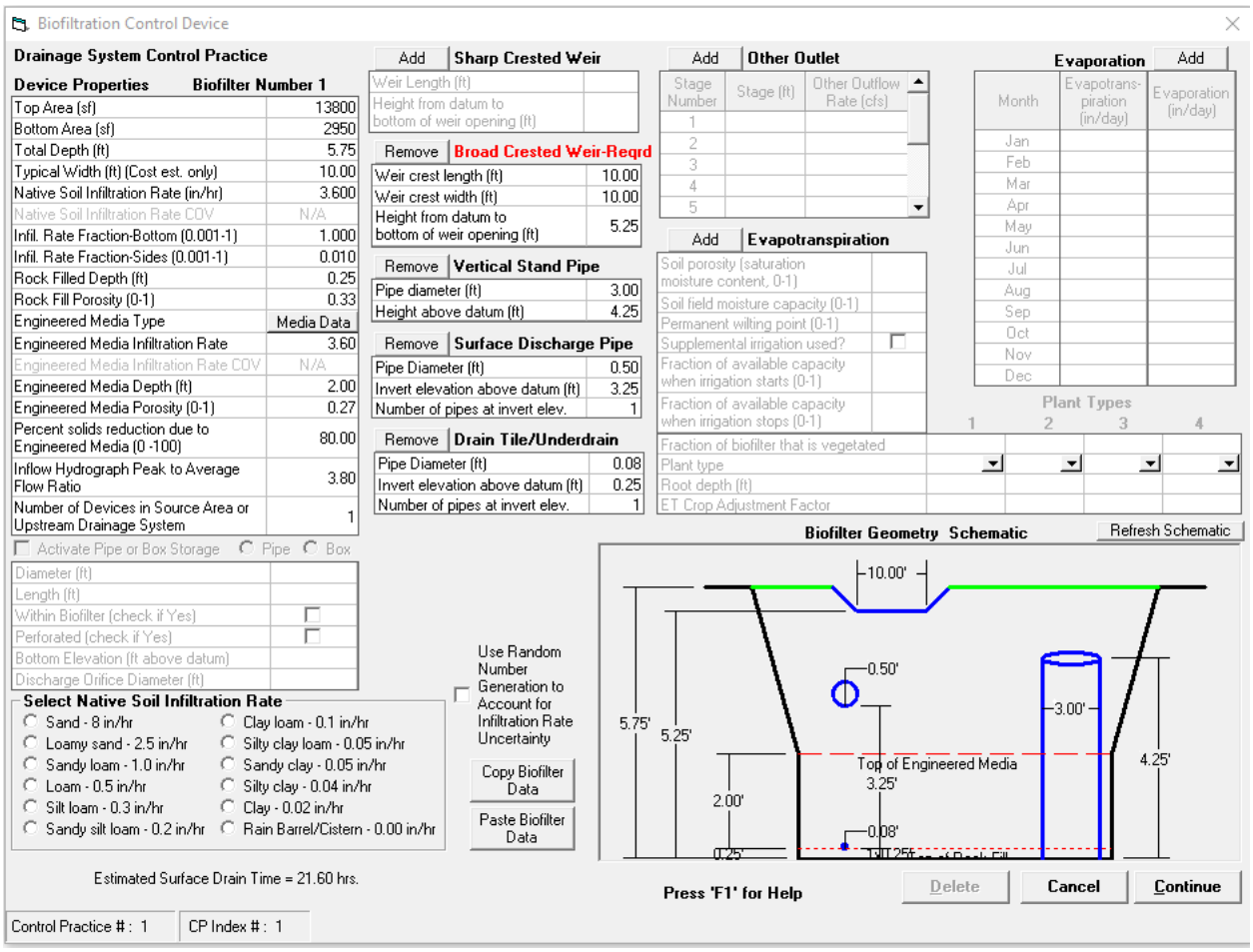
Land Use:
Area to BioBasin

Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	1.520			
1	Roofs 1	1.520	Entered	--	--
	Parking	1.910			
13	Paved Parking 1	1.910	Entered	--	--
	Driveways/Sidewalks	0.000			
	Streets	0.000			
	Landscaped Areas	0.220			
45	Large Landscaped Areas 1	0.220	Entered	--	--
	Other Areas	0.230			
70	Water Body Areas	0.230	Entered	--	--

Land Use:
Uncontrolled

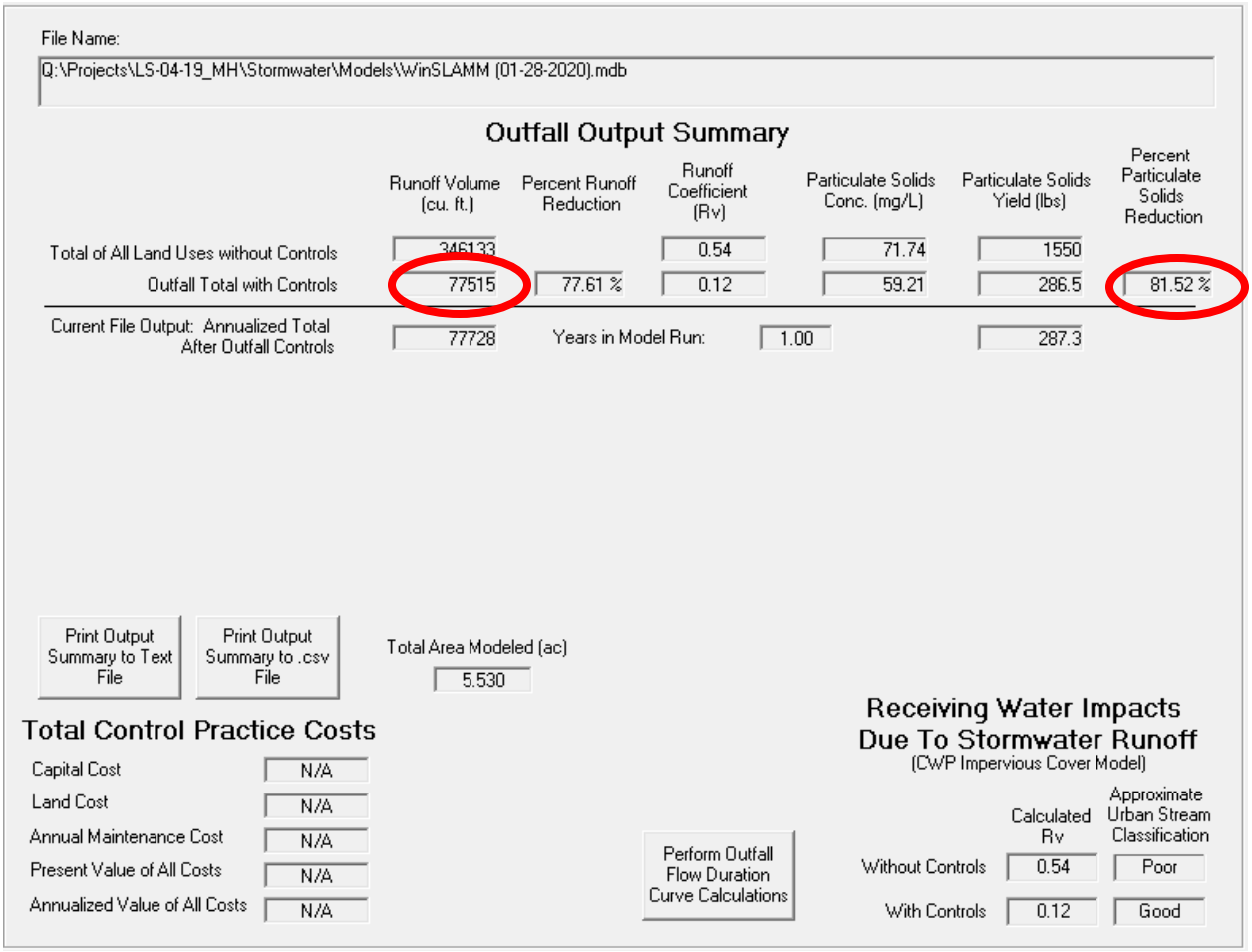
Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
	Roofs	0.190			
1	Roofs 1	0.190	Entered	--	--
	Parking	0.000			
	Driveways/Sidewalks	0.000			
	Streets	0.000			
	Landscaped Areas	1.460			
57	Undeveloped Areas 1	1.460	Entered	--	--
	Other Areas	0.000			

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Commercial	Area to BioBasin	3.880
2	**Commercial**	**Uncontrolled**	**1.650**


Biofiltration Control Device
Drainage System Control Practice
Device Properties
Biofilter Number 1
Top Area (sf) 13800
Bottom Area (sf) 2950
Total Depth (ft) 5.75
Typical Width (ft) (Cost est. only) 10.00
Native Soil Infiltration Rate (in/hr) 3.600
Native Soil Infiltration Rate COV N/A
Infil. Rate Fraction-Bottom (0.001-1) 1.000
Infil. Rate Fraction-Sides (0.001-1) 0.010
Rock Filled Depth (ft) 0.25
Rock Fill Porosity (0-1) 0.33
Engineered Media Type Media Data
Engineered Media Infiltration Rate 3.60
Engineered Media Infiltration Rate COV N/A
Engineered Media Depth (ft) 2.00
Engineered Media Porosity (0-1) 0.27
Percent solids reduction due to Engineered Media (0 -100) 80.00
Inflow Hydrograph Peak to Average Flow Ratio 3.80
Number of Devices in Source Area or Upstream Drainage System 1
Activate Pipe or Box Storage
Pipe
Box
Diameter (ft)
Length (ft)
Within Biofilter (check if Yes)
Perforated (check if Yes)
Bottom Elevation (ft above datum)
Discharge Orifice Diameter (ft)
Select Native Soil Infiltration Rate
Sand - 8 in/hr
Loamy sand - 2.5 in/hr
Sandy loam - 1.0 in/hr
Loam - 0.5 in/hr
Silt loam - 0.3 in/hr
Sandy silt loam - 0.2 in/hr
Clay loam - 0.1 in/hr
Silty clay loam - 0.05 in/hr
Sandy clay - 0.05 in/hr
Silty clay - 0.04 in/hr
Clay - 0.02 in/hr
Rain Barrel/Cistern - 0.00 in/hr
Estimated Surface Drain Time = 21.60 hrs.
Add Sharp Crested Weir
Weir Length (ft)
Height from datum to bottom of weir opening (ft)
Remove Broad Crested Weir-Reqrd
Weir crest length (ft) 10.00
Weir crest width (ft) 10.00
Height from datum to bottom of weir opening (ft) 5.25
Remove Vertical Stand Pipe
Pipe diameter (ft) 3.00
Height above datum (ft) 4.25
Remove Surface Discharge Pipe
Pipe Diameter (ft) 0.50
Invert elevation above datum (ft) 3.25
Number of pipes at invert elev. 1
Remove Drain Tile/Underdrain
Pipe Diameter (ft) 0.08
Invert elevation above datum (ft) 0.25
Number of pipes at invert elev. 1
Use Random Number Generation to Account for Infiltration Rate Uncertainty
Copy Biofilter Data
Paste Biofilter Data
Add Other Outlet
Stage Number
Stage (ft)
Other Outflow Rate (cfs)
1
2
3
4
5
Add Evapotranspiration
Soil porosity (saturation moisture content, 0-1)
Soil field moisture capacity (0-1)
Permanent wilting point (0-1)
Supplemental irrigation used?
Fraction of available capacity when irrigation starts (0-1)
Fraction of available capacity when irrigation stops (0-1)
Plant Types
1
2
3
4
Fraction of biofilter that is vegetated
Plant type
Root depth (ft)
ET Crop Adjustment Factor
Evaporation
Add
Month
Evapotrans-piration (in/day)
Evaporation (in/day)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Biofilter Geometry Schematic
Refresh Schematic
10.00'
0.50'
3.00'
5.75'
5.25'
Top of Engineered Media
3.25'
4.25'
2.00'
0.08'
0.25'
Press 'F1' for Help
Delete
Cancel
Continue
Control Practice # : 1
CP Index # : 1

INFILTRATION & SEDIMENT CONTROL CALCULATIONS

WinSLAMM Output Summary:



File Name:

Q:\Projects\LS-04-19_MH\Stormwater\Models\WinSLAMM (01-28-2020).mdb

Outfall Output Summary

	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of All Land Uses without Controls	346133		0.54	71.74	1550	
Outfall Total with Controls	77515	77.61 %	0.12	59.21	286.5	81.52 %
Current File Output: Annualized Total After Outfall Controls	77728	Years in Model Run:	1.00		287.3	

Print Output Summary to Text File

Print Output Summary to .csv File

Total Area Modeled (ac): 5.530

Total Control Practice Costs

Capital Cost	N/A
Land Cost	N/A
Annual Maintenance Cost	N/A
Present Value of All Costs	N/A
Annualized Value of All Costs	N/A

Perform Outfall Flow Duration Curve Calculations

Receiving Water Impacts Due To Stormwater Runoff
(CWP Impervious Cover Model)

	Calculated Rv	Approximate Urban Stream Classification
Without Controls	0.54	Poor
With Controls	0.12	Good

INFILTRATION & SEDIMENT CONTROL CALCULATIONS

WinSLAMM Input Data:

Data file name: Q:\Projects\LS-04-19_MH\Stormwater\Models\WinSLAMM (01-28-2020).mdb
WinSLAMM Version 10.4.0
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Madison WI 1981.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: 01/01/81 Study period ending date: 12/31/81
Start of Winter Season: 12/02 End of Winter Season: 03/12
Date: 01-31-2020 Time: 12:09:34
Site information:

Pre-Development Area Description	Pre-Development Area (ac)	Pre-Development CN
Open Ag, HSG B	5.530	70
Total Area (ac)/Composite CN	5.530	70

LU# 1 - Commercial: Area to BioBasin Total area (ac): 3.880
1 - Roofs 1: 1.520 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
13 - Paved Parking 1: 1.910 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.220 ac. Normal Clayey Medium/High Density Alleys Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
70 - Water Body Areas: 0.230 ac. Source Area PSD File:

LU# 2 - Commercial: Uncontrolled Total area (ac): 1.650
1 - Roofs 1: 0.190 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
57 - Undeveloped Areas 1: 1.460 ac. Normal Clayey Medium/High Density No Alleys Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

INFILTRATION & SEDIMENT CONTROL CALCULATIONS

Control Practice 1: Biofilter CP# 1 (DS) - DS Biofilters # 2

1. Top area (square feet) = 13800
2. Bottom aea (square feet) = 2950
3. Depth (ft): 5.75
4. Biofilter width (ft) - for Cost Purposes Only: 10
5. Infiltration rate (in/hr) = 3.6
6. Random infiltration rate generation? No
7. Infiltration rate fraction (side): 0.01
8. Infiltration rate fraction (bottom): 1
9. Depth of biofilter that is rock filled (ft) 0.25
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

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: 5.25

Outlet type: Vertical Stand Pipe

1. Stand pipe diameter (ft): 3
2. Stand pipe height above datum (ft): 4.25

Outlet type: Surface Discharge Pipe

1. Surface discharge pipe outlet diameter (ft): 0.5
2. Pipe invert elevation above datum (ft): 3.25
3. Number of surface pipe outlets: 1

Outlet type: Drain Tile/Underdrain

1. Underdrain outlet diameter (ft): 0.08
2. Invert elevation above datum (ft): 0.25
3. Number of underdrain outlets: 1

Ditch Velocity Worksheet

PROJECT: Arthur Drive Mini-Warehouses - City of Milton
FILE NUMBER: LS-04-20
LOCATION: South side of site

Enter the channel characteristics (see Diagram 1):

Channel Slope (S):	0.008	feet/feet
10-Year Design Flow (Q):	15.18	CFS
100-Year Design Flow (Q):	31.58	CFS
Bottom Width (W):	4.0	feet
Avg. Side Slope (X):	4	horiz./vert.
Min. Depth of Channel (Y):	2	feet
Retardance Class:	D	
Manning's Number (N):	0.03	

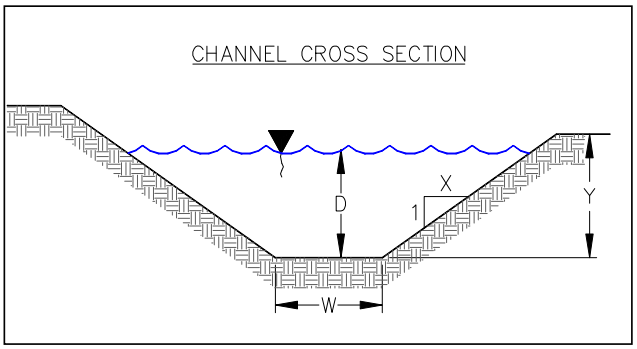


Diagram 1

The channel will behave as follows:

	10-Year	100-Year
Hydraulic Radius (R):	**0.52 ft**	**0.70 ft**
Depth (D):	**0.75 ft**	**1.08 ft**
Velocity (V):	**2.87 ft/s**	**3.50 ft/s**
Shear Stress:	**0.38 psf**	

10-Year Peak Flow Rate:

Using the Rational Method:

Q_{10} =CIA= 0.15 4.28 23.6 = 15.18 cfs

C = 0.15 Agriculture, HSG B, slopes 2-6%
I = 4.28 in/hr per City of **Milton** rainfall intensity for Time of Concentration = 15 min
A = 23.6 acres;

100-Year Peak Flow Rate:

Using the Rational Method:

Q_{100} =CIA= 0.21 6.36 23.6 = 31.58 cfs

C = 0.21 Agriculture, HSG B, slopes 2-6%
I = 6.36 in/hr per City of **Milton** rainfall intensity for Time of Concentration = 15 min
A = 23.6 acres;

* The rational method runoff coefficients and rainfall intensity were determined using the Wisconsin Department of Transportation Facilities Development Manual Procedure 13-10-5 Figures 2 and 4.

Designed By:	MAF
Date:	2/4/2020
Checked By:	AFF
Date:	2/4/2020

Ditch Velocity Worksheet

PROJECT: Arthur Drive Mini-Warehouses - City of Milton
FILE NUMBER: LS-04-20
LOCATION: North Side of site

Enter the channel characteristics (see Diagram 1):

Channel Slope (S):	0.008	feet/feet
10-Year Design Flow (Q):	0.61	CFS
100-Year Design Flow (Q):	1.13	CFS
Bottom Width (W):	4.0	feet
Avg. Side Slope (X):	4	horiz./vert.
Min. Depth of Channel (Y):	2	feet
Retardance Class:	D	
Manning's Number (N):	0.03	

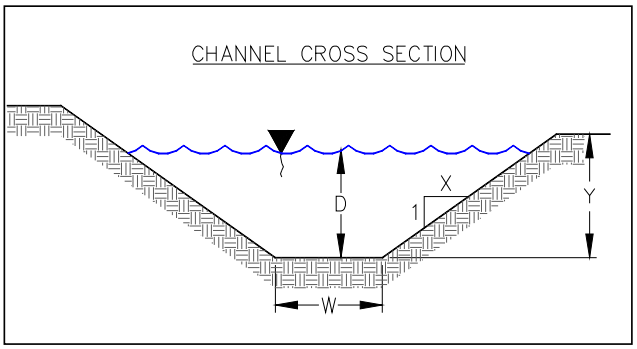


Diagram 1

The channel will behave as follows:

	10-Year	100-Year
Hydraulic Radius (R):	**0.11 ft**	**0.16 ft**
Depth (D):	**0.13 ft**	**0.18 ft**
Velocity (V):	**1.05 ft/s**	**1.29 ft/s**

Shear Stress: **0.06 psf**

10-Year Peak Flow Rate:

Using the Rational Method:

Q_{10} =CIA= 0.72 7.20 0.1 = 0.61 cfs

C = 0.72 Commercial, HSG B, slopes 2-6%
I = 7.20 in/hr per City of **Milton** rainfall intensity for Time of Concentration = 5 min
A = 0.12 acres;

100-Year Peak Flow Rate:

Using the Rational Method:

Q_{100} =CIA= 0.89 10.70 0.1 = 1.13 cfs

C = 0.89 Commercial, HSG B, slopes 2-6%
I = 10.70 in/hr per City of **Milton** rainfall intensity for Time of Concentration = 5 min
A = 0.12 acres;

* The rational method runoff coefficients and rainfall intensity were determined using the Wisconsin Department of Transportation Facilities Development Manual Procedure 13-10-5 Figures 2 and 4.

Designed By:	MAF
Date:	2/4/2020
Checked By:	AFF
Date:	2/4/2020

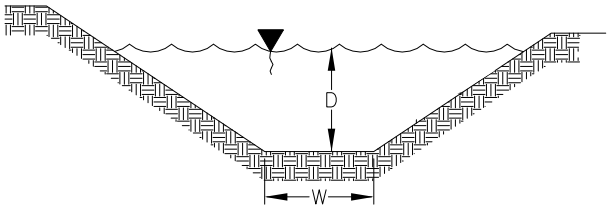
W.D.O.T. FACILITIES DEVELOPMENT MANUAL
EROSION MAT DESIGN

Description:

Drainage Swale – South side of site

Given:

CHANNEL CROSS SECTION



Width (W) = 4 feet
Depth (D_{10}) = 0.74 feet
Slope (s) = 0.008 ft/ft

Calculate maximum shear stress in the swale, τ_m:

$\tau_m = \gamma ds = (62.4 \text{ lb/ft}^2)(0.74 \text{ ft})(0.008 \text{ ft/ft}) = 0.36 \text{ lb/ft}^2$

Double Netted Light Duty (WisDOT Class I Type B) erosion mat: $\tau_{m(permissible)} = 1.5 \text{ lb/ft}^2$
(Permissible Shear Stress per Facilities Development Manual 10-5-35 Figure 1)

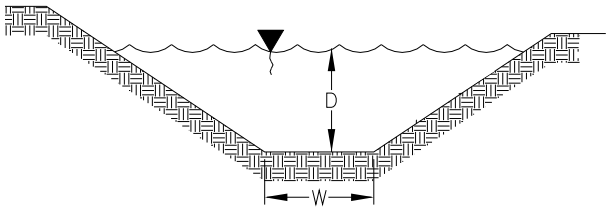
W.D.O.T. FACILITIES DEVELOPMENT MANUAL
EROSION MAT DESIGN

Description:

Drainage Swale – North side of site

Given:

CHANNEL CROSS SECTION



Width (W) = 4 feet
Depth (D_{10}) = 0.13feet
Slope (s) = 0.008 ft/ft

Calculate maximum shear stress in the swale, τ_m:

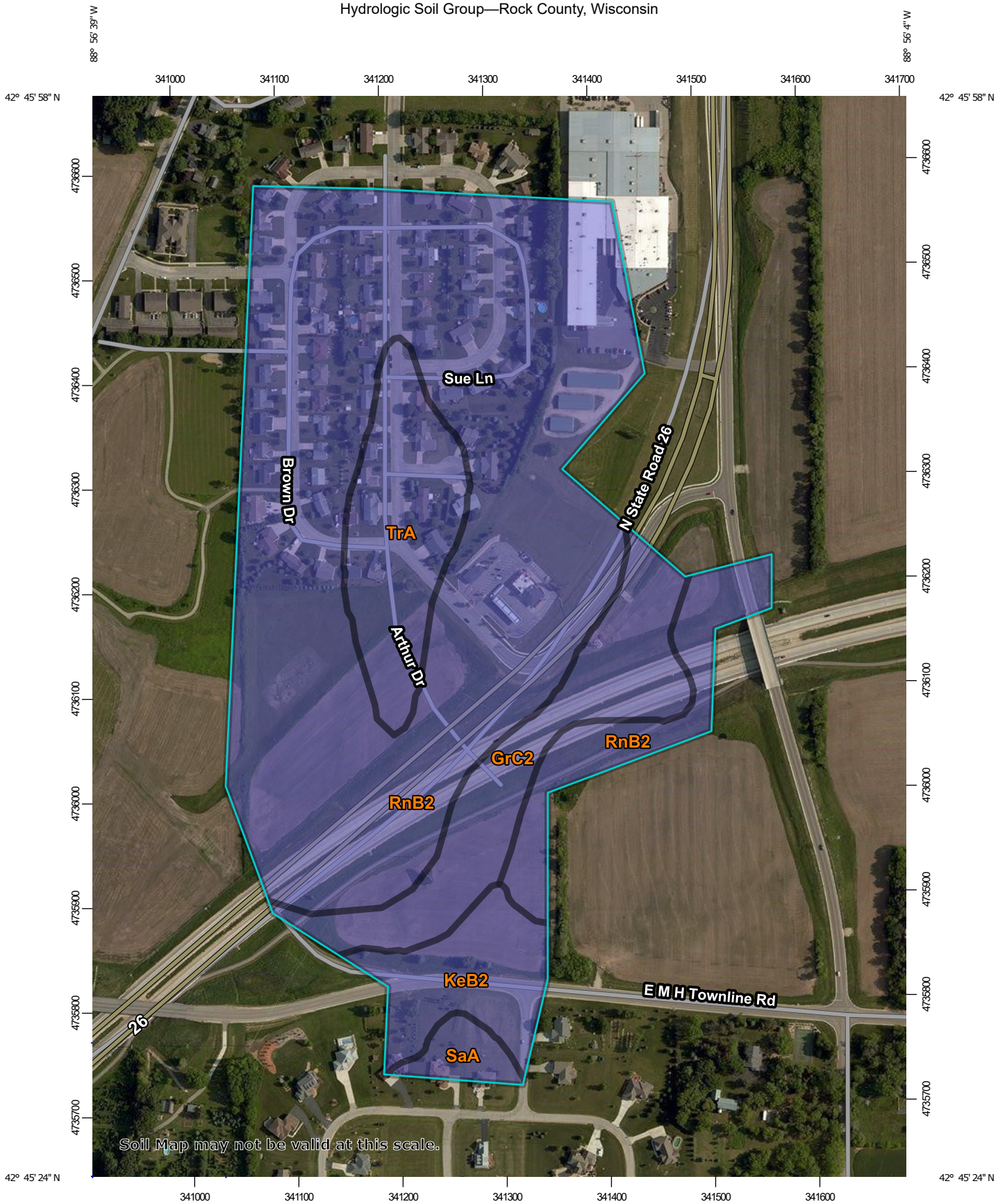
$\tau_m = \gamma ds = (62.4 \text{ lb/ft}^2)(0.13 \text{ ft})(0.008 \text{ ft/ft}) = 0.06 \text{ lb/ft}^2$

Double Netted Light Duty (WisDOT Class I Type B) erosion mat: $\tau_{m(permissible)} = 1.5 \text{ lb/ft}^2$
(Permissible Shear Stress per Facilities Development Manual 10-5-35 Figure 1)

COST ESTIMATE

The following table summarizes the estimated cost of installation for all elements of erosion control and storm water management for the proposed development.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Amount
1.	Stone Construction Entrance	1	EA	$500.00	$500.00
2.	Silt Fence or Sock	980	LF	$2.00	$1,960.00
3.	Temporary Rock Check Dam	3	EA	$150.00	$450.00
4.	Flex Storm Inlet Protection	2	EA	$150.00	$300.00
5.	Medium Riprap w/ Fabric	40	CY	$25.00	$1,000.00
6.	WisDOT Class I, Type B, Erosion Mat	5,000	SY	$1.00	$5,000.00
7.	Bio-retention Device w/ 6” underdrain	2,950	SF	$15.00	$44,250.00
8.	15” HDPE Storm Sewer	89	LF	$25.00	$2,225.00
9.	2’x3’ Inlet w/ Neenah R-3067	2	EA	$1,200.00	$2,400.00
10.	3’ Dia Outlet Structure w/ Trash Rack	1	EA	$1,750.00	$1,750.00
11.	Restoration (seed and mulch)	4,000	SY	$0.50	$2,000.00
	Total				**$61,835.00**



Map Scale: 1:5,030 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Rock County, Wisconsin
Survey Area Data: Version 17, Sep 14, 2019

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

Date(s) aerial images were photographed: Jun 6, 2015—Jun 10, 2015

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
GrC2	Griswold loam, 6 to 12 percent slopes, eroded	B	8.0	11.3%
KeB2	Kidder silt loam, 2 to 6 percent slopes, eroded	B	4.5	6.4%
RnB2	Ringwood silt loam, 2 to 6 percent slopes, eroded	B	50.6	71.1%
SaA	St. Charles silt loam, 0 to 2 percent slopes	B	1.2	1.7%
TrA	Troxel silt loam, 0 to 3 percent slopes	B	6.8	9.6%
Totals for Area of Interest			**71.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

QUAM ENGINEERING, LLC 4604 Siggelkow Road, Suite A – McFarland, WI 53558 (608) 838-7750 \LS-04-19\LS04BASE.DWG

TEST PIT #1
TEST PIT #2
TEST PIT #3
TEST PIT #4
infiltration=887.66
TEST PIT #5
TEST PIT #6
160'
96'
162'
180'
171'
140'
147'
N09°41'13"W 298.23'
S49°08'29"W 603.46'
S50°56'12"W 423.27'
S41°17'48"E 319.75'
GAS
OHEL
SAN
883
885
890
892
894
895
897
900
905
910

0 40 80

ARTHUR DRIVE MINI-WAREHOUSES – CITY OF MILTON
TEST PIT MAP

PAGE: 1
DATED: JANUARY 16, 2020

QUAM ENGINEERING, LLC
Residential and Commercial Site Design Consultants
www.quamengineering.com
4604 Siggelkow Road, Suite A – McFarland, Wisconsin 53558
Phone (608) 838-7750; Fax (608) 838-7752

Attachment 2:

SOIL AND SITE EVALUATION – STORM

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

1002-CPS-23
Division of Industry Services
P. O. Box 2658
Madison, Wisconsin 53701
Scott Walker, Governor
Laura Gutierrez, Secretary

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

Please print all information

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

County: Rock
Parcel I.D.:
Reviewed by:
Date:

Property Owner: Hickey, Anthony
Property Owner' Mail Address: 5409 N. Cypress Dr.
City: Milton State: WI Zip Code: 53563-9435 Phone Number:

Property Location: Govt. Lot ¼ SE ¼ S 34 T 4 N R 13 (E) or W
Lot # | Block # | Subd. Name or CSM #
☒ City ☐ Village ☐ Town: Milton
Nearest Road: Arthur Dr.

Drainage area _____ ☐ sq .ft ☐ acres

Test site suitable for (check all that apply): ☐ Site not suitable;
☐ Bioretention; ☐ Subsurface Dispersal System;
☐ Reuse; ☐ Irrigation; ☐ Other _____

Hydraulic Application Test Method
☒ Morphological Evaluation
☐ Double Ring Infiltrometer
☐ Other: (specify) _____

Soil Moisture
Date of soil borings: _____
USDA-NRCS WETS Value:
☐ Dry = 1;
☒ Normal = 2;
☐ Wet = 3.

B1 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 893 ft. Elevation of limiting factor 893 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-42	10YR 4/4	fill	*grs	0m	mvfr	as	25	–	0
2	42-52	10YR 3/2	—	sil	2mgr	mfr	cs	5	–	.13
3	52-115	10YR 4/4	C2d 10YR 7/2 7.5YR 5/8	sicl	1m6bk	mfr	—	5	–	.04

Comments: * Mixed Fill with silt loam and scl.

B2 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 893.2 ft. Elevation of limiting factor 883.2 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-8	10YR 3/2	—	sil	2mgr	mfr	cs	5	–	.13
2	8-34	10YR 4/4	—	cl	1m2bk	mfr	gw	5	–	.03
3	34-100	10YR 5/4	—	grs	0sg	ml	gw	50	–	3.6
4	100-120	10YR 5/4	—	sl	1fpl	mvfr	—	15	–	.5

Comments:

Name (Please Print): Jeffrey T. Levake
Signature:
Credential Number: 225372
Address: P.O. Box 568 Lake Mills, WI 53551
Date Evaluation Conducted: 1-27-2020
Telephone Number: 720-988-7567

SBD-10793 (R01/17)

WDNR
September 2017

B3 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 897.2 ft. Elevation of limiting factor 884.7 ft. Page 2 of 2

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-72	10YR 3/2	—	sil	2mgr	mfr	cs	5	—	.13
2	72-100	10YR 4/4	—	cl	1msbk	mfr	gw	5	—	.03
3	100-150	10YR 5/4	—	grs	osgr	ml	—	50	—	3.6

Comments:

B4 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 893 ft. Elevation of limiting factor 883 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-24	10YR 3/2	—	sil	2mgr	mfr	cs	5	—	.13
2	24-64	7.5YR 4/4	—	cl	1msbk	mfr	gw	5	—	.03
3	64-120	10YR 5/4	—	grs	Osgr	ml	—	50	—	3.6

Comments:

B5 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 889.7 ft. Elevation of limiting factor 889.7 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-48	10YR 3/2	Fill	sil	1mgr	mfr	cs	5	—	.13
2	48-84	10YR 4/4	F/F 7.5YR 5/8	sicl	1msbk	mfr	gw	5	—	.04
3	84-144	7.5YR 4/4	C2d 7.5YR 5/8 10YR 7/2	scl	1msbk	mfr	—	5	—	.11

Comments:

B6 #OBS. ☒ Pit ☐ Boring Ground surface elevation. 889 ft. Elevation of limiting factor 889 ft.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr
1	0-72	10YR 3/2	Fill	sil	1mgr	mfr	cs	5	—	.13
2	72-112	10YR 4/4	F/F 7.5YR 5/8	sicl	1msbk	mfr	gw	5	—	.04
3	112-144	7.5YR 4/4	C2d 7.5YR 5/8 10YR 7/2	scl	1msbk	mfr	—	5	—	.11

Comments:

Overall Site Comments:

Stormwater Maintenance Plan

Storm Sewer:

- Visual inspection of components shall be performed, and debris removed from inlets and storm sewer manholes.

- Repair inlet/outlet areas that are damaged or show signs of erosion.

- Repairs must restore the component to the specifications of the original plan.

Riprap

- Riprap should be inspected after all storm events for displaced stones and erosion. All necessary repairs should be made immediately.

- Accumulated sediment should be removed periodically.

Bio-Retention Device

- Owner shall install and maintain Bio-Retention Device in accordance with plans approved by the City. Owner shall maintain records of installation, inspections, cleaning and any other maintenance all in accordance with the applicable Ordinances. Visual Inspection of the Bio-Retention Device shall be performed monthly to identify and repair eroded areas and remove liter and debris, if applicable.

- The Owner shall maintain plants by watering, weeding, hand pulling and/or herbicide applications, restoring plant saucers around planting holes, tightening and repairing any guy supports, replacing flagging of guy wires, pruning and resetting plants to proper grades or vertical positions, as required to establish healthy, viable plantings. Herbicide treatments shall be performed by licensed applicators who are experienced with native and non-native plant identification. Herbicides will be used in full conformance with label requirements and application techniques will limit overspray and damage to off-target species.

- The Owner is responsible for a spot selective invasive weed control treatment on the entire basin area once in the initial growing season, two times in the first full growing season after seeding, two times in the second full growing season after seeding, and three times in the third full growing season after seeding. This can include combinations of hand weed control and selective herbicide treatment. Herbicide treatment can be conducted with tools such as handheld or backpack sprayers. Examples of common invasive species to be controlled from spread are Narrow-leaved cattail and reed canary grass in wetland areas; Canada thistle, Flowering spurge, Common teasel, Sweet clover, Red clover, Wild parsnip are examples of more upland type species to be controlled. Applications to perennial weeds need to occur prior to seed formation of such species. If such species do go to seed, contractor is responsible for cutting the seed heads, bagging them, and removing them from the project site. Herbicide applications that are necessary must be performed by qualified personnel trained in the identification of native species and also licensed appropriately for herbicide applications in the state or region in which they are applying.

- Watering shall be provided every day for the first 10 days after installation, if rainfall is not sufficient. If plantings are planted in spring, water for 3 to 6 weeks after seed placement. If plantings are planted in the fall, water for 3 to 6 weeks in the spring if dry conditions exist until established. Apply water in a manner to preclude puddling, washing and erosion. The equivalent of one-half inch of rainfall per week shall be considered the minimum until germination.

- All areas of the Bio-Retention Device where the mulch has been displaced shall be re-mulched as needed. Additional mulch shall be applied annually.

- Snow shall not be dumped directly onto the Bio-Retention Device.

- Maintenance of the Bio-Retention Device shall conform to Wisconsin Department of Natural Resources Technical Standard 1004.

- Repair shall be required when system shows standing water beyond 24 hours of rain event. Cleaning shall consist of removal of sediment, two (2) foot undercut, undercut replacement with material consisting of 30% compost and 70% sand and restoration in-kind. Restoration of plant material shall be by plugging, not seeding alone.

- Any alterations to approved Bio-Retention Device shall be approved by the City. Owner shall maintain records of inspections, cleaning and replacement of the Bio-Retention Device all in accordance with the City Ordinances.