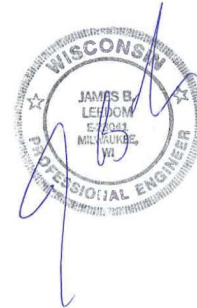


Harlow and Hem Mixed Use Development Stormwater Management Report

7470 Blanchard Street
Wauwatosa, WI

PREPARED FOR
Mandel Group
330 E. Kilbourn Ave.
Milwaukee, WI, 53202



PREPARED BY

Single Source. Sound Solutions. GROUP

Project Number – 20176
2024/04/03

Terry Meyer, P.E.
Senior Civil Engineer

James Leedom, P.E., LEED A.P.,
Senior Project Engineer

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1. Introduction

This Storm Water Management memo presents the design calculations and considerations for the proposed redevelopment located at the corner of Wauwatosa Avenue and Blanchard Street in Wauwatosa, WI. The proposed redevelopment encompasses approximately 1.58 acres. The proposed project will disturb more than one acre of land but less than two acres. The project will also result in an increase of impervious area over the site by approximately 3509 square feet. This storm water management report serves as a summary of calculations showing the proposed development meets all applicable ordinances.

2. Design Criteria

Wauwatosa, Wisconsin

Wauwatosa Water Quality

- Total Suspended Solids. BMPs shall be designed, installed, and maintained to control total suspended solids carried in runoff from the post-construction site as follows:
 - For redevelopment, reduce to the maximum extent practicable, the total suspended solids load from exposed parking areas and roads by 40%, based on the average annual rainfall, as compared to no runoff management controls.

Wauwatosa Water Quantity and Management of Peak Runoff

- Stormwater quantity control requirements under the City of Wauwatosa storm water management regulations (Chapter 24.13.040) apply to projects that increase impervious area by ½ acre or more. As the project does not create more than ½-acre of additional impervious surface, the City's storm water quantity requirements do not apply to the project.

Wisconsin Department of Natural Resources

- WDNR – Technical Standards (NR151 and NR216)

DNR Water Quality:

- For redevelopment, reduce to the maximum extent practicable, the total suspended solids load by 40%, based on the average annual rainfall, as compared to no runoff management controls.

MMSD Quantity:

- MMSD Chapter 13 storm water management regulations apply to projects that either create more than 5,000 square feet of additional impervious surface, creates more than 1/2-acre of additional impervious surface or a redevelopment project that disturbs more than 2-acres of land. The project will not create more than 1/2-acre of additional impervious surface or disturb more than 2-acres of land. Therefore, the project is exempt from the MMSD peak flow control requirements.
- The project will create between 5,000 square feet and ½-acre of additional impervious. As such, the MMSD Green Infrastructure requirements apply. For projects that create between 5,000 square feet and ½-acre of additional impervious surface, green infrastructure must be designed and implemented with a detention volume equal to ½-inch multiplied by the net new impervious surface area. Green infrastructure includes, but is not limited to, rain gardens, green roofs, bioswales, permeable paving, cisterns and rain gardens. The green infrastructure requirement will be met using porous pavement to be constructed in the surface parking lot.

3. Design Analysis

- Rainfall data used in the hydrologic analysis were obtained from the NOAA Atlas 14 precipitation depths, and the appropriate NRCS Wisconsin MSE3 precipitation distribution for 24 hour duration (1-yr, 2-yr, 10-yr, and 100-yr storm events).

1 year	2 year	10 year	100 year
2.34"	2.64"	3.73"	6.06"

- Curve numbers for the soils within the analysis region were selected from the values published in TR-55. Native soil types were determined from NRCS maps and borings.
- Time of concentration values were calculated based on the standard TR-55 method.
- The hydraulic calculations and analysis presented in this report were performed using HydroCad Watershed Modeling software which utilizes the methodologies of TR-55 for a hydrograph based analysis of watershed conditions. Hydrographs were developed using a standard MSE-3 24-hour hydrograph for the various 24-hr storm events.
- Sediment reduction characteristics for the proposed water quality facilities were determined using WinSLAMM (Version 10.3.4) Source Loading and Management Model.

4. Existing Condition Analysis

The project site currently includes an existing residential/commercial building along Harwood Avenue, a residential building and garage along Blanchard Street and a public surface parking lot at the north east quadrant of Wauwatosa Avenue and Blanchard Street. Approximately 1.36 acres of the disturbed area is covered with impervious surface (buildings or pavements). There are significant grade changes across the site with an approximate 37 ft grade difference between the high north end of the site along Harwood Avenue and the low southern end of the site along Blanchard Street. There are several existing retaining walls on the project used to accommodate the grade changes. An existing conditions survey is included as Appendix C.

5. Proposed Developed Conditions Description

The project site will be redeveloped with a multi-family residential development with below grade parking, and roof top terrace for residence to community gather. A public surface parking is proposed that will have access from Harwood Avenue. The project will disturb the entire site and will result in approximately 1.44 acres of impervious surface which is an increase of 3,509 square feet from existing conditions. The proposed site plan is included in Appendix C.

6. Storm Water Quality Modeling

NR 151 regulations require that the project employ BMPs to reduce sediment load leaving the site from parking and roads by 40% compared to no controls.

Quality Summary Table

Total Suspended Solids Loading	
Total TSS prior to controls/treatment	178.3 lbs
Total TSS After controls/treatment	52.31 lbs
Total Percent TSS Reduction	70.66%

7. Green Infrastructure

The project will create 3508 square feet of additional impervious surface. As such, green infrastructure with a detention volume of 146 cubic feet (1093 gallons) is required for the project. See calculation below.

$$\begin{aligned} 1/2\text{-inch}/12\text{ inches / ft} \times 3508\text{ SF} &= 146\text{ CF} \\ 92\text{ CF} \times 7.481\text{ gallons/CF} &= 1093\text{ gallons} \end{aligned}$$

The green infrastructure requirement will be met using two porous pavement areas within the surface parking lot. The northern porous pavement has approximately 1815 square feet, with 12" of stone storage. The southern porous pavement has approximately 1341 square feet, with 12" of stone storage. Stormwater will infiltrate through the porous pavement and stored in the 12" stone storage layer. A 6 inch underdrain will collect the stormwater from the stone storage layer and convey the stormwater into a private storm sewer system. The storm sewer system will connect into the public storm sewer system within Blanchard Street.

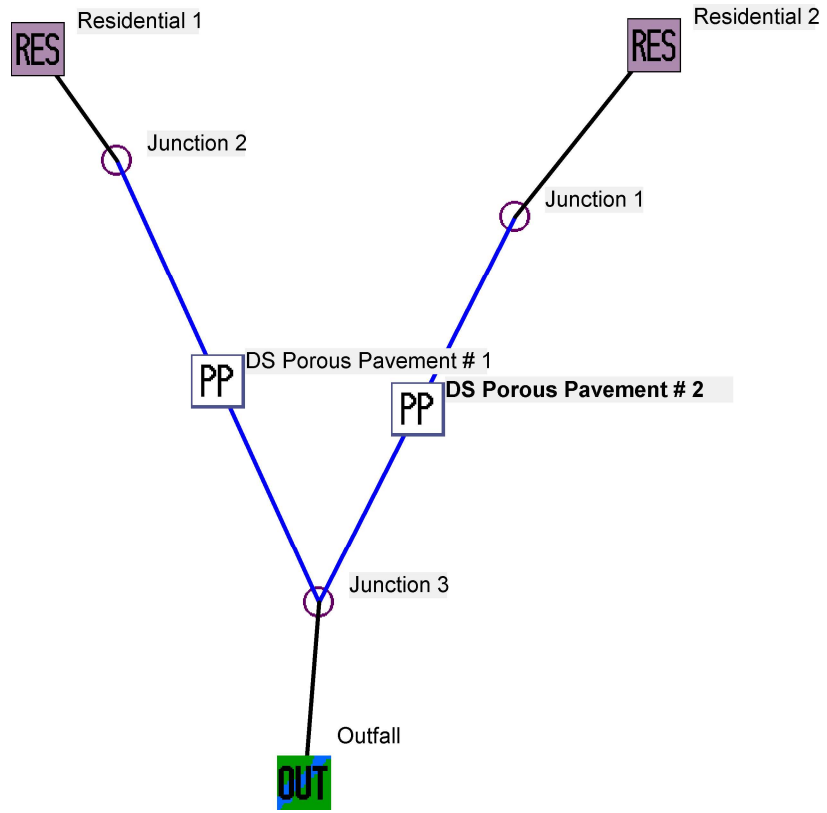
MMSD volume credit for porous pavement is 3 gallons per square feet of porous pavement. The proposed porous pavement for the project is 3156 square feet. The redevelopment would provide 9468 gallons of storage which exceeds the required green infrastructure volume of 1093 gallons.

Therefore, the project meets and exceeds the MMSD and the City of Wauwatosa green infrastructure requirements.

8. Conclusion

The proposed stormwater management plan meets the requirements of the local municipality, WDNR, and other regulatory bodies through the implementation of best management practices described within this report to the greatest extent practicable.

Appendix A Calculations - Storm Water Quality (WinSLAMM)



Data file name: I:\Mandel\20176 Harlow & Hem Tosa Development Surveying\060 CAD 2024\800_SWMP\040_WinSLAMM\20176 H&H WINSLAMM.mdb
WinSLAMM Version 10.4.1
Rain file name: N:\000-CAD Resource Library\Software Support Files\WinSLAMM\Vers 10.0.2 Downloaded November 11, 2013\Parameter Files v10\WisReg - Milwaukee
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.ppd
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
Seed for random number generator: -42
Study period starting date: 01/05/69 Study period ending date: 12/31/69
Start of Winter Season: 12/06 End of Winter Season: 03/28
Date: 04-03-2024 Time: 12:52:14
Site information:

LU# 1 - Residential: Residential 1 Total area (ac): 0.161
13 - Paved Parking 1: 0.161 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Residential: Residential 2 Total area (ac): 0.125
13 - Paved Parking 1: 0.125 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Porous Pavement CP# 1 (DS) - DS Porous Pavement # 1
Porous pavement area (ac): 0.042
Inflow hydrograph peak to average flow ratio: 3.8
Porous pavement thickness (in): 4
Porous pavement porosity: 0.24
Aggregate bedding thickness (in): 4
Aggregate bedding porosity: 0.3
Aggregate base reservoir thickness (in): 12
Aggregate base reservoir porosity: 0.4
Underdrain diameter (in): 6
Underdrain outlet invert elevation (inches above datum): 0
Number of underdrains: 1
Subgrade seepage rate (in/hr): 0.05
Use random number generation to account for uncertainty in seepage rate: 0
Subgrade seepage rate COV: 0
Surface pavement initial infiltration rate (in/hr): 100
Surface pavement initial infiltration rate (in/hr): 100
Surface Pavement Percent Solids Removal Upon Cleaning: 50
Porous pavement surface clogging load (lbs/sf): 0.06
Porous pavement restorative cleaning frequency: Semi-annually
TSS concentration reduction percentage through underdrain: 0
Porous pavement particle size distribution file name: Not needed - calculated by program

Control Practice 2: Porous Pavement CP# 2 (DS) - DS Porous Pavement # 2
Porous pavement area (ac): 0.031
Inflow hydrograph peak to average flow ratio: 3.8
Porous pavement thickness (in): 4
Porous pavement porosity: 0.24
Aggregate bedding thickness (in): 4
Aggregate bedding porosity: 0.3
Aggregate base reservoir thickness (in): 12
Aggregate base reservoir porosity: 0.4
Underdrain diameter (in): 6
Underdrain outlet invert elevation (inches above datum): 0
Number of underdrains: 1
Subgrade seepage rate (in/hr): 0.05
Use random number generation to account for uncertainty in seepage rate: 0
Subgrade seepage rate COV: 0
Surface pavement initial infiltration rate (in/hr): 100
Surface pavement initial infiltration rate (in/hr): 100
Surface Pavement Percent Solids Removal Upon Cleaning: 50
Porous pavement surface clogging load (lbs/sf): 0.06
Porous pavement restorative cleaning frequency: Semi-annually
TSS concentration reduction percentage through underdrain: 0
Porous pavement particle size distribution file name: Not needed - calculated by program

SLAMM for Windows Version 10.4.1
(c) Copyright Robert Pitt and John Voorhees 2019, All Rights Reserved

Data file name: I:\Mandel\20176 Harlow & Hem Tosa Development Surveying\060 CAD 2024\800_SWMP\040_WinSLAMM\20176 H&H WINSLAMM.mdb
WinSLAMM Version 10.4.1

Rain file name: N:\000-CAD Resource Library\Software Support Files\WinSLAMM\Vers 10.0.2 Downloaded November 11, 2013\Parameter Files v10\WisReg - Milwaukee

Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx

Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx

Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx

Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std

Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std

Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std

Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std

Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std

Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std

Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False

Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv

Cost Data file name:

Seed for random number generator: -42

Study period starting date: 01/05/69 Study period ending date: 12/31/69

Start of Winter Season: 12/06 End of Winter Season: 03/28

Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69

Date of run: 04-03-2024 Time of run: 12:51:48

Total Area Modeled (acres): 0.286

Years in Model Run: 0.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	21972	-	130.0	178.3	-
Outfall Total with Controls:	19365	11.87%	27.54	33.29	81.33%
Annualized Total After Outfall Controls:	19634			33.76	

Appendix B Green Infrastructure Detention Volume Calculations

Green Infrastructure Detention Volume Calculations

[1] New and Redeveloped Impervious Area

Land Type	Area <i>acres</i>	Area <i>sq.ft.</i>
Building	1.006	43828
Greenspace	0.143	6229
Impervious	0.436	18992

Existing Impervious	1.362	59322
Proposed Impervious	1.442	62831
New pervious area	0.081	3507

[2] Required Detention Volume	1093 gallons
--------------------------------------	---------------------

[3] Green Infrastructure Unit Detention Volume

Green Infrastructure	Unit Detention Volume
Bioswale	7.5 gal. per sq.ft.
Cistern	Capacity of cistern
Constructed wetlands	8.3 gal. per sq.ft.
Green roof	1 gal. per sq.ft.
Native landscaping	0.4 gal. per sq.ft.
Porous pavement	3 gal. per sq.ft.
Rain garden	4.4 gal. per sq.ft.
Rain barrel	Capacity of barrel
Tree	25 gal. per tree

per MMSD's Chapter 13: Surface Water and Stormwater

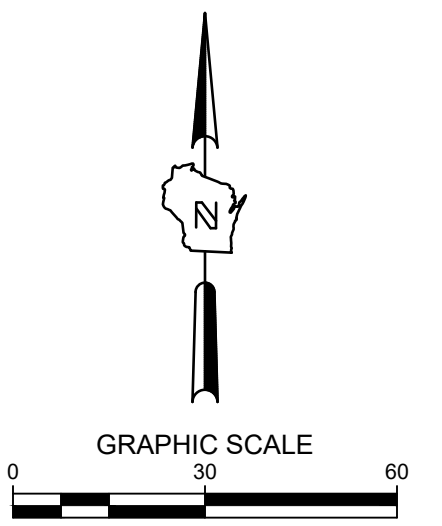
[4] Proposed Green Infrastructure

Proposed Green Infrastructure	Area
Porous Pavement (North)	1815 SF
Porous Pavement (South)	1341 SF
Porous Pavement (North)	5445 gallons
Porous Pavement (South)	4023 gallons
Total Green Infrastructure Area	9468 gallons

[5] Proposed Detention Volume	9468 gallons
Required Detention Volume	1093 gallons

[6] Does it meet requirements?	Yes
---------------------------------------	------------

Appendix C Figures



**HARLOW AND HEM
 7487 HARWOOD AVENUE
 WAUWATOSA, WI**

SITE SURVEY

**PRELIMINARY
 NOT FOR
 CONSTRUCTION**

ISSUANCE	DATE
NO. REVISION	DATE

PROJECT NO:	20176
DESIGN DATE:	---
PLOT DATE:	2024.04.03
DRAWN BY:	---
CHECKED BY:	---
APPROVED BY:	---
SHEET NO:	C001

- LEGEND:**
- SECTION 1/4 SECTION LINE
 - PROPERTY LINE
 - EASEMENT
 - X-X- CHAIN LINK FENCE
 - O-O- GUARD RAIL
 - METAL FENCE
 - WOOD FENCE
 - ~ TREE LINE
 - OH OVERHEAD UTILITY LINE
 - E ELECTRIC
 - T TELEPHONE
 - FO FIBER OPTIC
 - CTV CABLE TV
 - SAN SANITARY SEWER
 - FS FORCE MAIN
 - ST STORM SEWER
 - W WATER MAIN
 - G GAS
 - 670 EXISTING CONTOUR
 - WET WETLAND
 - FP FLOODPLAIN
 - ⊕ UNKNOWN MANHOLE
 - ⊕ SANITARY MANHOLE
 - ⊕ STORM MANHOLE
 - ⊕ ELECTRIC MANHOLE
 - ⊕ MMSD MANHOLE
 - ⊕ TELEPHONE MANHOLE
 - ⊕ CLEANOUT
 - ⊕ CATCH BASIN
 - ⊕ CATCH BASIN (ROUND)
 - ⊕ ROOF DRAIN
 - ⊕ CULVERT END
 - ⊕ HYDRANT
 - ⊕ WATER VALVE
 - ⊕ GAS VALVE
 - ⊕ GAS METER
 - ⊕ ELECTRIC METER
 - ⊕ UTILITY PEDESTAL
 - ⊕ HANDHOLE
 - ⊕ VENT
 - ⊕ MONITORING WELL
 - ⊕ IRON PIPE FOUND/SET
 - ⊕ REBAR FOUND/SET
 - ⊕ CHISELED CROSS FOUND/SET
 - ⊕ PK NAIL FOUND/SET
 - ⊕ SPIKE/NAIL
 - ⊕ MONUMENT
 - ⊕ BENCHMARK
 - ⊕ SIGN
 - ⊕ PARKING METER
 - ⊕ FLAG POLE
 - ⊕ DECIDUOUS TREE
 - ⊕ CONIFEROUS TREE
 - ⊕ BUSH
 - ⊕ POST
 - ⊕ SOIL BORING
 - ⊕ TRAFFIC SIGNAL
 - ⊕ LIGHT POLE
 - ⊕ UTILITY POLE
 - ⊕ GUY WIRE
 - ⊕ GUY POLE



GENERAL NOTES:

1. THE UNDERGROUND UTILITY INFORMATION SHOWN ON THIS DRAWING IS BASED ON FIELD LOCATIONS AND/OR RECORDS FURNISHED BY MUNICIPALITIES AND UTILITY COMPANIES. THE LOCATION AND ACCURACY OF WHICH CANNOT BE GUARANTEED. THERE MAY BE ADDITIONAL UNDERGROUND UTILITY INSTALLATIONS WITHIN THE PROJECT AREA THAT ARE NOT SHOWN.
2. VERIFY ACTUAL LOCATIONS AND INVERTS IN THE FIELD. ANY POTENTIAL ERRORS, OMISSIONS, OR DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROCEEDING WITH CONSTRUCTION.
3. DRAWING IS BASED ON FIELD SURVEY COMPLETED BY THE SIGMA GROUP, INC. ON JUNE 16, 2021.
4. DATUM FOR THE PROJECT SURVEY IS CITY OF WAUWATOSA DATUM. BENCHMARK FOR THE PROJECT SURVEY IS THE WEST 1/4 CORNER OF SECTION 22-7-1 CONCRETE MONUMENT ELEV 127.85.
5. CONTRACTOR TO VERIFY EXISTING CONDITIONS. CONTACT ENGINEER WITH DISCREPANCIES.



CALL DIGGERS HOTLINE
 1-800-242-8511
 TOLL FREE

THE UNDERGROUND UTILITY INFORMATION SHOWN ON THIS MAP IS BASED ON FIELD MARKINGS AND INFORMATION FURNISHED BY UTILITY COMPANIES AND THE LOCAL MUNICIPALITY. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, ITS ACCURACY AND COMPLETENESS CANNOT BE GUARANTEED.

2024.04.03

TMeyer

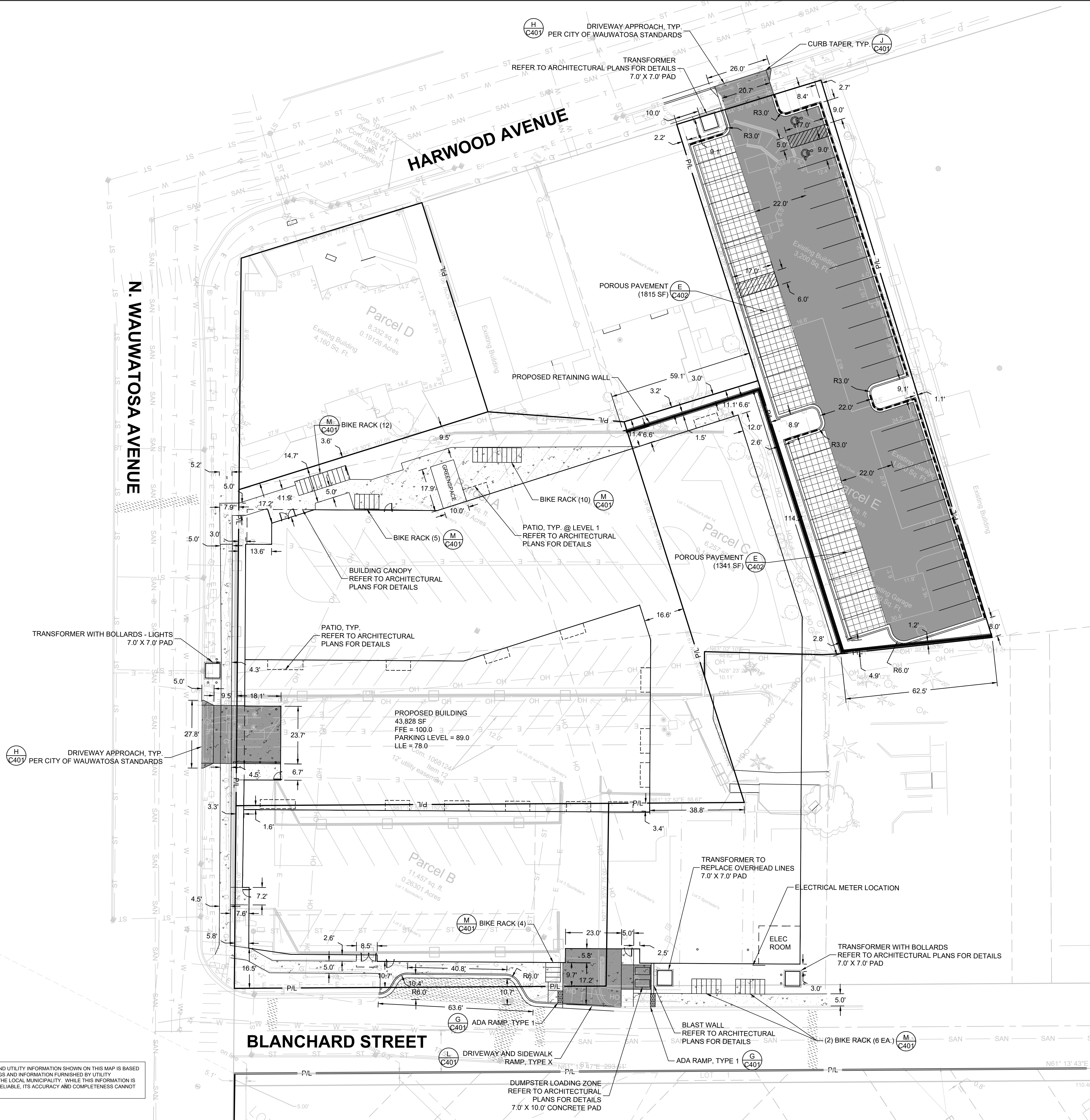
C-100

20176



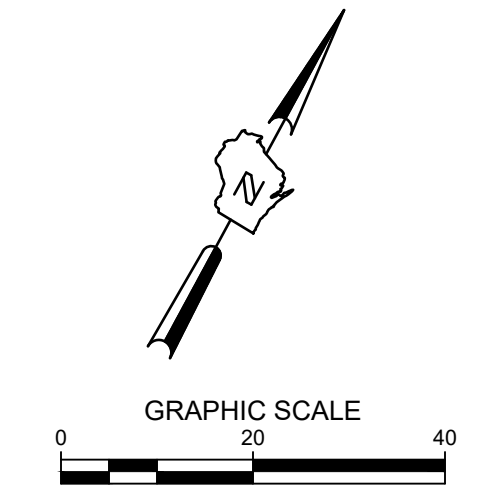
CALL DIGGERS HOTLINE 1-800-242-8511 TOLL FREE WIS. STATUTE 182.07(2)(a) REQUIRES MIN. 3 WORK DAYS NOTICE BEFORE YOU EXCAVATE MILW. AREA 259-1181

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SITE INFORMATION			
SITE AREA	69053	1.585 AC	
SITE DISTURBED AREA	71304	1.637 AC	
EXISTING IMPERVIOUS AREA	59322	1.362 AC	85.9 %
PROPOSED IMPERVIOUS AREA	62831	1.442 AC	91.0 %
TOTAL PARKING SPACES	----		
ADA PARKING SPACES	----		

LEGEND:	
	(A C401) 5' THICK CONCRETE WALK
	(C C401) CONCRETE PAVEMENT
	(B C401) ASPHALT SURFACE
	(E C402) POROUS PAVEMENT
	(D C401) CITY OF WAUWATOSA ASPHALT SURFACE
	(E C401) CURB & GUTTER (ACCEPT)
	(E C401) CURB & GUTTER (REJECT)



HARLOW AND HEM
7487 HARWOOD AVENUE
WAUWATOSA, WI

SITE PLAN

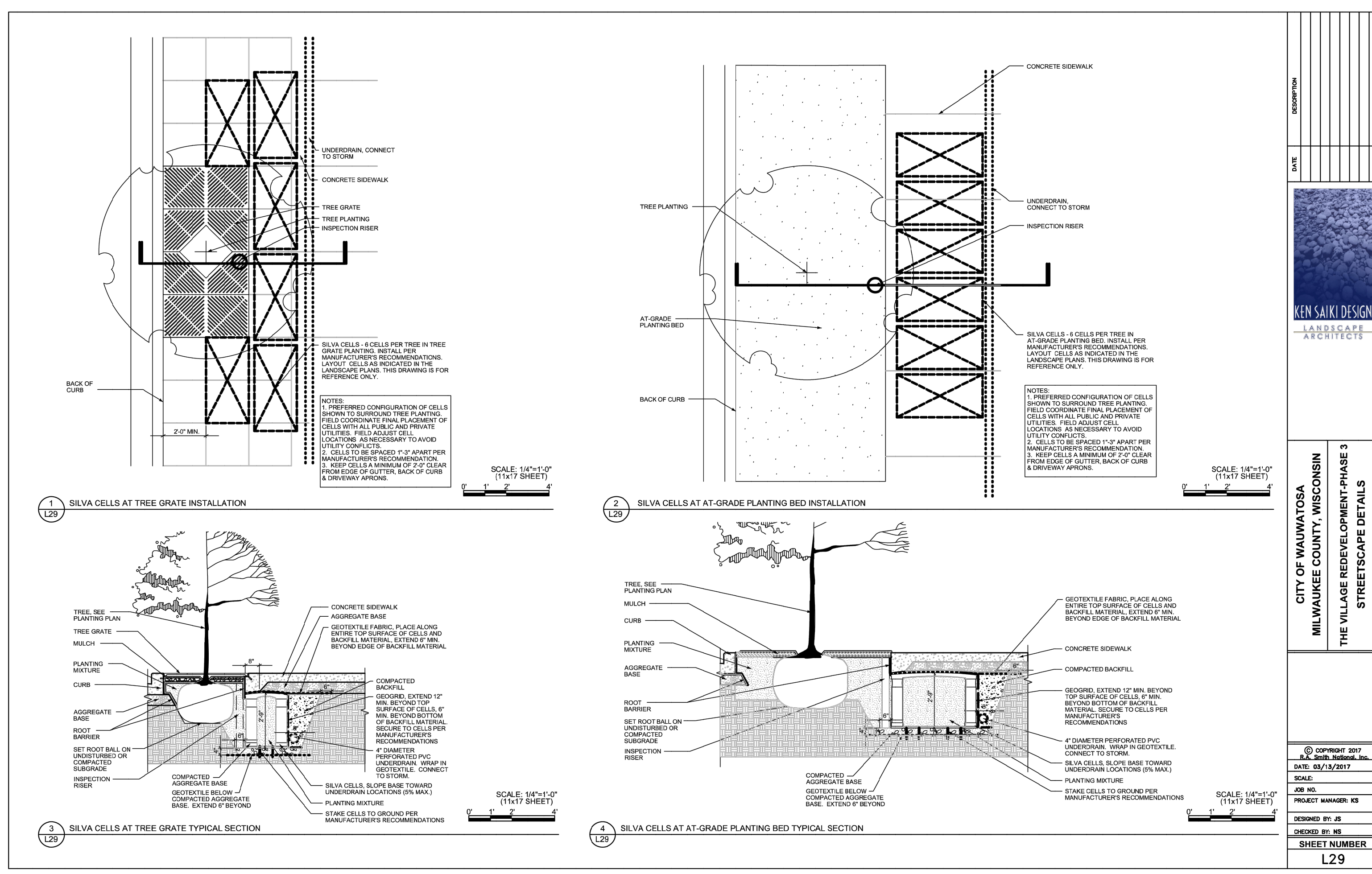
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 - VERIFY ACTUAL LOCATIONS AND INVERTS IN THE FIELD. ANY POTENTIAL ERRORS, OMISSIONS, OR DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROCEEDING WITH CONSTRUCTION.
 - WORK TO BE COMPLETED IS INDICATED IN BOLD TYPE LINES AND EXISTING CONDITIONS ARE INDICATED BY LIGHT TYPE LINES.
 - ELECTRONIC CIVIL FILES ARE AVAILABLE UPON WRITTEN REQUEST. DO NOT USE ELECTRONIC CIVIL FILES TO LAYOUT FOUNDATIONS, COLUMN LINES, LIGHT POLES, OR OTHER NON CIVIL SITE WORK. REFER TO ARCHITECTURAL DRAWINGS FOR DIMENSIONS OF BUILDING AND ARCHITECTURAL FEATURES.
 - DIMENSIONS ARE FROM FACE OF CURB OR EDGE OF PAVEMENT.
 - WORK WITHIN THE PUBLIC RIGHT OF WAY, INCLUDING BUT NOT LIMITED TO DRIVEWAY OPENINGS, SIDEWALK AND RAMPS, PAVING, AND CURB AND GUTTER SHALL BE COMPLETED PER MUNICIPAL AND/OR COUNTY REQUIREMENTS AND STANDARDS.
 - EARTHWORK SHALL BE IN ACCORDANCE WITH GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.

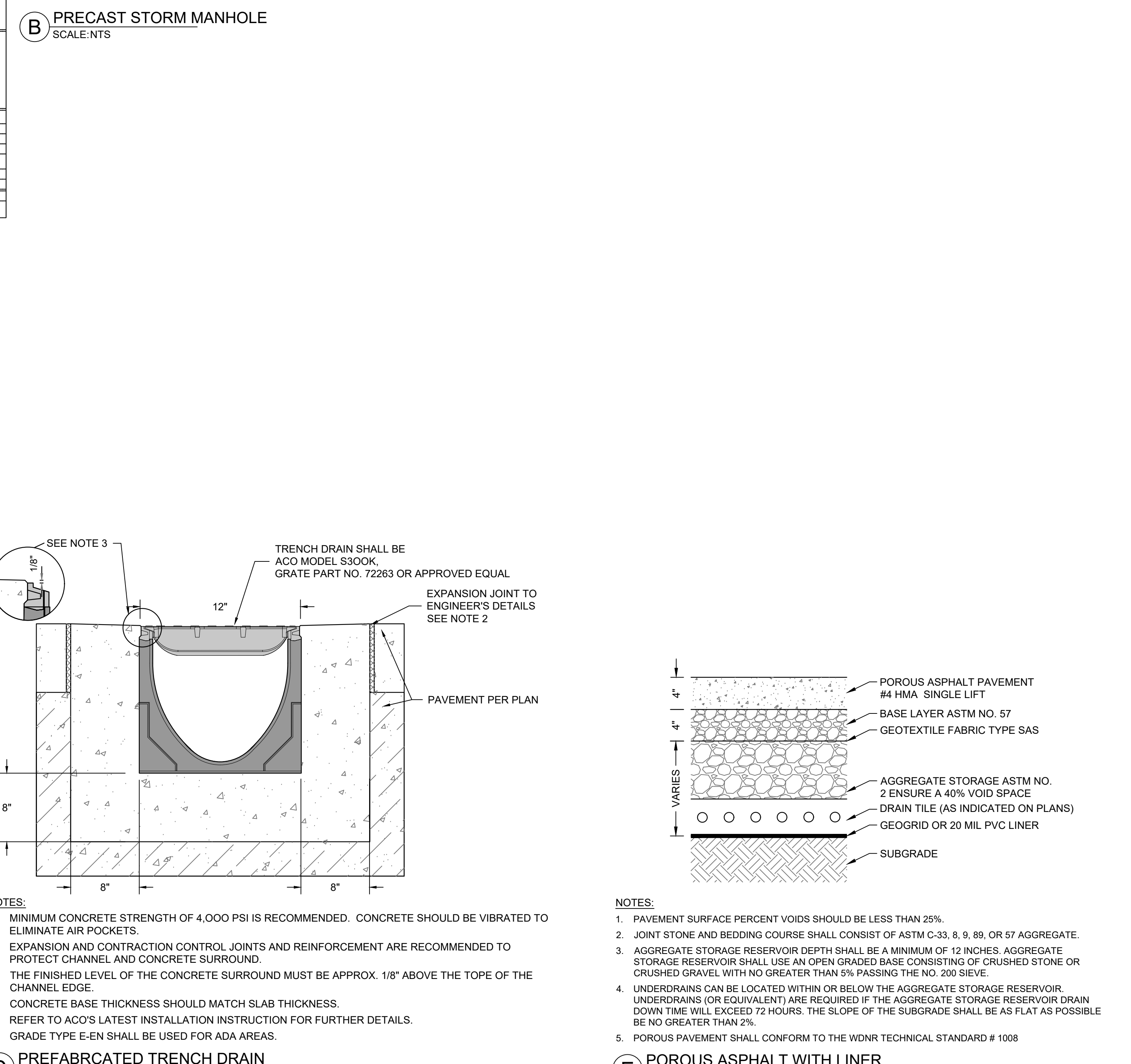
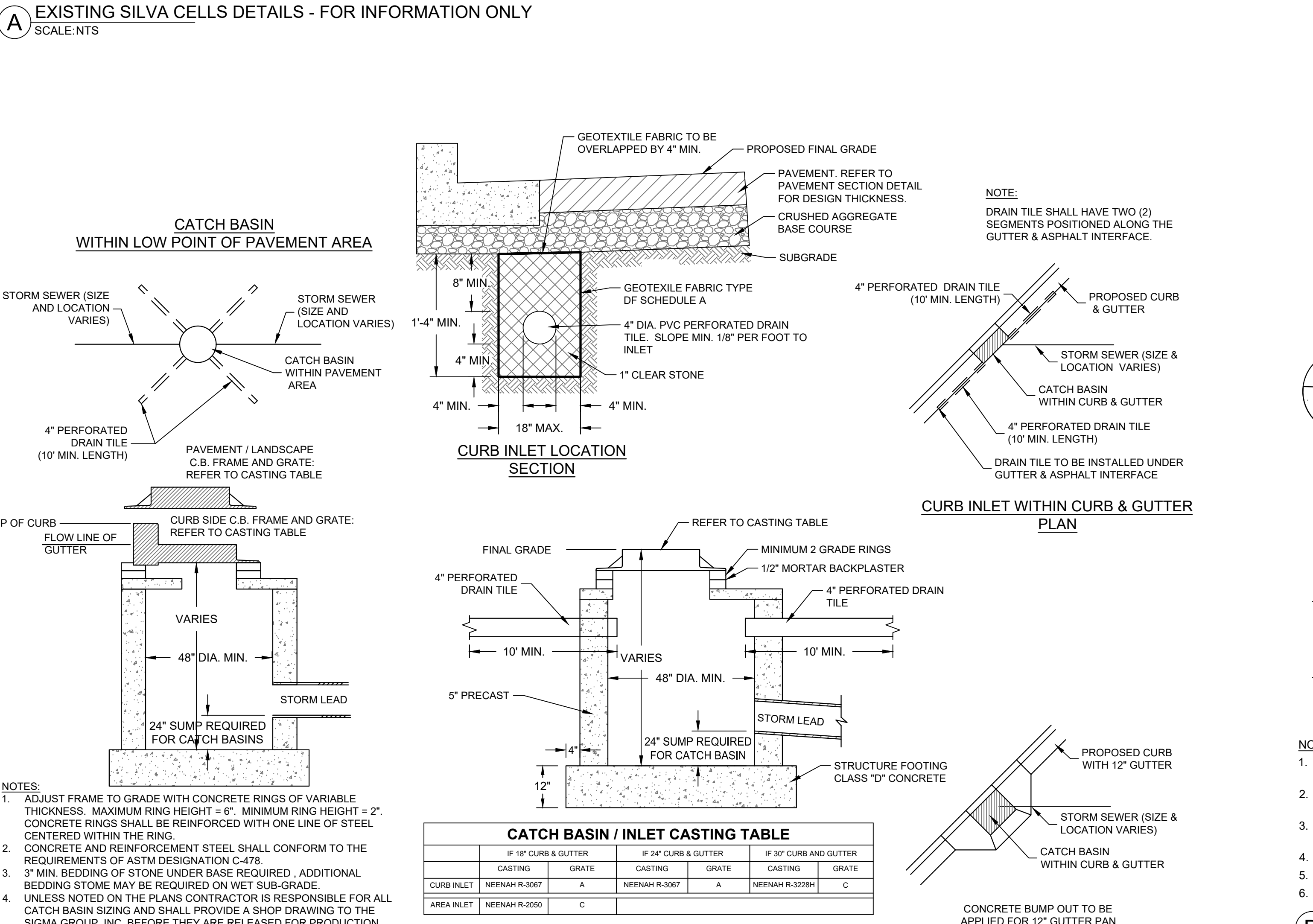
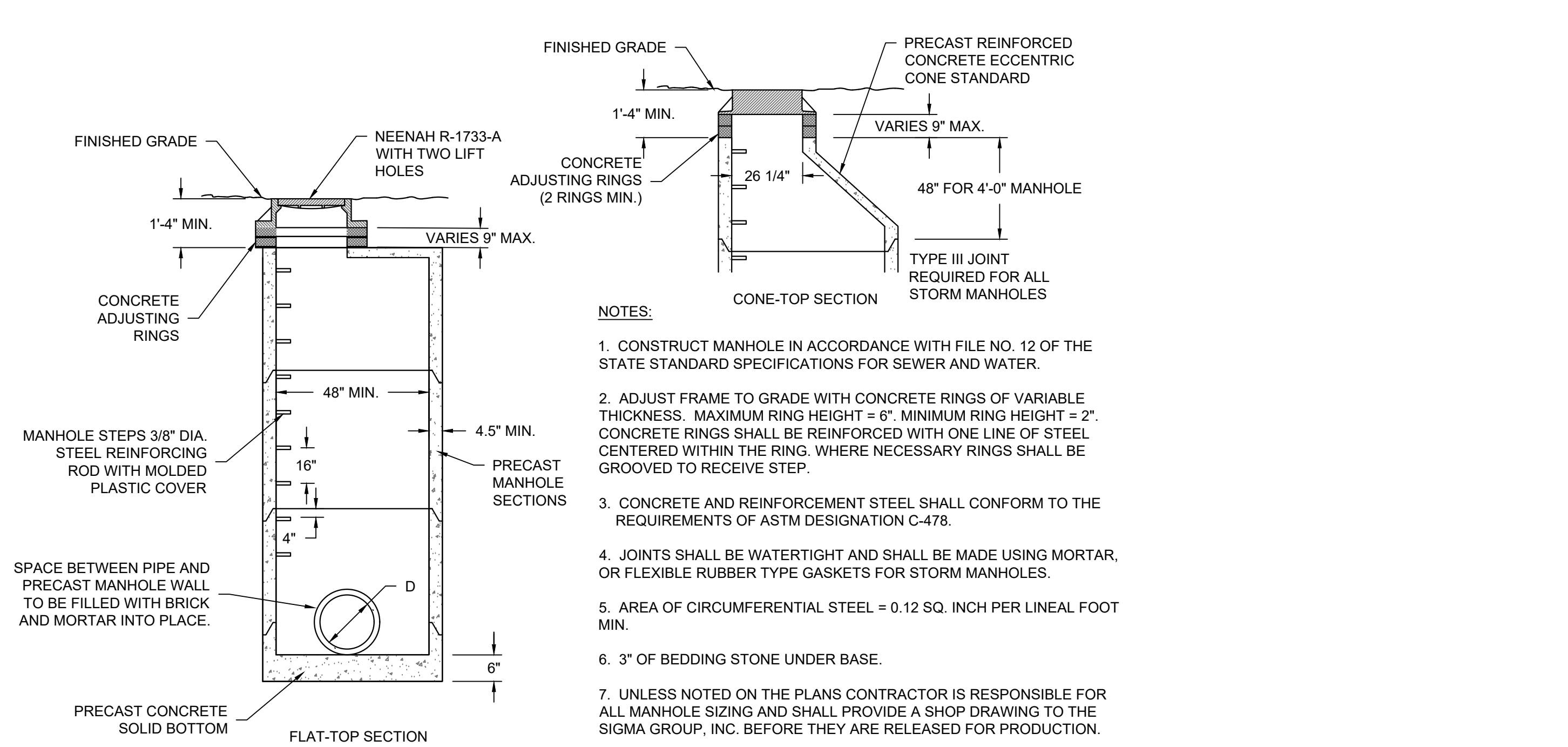
ISSUANCE DATE

NO. REVISION DATE

PROJECT NO:	20176
DESIGN DATE:	----
PLOT DATE:	2024.04.03
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APPROVED BY:	----
SHEET NO:	C100



DATE	
DESCRIPTION	
CITY OF WAUWATOSA MILWAUKEE COUNTY, WISCONSIN THE VILLAGE REDEVELOPMENT PHASE 3 STREETSCAPE DETAILS	
© COPYRIGHT 2017 J.K. Sigmund, Inc. DATE: 03/13/2017	
SCALE	
JOB NO.	
PROJECT MANAGER: KS	
DESIGNED BY: JS	
CHECKED BY: MS	
SHEET NUMBER	L29



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DESIGN DATE:	----
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DRAWN BY:	----
CHECKED BY:	----
APPROVED BY:	----
SHEET NO:	C402