

DEPARTMENT OF ENERGY & THE ENVIRONMENT

CONCEPT DESIGN DRAWINGS FOR DPR PARKLAND STORMWATER RETROFITS IV NORTH MICHIGAN PARK LID RETROFITS JANUARY 2024

SWM PLAN # XXXX
1333 EMERSON ST NE
WASHINGTON, DC 20017

CLIENT

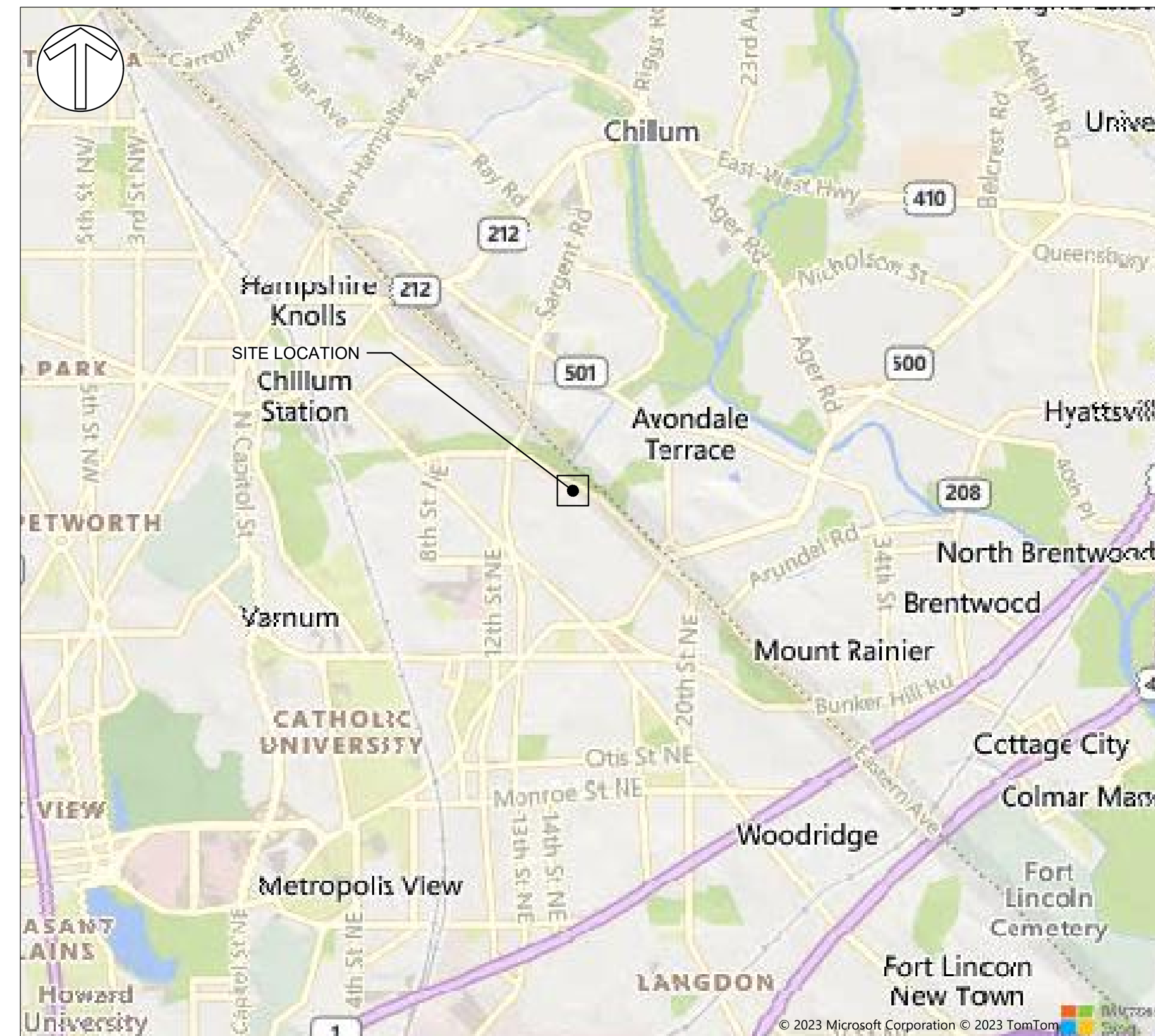
ELAINE VIDAL, ENVIRONMENTAL PROTECTION SPECIALIST
WATERSHED PROTECTION DIVISION
DEPARTMENT OF ENERGY AND ENVIRONMENT
GOVERNMENT OF THE DISTRICT OF COLUMBIA
1200 FIRST STREET, NE 5TH FLOOR
WASHINGTON DC 20002

DATE: ISSUES / REVISIONS

LEGEND

EXISTING	PROPOSED
— MAJOR CONTOUR	— LOD — LIMIT OF DISTURBANCE
— MINOR CONTOUR	— TOP OF BIORETENTION
— PROPERTY LINE	— BOTTOM OF BIORETENTION
— SD — SD — STORM DRAIN (GIS)	— UNDERDRAIN
— SS — SS — SANITARY SEWER LINE (GIS)	— EDGE OF PAVEMENT
— BUILDING OUTLINE (GIS)	— SF — SF — SILT FENCE
— TREE (GIS)	— TRENCH DRAIN
	— AT-GRADE INLET PROTECTION
	— STABILIZED CONSTRUCTION ENTRANCE

VICINITY MAP



LIMIT OF DISTURBANCE = 0.47 ACRES
PROPERTY OWNER: DISTRICT OF COLUMBIA DEPARTMENT OF PARKS AND RECREATION
SCALE: 1" = 2,000'

PROJECT NARRATIVE

THE PROJECT AREA IS IN WARD 5, IN THE NORTH EASTERN PORTION OF THE DISTRICT OF COLUMBIA AT 1333 EMERSON ST NE. THE PROJECT SITE WAS IDENTIFIED THROUGH DOE'S DPR PARKLAND STORMWATER RETROFITS IV TO DESIGN AND CONSTRUCT LOW IMPACT DEVELOPMENT RETROFITS.

THIS PROJECT INVOLVES THE INSTALLATION OF THREE BIORETENTION BASINS TO CAPTURE DRAINAGE FROM AN EXISTING PLAYGROUND, THE NORTH MICHIGAN PARK RECREATION CENTER, REDUCE THE QUANTITY OF STORMWATER RUNOFF AND IMPROVE THE WATER QUALITY BEFORE RETURNING BACK TO THE CONVEYANCE SYSTEM.

STATEMENT BY PROFESSIONAL ENGINEER REGISTERED IN THE DISTRICT OF COLUMBIA

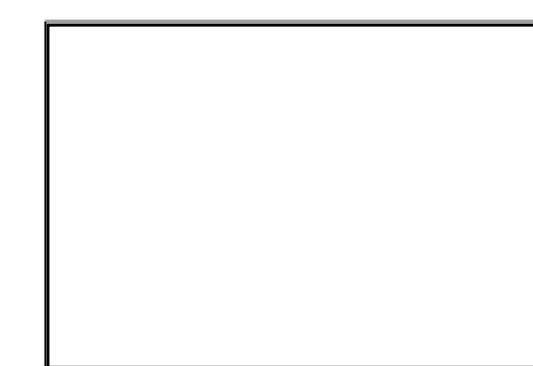
This is to certify that the engineering features of all stormwater best management practices (BMPs), stormwater infrastructure, and land covers (collectively the "Facility") have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of stormwater pollutants. I further certify that the Facility has been designed in accordance with the specification required under Chapter 5 of Title 21 of the District of Columbia Municipal Regulations. It is also stated that the undersigned has furnished the applicant with a set of instructions for the maintenance and operation of the site's Facility.

BRYAN ARVAL, PROJECT MANAGER
Name and Title (please type)

2081 CLIPPER PARK RD, BALTIMORE, MD 21211
Address

Date: 01/05/2024 Phone No: 410.554.0156

Affix Seal:



AS-BUILT CERTIFICATION BY PROFESSIONAL ENGINEER

Within 21 days after completion of construction of all stormwater best management practices (BMPs), stormwater infrastructure, and land covers (collectively the "Facility"), please send this page to the Watershed Protection Division of the District Department of the Environment.

1. Facility Information:

Source Name: _____
Source Location Street: _____
City: _____
DCRA Permit No.: _____
Date Issued: _____

2. As Built Certification

I hereby certify that all stormwater best management practices (BMPs), stormwater infrastructure, and land covers have been built substantially in accordance with the approved plans and specifications and that any deviations noted below will not prevent the system from functioning in compliance with the requirements Chapter 5 of Title 21 of the District of Columbia Municipal Regulations when properly maintained and operated. These determinations have been based upon on-site observation of construction, scheduled and conducted by me or by a project representative under my direct supervision. I have enclosed one set of as-built engineering drawings.

Signature of Engineer: _____ Name (Please Type) D.C. Reg. No. _____

Affix Seal:

Company Name: _____

Company Address: _____

Date: _____ Phone No.: _____

Substantial deviations from the approved plans and specifications (attach additional sheets if required).

SHEET LIST TABLE

SHEET NUMBER	SHEET TITLE
C001	COVER SHEET
C010	GENERAL NOTES (NOT INCLUDED IN CONCEPT DRAWINGS)
C020	SPECIFICATIONS (NOT INCLUDED IN CONCEPT DRAWINGS)
C100	SITE PLAN
C101	TREE SURVEY PLAN
C110	EXISTING CONDITIONS PLAN
C120	EROSION AND SEDIMENT CONTROL
C130	STORMWATER MANAGEMENT PLAN
L150	PLANTING PLAN
C500	DETAILS
C510	ESC NOTES (NOT INCLUDED IN CONCEPT DRAWINGS)
C530	ESC DETAILS
C560	PLANTING DETAILS
C600	DA PLAN
C700	STORMWATER CALCULATIONS

30% CONCEPT DRAWINGS



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Restore the Earth & Inspire Ecological Stewardship

NORTH MICHIGAN PARK LID RETROFITS

COVER SHEET

PROJECT NO.: 23014.02 SCALE: N/A
SEAL: BY: EM CHECK: BA
DWG. NO.:

C001

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NORTH MICHIGAN PARK LID RETROFITS

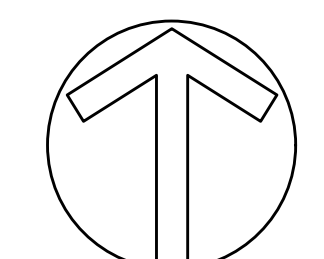
SITE PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 40'
SEAL: BY: EM CHECK: BA
DWG. NO.:

C100

LEGEND

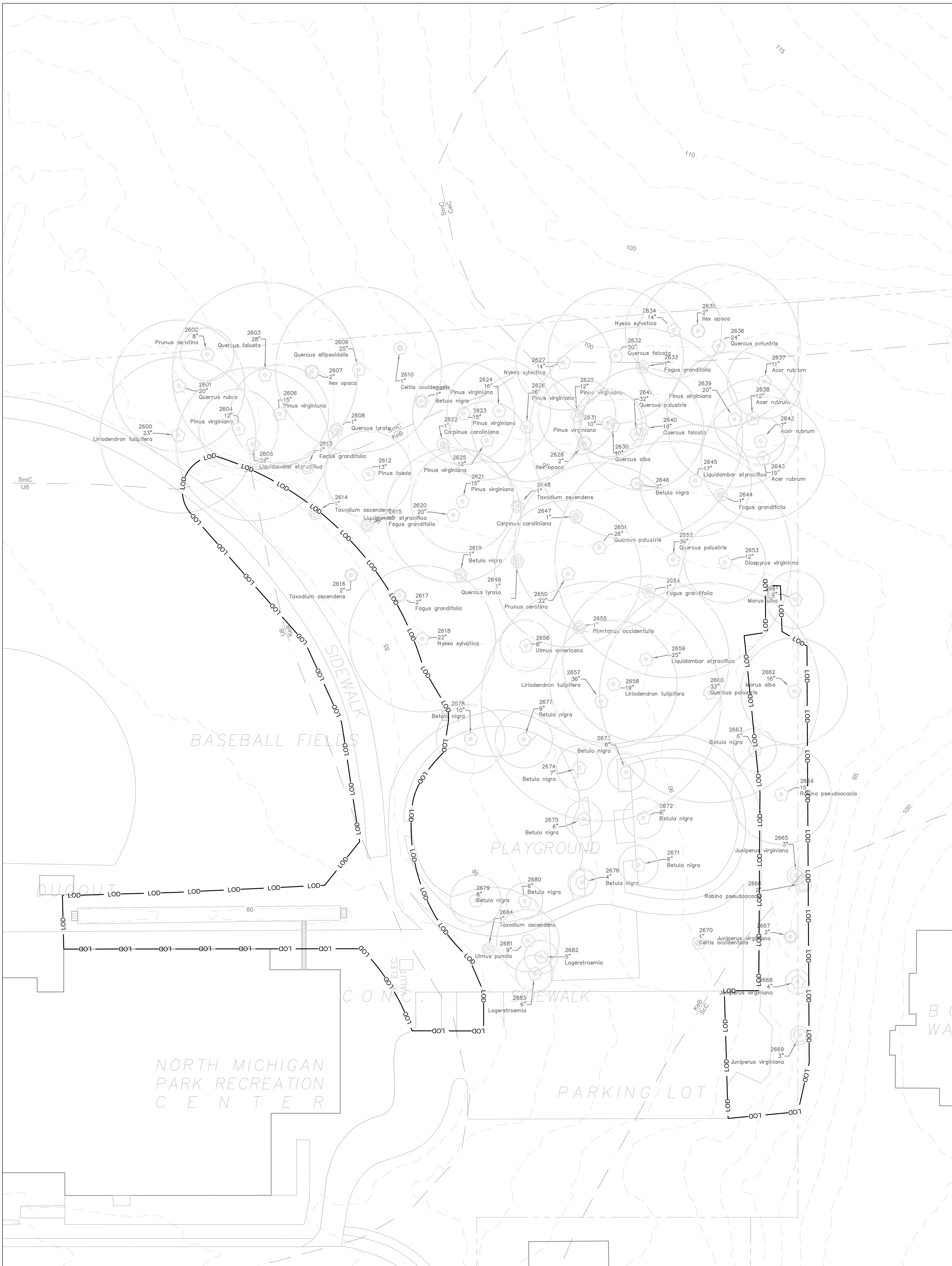
- PROPERTY LINE (GIS)
- LOD LIMIT OF DISTURBANCE



HORIZONTAL SCALE
0 40 80

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Condition Score		Scoring System		FACTOR 1 - ROOTS										FACTOR 2 - TRUNK		FACTOR 3 - SCAFFOLD BRANCHES		FACTOR 4 - SMALL BRANCHES AND TWIGS		FACTOR 5 - FOLIAGE AND/OR BUDS		TOTAL	CONDITION SCORE	CONDITION RATING	Critical Root Zone (CRZ)		Comments														
Percentage out of:	No Apparent Problems	Major Problems	Minor Problems	Structure	Health	Substrate	Structure	Health	Substrate	Structure	Health	Substrate	Structure	Health	Substrate	Structure	Health	Substrate	Structure	Health	Substrate				Total Area (sq ft)	Impacts (sq ft)															
Deciduous Trees	28	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	24	75%	Good	8.55	0	0%	2 in caliper													
Coniferous Trees	32	2	3	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	24	75%	Good	1486.17	0	0%														
		Extrema Problems																																							



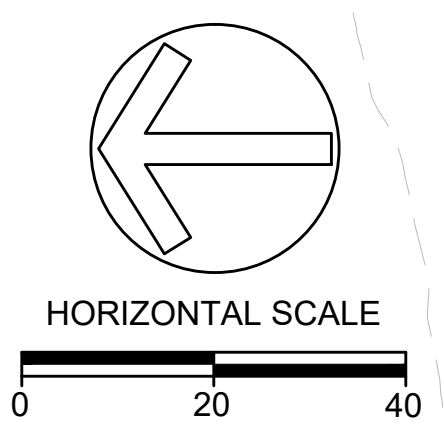
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NORTH MICHIGAN PARK LID RETROFITS

TREE SURVEY PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 20'
 SEAL: BY: EM CHECK: BA
 DWG. NO.:



C101



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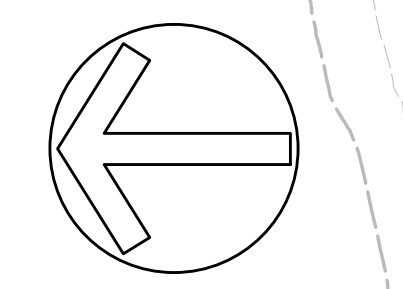
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NORTH MICHIGAN PARK LID RETROFITS

EXISTING CONDITIONS PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 20'
 BY: EM CHECK: BA
 DWG. NO.:

C110



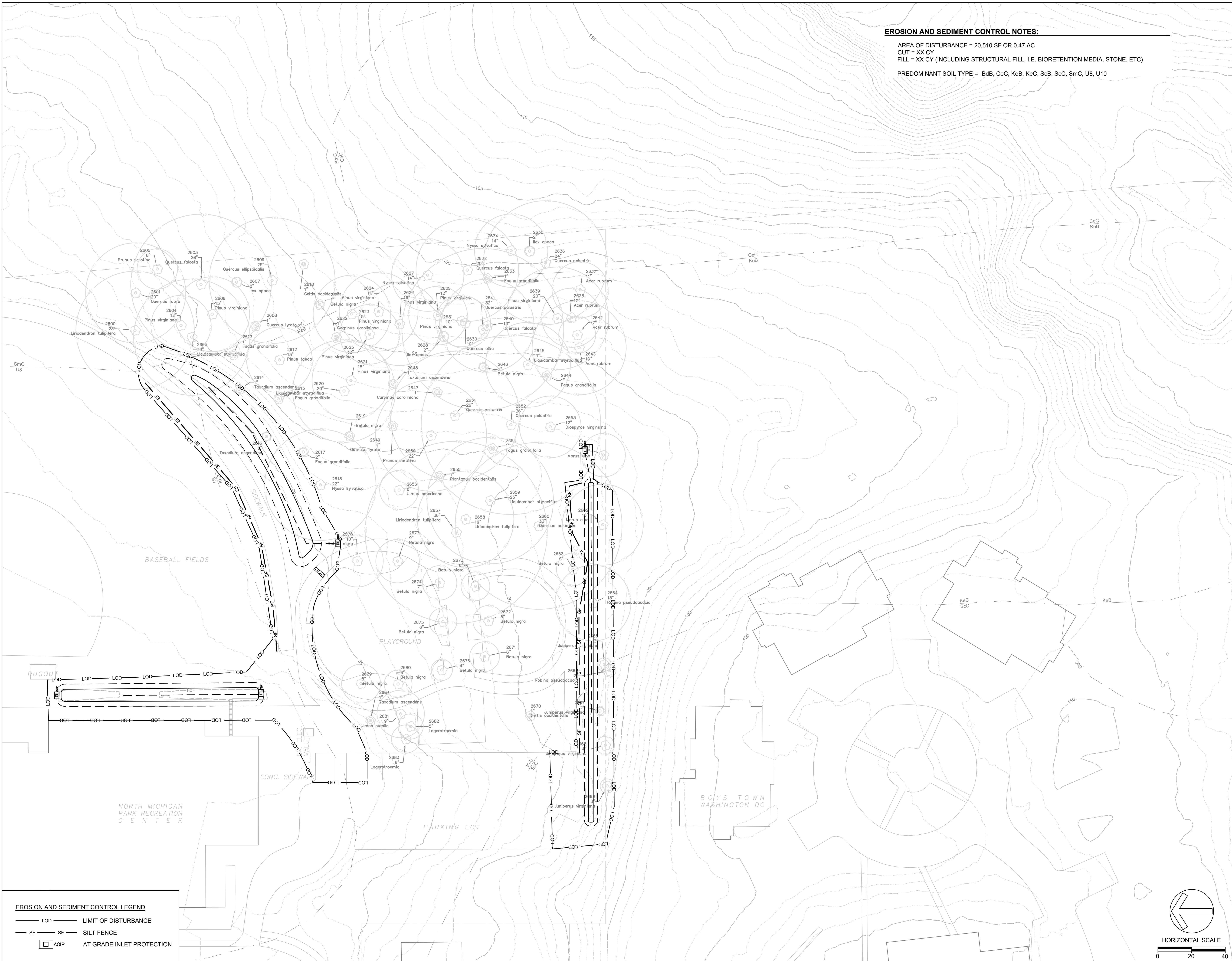
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EROSION AND SEDIMENT CONTROL NOTES:

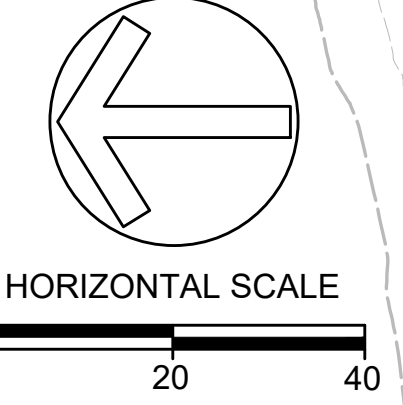
AREA OF DISTURBANCE = 20,510 SF OR 0.47 AC
 CUT = XX CY
 FILL = XX CY (INCLUDING STRUCTURAL FILL, I.E. BIORETENTION MEDIA, STONE, ETC)
 PREDOMINANT SOIL TYPE = BdB, CeC, KeB, KeC, ScB, ScC, SmC, U8, U10

DATE: ISSUES / REVISIONS



EROSION AND SEDIMENT CONTROL LEGEND

	LOD	—	LIMIT OF DISTURBANCE
	SF	—	SILT FENCE
	AGIP		AT GRADE INLET PROTECTION



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NORTH MICHIGAN PARK LID RETROFITS

EROSION AND SEDIMENT CONTROL

PROJECT NO.:	23014.02	SCALE:	1" = 20'
SEAL:		BY:	EM
		CHECK:	BA
		DWG. NO.:	

C120

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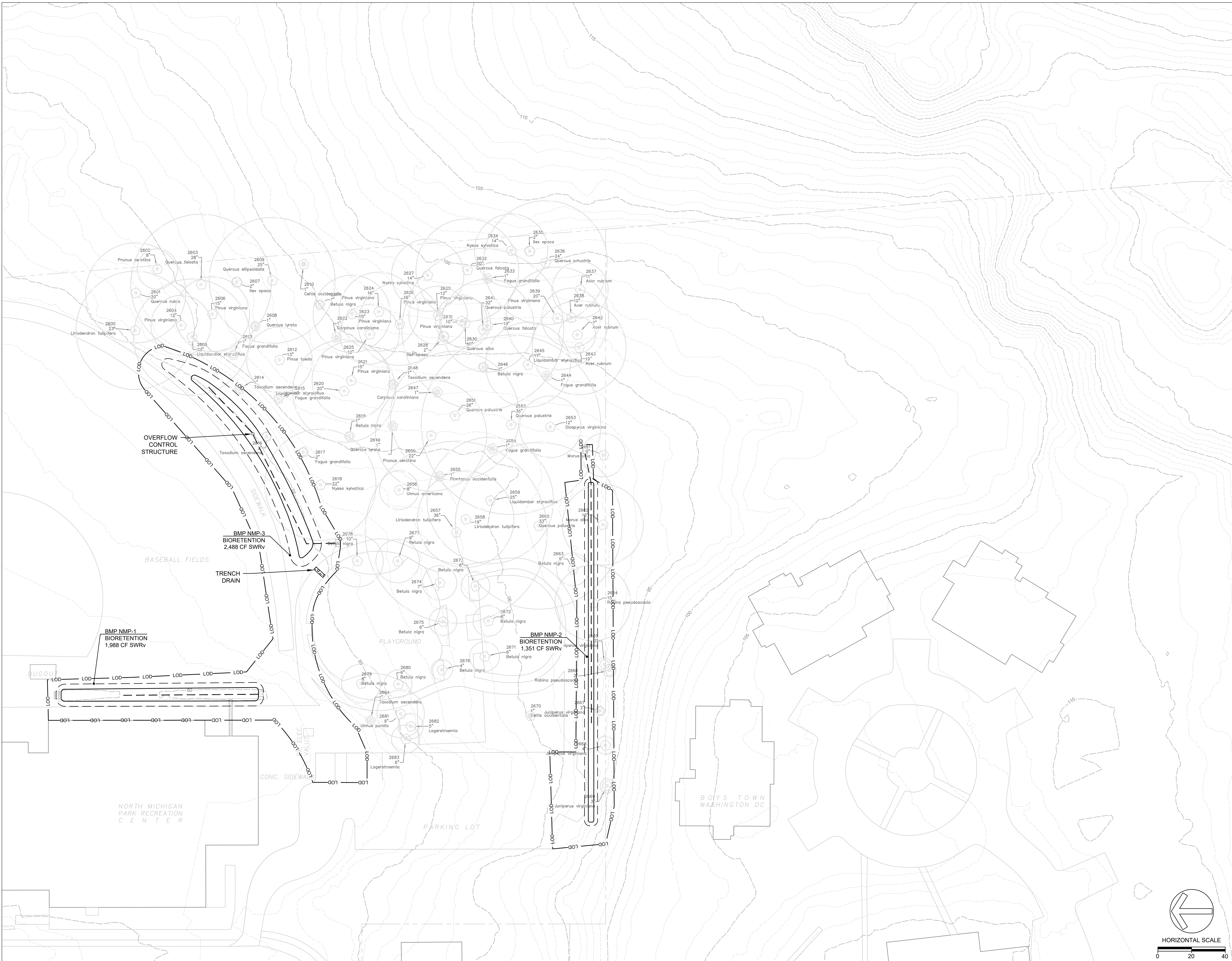
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STORMWATER MANAGEMENT PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 20'
BY: EM CHECK: BA
DWG. NO.:

C130





PLANTING LEGEND

BIORETENTION BOTTOM

SIDE SLOPES

Concept Plant Species List

Scientific name	Common name
TREES	
<i>Quercus palustris</i>	Pin oak
<i>Quercus falcata</i>	Southern red oak
<i>Fagus grandifolia</i>	American beech
<i>Liquidambar styraciflua</i>	Sweetgum
<i>Diospyros virginiana</i>	Persimmon
<i>Nyssa sylvatica</i>	Blackgum
<i>Taxodium distichum</i>	Bald cypress
<i>Betula nigra</i>	River birch
<i>Carpinus caroliniana</i>	American hophornbeam
<i>Platanus occidentalis</i>	American sycamore
SHRUBS	
<i>Alnus serrulata</i>	Smooth alder
<i>Prunus maritima</i>	Beech plum
<i>Corylus americana</i>	American hazelnut
<i>Cornus amomum</i>	Silky dogwood
<i>Cephaelis occidentalis</i>	Butternutbush
<i>Physocarpus opulifolius</i>	Ninebark
<i>Hamamelis virginiana</i>	Witchhazel
<i>Baccharis halimifolia</i>	Groundselbush
<i>Sambucus canadensis</i>	Elderberry
<i>Amorpha fruticosa</i>	False indigo
<i>Myrica pensylvanica</i>	Bayberry
<i>Ilex verticillata</i>	Winterberry holly
PERENNIALS	
<i>Scilla non-scripta</i>	Seaside scilla
<i>Scilla maritima</i>	Seaside scilla
<i>Eupatorium coelestinum</i>	Blue mistflower
<i>Helianthus scaberrimus</i>	Oxeye sunflower
<i>Helianthus angustifolius</i>	Swamp sunflower
<i>Iris versicolor</i>	Road mallow
<i>Schizanthus luteus</i>	Little bluestem
<i>Panicum virgatum</i>	Switchgrass
<i>Geranium maculatum</i>	Spotted geranium
<i>Asclepias incarnata</i>	Swamp milkweed
<i>Asclepias syriaca</i>	Common milkweed

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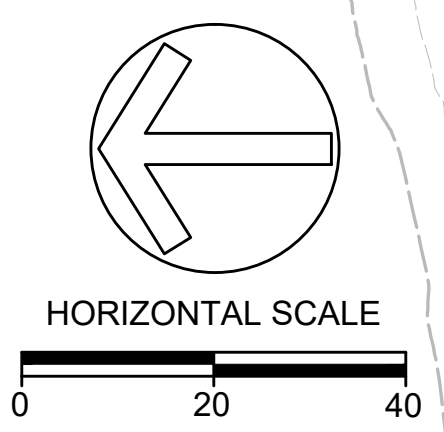
NORTH MICHIGAN PARK LID RETROFITS

PLANTING PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 20'

SEAL: BY: EM CHECK: BA

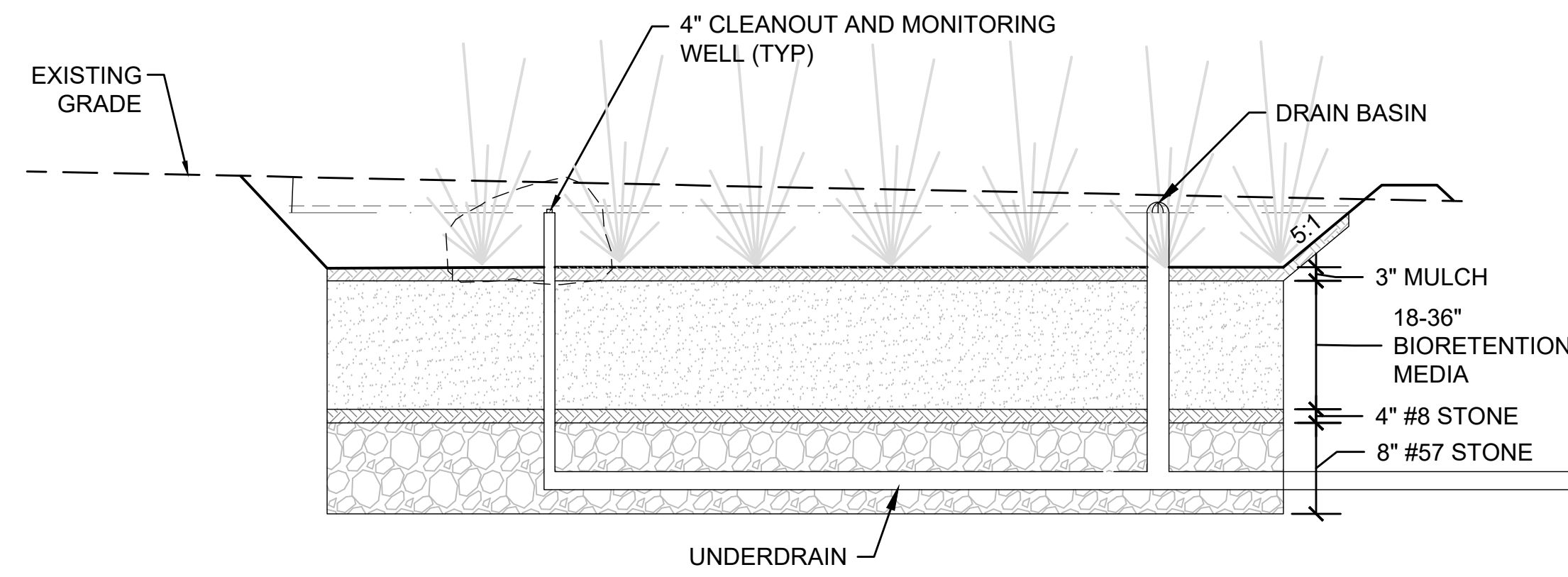
DWG. NO.:



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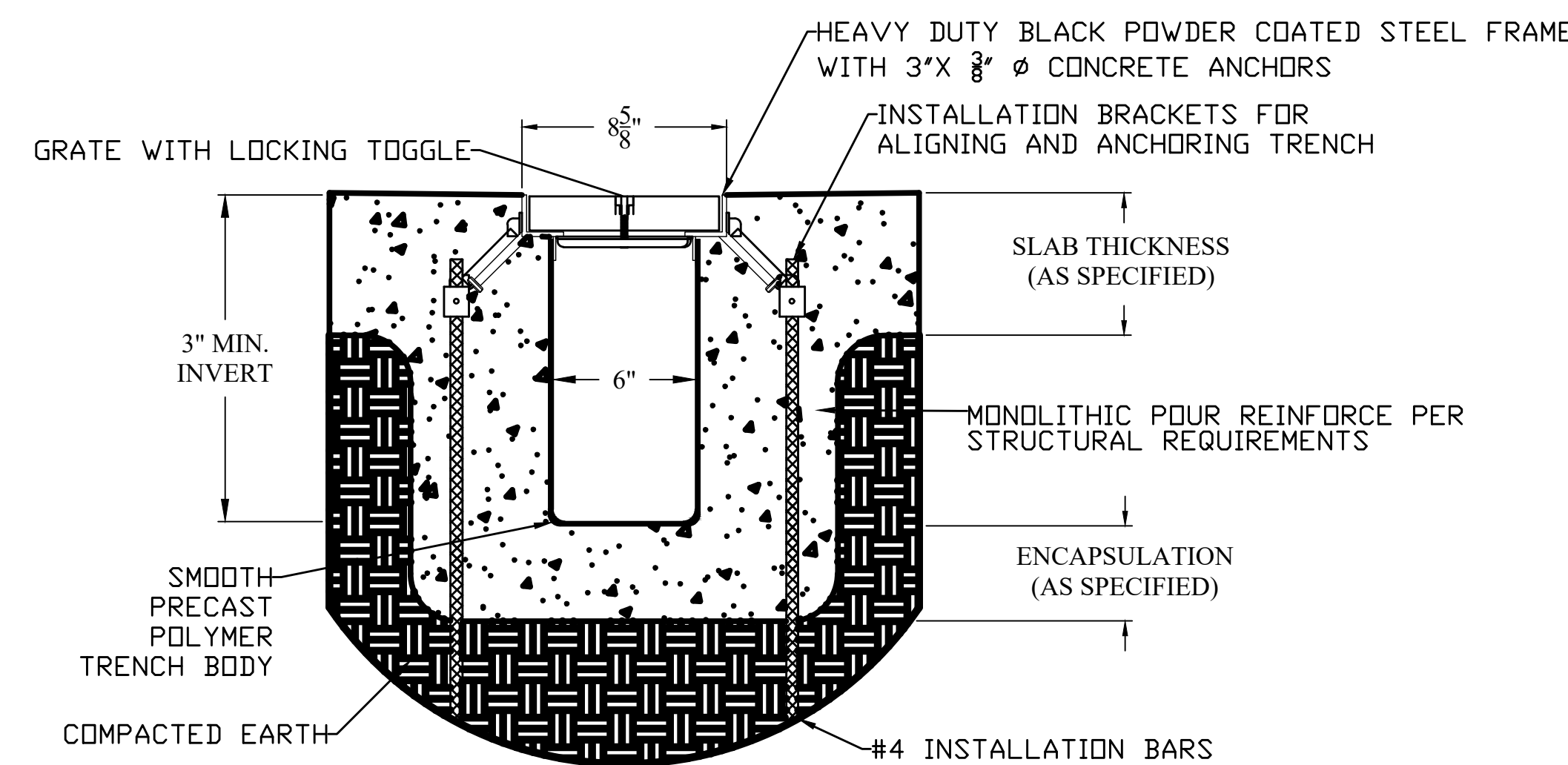
DATE: ISSUES / REVISIONS



- NOTES:
1. BIORETENTION IS AN OFF-LINE BIORETENTION. IN-FLOW WILL BE CONTROLLED BY ENGINEERED INLET TO ONLY CONVEY STORMS BELOW 1.2".
 2. TOP OF CLEANOUT ELEVATIONS SHALL BE INSTALLED 1" ABOVE PONDING DEPTH.
 3. MULCH LAYERS MAY BE REPLACED BY BIORETENTION MEDIA IF DESIRED. IF OMITTING MULCH, FACILITY SHALL BE LINED WITH COIR FIBER MATTING.

**BIORETENTION
 TYPICAL SECTION**

NOT TO SCALE

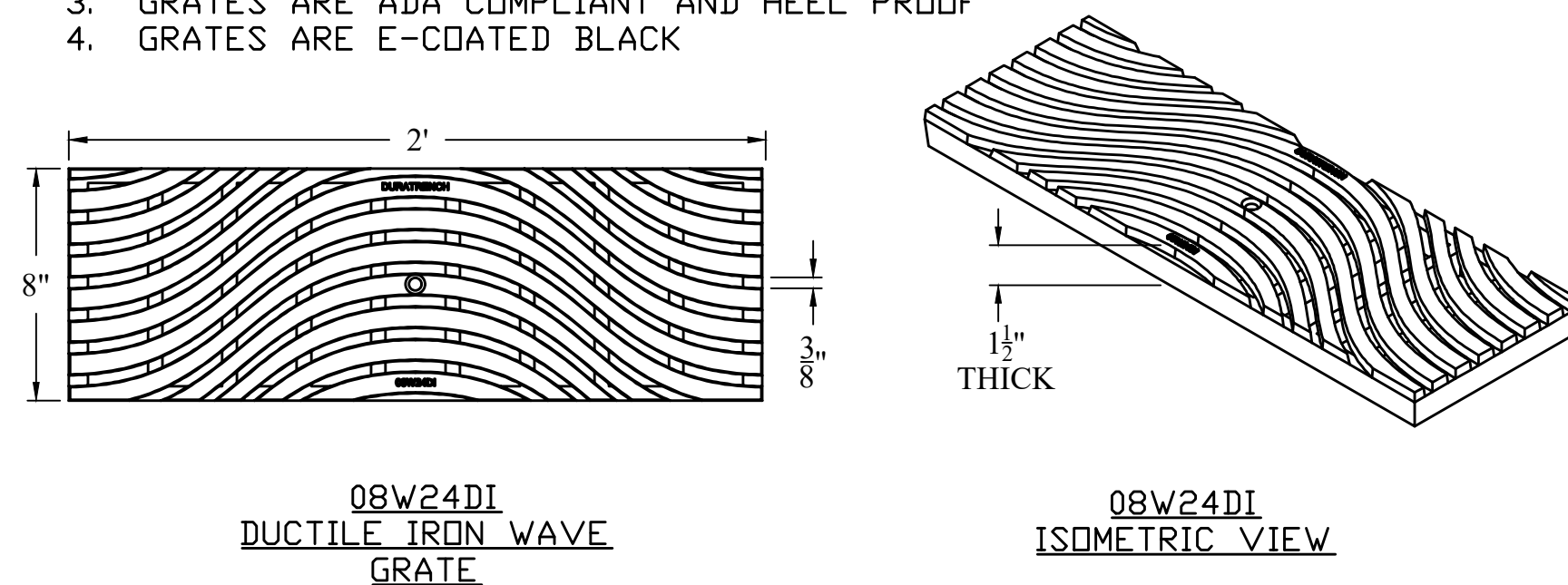


- NOTES:
1. STANDARD SLOPE IS 0.5% UNLESS OTHERWISE SPECIFIED
 2. REINFORCE ACCORDING TO STRUCTURAL REQUIREMENTS
 3. TRENCH DRAIN MUST BE 1/8" BELOW FINISHED CONCRETE GRADE

TYPICAL DTRPF6-HDBPR15TSA (RADIUS) TRENCH SECTION

NOTES:

1. GRATE MATERIAL IS DUCTILE IRON 65-45-12
2. GRATES ARE LOAD CLASS E
3. GRATES ARE ADA COMPLIANT AND HEEL PROOF
4. GRATES ARE E-COATED BLACK



6" TRENCH DRAIN AND GRATE

NOT TO SCALE

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 DRAWINGS**



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**NORTH MICHIGAN
 PARK LID RETROFITS**

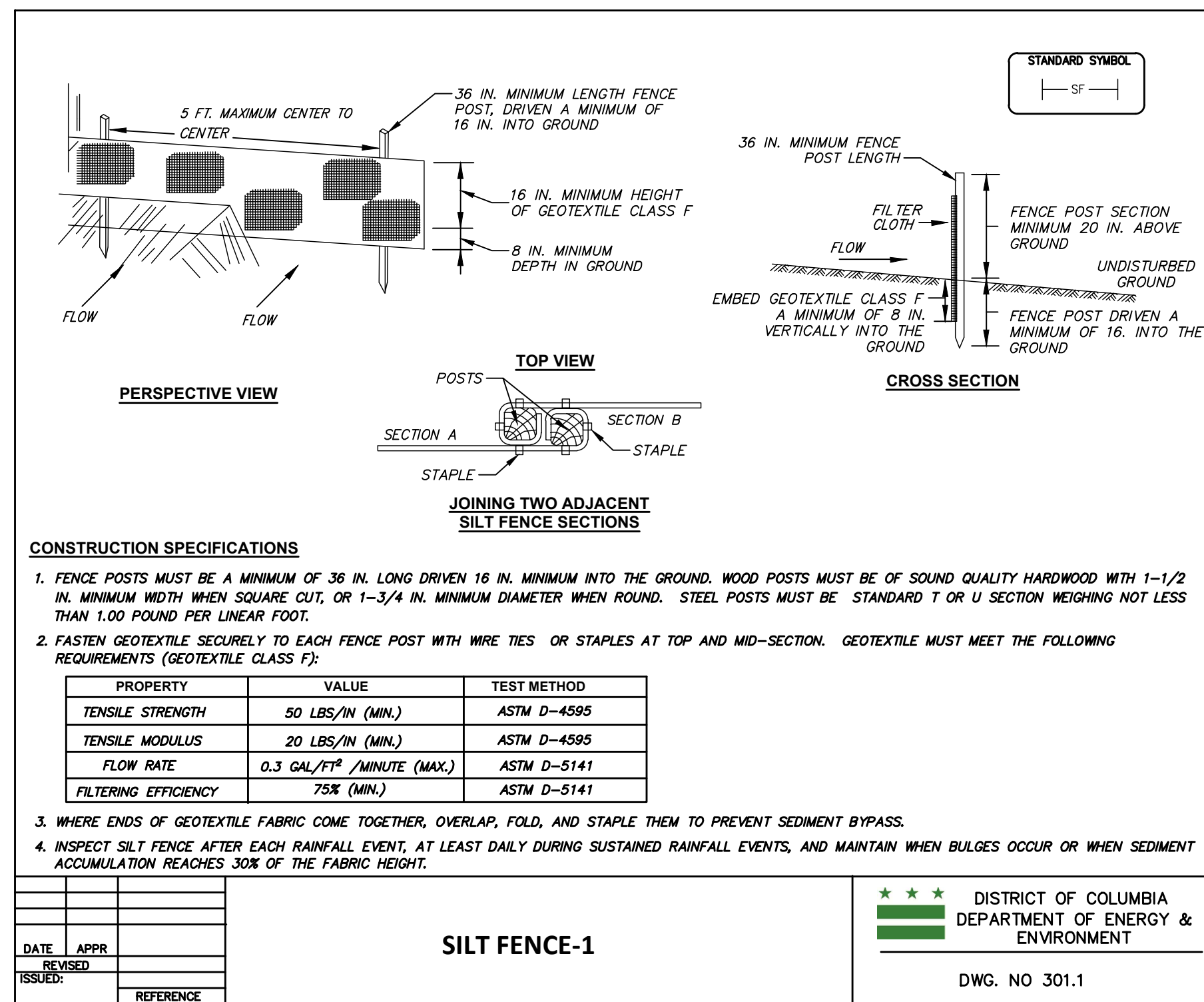
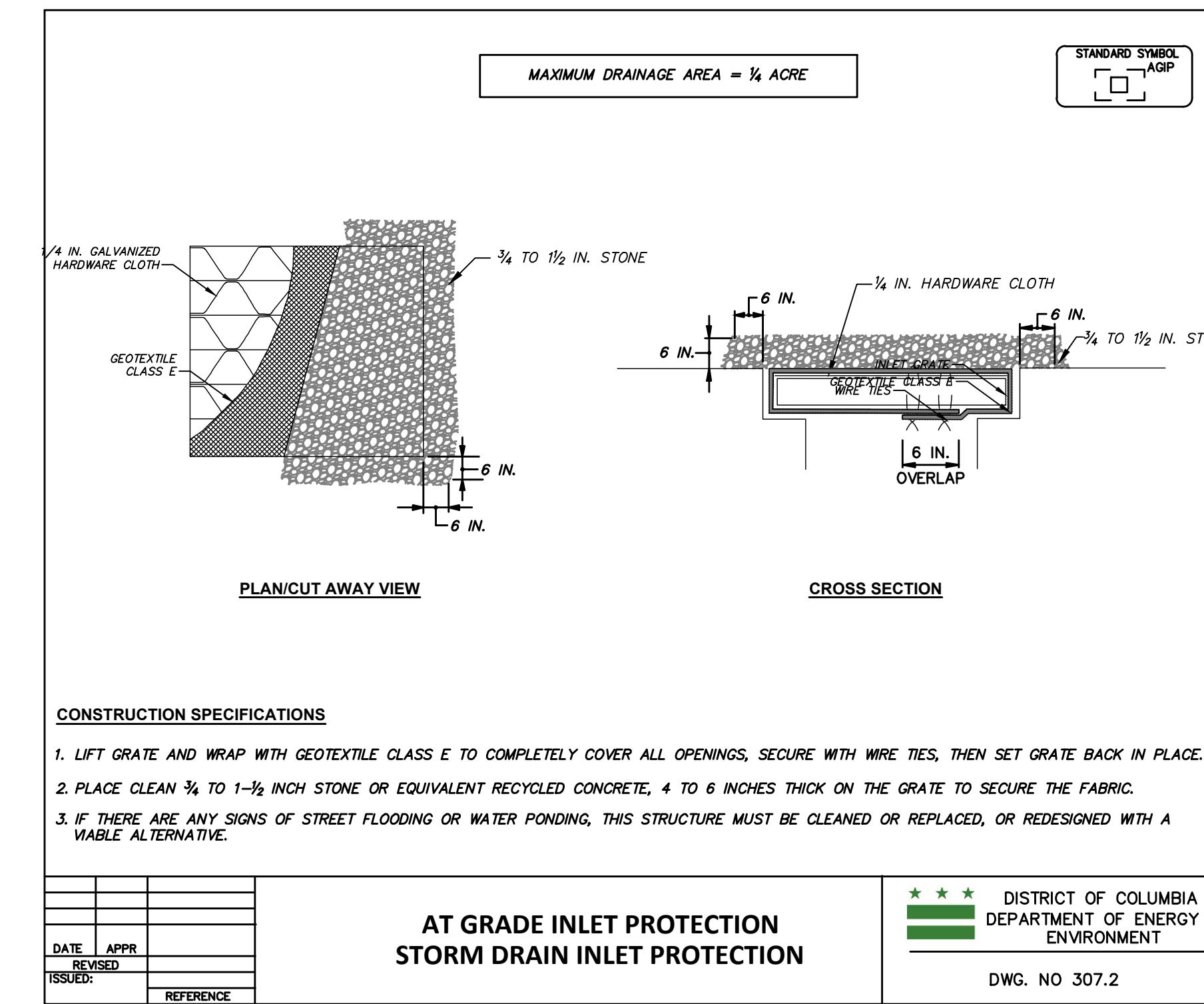
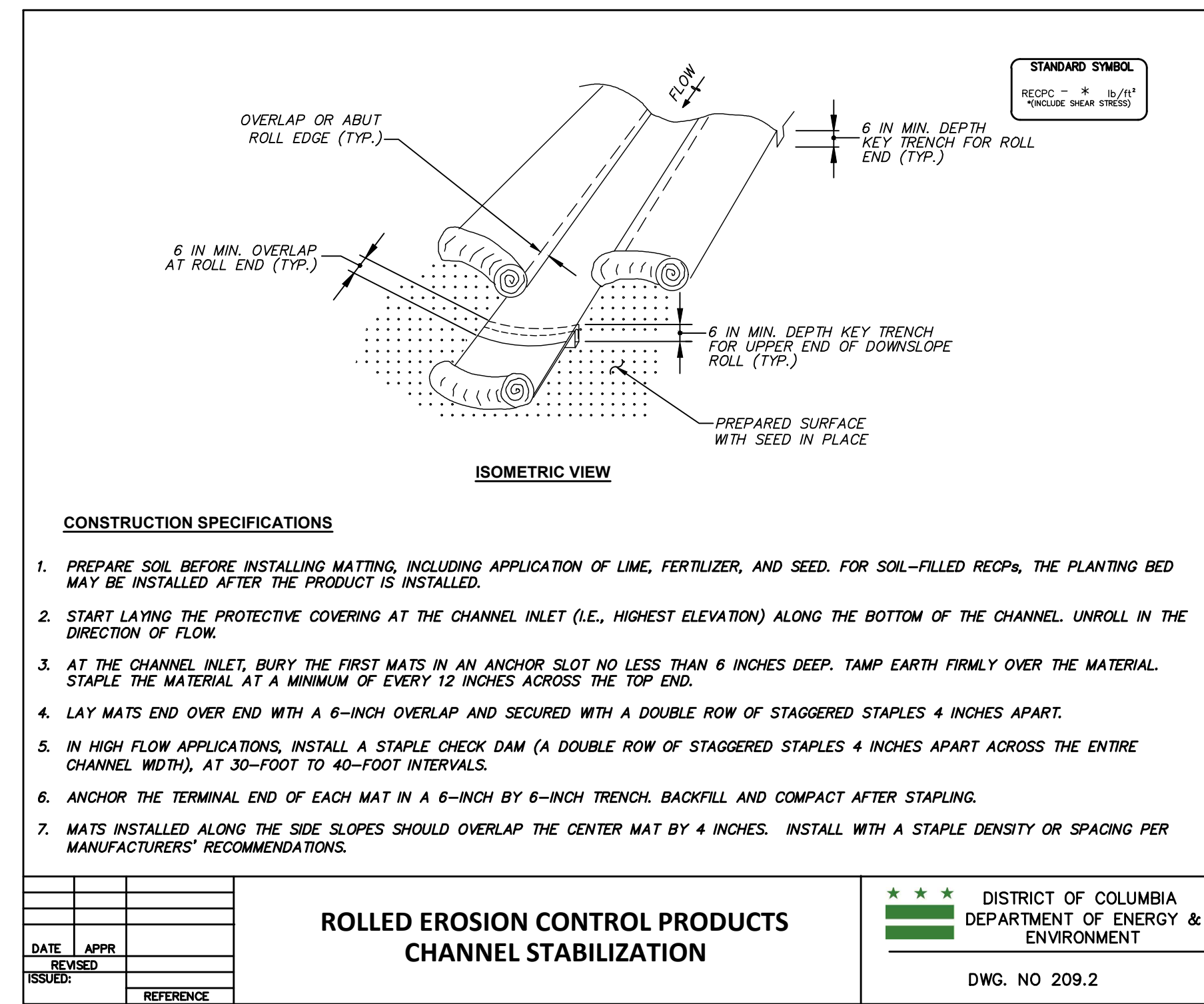
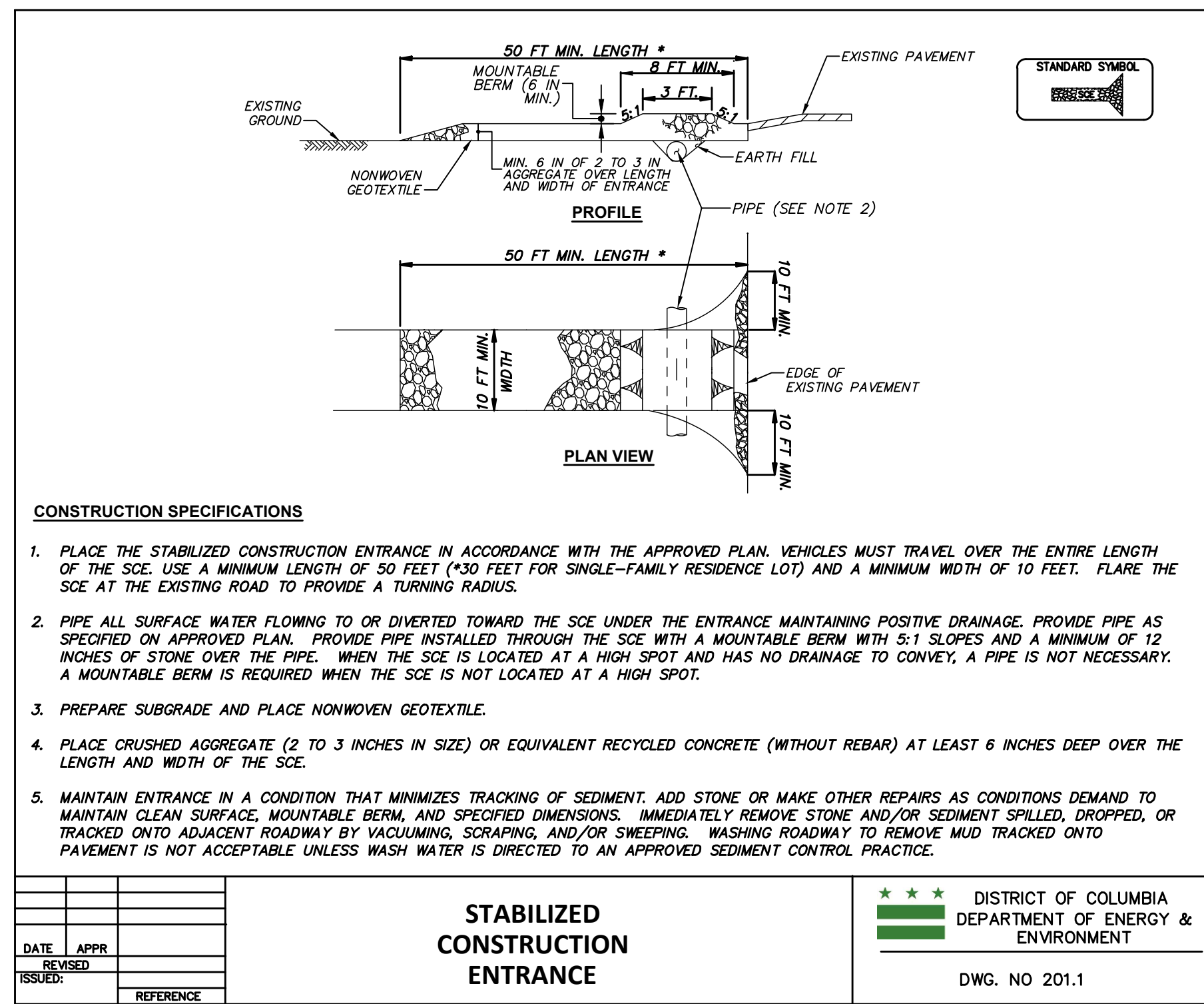
DETAILS

PROJECT NO.:	23014.02	SCALE:	NTS
SEAL:	BY: EM	CHECK:	BA
DWG. NO.:		C500	

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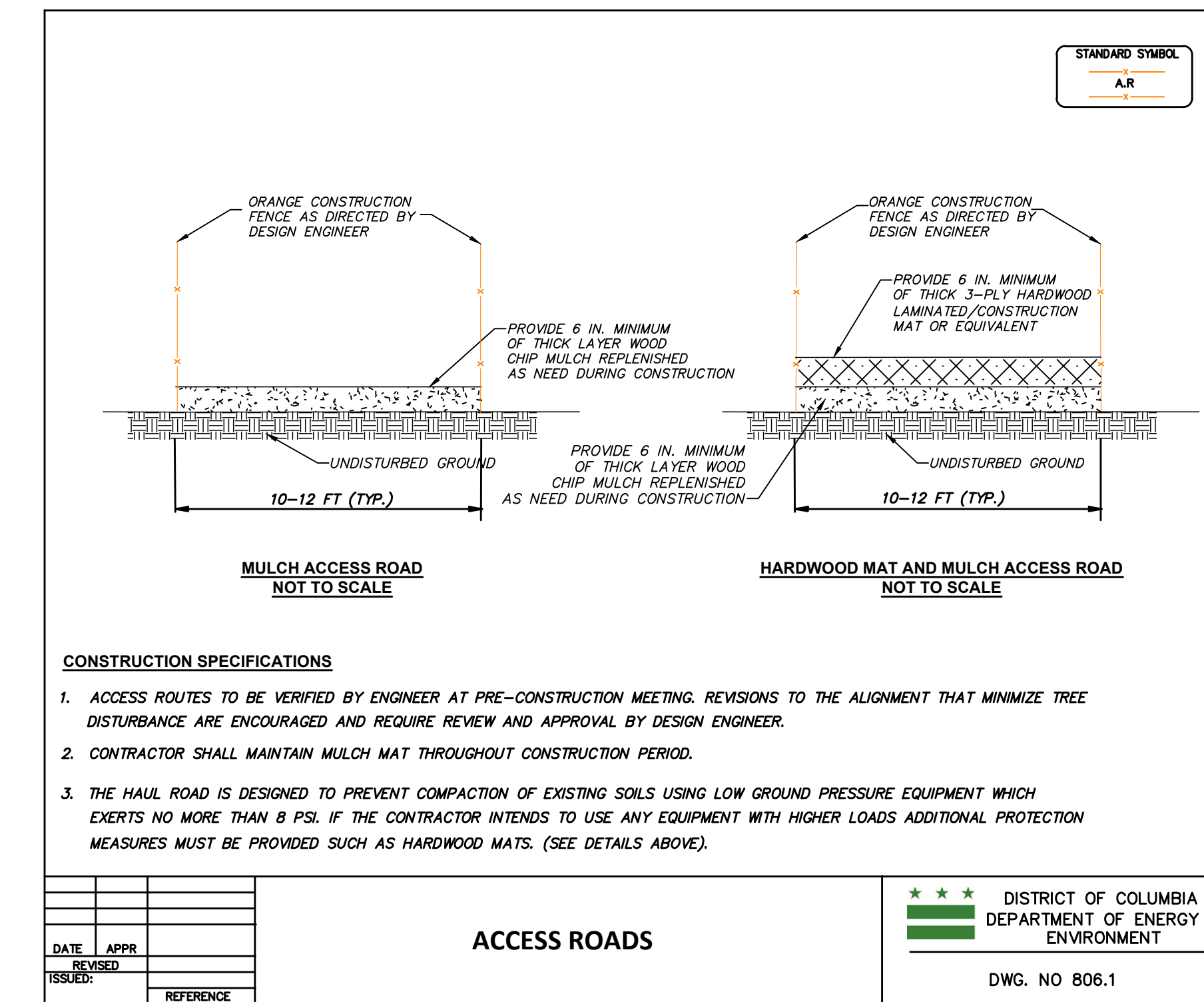


SILT FENCE DESIGN CRITERIA:

SLOPE STEEPNESS	SLOPE LENGTH (MAXIMUM) (FEET)	SILT FENCE LENGTH (MAXIMUM) (FEET)
FLATTER THAN 50:1 (2%)	UNLIMITED	UNLIMITED
> 50:1 TO 10:1 (2% TO 10%)	125	1,000
> 10:1 TO 5:1 (10% TO 20%)	100	750
> 5:1 TO 3:1 (20% TO 33%)	60	500
> 3:1 TO 2:1 (33% TO 50%)	40	250
> 2:1 (> 50%)	20	125

NOTE:
 * IN AREAS OF LESS THAN 2% SLOPE AND SANDY SOILS (USDA GENERAL CLASSIFICATION SYSTEM, SOIL CLASS A), MAXIMUM SLOPE LENGTH AND SILT FENCE LENGTH WILL BE UNLIMITED. IN THESE AREAS A SILT FENCE MAY BE THE ONLY PROTECTIVE CONTROL REQUIRED.
 * TO AVOID CIRCUMVENTION, EXTEND THE ENDS OF THE SILT FENCE UPSLOPE TO PREVENT WATER AND SEDIMENT FROM FLOWING AROUND THE ENDS OF THE FENCE.

DISTRICT OF COLUMBIA
 DEPARTMENT OF ENERGY & ENVIRONMENT
 DWG. NO 301.2



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NORTH MICHIGAN PARK LID RETROFITS

ESC DETAILS

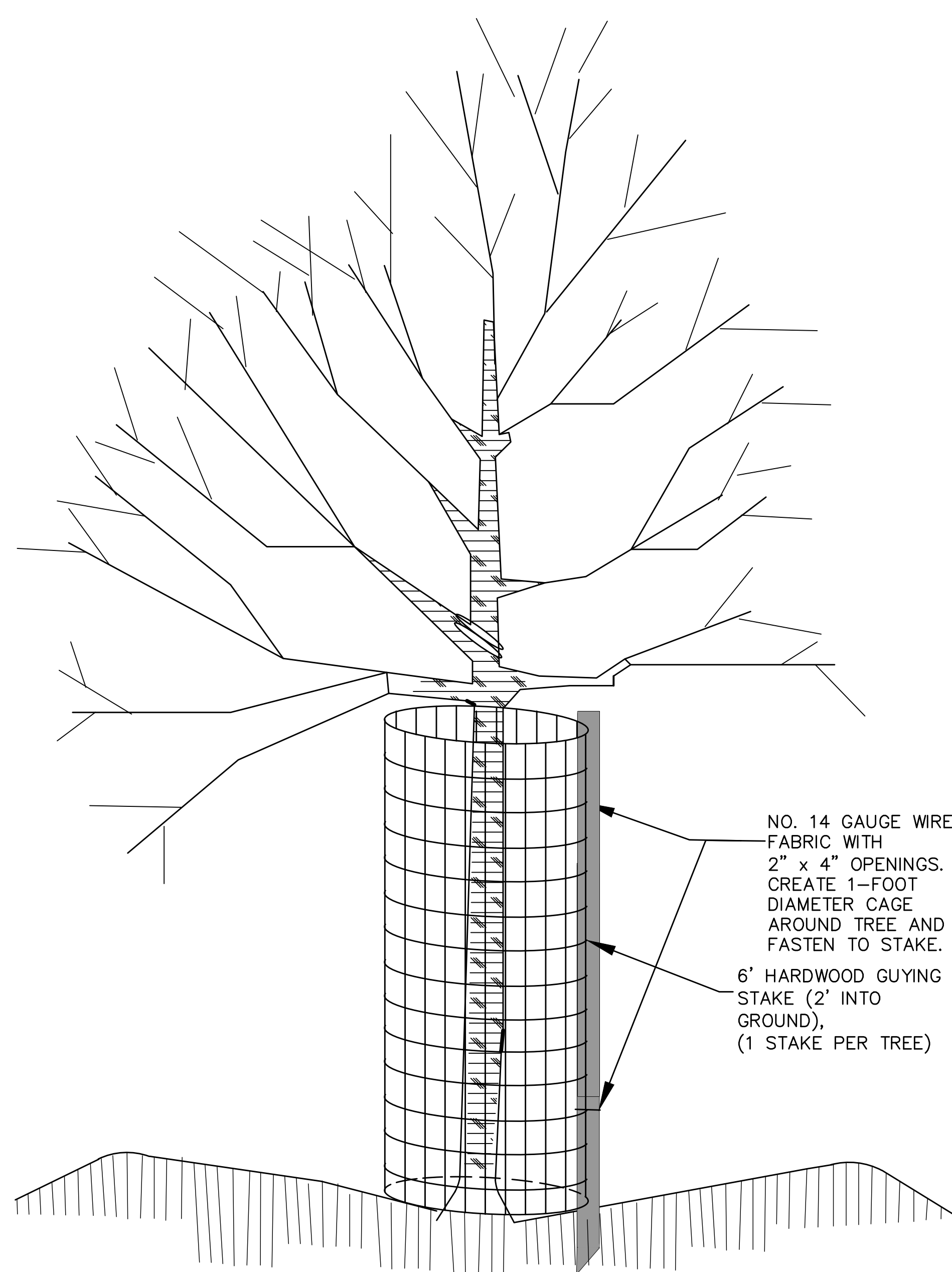
PROJECT NO.: 23014.02 SCALE: NTS
 SEAL: BY: EM CHECK: BA
 DWG. NO.:

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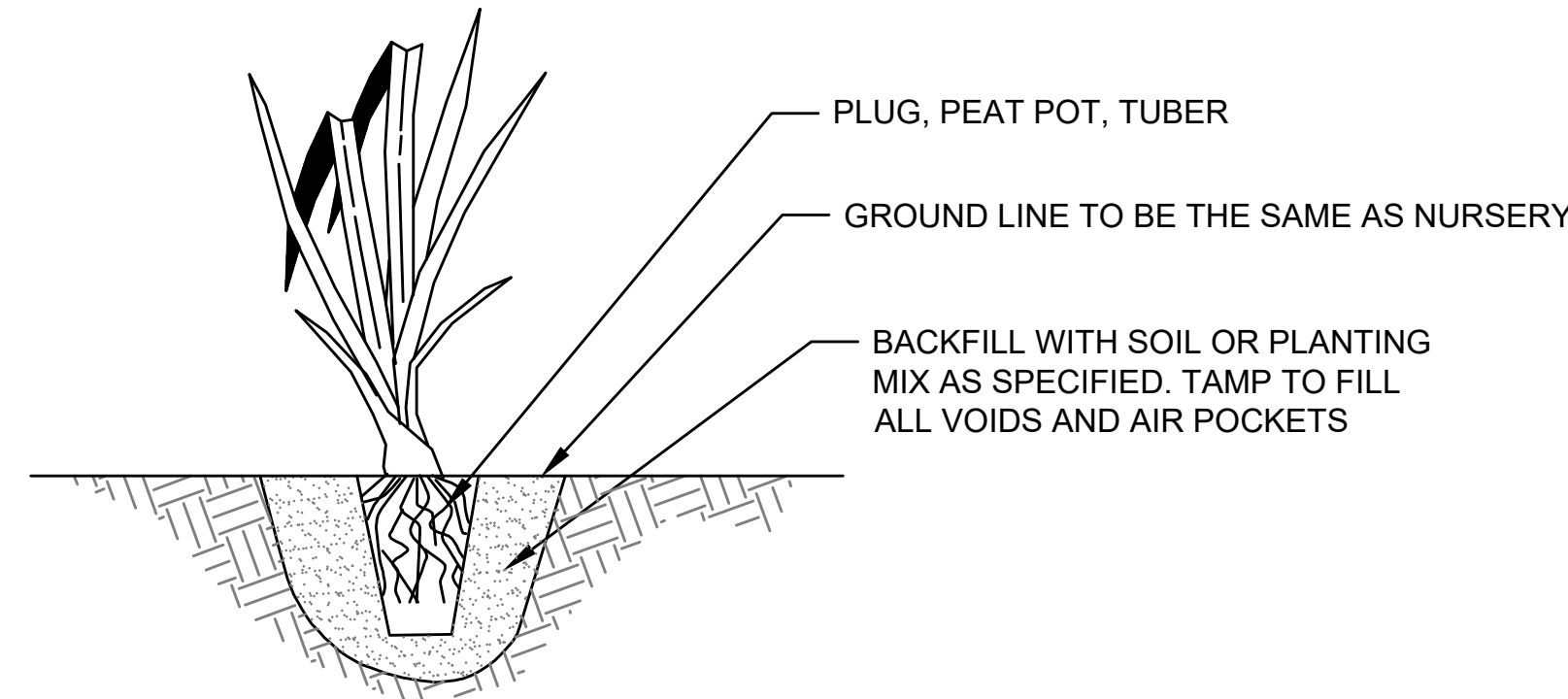


NO. 14 GAUGE WIRE FABRIC WITH 2" x 4" OPENINGS. CREATE 1-FOOT DIAMETER CAGE AROUND TREE AND FASTEN TO STAKE.
 6' HARDWOOD GUYING STAKE (2' INTO GROUND), (1 STAKE PER TREE)

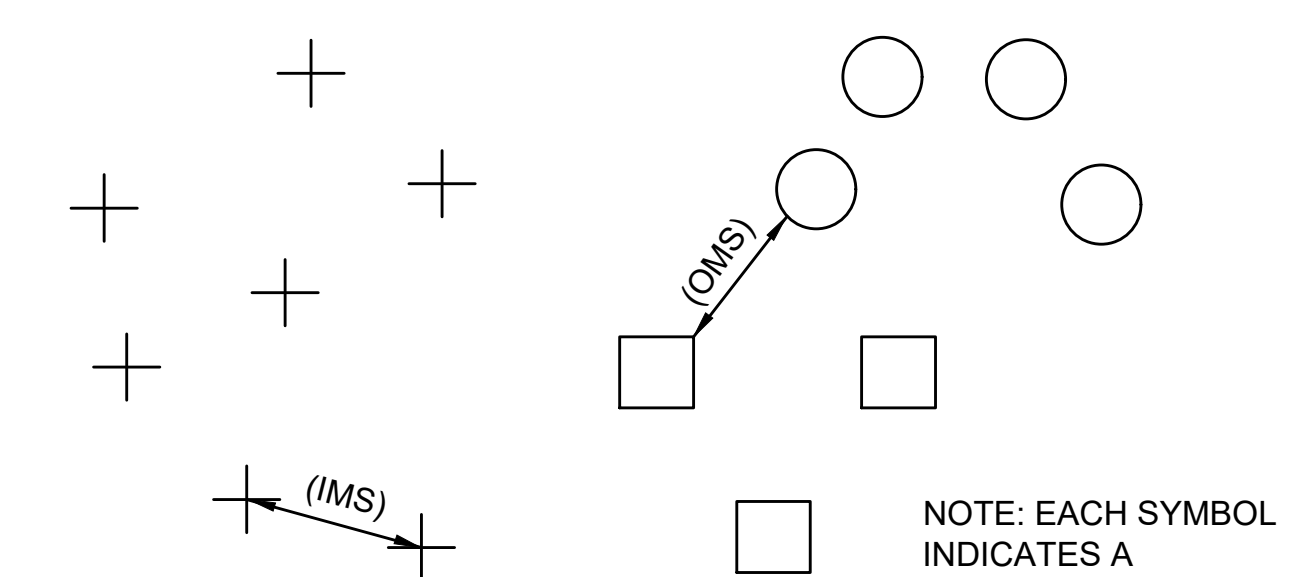
- NOTES:**
1. DEER PROTECTION CAGES TO BE INSTALLED AROUND ALL PLANTED TREES AND SHRUB CLUSTERS AS DIRECTED BY LANDSCAPE ARCHITECT.
 2. HEIGHT OF CAGE SHALL BE 4-FEET (MIN.)
 3. CAGE SHALL BE FASTENED TO STAKE WITH TWO (MIN.) 11-INCH RELEASABLE CABLE TIES (ONE AT TOP AND ONE 6" (MIN.) ABOVE THE GROUND.
 4. DO NOT DAMAGE TREE DURING INSTALLATION.
 5. DEER BARK PROTECTORS (ITEM #bg48, BY A.M. LEONARD, OR EQUAL) MAY BE SUBSTITUTED FOR TREES GREATER THAN 3/4" CALIPER. ALL OTHER SUBSTITUTIONS MUST BE APPROVED BY FOREST ECOLOGIST.
 6. CAGES TO BE REMOVED AT DIRECTION OF FOREST ECOLOGIST.
 7. ENSURE CAGE IS SECURE TO GROUND TO PREVENT UPLIFT BY DEER.

DEER PROTECTION CAGE

NOT TO SCALE



HERBACEOUS PLANTING - QUARTS

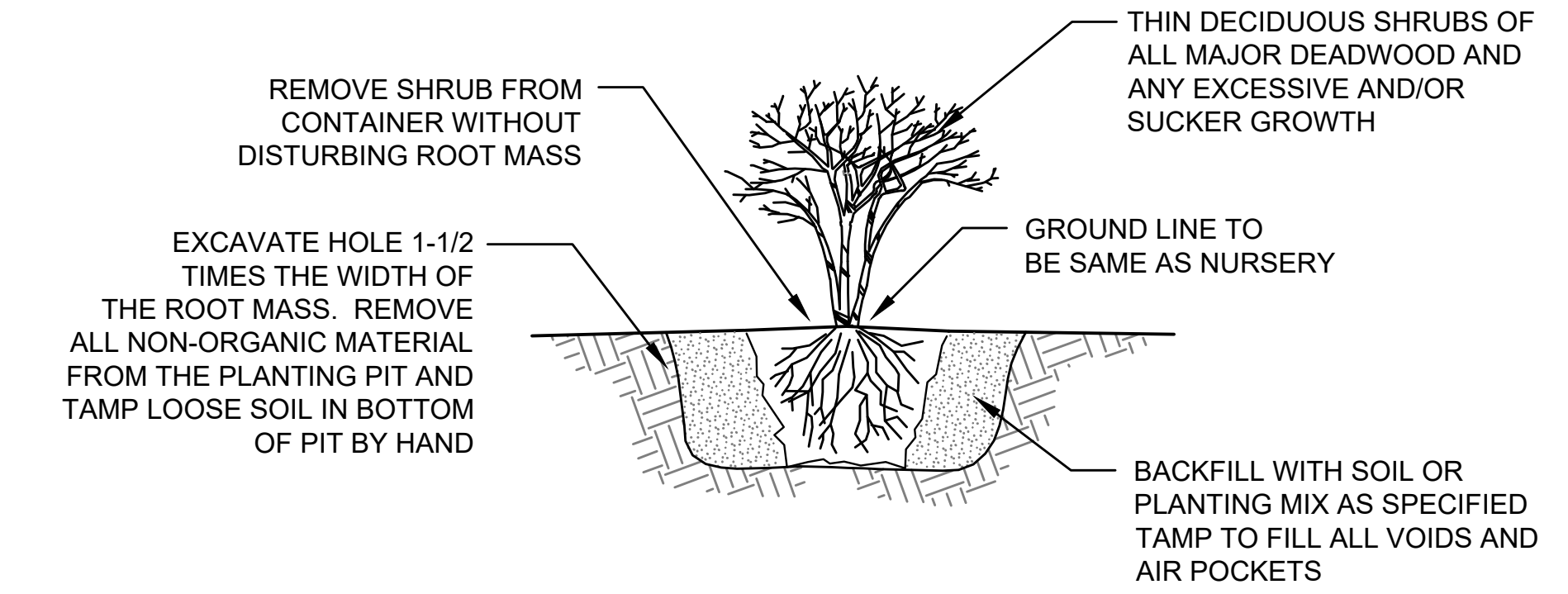


- NOT TO SCALE
1. PLANTS ARE ARRANGED IN CLUSTERS CONSISTING OF THE SAME SPECIES.
 2. SPACING BETWEEN EACH CLUSTER IS DETERMINED BY THE OVERALL MINIMUM SPACING DISTANCE (OMS).
 3. SPACING BETWEEN EACH SPECIES WITHIN EACH CLUSTER IS DETERMINED BY THE INDIVIDUAL MINIMUM SPACING DISTANCE (IMS).
 4. CLUSTERS, WHENEVER POSSIBLE, SHALL CONSIST OF ODD NUMBERS WITH NO LESS THAN 3 AND NO MORE THAN 11 INDIVIDUALS OF ONE SPECIES.

PLANT SPACING - CLUSTER

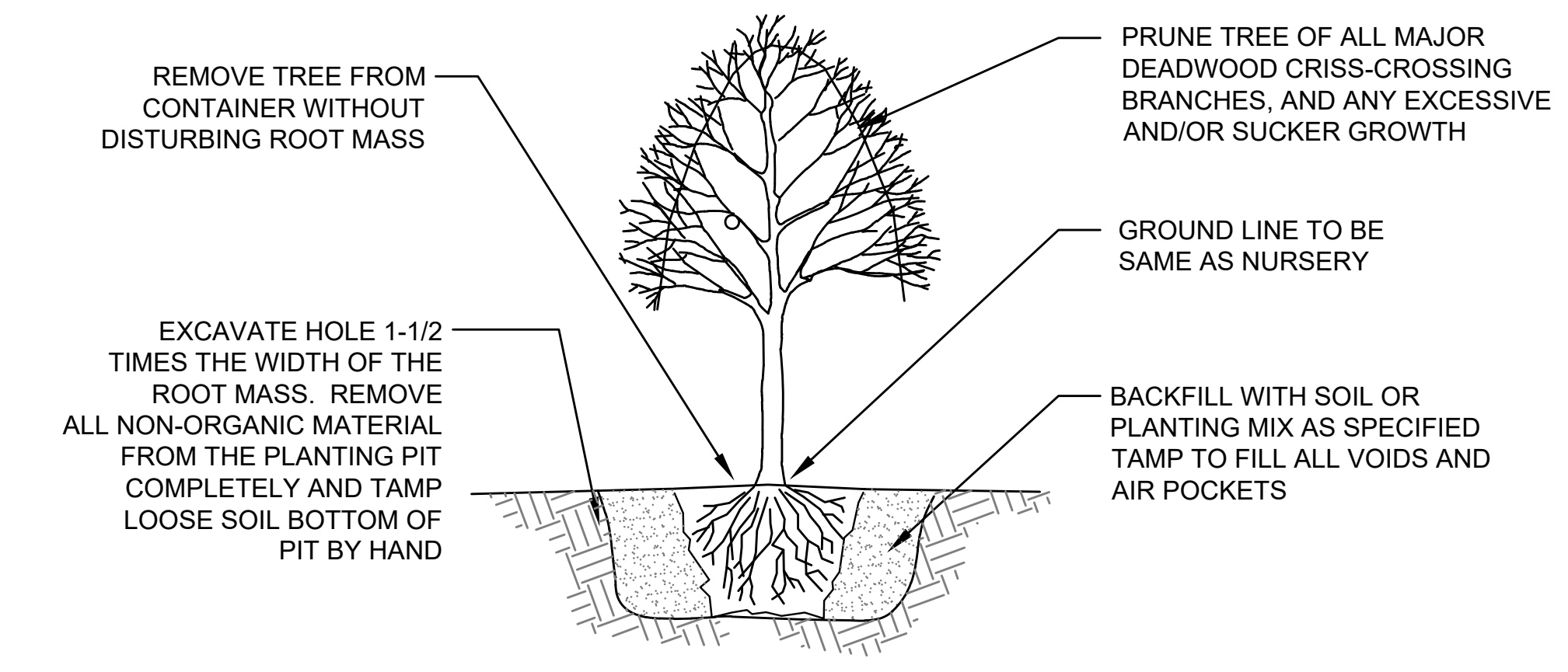
PLAN VIEW

NOT TO SCALE



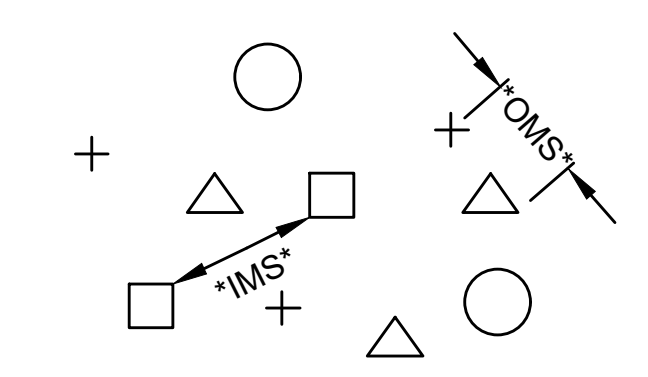
SHRUB PLANTING - CONTAINER GROWN

NOT TO SCALE



TREE PLANTING - CONTAINER GROWN

NOT TO SCALE



OMS- AN OVERALL MINIMUM SPACING DISTANCE "OMS" IS ASSIGNED TO THE PLANTING CONFIGURATION "SEE PLANT SCHEDULE"
 IMS- AN INDIVIDUAL MINIMUM SPACING DISTANCES "IMS" IS ASSIGNED TO EACH INDIVIDUAL SPECIES "SEE PLANT SCHEDULE"

PLANT SPACING - RANDOM

NOTE: EACH SYMBOL INDICATES A DIFFERENT SPECIES

PLAN VIEW

NOT TO SCALE

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NORTH MICHIGAN PARK LID RETROFITS

PLANTING DETAILS

PROJECT NO. : 23014.02	SCALE: NTS
SEAL:	BY: EM CHECK: BA
DWG. NO. : C560	

CLIENT

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 1200 FIRST STREET, NE 5TH FLOOR
 WASHINGTON DC 20002

DATE: 12/18/23 ISSUES / REVISIONS



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NORTH MICHIGAN PARK LID RETROFITS

DA PLAN

PROJECT NO.: 23014.02 SCALE: 1" = 30'
 SEAL: BY: EM CHECK: BA
 DWG. NO.:

C600

LEGEND

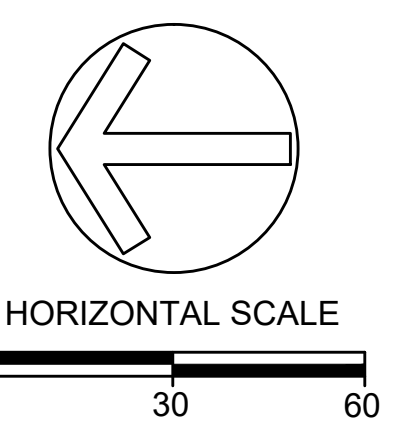
- CDA X SITE DRAINAGE AREA ID
- CONTRIBUTING DRAINAGE AREA
- IMPERVIOUS COVER
- COMPACTED COVER
- NATURAL COVER
- CONVERSION FROM COMPACTED TO BMP COVER

PRE-PROJECT CONTRIBUTING DRAINAGE AREA (CDA)

BMP ID	Total CDA SF	Natural SF	Compacted SF	Impervious SF	BMP SF	Vehicular SF	Target SWRv	Max SWRv
							(P = 1.2") CF	(P = 1.7") CF
NMP-1	41,137	0	27,587	13,550			1,977	2,801
NMP-2	30,916	7,011	16,716	7,189	0	0	1,101	1,560
NMP-3	191,473	161,511	12,806	17,156			1,950	2,762
				37,895				


POST-PROJECT CONTRIBUTING DRAINAGE AREA (CDA)

BMP ID	Total CDA SF	Natural SF	Compacted SF	Impervious SF	BMP SF	Vehicular SF	Target SWRv	Max SWRv
							(P = 1.2") CF	(P = 1.7") CF
NMP-1	41,137	0	25,898	13,550	1,689	-	2,095	2,968
NMP-2	30,916	7,011	15,126	7,189	1,590	-	1,212	1,717
NMP-3	191,473	161,511	10,291	17,156	2,515	-	2,126	3,012



SUMMARY TABLE

BMP	Bioretention Version	CDA	SWR _v		Areas				Depths				Retention Volume Provided %	Retention Volume Provided CF
			P = 1.2"	P = 1.7"	SA _{top} SF	SA _{bottom} SF	SA _{average} SF	d _{ponding} IN	d _{media} IN	Gravel Underdrain IN	Infiltration Sump IN			
												CF		
NMP-3 Standard	1	1,977	2,803	1,688	857	1,293	12	18	12	0	1,988	60%	1,193	
NMP-2 Standard	2	1,101	1,560	1,590	656	1,123	9	18	12	0	1,351	60%	810	
NMP-3 Standard	3	1,950	2,762	2,515	965	1,740	12	18	12	0	2,488	60%	1,493	
		3,078	4,360								3,339		2,003	



Project: DOEE DPR IV - North Michigan Park
 No: 23014.02
 Date: 1/8/2023
 Subject: NMP-1 Bioretention Basin Design Calculations
 Completed By: EM
 QA/QC By: BA

Calculations

BMP 1
 Step 1: Determine Max. Filter Depth from SACDA & RvCDA (Table 3.21)

$$SA_{CDA} = 1689 \cdot 41137$$

$$SA_{CDA} = 4.1\%$$

$$R_v CDA = [A_{bottom} \cdot 0.25 + A_{top} \cdot 0.95 + 0 \cdot A_{natural}] / A_{total}$$

$$R_v CDA = 0.47$$

From DDOE Table 3.21 for SA_{CDA} & RvCDA Above
 Max. Filter Media Depth = 42 inches

Step 2: Select Ponding & Media Depths, based on Site Constraints
 Note: Gravel Depth layer to the Underdrain (d_{gravel}) has been capped at 12" during treatment

$$d_{ponding} = 12.0 \text{ inches}$$

$$d_{media} = 18.0 \text{ inches}$$

$$d_{gravel \text{ up}} = 12.0 \text{ inches}$$

$$d_{gravel \text{ sump}} = 0.0 \text{ inches}$$

$$d_p = 30.0 \text{ inches}$$

Step 3: Calculate Storage Volume

$$S_v = SA_{bottom} \times [(d_{media} \times \eta_{media}) + (d_{stone} \times \eta_{stone})] + [(SA_{bottom} + SA_{top}) / 2 \times d_{ponding \text{ bio}}]$$


$$S_v = 897 \times [(1.5 \times 0.25) + (1 \times 0.4)] + [(1689 + 897) / 2 \times 1]$$

$$S_v = 1,988 \text{ cubic feet}$$

Step 4: Check Sv vs SWRv of Drainage Area

$$S_v : SWR_v = 1988 : 1977$$

$$S_v : SWR_v = 101\%$$



Project: DOEE DPR IV - North Michigan Park
 No: 23014.02
 Date: 1/8/2023
 Subject: NMP-2 Bioretention Basin Design Calculations
 Completed By: EM
 QA/QC By: BA

Calculations

BMP 2
 Step 1: Determine Max. Filter Depth from SACDA & RvCDA (Table 3.21)

$$SA_{CDA} = 1590 \cdot 30916$$

$$SA_{CDA} = 5.1\%$$

$$R_v CDA = [A_{bottom} \cdot 0.25 + A_{top} \cdot 0.95 + 0 \cdot A_{natural}] / A_{total}$$

$$R_v CDA = 0.34$$

From DDOE Table 3.21 for SA_{CDA} & RvCDA Above
 Max. Filter Media Depth = 42 inches

Step 2: Select Ponding & Media Depths, based on Site Constraints
 Note: Gravel Depth layer to the Underdrain (d_{gravel}) has been capped at 12" during treatment

$$d_{ponding} = 9.0 \text{ inches}$$

$$d_{media} = 18.0 \text{ inches}$$

$$d_{gravel \text{ up}} = 12.0 \text{ inches}$$

$$d_{gravel \text{ sump}} = 0.0 \text{ inches}$$

$$d_p = 30.0 \text{ inches}$$

Step 3: Calculate Storage Volume

$$S_v = SA_{bottom} \times [(d_{media} \times \eta_{media}) + (d_{stone} \times \eta_{stone})] + [(SA_{bottom} + SA_{top}) / 2 \times d_{ponding \text{ bio}}]$$


$$S_v = 656 \times [(1.5 \times 0.25) + (1 \times 0.4)] + [(1590 + 656) / 2 \times 0.75]$$

$$S_v = 1,351 \text{ cubic feet}$$

Step 4: Check Sv vs SWRv of Drainage Area

$$S_v : SWR_v = 1351 : 1101$$

$$S_v : SWR_v = 123\%$$



Project: DOEE DPR IV - North Michigan Park
 No: 23014.02
 Date: 1/8/2023
 Subject: NMP-3 Bioretention Basin Design Calculations
 Completed By: EM
 QA/QC By: BA

Calculations

BMP 3
 Step 1: Determine Max. Filter Depth from SACDA & RvCDA (Table 3.21)

$$SA_{CDA} = 2515 \cdot 191473$$

$$SA_{CDA} = 1.3\%$$

$$R_v CDA = [A_{bottom} \cdot 0.25 + A_{top} \cdot 0.95 + 0 \cdot A_{natural}] / A_{total}$$

$$R_v CDA = 0.10$$

From DDOE Table 3.21 for SA_{CDA} & RvCDA Above
 Max. Filter Media Depth = 60 inches

Step 2: Select Ponding & Media Depths, based on Site Constraints
 Note: Gravel Depth layer to the Underdrain (d_{gravel}) has been capped at 12" during treatment

$$d_{ponding} = 12.0 \text{ inches}$$

$$d_{media} = 18.0 \text{ inches}$$

$$d_{gravel \text{ up}} = 12.0 \text{ inches}$$

$$d_{gravel \text{ sump}} = 0.0 \text{ inches}$$

$$d_p = 30.0 \text{ inches}$$

Step 3: Calculate Storage Volume

$$S_v = SA_{bottom} \times [(d_{media} \times \eta_{media}) + (d_{stone} \times \eta_{stone})] + [(SA_{bottom} + SA_{top}) / 2 \times d_{ponding \text{ bio}}]$$

$$S_v = 965 \times [(1.5 \times 0.25) + (1 \times 0.4)] + [(2515 + 965) / 2 \times 1]$$

$$S_v = 2,488 \text{ cubic feet}$$

Step 4: Check Sv vs SWRv of Drainage Area

$$S_v : SWR_v = 2488 : 1950$$

$$S_v : SWR_v = 128\%$$

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TITLE: STORMWATER CALCULATIONS

PROJECT NO.: 23014.02 SCALE: N/A
 SEAL: BY: EM CHECK: BA
 DWG. NO.:

C700