

INNOVATIVE GEOSPATIAL & ENGINEERING SOLUTIONS ing Group

298 VETERANS DRIVE FOWLERVILLE. MICHIGAN 48836 (OFFICE) 517-223-3512 MONUMENTENGINEERING.COM ERVICE DISABLED VETERAN OWNE SMALL BUSINESS (SDVOSB)

**KEVIN C.** MCDEVITT **ENGINEER** 6201043260

Kevin CM Levis Call MISS DIG 3 full working days before you dig One-Call Organizati

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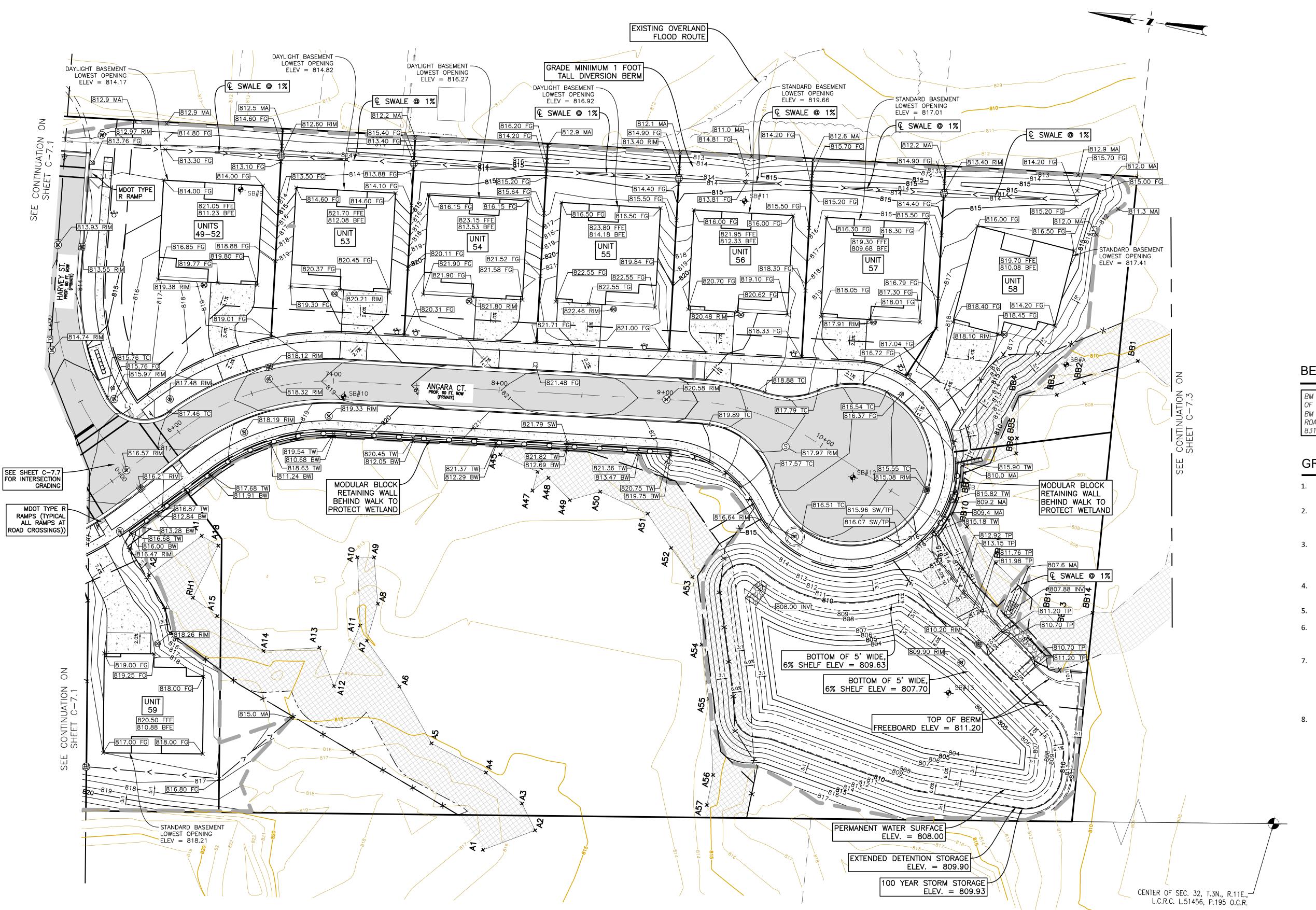
# **AUBURN ANGARA**

OAKS, LLC 14496 N SHELDON RE SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

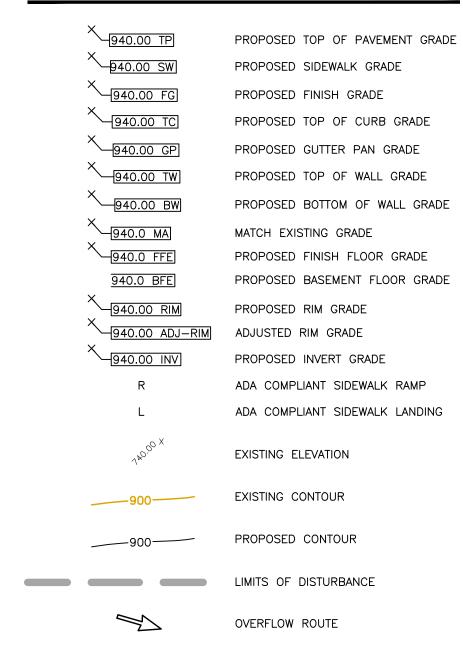
ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: 1" = 30'

1/2" FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM



# GRADING LEGEND



# **BENCHMARKS**

BM #1 ARROW ATOP FIRE HYDRANT AT THE N.W. CORNER OF LOT 11 ELEVATION 835.42 N.A.V.D.88 DATUM BM #2 ARROW ATOP FIRE HYDRANT N. SIDE OF AUBURN ROAD OPPOSITE N.E. CORNER OF LOT 11 ELEVATION 831.89 N.A.V.D. 88 DATUM

# **GRADING NOTES**

- 1. ALL CURB SPOT ELEVATIONS ARE TO TOP OF BACK OF CURB, UNLESS OTHERWISE NOTED.
- 2. ANY RETAINING WALLS OVER 4' TALL ARE TO BE DESIGNED, SIGNED AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
- 3. ALL SIDEWALK SHALL BE CONSTRUCTED WITH MAXIMUM 2 PERCENT CROSS SLOPE. ALL SIDEWALK CONSTRUCTED WITHIN THE RIGHT OF WAY SHALL DRAIN TOWARDS THE CURB.
- 4. ALL SIDEWALK RAMPS WILL MEET THE REQUIREMENTS OF ADA.
- 5. MAXIMUM GRASS SLOPES TO BE 3 ON 1.
- 6. MINIMUM GRASS SLOPES TO BE 1 PERCENT.
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  PERCENT.
- 7. EXISTING TOPSOIL SHALL BE STRIPPED FROM ALL DISTURBED AREAS PRIOR TO BEGINNING CONSTRUCTION AND STOCKPILED ON SITE. EXISTING TOPSOIL FROM WETLAND AREAS SHALL BE STOCKPILED SEPARATELY FOR RE-USE IN DISTURBED WETLAND AREAS AND BUFFER ZONES.
- 8. THE SITE MUST BE BALANCED AND CERTIFIED BY A LICENSED PROFESSIONAL SURVEYOR WITHIN ONE (1') FOOT OF FINISHED GRADE PRIOR TO UNDERGROUND UTILITY INSTALLATION.

Add benchmark #3 to the list here as it is on the Cover page

# WETLAND / NATURAL FEATURES NOTE

THIS PROPOSED ACTION QUALIFIES FOR AN EXEMPTION TO THE WETLAND AND WATERCOURSE ORDINANCE PROVIDED THAT:

(1) A PRIOR WRITTEN NOTICE IS GIVEN TO THE CITY ENGINEER AND WRITTEN CONSENT IS OBTAINED FROM THE CITY MAYOR

PRIOR TO WORK COMMENCING;

(2) THE WORK IS CONDUCTED USING BEST MANAGEMENT PRACTICES (BMPS) TO ENSURE FLOW AND CIRCULATION PATTERNS AND CHEMICAL AND BIOLOGICAL CHARACTERISTICS OF WETLANDS ARE NOT IMPACTED; AND

(3) SUCH THAT ALL IMPACTS TO THE AQUATIC ENVIRONMENT ARE MINIMIZED.

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OF Group

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KEVIN C.
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ENGINEER

NO.
6201043260

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IN, R11E

BURN ANGARA OAKS

OF SEC. 32, T3N, R1

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12/19/2024 12/19/2024 04/02/2025 05/29/2025 07/07/2025

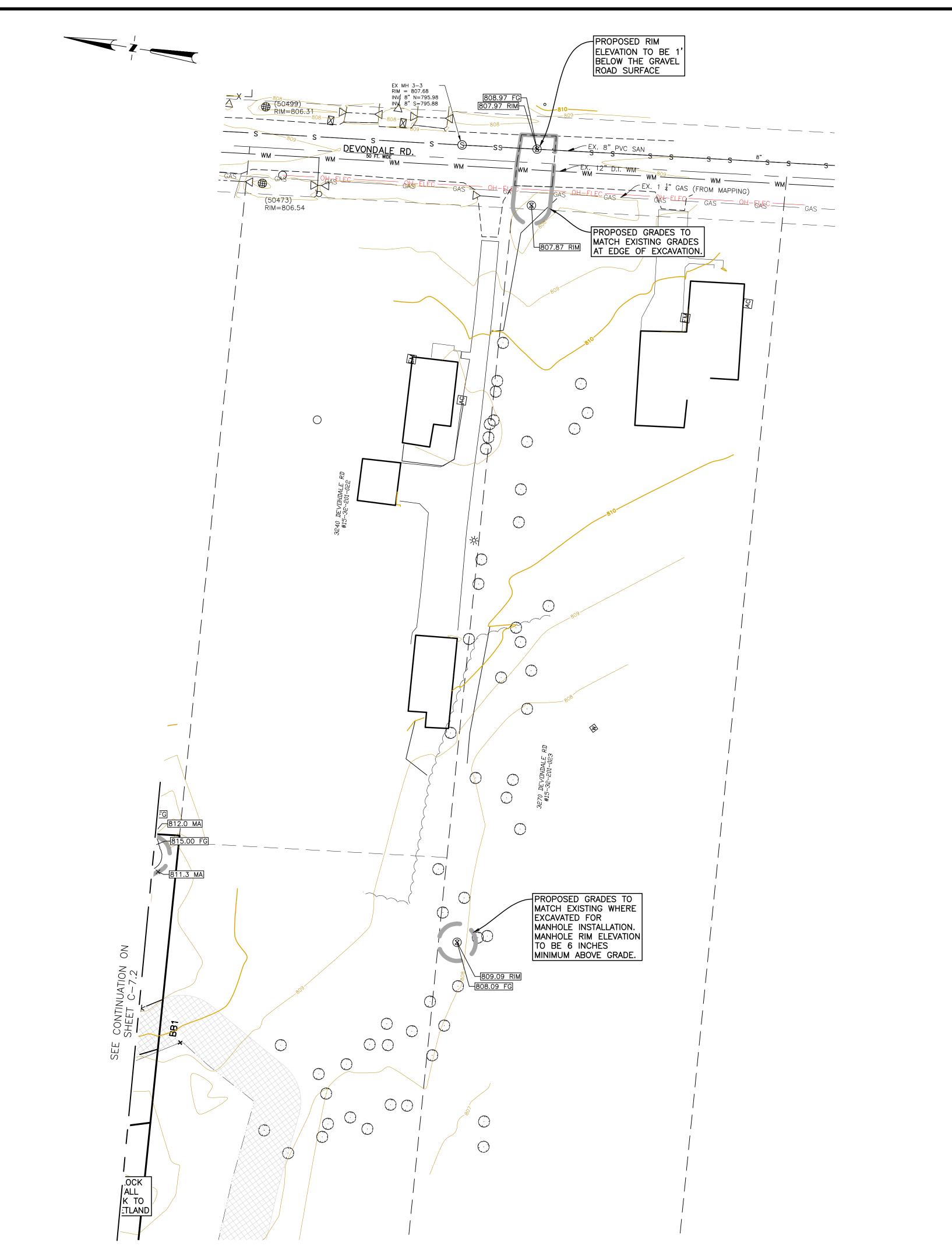
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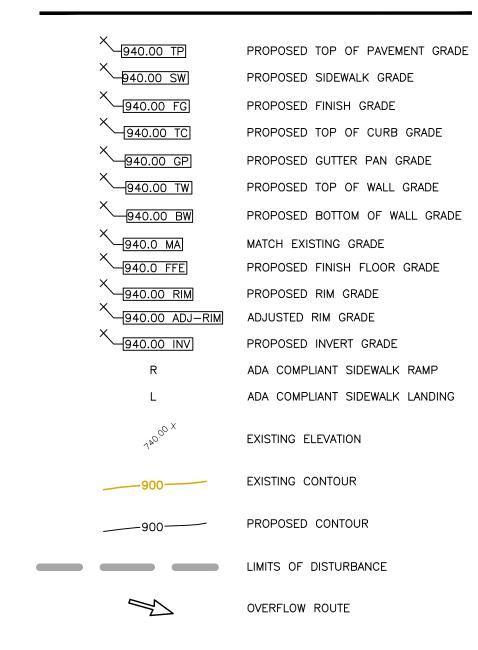
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FIELD: REICHERT
DRAWN BY: MN
DESIGN BY: KM
CHECK BY: AP



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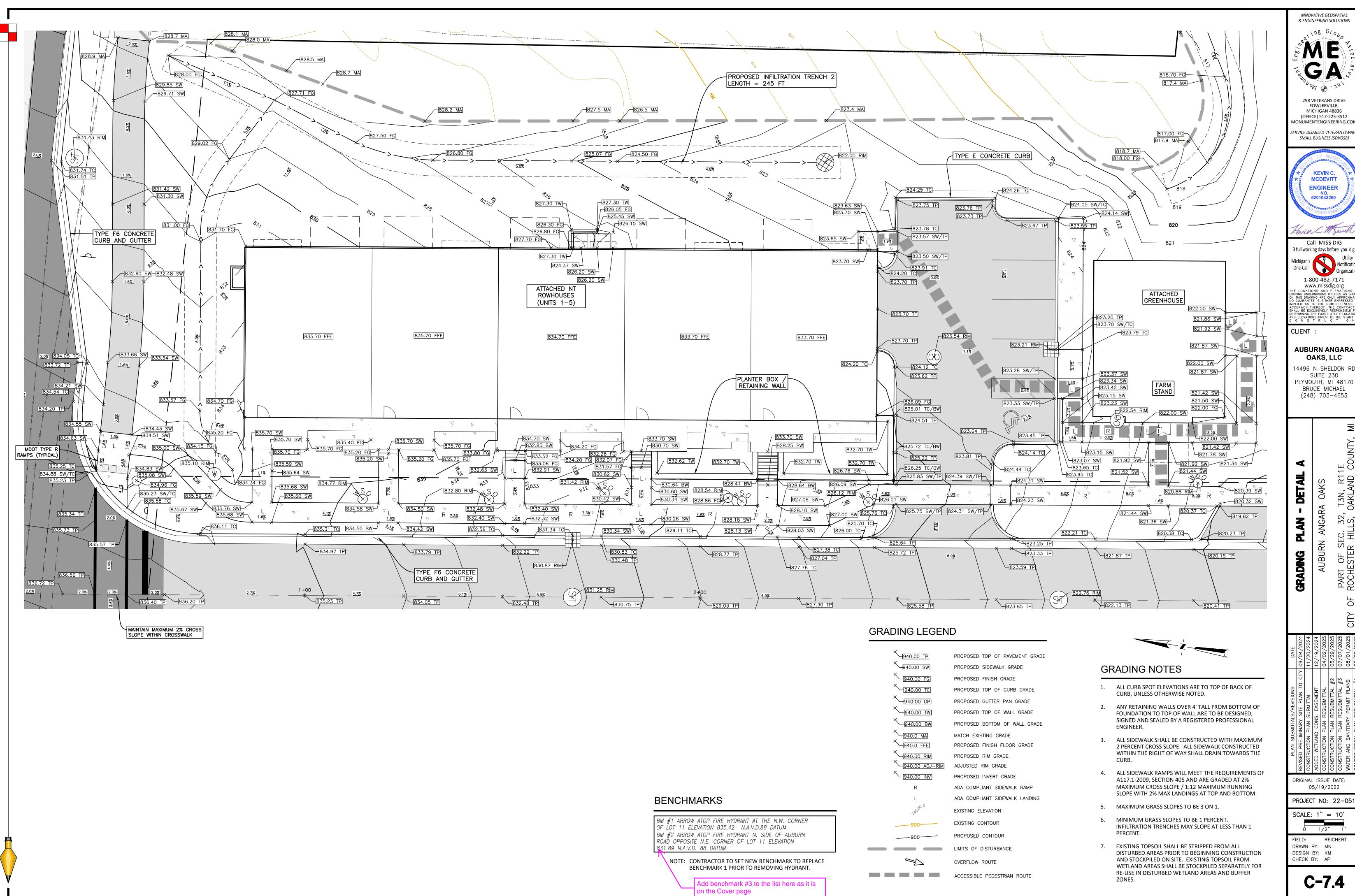
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DRAWN BY: MN DESIGN BY: KM CHECK BY: AP



FILE:P:\Projects\2022\22-051 Auburn Angara Sub\Dwg\Engineering\22-051\_C-7.4\_Grad-Detail.dwg PLOT DATE:8/20/2025 10:13 AM

CITY FILE #22-037 SECTION #32

PROPOSED TOP OF PAVEMENT GRADE 940.00 SW PROPOSED SIDEWALK GRADE 940.00 FG PROPOSED FINISH GRADE 940.00 TC PROPOSED TOP OF CURB GRADE ×\_\_940.00 GP PROPOSED GUTTER PAN GRADE 940.00 TW PROPOSED TOP OF WALL GRADE 940.00 BW PROPOSED BOTTOM OF WALL GRADE 940.0 MA MATCH EXISTING GRADE PROPOSED FINISH FLOOR GRADE 940.00 RIM PROPOSED RIM GRADE × 940.00 ADJ-RIM ADJUSTED RIM GRADE 940.00 INV PROPOSED INVERT GRADE ADA COMPLIANT SIDEWALK RAMP ADA COMPLIANT SIDEWALK LANDING EXISTING ELEVATION EXISTING CONTOUR PROPOSED CONTOUR LIMITS OF DISTURBANCE OVERFLOW ROUTE ACCESSIBLE PEDESTRIAN ROUTE

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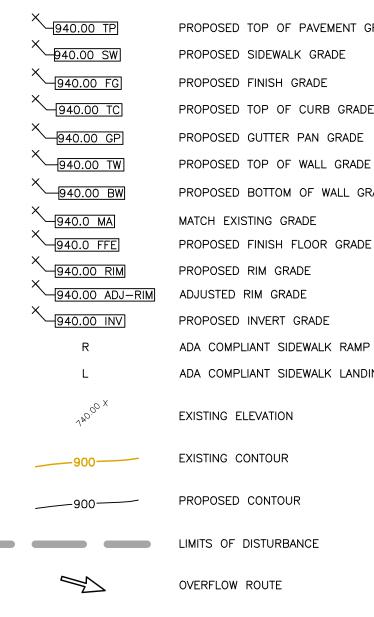
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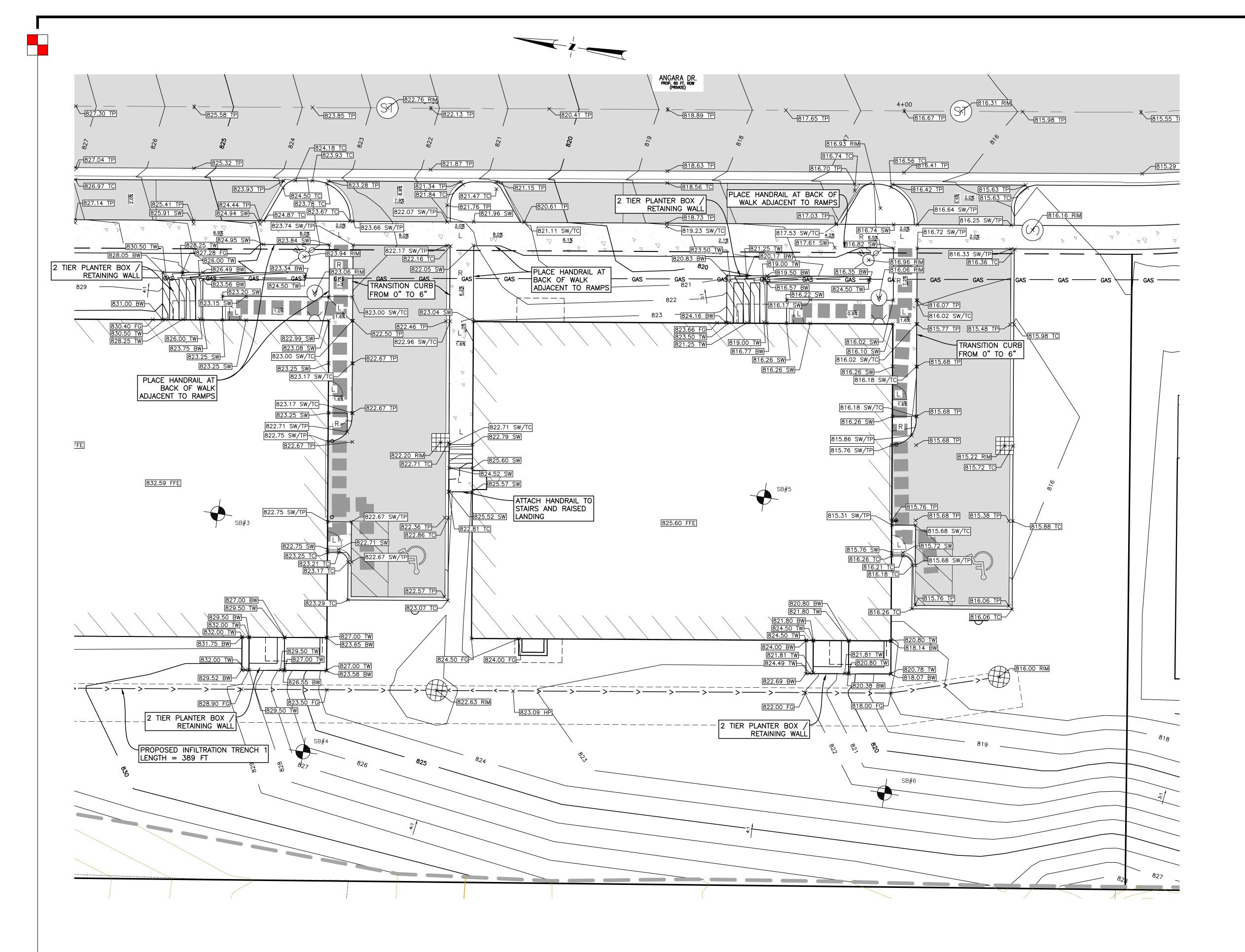
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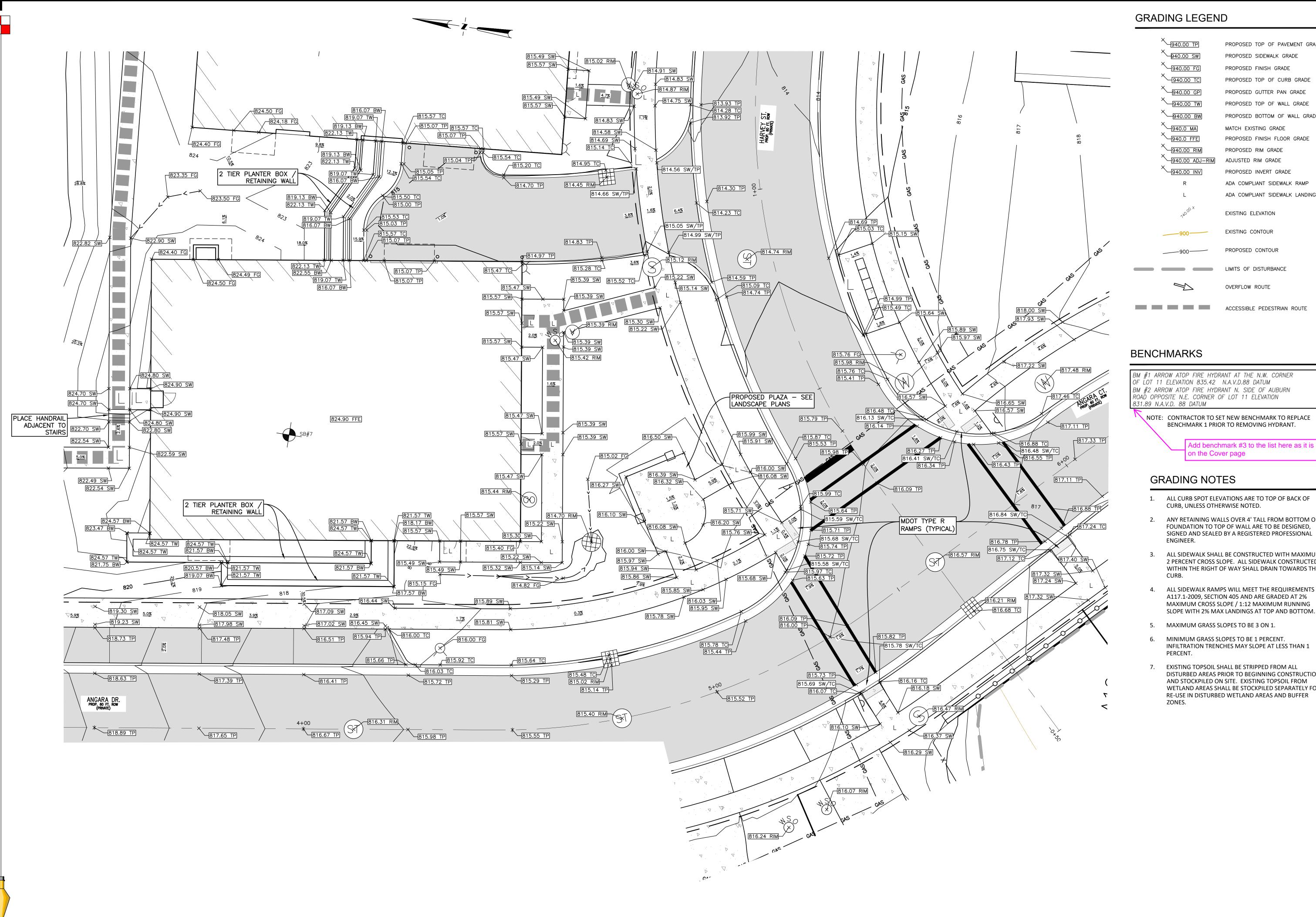
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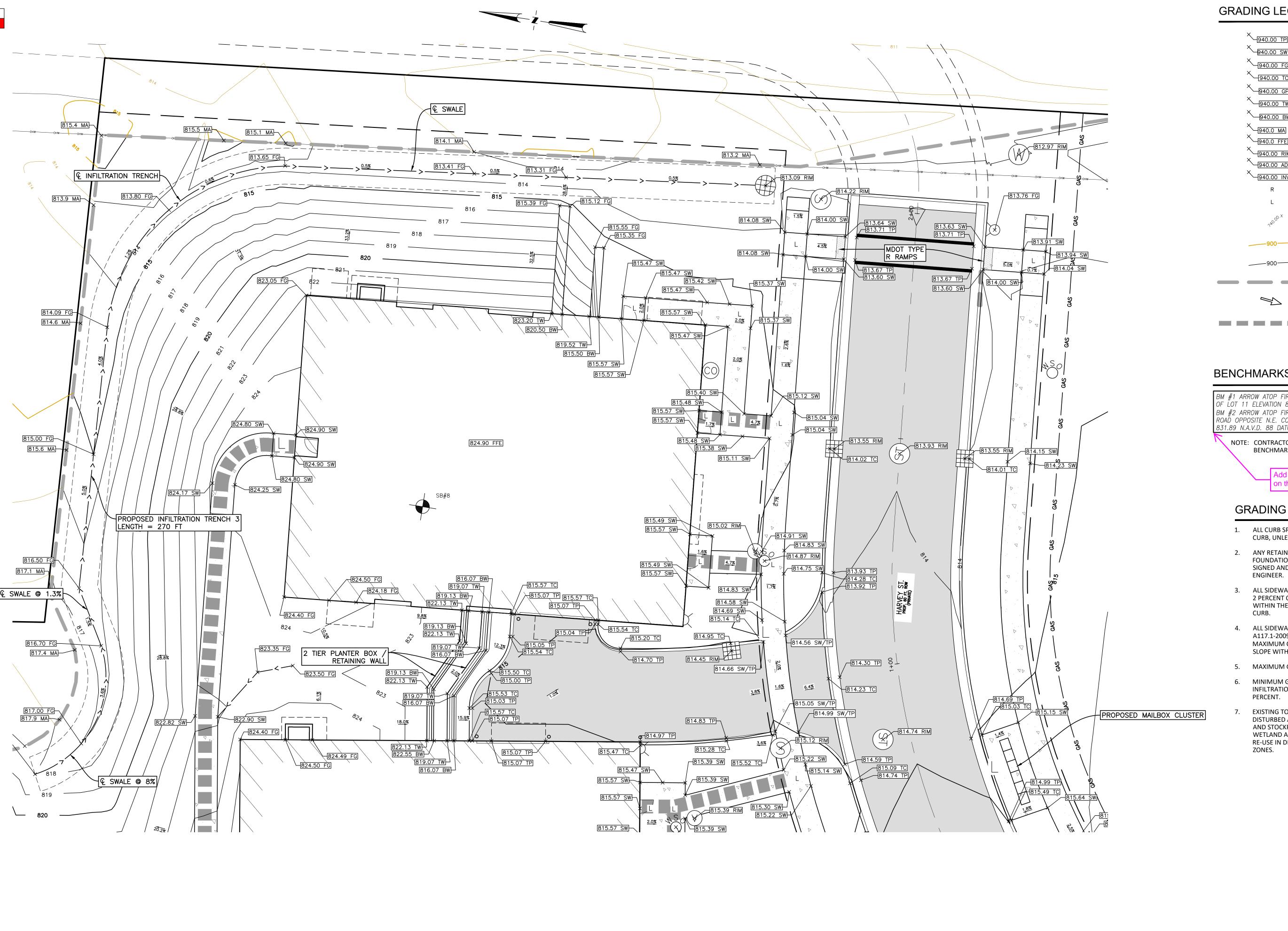
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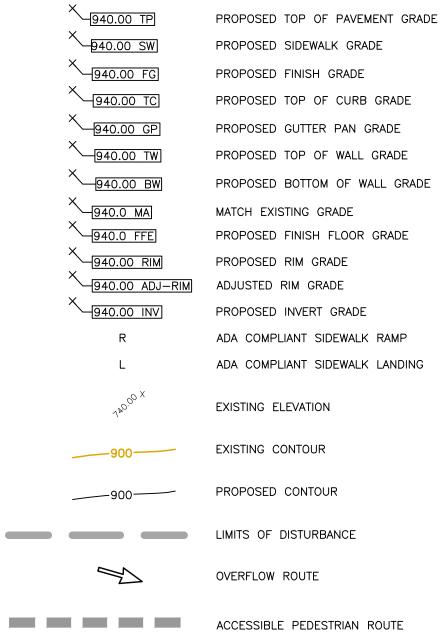
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# SESC LEGEND

STABILIZED CONSTRUCTION ACCESS

# **EROSION CONTROL QUANTITIES**

RIP RAP

## Disturbed Area: 7.74 Acres

	-	
QTY	UNIT	ITEM
3,717	LF	SILT FENCE
25	EA	INLET FILTER
1	EA	STABILIZED CONSTRUCTION ACCESS
1000	SY	RIP-RAP
	•	·

NOTE: QUANTITIES ARE FOR ENTIRE SITE

# SOILS INFO

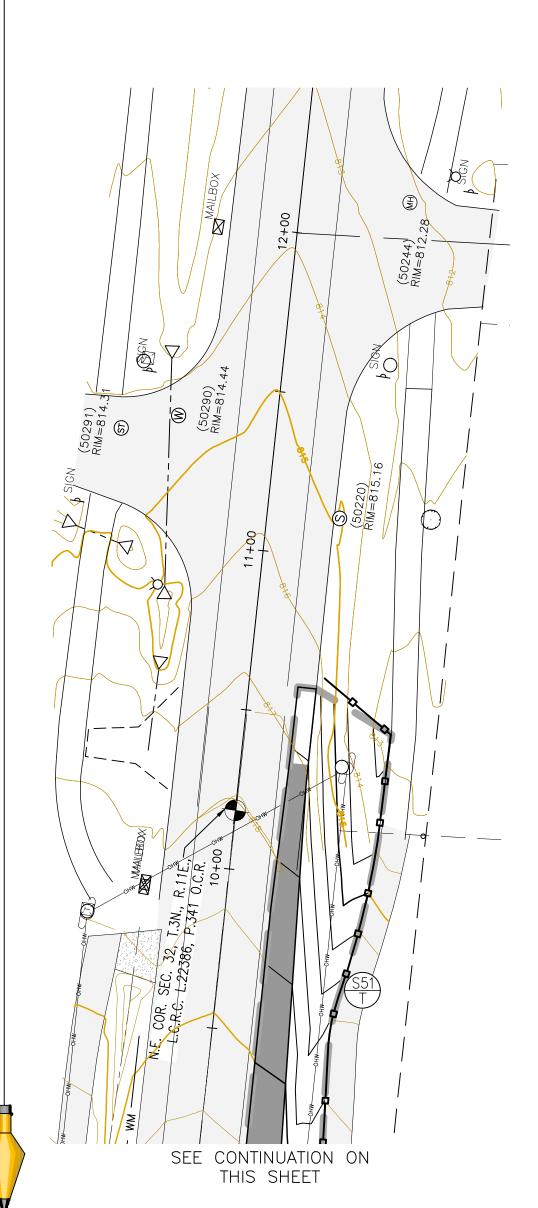
SOIL TYPES ARE ACCORDING TO THE USDA SOIL SURVEY WEB SITE (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)

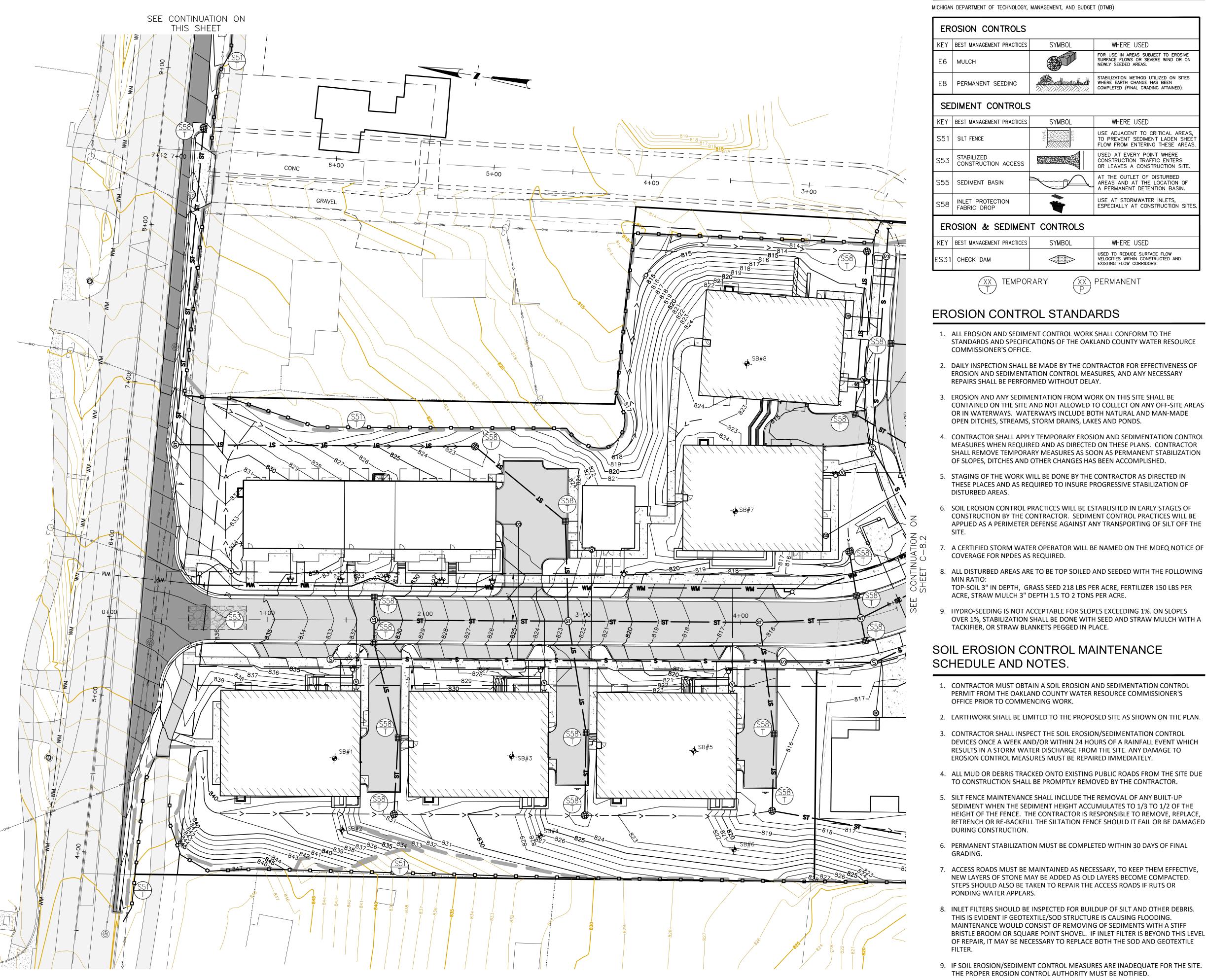
THE MAJORITY OF THE BUILDABLE AREAS OF THE SITE ARE COMPRISED OF THE FOLLOWING SOIL TYPES:

- URBAN LAND-SPINKS COMPLEX, 0 TO 8 PERCENT SLOPES
- FOX SANDY LOAM, TILL PLAIN, 2 TO 6 PERCENT SLOPES
- 35A: THETFORD LOAMY FINE SANDS, 0 TO 3 PERCENT SLOPES

THE WETLAND AREAS ARE COMPRISED OF THE FOLLOWING SOIL

GRANBY LOAMY SAND





# **DTMB SOIL EROSION & SEDIMENTATION** CONTROL MEASURES

MICHIGAN DEPARTMENT OF TECHNOLOGY, MANAGEMENT, AND BUDGET (DTMB)

KEY	BEST MANAGEMENT PRACTICES	SYMBOL	WHERE USED
E6	MULCH		FOR USE IN AREAS SUBJECT TO EROSIVE SURFACE FLOWS OR SEVERE WIND OR ON NEWLY SEEDED AREAS.
E8	PERMANENT SEEDING	suffer where the same of the s	STABILIZATION METHOD UTILIZED ON SITES WHERE EARTH CHANGE HAS BEEN COMPLETED (FINAL GRADING ATTAINED).
SEI	DIMENT CONTROLS	5	
KEY	BEST MANAGEMENT PRACTICES	SYMBOL	WHERE USED
S51	SILT FENCE		USE ADJACENT TO CRITICAL AREAS, TO PREVENT SEDIMENT LADEN SHEET FLOW FROM ENTERING THESE AREAS.
S53	STABILIZED CONSTRUCTION ACCESS		USED AT EVERY POINT WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES A CONSTRUCTION SITE.
S55	SEDIMENT BASIN		AT THE OUTLET OF DISTURBED AREAS AND AT THE LOCATION OF A PERMANENT DETENTION BASIN.
S58	INLET PROTECTION FABRIC DROP		USE AT STORMWATER INLETS, ESPECIALLY AT CONSTRUCTION SITES
ER	OSION & SEDIMEN	T CONTROLS	
KEY	BEST MANAGEMENT PRACTICES	SYMBOL	WHERE USED
ES31	CHECK DAM		USED TO REDUCE SURFACE FLOW VELOCITIES WITHIN CONSTRUCTED AND EXISTING FLOW CORRIDORS.

XX TEMPORARY

1. ALL EROSION AND SEDIMENT CONTROL WORK SHALL CONFORM TO THE STANDARDS AND SPECIFICATIONS OF THE OAKLAND COUNTY WATER RESOURCE COMMISSIONER'S OFFICE.

PERMANENT

DAILY INSPECTION SHALL BE MADE BY THE CONTRACTOR FOR EFFECTIVENESS OF EROSION AND SEDIMENTATION CONTROL MEASURES, AND ANY NECESSARY REPAIRS SHALL BE PERFORMED WITHOUT DELAY.

EROSION AND ANY SEDIMENTATION FROM WORK ON THIS SITE SHALL BE CONTAINED ON THE SITE AND NOT ALLOWED TO COLLECT ON ANY OFF-SITE AREAS OR IN WATERWAYS. WATERWAYS INCLUDE BOTH NATURAL AND MAN-MADE OPEN DITCHES, STREAMS, STORM DRAINS, LAKES AND PONDS.

MEASURES WHEN REQUIRED AND AS DIRECTED ON THESE PLANS. CONTRACTOR

SHALL REMOVE TEMPORARY MEASURES AS SOON AS PERMANENT STABILIZATION OF SLOPES, DITCHES AND OTHER CHANGES HAS BEEN ACCOMPLISHED. STAGING OF THE WORK WILL BE DONE BY THE CONTRACTOR AS DIRECTED IN

DISTURBED AREAS. 6. SOIL EROSION CONTROL PRACTICES WILL BE ESTABLISHED IN EARLY STAGES OF CONSTRUCTION BY THE CONTRACTOR. SEDIMENT CONTROL PRACTICES WILL BE APPLIED AS A PERIMETER DEFENSE AGAINST ANY TRANSPORTING OF SILT OFF THE

THESE PLACES AND AS REQUIRED TO INSURE PROGRESSIVE STABILIZATION OF

7. A CERTIFIED STORM WATER OPERATOR WILL BE NAMED ON THE MDEQ NOTICE OF COVERAGE FOR NPDES AS REQUIRED.

ALL DISTURBED AREAS ARE TO BE TOP SOILED AND SEEDED WITH THE FOLLOWING TOP-SOIL 3" IN DEPTH, GRASS SEED 218 LBS PER ACRE, FERTILIZER 150 LBS PER ACRE, STRAW MULCH 3" DEPTH 1.5 TO 2 TONS PER ACRE.

HYDRO-SEEDING IS NOT ACCEPTABLE FOR SLOPES EXCEEDING 1%. ON SLOPES OVER 1%, STABILIZATION SHALL BE DONE WITH SEED AND STRAW MULCH WITH A TACKIFIER, OR STRAW BLANKETS PEGGED IN PLACE.

# SOIL EROSION CONTROL MAINTENANCE SCHEDULE AND NOTES.

- 1. CONTRACTOR MUST OBTAIN A SOIL EROSION AND SEDIMENTATION CONTROL PERMIT FROM THE OAKLAND COUNTY WATER RESOURCE COMMISSIONER'S OFFICE PRIOR TO COMMENCING WORK.
- 2. EARTHWORK SHALL BE LIMITED TO THE PROPOSED SITE AS SHOWN ON THE PLAN.
- 3. CONTRACTOR SHALL INSPECT THE SOIL EROSION/SEDIMENTATION CONTROL DEVICES ONCE A WEEK AND/OR WITHIN 24 HOURS OF A RAINFALL EVENT WHICH RESULTS IN A STORM WATER DISCHARGE FROM THE SITE. ANY DAMAGE TO EROSION CONTROL MEASURES MUST BE REPAIRED IMMEDIATELY.
- 4. ALL MUD OR DEBRIS TRACKED ONTO EXISTING PUBLIC ROADS FROM THE SITE DUE TO CONSTRUCTION SHALL BE PROMPTLY REMOVED BY THE CONTRACTOR.
- SILT FENCE MAINTENANCE SHALL INCLUDE THE REMOVAL OF ANY BUILT-UP SEDIMENT WHEN THE SEDIMENT HEIGHT ACCUMULATES TO 1/3 TO 1/2 OF THE HEIGHT OF THE FENCE. THE CONTRACTOR IS RESPONSIBLE TO REMOVE, REPLACE, RETRENCH OR RE-BACKFILL THE SILTATION FENCE SHOULD IT FAIL OR BE DAMAGED DURING CONSTRUCTION.
- PERMANENT STABILIZATION MUST BE COMPLETED WITHIN 30 DAYS OF FINAL
- ACCESS ROADS MUST BE MAINTAINED AS NECESSARY, TO KEEP THEM EFFECTIVE, NEW LAYERS OF STONE MAY BE ADDED AS OLD LAYERS BECOME COMPACTED. STEPS SHOULD ALSO BE TAKEN TO REPAIR THE ACCESS ROADS IF RUTS OR PONDING WATER APPEARS.
- 8. INLET FILTERS SHOULD BE INSPECTED FOR BUILDUP OF SILT AND OTHER DEBRIS. THIS IS EVIDENT IF GEOTEXTILE/SOD STRUCTURE IS CAUSING FLOODING. MAINTENANCE WOULD CONSIST OF REMOVING OF SEDIMENTS WITH A STIFF BRISTLE BROOM OR SQUARE POINT SHOVEL. IF INLET FILTER IS BEYOND THIS LEVEL OF REPAIR, IT MAY BE NECESSARY TO REPLACE BOTH THE SOD AND GEOTEXTILE FILTER.
- 9. IF SOIL EROSION/SEDIMENT CONTROL MEASURES ARE INADEQUATE FOR THE SITE. THE PROPER EROSION CONTROL AUTHORITY MUST BE NOTIFIED.
- 10. THE EROSIONS CONTROLS WILL BE MAINTAINED WEEKLY AND AFTER EVERY STORM BY THE CONTRACTOR. ENSURING MAINTENANCE IS THE RESPONSIBILITY OF THE PROPERTY OWNER.

INNOVATIVE GEOSPATIAL & ENGINEERING SOLUTIONS , ing Group

298 VETERANS DRIVE FOWLERVILLE. MICHIGAN 48836 (OFFICE) 517-223-3512

MONUMENTENGINEERING.COM SERVICE DISABLED VETERAN OWNE SMALL BUSINESS (SDVOSB)

**KEVIN C. MCDEVITT ENGINEER** 

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1-800-482-7171 www.missdig.org

CCURACY THEREOF. THE CONTRACT
HALL BE EXCLUSIVELY RESPONSIBLE F
ETERMINING THE EXACT UTILITY LOCATIC
ND ELEVATIONS PRIOR TO THE START
ONSTRUCTION CLIENT:

**AUBURN ANGARA** 

OAKS, LLC 14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

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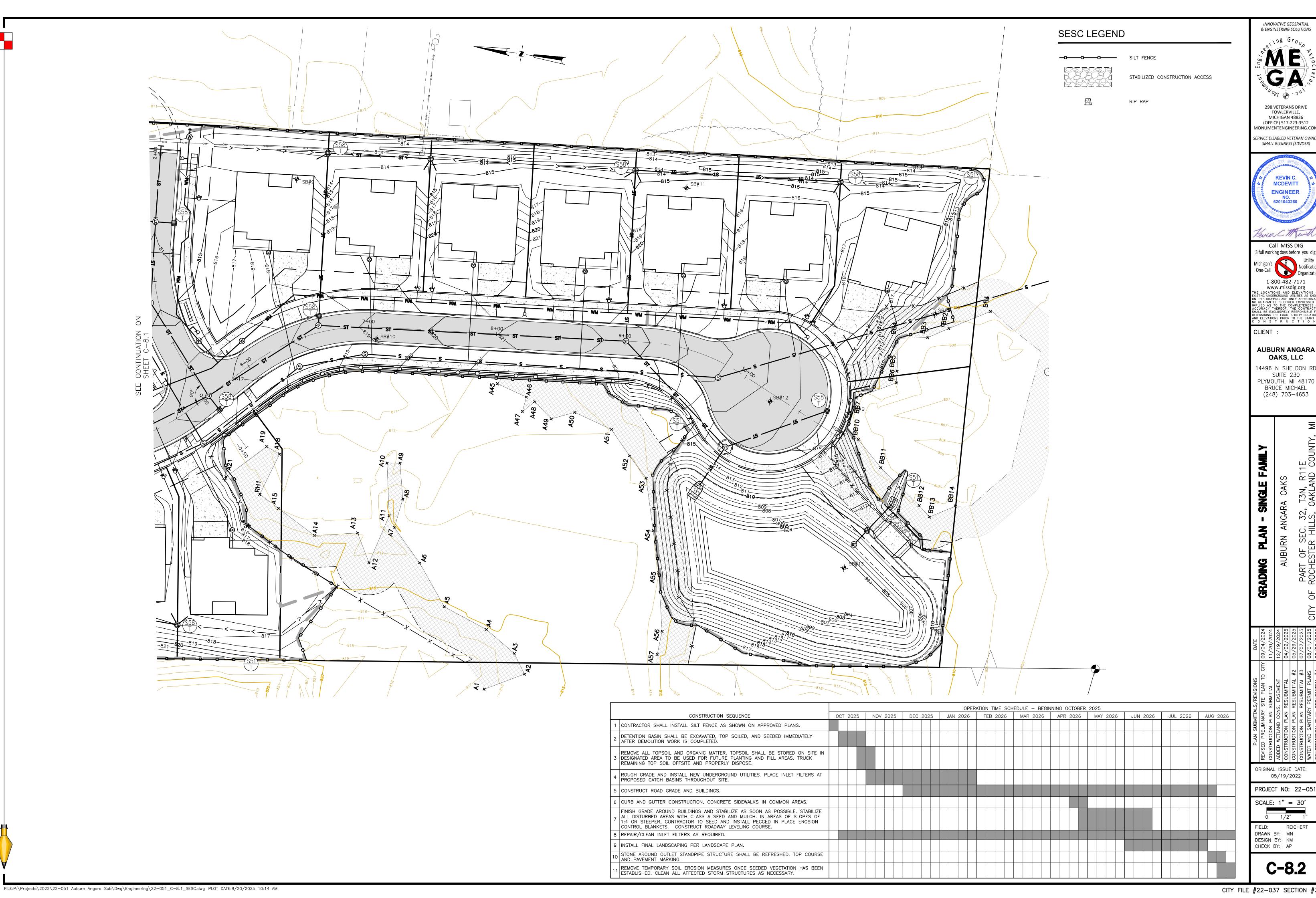
BU

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: 1" = 30'

1/2" FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

**C-8.1** 



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CLIENT:

#### **AUBURN ANGARA** OAKS, LLC

14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: 1" = 30'

FIELD: REICHERT DRAWN BY: MN



STABILIZED CONSTRUCTION ACCESS

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**KEVIN C. MCDEVITT ENGINEER** NO. 6201043260

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THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE NO GUARANTEE IS EITHER EXPRESSED OF IMPLIED AS TO THE COMPLETENESS OF ACCURACY THEREOF. THE CONTRACTO SHALL BE EXACTUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATION AND ELEVATIONS PRIOR TO THE START CONTRACTORY.

CLIENT :

# AUBURN ANGARA OAKS, LLC

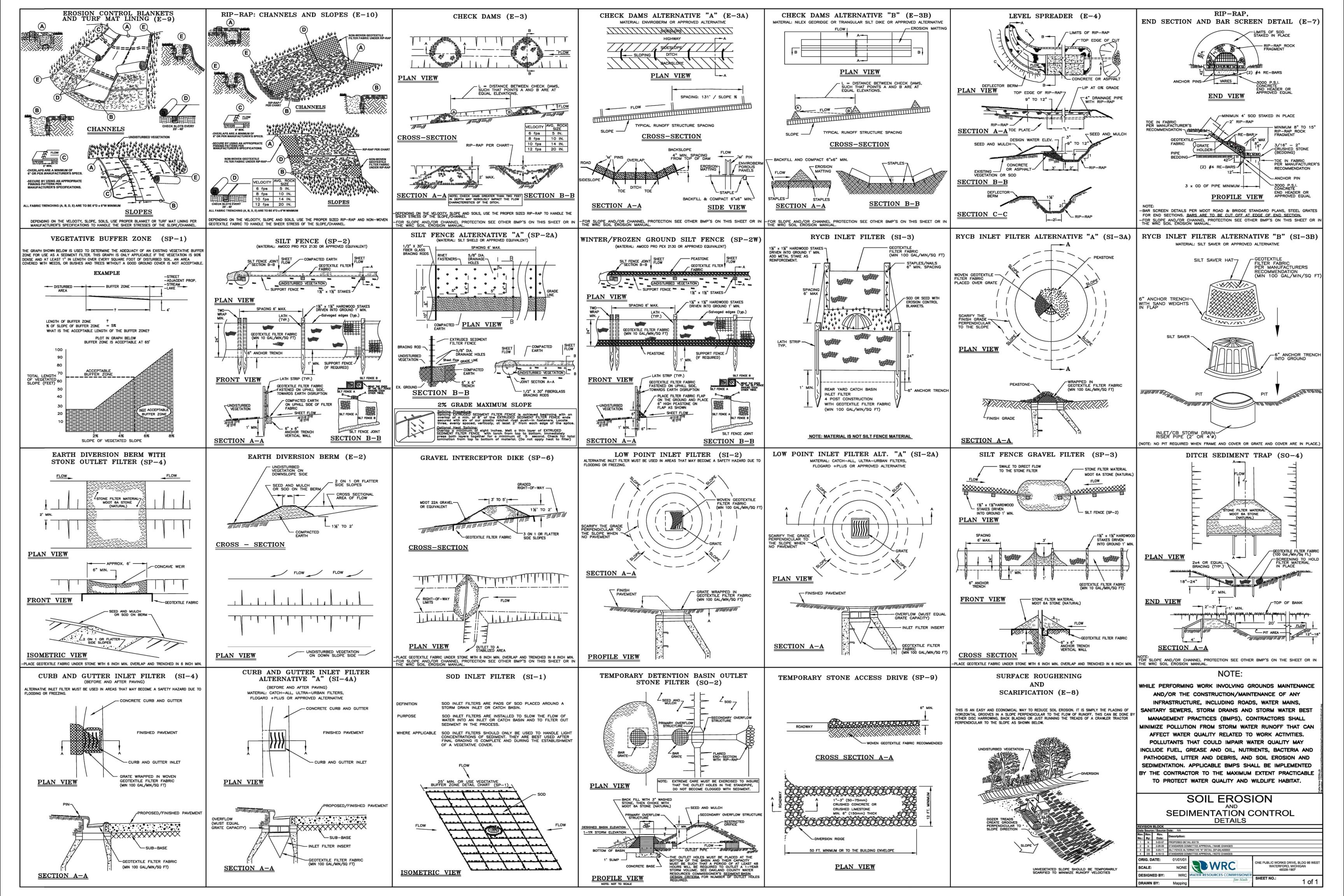
14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: 1" = 30'

DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

C-8.3



# WEIGHTED 'C' VALUE CALCULATIONS

COMPOUND RUNOFF COEFFICIENT FOR AREA 1 (TO IN-1)						
	AREA (SF)	AREA (AC)	С			
OVERALL	9757	0.22				
CONTRIBUTING	9757	0.22				
FLOWING OFF	0	0.00				
				AXC		
BUILDING	2501		0.95	2375.95		
PAVEMENT	0		0.95	0		
LAWN	7256		0.20	1451.2		
TOTALS	9757			3827.15		
COMPOUND C =	$TOTAL\ A \times C$	· _	3827.15	0.39		
$COMFOUNDC = \frac{1}{CO}$	NTRIBIITING	ARFA	9757			

COMPOUND RUNOFF	COEFFICIENT FOR A	REA 2 (TO CB-	·2)
$COMPOUND C = \frac{1}{CON}$	TRIBUTING AREA	9757	
COMPOUND C -	$TOTAL\ A \times C$	3827.15	0.3

COMPOUND RUNG	FF COEFFICIEN	IT FOR ARE	A 2 (TO C	B-2)
	AREA (SF)	AREA (AC)	С	
OVERALL	6922	0.16		
CONTRIBUTING	6922	0.16		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3668		0.95	3484
PAVEMENT	2240		0.95	212
LAWN	1014		0.20	202
TOTALS	6922			5815
COMPOUND C = -	$TOTAL A \times C$		5815.4	0.8
$COMFOONDC = \frac{1}{COMFOONDC}$	ONTRIBUTING A	AREA -	6922	

DRAINAGE AREA MAP

DRAINAGE AREA 40

DRAINAGE AREA 45 0.05 AC

DRAINAGE AREA 41 0.06 AC

DRAINAGE AREA 42 0.07 AC

DRAINAGE

DRAINAGE AREA 44 0.14 AC

DRAINAGE

AREA 289 11.46 AC

MH-34

		AREA (SF)	AREA (AC)	С	
OVERALL		5127	0.12		
CONTRIBUTING		5127	0.12		
FLOWING OFF		0	0.00		
					AXC
BUILDING		742		0.95	704.9
PAVEMENT		2479		0.95	2355.05
LAWN		1906		0.20	381.2
	TOTALS	5127			3441.15
COMPOUNT	) C —	$TOTAL\ A \times C$	C	3441.15	0.67
COMPOUNL	$C = \frac{1}{COI}$	NTRIBUTING	AREA	5127	
COMPOUND	RUNOF	F COEFFICIEN	NT FOR ARE	A 4 (TO II	N-14)
		AREA (SF)	AREA (AC)	С	
OVERALL		2478	0.06		
CONTRIBUTING		2478	0.06		
FLOWING OFF		^	0.00		
I LO WING OIL		0	0.00		
12011110011		U	0.00		AXC

BUILDING

PAVEMENT

+ + + + AREA 47 5+00 + + 0.66 AC

FUTURE DEVELOPMENT AREA
MULTI-FAMILY RESIDENTIAL
ASSUMED DETAINED TO
NATURAL RUNOFF RATE

0.88 AC

 $COMPOUND C = \frac{1}{CONTRIBUTING AREA}$ 

FUTURE DEVELOPMENT AREA

ASSUME DETAINED TO

NATURAL RUNOFF RATE

DRAINAGE AREA 8 0.19 AC

MULTI-FAMILY RESIDENTIAL

0.95

2478

0.95 1902.85

1997.85

0.81

FUTURE AREA

DETAINED

TO C=0.20

DRAINAGE AREA 15

N-17A 81F

COMPOUND RUNOFF COEFFICIENT FOR AREA 3 (TO CB-3)

COMPOUND RUNOFF COEFFICIENT FOR AREA 5 (TO IN-15)							
	AREA (SF)	AREA (AC)	С				
OVERALL	8410	0.19					
CONTRIBUTING	8410	0.19					
FLOWING OFF	0	0.00					
				AXC			
BUILDING	1982		0.95	1882.9			
PAVEMENT	0		0.95	0			
LAWN	6428		0.20	1285.6			
TOTALS	8410			3168.5			
COMPOUND	$TOTAL A \times C$		3168.5	0.38			
$COMPOUND C = \frac{1}{CC}$	ONTRIBUTING A	REA	8410				
COMPOUND RUNOFF COEFFICIENT FOR AREA 6 (TO CB-16)							
	AREA (SF)	AREA (AC)	С				
OVED ALL	6076	0.16					

				AXC
BUILDING	1982		0.95	1882.9
PAVEMENT	0		0.95	C
LAWN	6428		0.20	1285.6
TOTALS	8410			3168.5
COMPOUND C =	$TOTAL A \times C$		3168.5	0.38
$COMFOOND C = \frac{1}{CO}$	NTRIBUTING A	IREA	8410	
COMPOUND RUNOF	F COEFFICIEN	T FOR ARE	A 6 (TO C	B-16)
	AREA (SF)	AREA (AC)	С	
OVERALL	6876	0.16		
CONTRIBUTING	6876	0.16		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3975		0.95	3776.25
PAVEMENT	2271		0.95	2157.45
LAWN	630		0.20	126
TOTALS	6876			6059.7
COMPOUND C =	$TOTAL A \times C$	_	6059.7	0.88
$COMPOUND C = \frac{COMPOUND}{COMPOUND}$	NTRIBUTING A	REA	6876	

	AREA (SF)	AREA (AC)	С	
OVERALL	9812	0.23		
CONTRIBUTING	9812	0.23		
FLOWING OFF	0	0.00		
				AXC
BUILDING	1965		0.95	1866.75
PAVEMENT	0		0.95	(
LAWN _	7847		0.20	1569.4
TOTALS	9812			3436.15
COMPOUND C = -	$TOTAL A \times$	<u>c</u>	3436.15	0.35
$COMFOOND C = \frac{CO}{CO}$	NTRIBUTING	AREA	9812	
			_	

COMPOUND RUNOFF COEFFICIENT FOR AREA 7 (TO CB-17)

COMPOUND C = -	TOTAL A × CONTRIBUTING		3436.15 9812	0.35
COMPOUND RUN	OFF COEFFICIE	NT FOR ARE	A 8 (TO C	B-18)
	AREA (SF)	AREA (AC)	С	
OVERALL	8289	0.19		
CONTRIBUTING	8289	0.19		
FLOWING OFF	0	0.00		
				AXC
BUILDING	2970		0.95	2821.5
PAVEMENT	1781		0.95	1691.95
LAWN	3538		0.20	707.6
TOTAL	S 8289			5221.05
COMPOUND C =	$\frac{TOTAL \ A \times}{CONTRIBUTING}$		5221.05 8289	0.63

MH-12 TO BE MECHANICAL SEDIMENTATION CONTROL

EXISTING WETLAND AREA + OVER-FLOWS TO POND +

STRUCTURE. SEE C-9.3.

INFILTRATION TRENCH 7 OVERFLOWING TO POND

	AREA (SF)	AREA (AC)	С	
OVERALL	16990	0.39		
CONTRIBUTING	16990	0.39		
FLOWING OFF	0	0.00		
				AXC
BUILDING	1688		0.95	1603.6
PAVEMENT	9646		0.95	9163.7
LAWN _	5656		0.20	1131.2
TOTALS	16990			11898.5
COMPOUND	$TOTAL A \times C$		11898.5	0.70
$COMPOUND C = \frac{1}{CC}$	ONTRIBUTING A	AREA	16990	

$COMPOUND C = \frac{1}{CO}$	$\frac{TOTAL\ A \times C}{ONTRIBUTING}$	_	11898.5 16990	0.70
COMPOUND RUNOF	F COEFFICIEN	IT FOR ARI	A 10 (TO	IN-20)
	AREA (SF)	AREA (AC)		
OVERALL	23111	0.53		
CONTRIBUTING	23111	0.53		
FLOWING OFF	0	0.00		
			С	AXC
BUILDING	3440		0.95	3268
PAVEMENT	13324		0.95	12657.8
LAWN	6347		0.20	1269.4
TOTALS	23111			17195.2
$COMPOUND C = \frac{1}{CC}$	TOTAL A ×		17195.2 23111	0.74

DRAINAGE AREA 18 0.80 AC

AREA 23 0.69 AC

COMPOUND RUNOFF COEFFICIENT FOR AREA 9 (TO CB-19)			COMPOUND RUNOFF COEFFICIENT FOR AREA 11 (TO IN-21)						
	AREA (SF)	AREA (AC)	С			AREA (SF)	AREA (AC)		
OVERALL	16990	0.39			OVERALL	15653	0.36		
CONTRIBUTING	16990	0.39			CONTRIBUTING	15653	0.36		
FLOWING OFF	0	0.00			FLOWING OFF	0	0.00		
				AXC				С	AXC
BUILDING	1688		0.95	1603.6	BUILDING	2683		0.95	2548.85
PAVEMENT	9646		0.95	9163.7	PAVEMENT	712		0.95	676.4
LAWN	5656		0.20	1131.2	LAWN	12258		0.20	2451.6
TOTALS	16990			11898.5	TOTALS	15653			5676.85
	$TOTALA \times C$		1000 E	0.70		$TOTALA \times C$	' -	- C-7-C 0.F	0.26

COMPOUND C -	$TOTAL A \times C$	5676.85	0.3
COMPOUND C =	CONTRIBUTING AREA	15653	

COMPOUND RUNO	FF COEFFICIEN	T FOR ARE	A 12 (TO	CB-25)
	AREA (SF)	AREA (AC)	С	
OVERALL	9423	0.22		
CONTRIBUTING	9423	0.22		
FLOWING OFF	0	0.00		
				AXC
BUILDING	5146		0.95	4888.7
PAVEMENT	1380		0.95	1311
LAWN	2897		0.20	579.4
TOTALS	9423			6779.1
COMPOUND C	$TOTAL\ A \times C$	_	6779.1	0.72
$COMPOUND C = \frac{1}{CC}$	NTRIBUTING A	REA	9423	

# COMPOUND RUNOFF COEFFICIENT FOR AREA 13 (TO IN-26)

	AREA (SF)	AREA (AC)	С	
OVERALL	3870	0.09		
CONTRIBUTING	3870	0.09		
FLOWING OFF	0	0.00		
				AXC
BUILDING	2022		0.95	1920.9
PAVEMENT	133		0.95	126.35
LAWN	1715		0.20	343
TOTALS	3870			2390.25
$COMPOUND C = \frac{1}{CO}$	$\frac{TOTAL\ A \times A}{NTRIBUTING}$		2390.25 3870	0.62

# COMPOUND RUNOFF COEFFICIENT FOR AREA 14 (TO IN-22)

	ANEA (SF)	ANEA (AC)	C	
OVERALL	10891	0.25		
CONTRIBUTING	10891	0.25		
FLOWING OFF	0	0.00		
				AXC
BUILDING	1297		0.95	1232.15
PAVEMENT	5659		0.95	5376.05
LAWN _	3935		0.20	787
TOTALS	10891			7395.2
$COMPOUND C = \frac{1}{C}$	$TOTAL \ A \times C$ $TOTAL \ A \times C$	REA –	7395.2 10891	0.68

# COMPOUND RUNOFF COEFFICIENT FOR AREA 15 (TO IN-22A)

			•	·
	AREA (SF)	AREA (AC)	С	
OVERALL	17481	0.40		
CONTRIBUTING	17481	0.40		
FLOWING OFF	0	0.00		
				AXC
BUILDING	1780		0.95	1691
PAVEMENT	7606		0.95	7225.7
LAWN	8095		0.20	1619
TOTAL	S 17481			10535.7
COMPOUND C =	$TOTAL A \times$	<u> </u>	10535.7	0.60
COMI OUND C -	CONTRIBUTIN	G AREA	17481	

# COMPOUND RUNOFF COEFFICIENT FOR AREA 16 (TO IN-27)

	ADEA (CE)	ADEA (AC)	С	
	AREA (SF)	AREA (AC)	C	
OVERALL	7924	0.18		
CONTRIBUTING	7924	0.18		
FLOWING OFF	0	0.00		
				AXC
BUILDING			0.95	0
PAVEMENT	4990		0.95	4740.5
LAWN	2934		0.20	586.8
TOTALS	7924			5327.3
	mom At. A.	0		
COMPOUND C =	$TOTAL\ A \times$	_	5327.3	0.67
$COMPOUND C = \frac{1}{COR}$	NTRIBUTING	AREA	7924	

# COMPOUND RUNOFF COEFFICIENT FOR AREA 17 (TO CB-29)

	AREA (SF)	AREA (AC)	С	
OVERALL	15409	0.35		
CONTRIBUTING	15409	0.35		
FLOWING OFF	0	0.00		
				AXC
BUILDING	4096		0.95	3891
PAVEMENT	5197		0.95	4937.
LAWN _	6116		0.20	1223
TOTALS	15409			10051.
COMPOUND C	$TOTAL\ A \times$	<i>C</i> .	10051.55	0.
$COMPOUND C = \frac{1}{CO}$	NTRIBIITING	$\Delta RF \Delta$	15409	

CONTRIBUTING AREA SEE SHEET C-9.1 FOR ADDITIONAL COMPOUND RUNOFF COEFFICIENT CALCULATIONS.

HA	ГСН	LEGI	END

AREA TO DETENTION BASIN

+ + + + OFF-SITE AREA (PASS THROUGH OR NOT to basin)

298 VETERANS DRIVE FOWLERVILLE, MICHIGAN 48836 (OFFICE) 517-223-3512 MONUMENTENGINEERING.COM SERVICE DISABLED VETERAN OWNE SMALL BUSINESS (SDVOSB) **KEVIN C. MCDEVITT ENGINEER** Call MISS DIG 3 full working days before you dig 1-800-482-7171 www.missdig.org ON GUARANTEE IS EITHER EXPRESSED IMPLIED AS TO THE COMPLETENESS ACCURACY THEREOF. THE CONTRACT SHALL BE EXCLUSIVELY RESPONSIBLE F DETERMINING THE EXACT UTILITY LOCATIO AND ELEVATIONS PRIOR TO THE START C O N S T R U C T I O N

INNOVATIVE GEOSPATIAL

& ENGINEERING SOLUTIONS

**AUBURN ANGARA** OAKS, LLC

CLIENT:

14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: 1" = 50'

REICHERT DRAWN BY: MN

CHECK BY: AP C-9.0

AREAS 40-45 IN AUBURN ROAD R/W INCLUDED IN STORM SEWER SYSTEM BUT PASSES THROUGH DETENTION BASIN.

DESIGN BY: KM

COMPOUND RUNOF	F COEFFICIEN	T FOR ARE	A 18 (TO	IN-32)
	ADEA (CE)	ADEA (AC)	C	
	AREA (SF)	AREA (AC)	С	
OVERALL	35050	0.80		
CONTRIBUTING	35050	0.80		
FLOWING OFF	0	0.00		
				AXC
BUILDING	6583		0.95	6253.85
PAVEMENT	17328		0.95	16461.6
LAWN	11139		0.20	2227.8
TOTALS	35050			24943.25
COMPOUND C =	$TOTAL A \times C$		24943.25	0.71

$COMPOUND C = \frac{1}{C}$	$TOTAL \ A \times C$ $CONTRIBUTING$	<u> </u>	24943.25 35050	0.7
COMPOUND RUNG	OFF COEFFICIEN	IT FOR AR	EA 19 (TO IN	1-28)
	AREA (SF)	AREA (AC)	С	
OVERALL	10836	0.25		
CONTRIBUTING	10836	0.25		

	AINLA (SI )	INLA (AC)	C		
OVERALL	10836	0.25			
CONTRIBUTING	10836	0.25			
FLOWING OFF	0	0.00			
				AXC	
BUILDING	3124		0.95	2967.8	
PAVEMENT	0		0.95	0	
LAWN _	7712		0.20	1542.4	
TOTALS	10836			4510.2	
$COMPOUND C = \frac{1}{COMPOUND}$	$TOTAL\ A \times C$	<del></del> -	4510.2	0.42	
CC	ONTRIBUTING AR	EA	10836		

COMPOUND	RUNOFF	COEFFICIENT	FOR ARI	FA 20 (	TO CE	いろり
JOIVII GOIVD		COLITICILITY	I ON AM	-~ 20 (	, I O CL	, 50,

	AREA (SF)	AREA (AC)	С	
OVERALL	11405	0.26		
CONTRIBUTING	11405	0.26		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3124		0.95	2967.8
PAVEMENT	0		0.95	0
LAWN	8281		0.20	1656.2
TOTALS	11405			4624
$COMPOUND C = \frac{1}{COMPOUND}$	$TOTAL\ A \times C$	·	4624	0.41
CO	NTRIBUTING	AREA -	11405	

### COMPOUND RUNOFF COEFFICIENT FOR AREA 21 (TO IN-31)

	AREA (SF)	AREA (AC)	С	
OVERALL	10667	0.24		
CONTRIBUTING	10667	0.24		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3124		0.95	2967.8
PAVEMENT	0		0.95	0
LAWN _	7543		0.20	1508.6
TOTALS	10667			4476.4
COMPOUND C = -	$TOTAL\ A \times C$	<u> </u>	4476.4	0.42
$\frac{COMIOUNDC}{CC}$	NTRIBUTING	AREA	10667	

### COMPOUND RUNOFF COEFFICIENT FOR AREA 23 (DETENTION POND AREA)

	AREA (SF)	AREA (AC)	С	
OVERALL	30084	0.69		
CONTRIBUTING	30084	0.69		
FLOWING OFF	0	0.00		
				AXC
BUILDING	0		0.95	0
PAVEMENT	0		0.95	0
LAWN	11740		0.20	2348
WATER SURFACE	18344		1.00	18344
TOTALS	30084			20692
$COMPOUND C = \frac{1}{CO}$	TOTAL A × C NTRIBUTING A		20692 30084	0.69

# COMPOUND RUNOFF COEFFICIENT FOR AREA 24 (TO IN-17A)

	AREA (SF)	AREA (AC)	С	
OVERALL	11144	0.26		
CONTRIBUTING	11144	0.26		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3240		0.95	3078
PAVEMENT	0		0.95	0
LAWN	7904		0.20	1580.8
TOTALS	11144			4658.8
COMPOUND C = -	$TOTAL A \times C$		4658.8	0.42
$COMFOONDC = \frac{CC}{CC}$	ONTRIBUTING A	AREA	11144	

# COMPOUND RUNOFF COEFFICIENT FOR AREA 25 (CB-35)

			•	•
	AREA (SF)	AREA (AC)	С	
OVERALL	10898	0.25		
CONTRIBUTING	10898	0.25		
FLOWING OFF	0	0.00		
				AXC
BUILDING	3472		0.95	3298.4
PAVEMENT	0		0.95	0
LAWN	7426		0.20	1485.2
TOTALS	10898			4783.6
$COMPOUND C = \frac{1}{1000}$	$TOTAL\ A \times C$		4783.6	0.44
COL	NTRIBUTING A	REA	10898	

# COMPOUND RUNOFF COEFFICIENT FOR AREA 26 (CB-36)

}	OVERALL CONTRIBUTING FLOWING OFF	ì	AREA (SF) 8693 8693 0	AREA (AC) 0.20 0.20 0.00	С	ΑXO
	BUILDING PAVEMENT LAWN	_	5287 3129 277		0.95 0.95 0.20	5022 2972 5
/	COMPOUN	TOTALS	8693 $TOTAL\ A \times C$		8050.6	805 0

#### **COMPOUND RUNOFF COEFFICIENT FOR AREA 40** (AUBURN ROW - INTO IN-33 - PASS THROUGH)

OVERALL

BUILDING

PAVEMENT

CONTRIBUTING

FLOWING OFF

BUILDING

**PAVEMENT** 

 $COMPOUND C = \frac{1}{C}$ 

TOTALS

 $COMPOUND C = \frac{1}{CONTRIBUTING AREA}$ 

CONTRIBUTING

FLOWING OFF

AREA (SF)

5436

5436

5436

2706

2706

2706

AREA (AC) 0.12

AREA (AC)

0.06

0.00

0.06

0.00

0.12

(1) C	(INCLUDE AS DE	(FUTURE MULTIFAMILY - INCLUDE IN MH-23) (INCLUDE AS DETAINED FLOW TO NATURAL RUNG RATE IN SEWER CALCS - PASS THROUGH POND)					
		AREA (SF)	AREA (AC)	С			
	OVERALL	38327	0.88				

	AREA (SF)	AREA (AC)	С	
OVERALL	38327	0.88		
CONTRIBUTING	38327	0.88		
FLOWING OFF	0	0.00		
				AXC
Detained - Offsite	38327		0.20	7665
TOTALS	38327			7665
COMPOUND C = -	$TOTAL\ A \times$	<u>c</u>	7665.4	0.2
00111 00110 0 -	CONTRIBUTING	<i>AREA</i>	38327	

### **COMPOUND RUNOFF COEFFICIENT FOR AREA 41** (AUBURN ROW - INTO CB-34 - PASS THROUGH)

5164.2

0.95

AXC

0.95 5164.2

0.95

0.20

5164.2

0.95

0.95

5436

	RATE IN SEWER CAL	.CS - PASS THI	ROUGH PO	טאי
		AREA (SF)	AREA (AC)	
	OVERALL	28594	0.66	
AXC	CONTRIBUTING	28594	0.66	
0	FLOWING OFF	0	0.00	
2570.7				
0	Detained - Offsite	28594		
2570.7	TOTALS	28594		
0.95	COMPOUND C =	$TOTAL A \times C$		57

#### COMPOUND RUNOFF COEFFICIENT FOR AREA 42 (AUBURN ROW - INCLUDE IN IN-14 - PASS THROUGH)

 $COMPOUND C = \frac{1}{CONTRIBUTING AREA}$ 

•				,
	AREA (SF)	AREA (AC)	С	
OVERALL	3014	0.07		
CONTRIBUTING	0	0.00		
FLOWING OFF	3014	0.07		
				AXC
BUILDING	0		0.95	0
PAVEMENT	3014		0.95	2863.3
LAWN	0		0.20	0
TOTALS	3014			2863.3

### CONTRIBUTING AREA COMPOUND RUNOFF COEFFICIENT FOR AREA 43 (AUBURN ROW - INCLUDE IN CB-3 - PASS THROUGH)

		AREA (SF)	AREA (AC)	С	
OVERALL		8439	0.19		
CONTRIBUTING		0	0.00		
FLOWING OFF		8439	0.19		
					AXC
BUILDING		0		0.95	(
PAVEMENT		5555		0.95	5277.2
LAWN		2884		0.20	576.
T	OTALS	8439			5854.0

# $COMPOUND C = \frac{1}{CONTRIBUTING AREA}$ 8439 COMPOUND RUNOFF COEFFICIENT FOR AREA 44 (AUBURN ROW - INCLUDE IN CB-3 - PASS THROUGH)

	AREA (SF)	AREA (AC)	С	
OVERALL	6194	0.14		
CONTRIBUTING	0	0.00		
FLOWING OFF	6194	0.14		
				AXC
BUILDING	0		0.95	0
PAVEMENT	3872		0.95	3678.4
LAWN	2322		0.20	464.4
TOTALS	6194			4142.8
COMPOUND C =	$TOTAL\ A \times C$		4142.8	0.67
COMITOUND C - CO	NTRIBIITING AR	$F\Delta$	619/	

 $TOTAL \ A \times C \qquad \qquad 5854.05 \qquad \qquad 0.69$ 

#### COMPOUND RUNOFF COEFFICIENT FOR AREA 45 (AUBURN ROW - INCLUDE IN CB-35 - PASS THROUGH)

	AREA (SF)	AREA (AC)	С	
VERALL	2187	0.05		
ONTRIBUTING	0	0.00		
OWING OFF	2187	0.05		
				AXC
JILDING	0		0.95	0
AVEMENT	488		0.95	463.6
wn _	1699		0.20	339.8
TOTALS	2187			803.4
COMPOUND C =	$TOTAL\ A \times C$		803.4	0.37
COMPOUND C				

# $COMPOUND C = \frac{1}{CONTRIBUTING AREA}$ COMPOUND RUNOFF COEFFICIENT FOR AREA 49 (OFFSITE AREA - DIRECTLY TO POND - PASS THROUGH)

	AREA (SF)	AREA (AC	C) C	
OVERALL	3066	0.0	7	
CONTRIBUTING	0	0.0	0	
FLOWING OFF	3066	0.0	7	
				AXC
BUILDING	0		0.95	0
PAVEMENT	0		0.95	0
LAWN	987		0.20	197.4
NATURAL AREAS	2079		0.20	415.8
TOTALS	3066			613.2
COMPOUND C =	$TOTAL A \times$	<u>C</u>	613.2	0.20
COMICOMDC = CO	NTRIBUTING	AREA	3066	

#### **RUNOFF FOR AREA 46** JDE IN MH-23) TO NATURAL RUNOFF

	AREA (SF)	AREA (AC)	С	
OVERALL	38327	0.88		
CONTRIBUTING	38327	0.88		
FLOWING OFF	0	0.00		
				AXC
Detained - Offsite	38327		0.20	7665
TOTALS	38327			7665
COMPOUND C	$TOTAL A \times C$		7665.4	0.2

#### COMPOUND RUNOFF COEFFICIENT FOR AREA 47 (FUTURE PRIVATE ROAD R/W - INCLUDE IN MH-23) (INCLUDE AS DETAINED FLOW TO NATURAL RUNOFF DATE IN SEWIED CALCS DASS THROUGH DONID)

		AREA (SF)	AREA (AC)	С	
OVE	ERALL	28594	0.66		
COI	NTRIBUTING	28594	0.66		
FLO	WING OFF	0	0.00		
					AXC
Det	ained - Offsite	28594		0.20	5718.8
	TOTALS	28594			5718.8
(	COMPOUND C =	$TOTAL\ A \times C$	_	5718.8	0.20
Ĺ	$\frac{COMFOONDC}{CO}$	NTRIBUTING A	$\overline{AREA}$	28594	

#### **COMPOUND RUNOFF COEFFICIENT FOR AREA 48** (FUTURE MULTIFAMILY - INCLUDE IN MH-23) (INCLUDE AS DETAINED FLOW TO NATURAL RUNOFF RATE IN SEWER CALCS - PASS THROUGH POND)

	AREA (SF) A	REA (AC)	С	
OVERALL	77174	1.77		
CONTRIBUTING	77174	1.77		
FLOWING OFF	0	0.00		
				AXC
Detained - Offsite	77174		0.20	15434.
TOTALS	77174			15434.
$COMPOUND C = \frac{1}{CO}$	$TOTAL\ A \times C$ $NTRIBUTING\ ARE$		15434.8 77174	0.20
00	TITLE OF THE TIME	***		

#### NOTE: AREAS 46, 47 AND 48 ARE FUTURE DEVELOPMENTAL AREAS. AREA TO BE DETAINED ON THOSE SITES TO A NATURAL RUNOFF COEFFICIENT (0.20). AREA INCLUDED IN STORM SEWER BUT CONSIDERED PASS THROUGH FOR ANGARA OAKS DETENTION SYSTEM.

#### COMPOUND RUNOFF COEFFICIENT FOR AREA 50 (IN-28A)

	AREA (SF)	AREA (AC)	С	
OVERALL	4915	0.11		
CONTRIBUTING	0	0.00		
FLOWING OFF	4915	0.11		
				AXC
BUILDING	1562		0.95	1483.9
PAVEMENT	0		0.95	0
LAWN	3353		0.20	670.6
NATURAL AREAS	0		0.20	0
TOTALS	4915			2154.5
COMPOUND C = -	$TOTAL A \times 0$	<u>c                                    </u>	2154.5	0.44
$COMFOOND C = \frac{CO}{CO}$	NTRIBUTING	AREA	4915	

# TOTAL AREA C FACTOR CALCULATION

COMPOUND RUNOFF COEFFICIENT

			AREA (AC)	AREA (SF)		
			11.15	485,524	OVERALL	
			7.25	315,957	CONTRIBUTING	
			3.89	169,567	FLOWING OFF	
RE	$A \times C$	С				
	0	0.95		0	EX BUILDING	
	0	0.95		0	EX PAVEMENT	
	65,997	0.95		69,471	PR BUILDING	
	75,792	0.95		79,781	PR PAVEMENT	
	18,125	1.00		18,344	POND AREA	
	22,254	0.15		148,361	GRASS	
RE	182,169			315,957	TOTALS	

315,957

# SITE INFO

COMPOUNDC = -

OVERALL AREA	=	11.15 AC
CONTRIBUTING AREA (A)	=	7.25 AC
ALLOWABLE DISCHARGE (Qa)	=	0.20 CFS/AC
COMPOUND C	=	0.58

 $TOTALA \times C$ 

CONTRIBUTING AREA

# REQUIRED CHANNEL PROTECTION VOLUME

19735 CF	$V_{cp} = \frac{1.3"}{12"} \times 43560 \times A \times C =$			AREA (AC)		
	12			11.15	485,524	<u>L</u>
				7.25	315,957	BUTING
				3.89	169,567	G OFF
	REQUIRED WATER QUALITY RATE (FOR MTS)	$A \times C$	С			
		0	0.95		0	DING
26.69 MII	$T_{c}$ =	0	0.95		0	EMENT
	20.20	65,997	0.95		69,471	DING
6.95 CF	$Q_{wq} = \frac{30.20}{(T_c + 9.17)^{0.81}} \times A \times C =$	75,792	0.95		79,781	EMENT
	$(T_c + 9.17)^{0.81}$	18,125	1.00		18,344	REA
		22,254	0.15		148,361	
	REQUIRED EXTENDED DETENTION VOLUME	182,169			315,957	TOTALS

# **EXTENDED DETENTION DISCHARGE RATE**

L AREA	=	11.15 AC	$Q_{ED} = \frac{v_{ED}}{172800} = 0.17 \text{ CFS}$
BUTING AREA (A)	=	7.25 AC	
ABLE DISCHARGE (Qa)	=	0.20 CFS/AC	100 YR STORM INLET RATE
JND C	=	0.58	30.2033 × 1000.2203

# $Q_{100in} = C \times A \times \frac{30.2332}{(T_c + 9.1747)^{0.8069}}$

100 YR STORM ALLOWABLE OUTLET RATE	
$Q_{VRR} = 1.1055 - 0.206 \ln(A) =$	0.70 CFS/ACRE

 $V_{ED} = \frac{1.7}{12"} \times 43560 \times A \times C =$ 

# 100 YR STORM ALLOWABLE OUTLET RATE

$Q_{100all} = A  imes Q_{VRR}$ =	5.06 CFS

22.29 CFS

# STORAGE CURVE FACTOR

$$R = 0.206 - 0.15 \times ln\left(\frac{Q_{100all}}{Q_{100in}}\right) = 0.43$$

### **100 YR STORM VOLUME IN**

ZIVI	VOLOWIL III		
	$V_{100R} = 18985 \times C \times A$	=	79396 CF

# 100 YR STORM STORAGE VOLUME

$V_{100det} = V_{100R} \times R - V_{cp-p}$	=	14284 CF

REQUIRED DETENTION VOLUME	=	28843 CF
<b>EXTENDED DETENTION VOLUME CONTROLS</b>		

# MANUFACTURED TREATMENT DEVICE SIZING

Project: Auburn Angara Oaks Location: Rochester Hills, MI

# **C**NTECH

# Oakland County Water Resources Commissioner's Office

Manufactured Treatment De	evice Sizing Calculation
Area (acres) =	10.39

10.39	Area (acres) =
0.48	Runoff Coefficient, C =
26.2	T <sub>c</sub> (min) =

1-year 
$$I_1$$
 (in/hr) = 30.20/(Tc+9.17)<sup>0.81</sup> = 1.68  
1-year Peak Flow (cfs) =  $Q_{WQ}$  = C x  $I_1$  x A = 8.39

Structure: MTD 12

# Recommended Model: CS-10

### CASCADE SEPARATOR™ MODEL SPECIFICATIONS PER NJDEP CERTIFICATION LETTER

Model	MTFR (cfs)
CS-4	1.80
CS-5	2.81
CS-6	4.05
CS-8	7.20
CS-10	11.30
CS-12	16.20

VOLUME PROVIDED = VOLUME REQUIRED = 28,843 CF (SEE SHEET C-9.2 FOR POND VOLUME CALCULATIONS)

# STORM SEWER CALCULATIONS

					3 TORIVI S	EWER DE	LOIGIN										ERANS DE		GROUP AS	JOUGA IE	.J, LLU			
	Q = CIA				t =	20	)										RVILLE, MI							-
Q = /	A x 1.486/n x R^2/3 x	S^1/2			n1 =			PVC (Oakl	and County)	)						517-223-3							-	
	I = 175/(t+25)				n2 =		CONC.	•	• •															
																			H.G. ELE	V.	INVERTE	LEV.	RIM ELEV.	RIM ELEV
	FROM STR	AREA	COEFF.		AREA	TOTAL	TIME	INT.	FLOW	PIPE	PIPE	PIPE	PIPE	PIPE	MIN PIPE	H.G.	VEL.	TIME	UP	DOWN	UP	DOWN	UP	DOWN
	TO STR	Α	С	AxC	TOTAL	CxA	t	1	Q	CAP.	AREA	LENGTH	DIA.	SLOPE	SLOPE	SLOPE	FULL	FLOW	STREAM	STREAM	STREAM	STREAM	STREAM	STREAM
					At																			
		ac.			ac.		min	in/hr	c.f.s.	c.f.s.	sq ft.	ft.	in.	%		%	ft/sec	min.						
MAIN RUN	IN-1 TO CB-2	0.22	0.39	0.087	0.224	0.087	20.00	3.89	0.34	2.04	0.79	48	12	0.33	0.30	0.33	2.60	0.31	826.51	826.35	825.71	825.55	830.65	830.41
	CB-2 TO CB-3	0.16	0.84	0.133	0.383	0.221	20.31	3.86	0.85	2.01	0.79	62	12	0.32	0.30	0.32	2.56	0.40	826.35	826.15	825.55	825.35	830.41	830.87
	CB-3 TO MH-4	0.45	0.68	0.308	0.837	0.529	20.71	3.83	2.02	3.24	0.79	15	12	0.83	0.30	0.83	4.13	0.06	826.15	826.03	825.35	825.23	830.87	831.25
	MH-4 TO MH-5			0.000	0.963	0.640	20.77	3.82	2.45	7.84	0.79	123	12	4.85	0.30	4.85	9.99	0.21	825.03	819.06	824.23	818.26	831.25	822.76
	MH-5 TO MH-6			0.000	2.000	1.345	23.44	3.61	4.86	7.09	0.79	121	12	3.97	0.30	3.97	9.03	0.22	817.33	812.52	816.53	811.72	822.76	816.31
	MH-6 TO MH-7			0.000	2.672	1.651	23.66	3.60	5.94	6.55	1.77	64	18	0.39	0.18	0.39	3.71	0.29	811.22	810.97	810.02	809.77	816.31	815.40
	MH-7 TO MH-8			0.000	3.681	2.371	23.95	3.57	8.48	10.11	3.14	84	24	0.20	0.12	0.20	3.22	0.43	810.97	810.80	809.27	809.10	815.40	816.57
	MH-8 TO MH-9			0.000	8.398	3.851	24.38	3.54	13.65	18.85	7.07	102	36	0.08	0.07	0.08	2.67	0.64	810.80	810.72	808.40	808.32	816.57	818.32
	MH-9 TO MH-11			0.000	9.249	4.290	25.02	3.50	15.01	18.85	7.07	240	36	0.08	0.07	0.08	2.67	1.50	810.72	810.53	808.32	808.13	818.32	820.58
	MH-11 TO MTD-12			0.000	9.756 10.561	4.500	26.52 27.23	3.40 3.35	15.29 16.99	18.85 21.08	7.07 7.07	113	36	0.08	0.07	0.08	2.67 2.98	0.71 0.21	810.53	810.44	808.13 808.04	808.04 808.00	820.58 816.64	816.64 810.70
	MTD-12 TO ES-13			0.000	10.501	5.071	21.23	3.35	10.99	21.00	7.07	38	36	0.10	0.07	0.10	2.90	0.21	810.44	810.40	000.04	000.00	010.04	610.70
LATERAL	IN-14 TO MH-4	0.13	0.89	0.112	0.126	0.112	20.00	3.89	0.43	3.24	0.79	15	12	0.83	0.30	0.83	4.13	0.06	827.15	827.03	826.35	826.23	830.87	831.25
LATERAL	IN-15 TO CB-16	0.19	0.38	0.073	0.193	0.073	20.00	3.89	0.29	2.01	0.79	52	12	0.32	0.30	0.32	2.56	0.34	818.50	818.33	817.70	817.53	822.63	822.20
	CB-16 TO MH-5	0.16	0.88	0.139	0.351	0.212	20.34	3.86	0.82	2.01	0.79	72	12	0.32	0.30	0.32	2.56	0.46	818.33	818.10	817.53	817.30	822.20	822.76
LATERAL	IN-17A TO CB-17	0.26	0.42	0.107	0.256	0.107	20.00	3.89	0.42	2.01	0.79	109	12	0.32	0.30	0.32	2.56	0.71	812.76	812.41	811.76	811.41	815.98	816.00
	CB-17 TO CB-18	0.23	0.35	0.079	0.481	0.186	20.71	3.83	0.71	3.52	0.79	49	12	0.98	0.30	0.98	4.49	0.18	812.41	811.93	811.41	810.93	816.00	815.22
	CB-18 TO MH-6	0.19	0.63	0.120	0.671	0.306	20.89	3.81	1.17	3.56	0.79	71	12	1.00	0.30	1.00	4.53	0.26	811.93	811.22	810.93	810.22	815.22	816.31
LATERAL	IN-26 TO CB-19	0.09	0.62	0.055	0.089	0.055	20.00	3.89	0.21	2.01	0.79	28	12	0.32	0.30	0.32	2.56	0.18	811.91	811.82	811.11	811.02	814.70	815.02
EATENAL	CB-19 TO MH-7	0.39	0.70	0.273	0.479	0.328	20.18	3.87	1.27	2.96	0.79	15	12	0.69	0.30	0.69	3.77	0.06	811.07	810.97	810.02	809.92	815.02	815.40
															.51550									
LATERAL	IN-20 TO MH-7	0.53	0.74	0.393	0.531	0.393	20.00	3.89	1.53	2.96	0.79	14	12	0.69	0.30	0.69	3.77	0.06	811.07	810.97	810.02	809.92	815.02	815.40
LATERAL	IN-22 TO MH-23	0.25	0.68	0.170	0.250	0.170	20.00	3.89	0.66	2.96	0.79	15	12	0.69	0.30	0.69	3.77	0.06	811.24	811.14	809.50	809.40	813.55	813.93
	MH-23 TO MH-24			0.000	3.959	1.072	20.37	3.86	4.14	4.69	1.77	63	18	0.20	0.18	0.20	2.66	0.40	811.14	811.01	809.00	808.87	813.93	814.74
	MH-24 TO MH-8			0.000	4.535	1.358	20.92	3.81	5.17	4.69	1.77	85	18	0.20	0.18	0.24	2.66	0.54	811.01	810.80	808.87	808.70	814.74	816.57
	W 04 TO 0D 05	0.00		0.400	0.050	0.400			0.50			400	40		0.00		0.50						040.00	044.54
LATERAL	IN-21 TO CB-25	0.36	0.36	0.129	0.359	0.129	20.00	3.89	0.50	2.01	0.79 0.79	103	12	0.32	0.30	0.32	2.56	0.67	811.47	811.14	809.93	809.60	813.09	814.54
	CB-25 TO MH-24	0.22	0.72	0.156	0.576	0.285	20.67	3.83	1.09	2.04	0.79	39	12	0.33	0.30	0.33	2.60	0.25	811.14	811.01	809.40	809.27	814.54	814.74
LATERAL	IN-22A TO MH-23	0.40	0.60	0.241	0.401	0.241	20.00	3.89	0.94	2.96	0.79	15	12	0.69	0.30	0.69	3.77	0.06	811.24	811.14	809.50	809.40	813.55	813.93
LATERAL	IN-27 TO MH-8	0.18	0.67	0.122	0.182	0.122	20.00	3.89	0.47	3.02	0.79	14	12	0.72	0.30	0.72	3.85	0.06	810.90	810.80	809.80	809.70	816.21	816.57
LATERAL	N 004 TO 0D 00	0.05	0.40	0.404	0.040	0.404	00.00	0.00	0.44	0.50	0.70	00	40	0.50	0.00	0.50	0.04	0.40	044.50	044.40	000 40	222.22	040.40	040.00
LATERAL	IN-28A TO CB-28	0.25	0.42	0.104	0.249	0.104	20.00	3.89	0.41	2.52	0.79	80	12	0.50	0.30	0.50	3.21	0.42	811.59	811.19	809.49	809.09	813.40	812.60
	CB-28 TO CB-29	0.25	0.42	0.104	0.498	0.209	20.42	3.85	0.81	2.01	0.79	127	12	0.32	0.30	0.32	2.56	0.83	811.19	810.78	809.09	808.68	812.60	818.12
	CB-29 TO MH-9	0.35	0.65	0.230	0.851	0.439	21.24	3.78	1.66	3.22	0.79	7	12	0.82	0.30	0.82	4.11	0.03	810.78	810.72	809.98	809.92	818.12	818.32
LATERAL	IN-31 TO CB-30	0.24	0.42	0.103	0.245	0.103	20.00	3.89	0.40	2.01	0.79	160	12	0.32	0.30	0.32	2.56	1.04	811.47	810.96	809.37	808.86	813.40	813.40
	CB-30 TO MH-11	0.26	0.41	0.107	0.507	0.210	21.04	3.80	0.80	2.01	0.79	133	12	0.32	0.30	0.32	2.56	0.87	810.96	810.53	808.86	808.43	813.40	820.58
LATERAL	FUTURE TO MH-23	3.31	0.20	0.662	3.308	0.662	20.00	3.89	2.57	4.69	1.77	59	18	0.20	0.18	0.20	2.66	0.37	811.26	811.14	809.12	809.00	813.56	813.93
LATERAL	IN-32 TO MTD-12	0.80	0.71	0.571	0.805	0.571	20.00	3.89	2.22	3.56	0.79	84	12	1.00	0.30	1.00	4.53	0.31	811.28	810.44	810.18	809.34	815.08	816.64
LATERAL	IN-33 TO CB-34	0.12	0.95	0.119	0.125	0.119	20.00	3.89	0.46	2.01	0.79	202	12	0.32	0.30	0.32	2.56	1.31	819.32	818.68	818.52	817.88	822.25	831.43
EA ILIME	CB-34 TO CB-35	0.12	0.95	0.059	0.123	0.119	21.31	3.78	0.40	2.01	0.79	190	12	0.32	0.30	0.32	2.56	1.23	818.68	818.07	817.88	817.27	831.43	822.00
	CB-35 TO CB-36	0.30	0.43	0.129	0.487	0.306	22.54	3.68	1.13	2.01	0.79	74	12	0.32	0.30	0.32	2.56	0.48	818.07	817.83	817.27	817.03	822.00	823.21
	CB 36 TO MH 5	0.00	0.43	0.126	0.407	0.402	23.03	3.64	1.70	2.01	0.70	63	12	0.32	0.30	0.32	2.56	0.41	817.83	817.63	817.03	816.83	823.21	822.76

CB-36 TO MH-5 0.20 0.93 0.186 0.687 0.492 23.03 3.64 1.79 2.01 0.79 63 12 0.32 0.30 0.32 2.56 0.41 817.83 817.63 817.03 816.83 823.21 822.76

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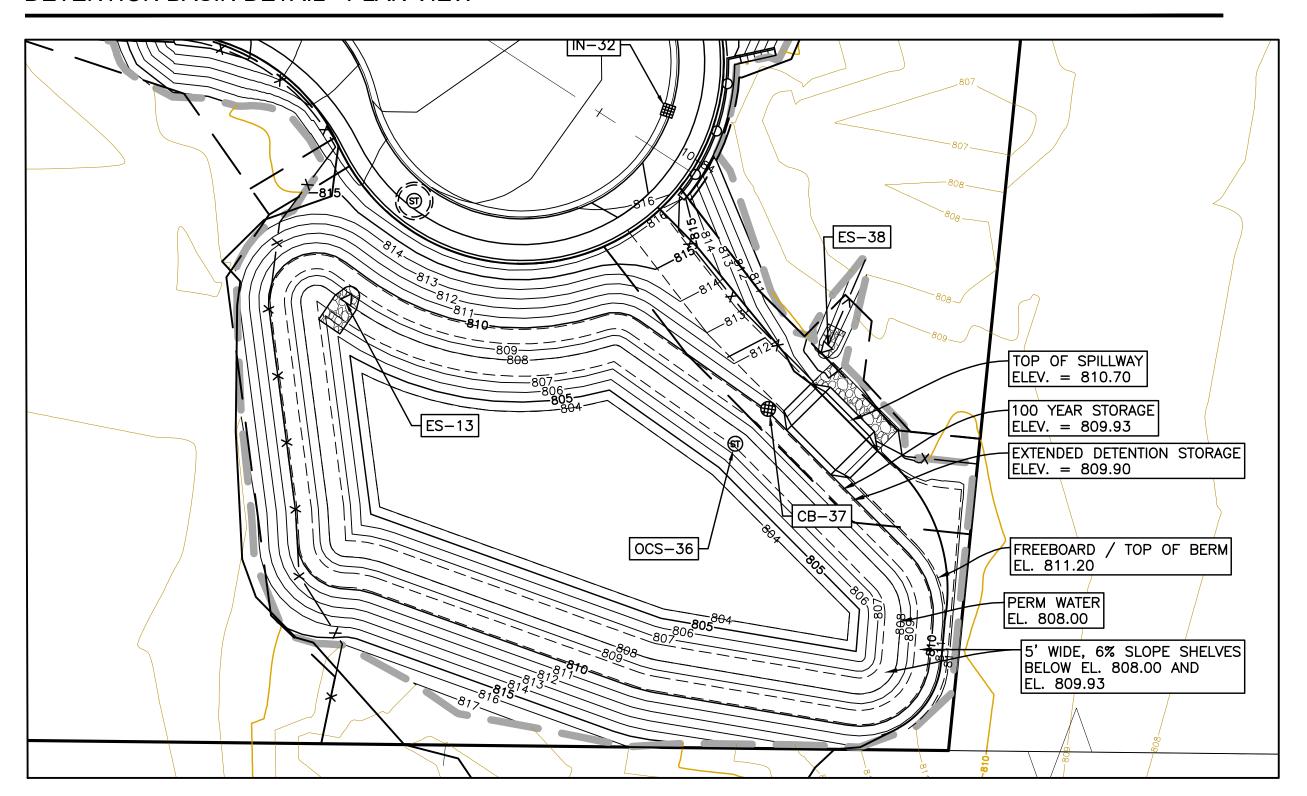
ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: N/A

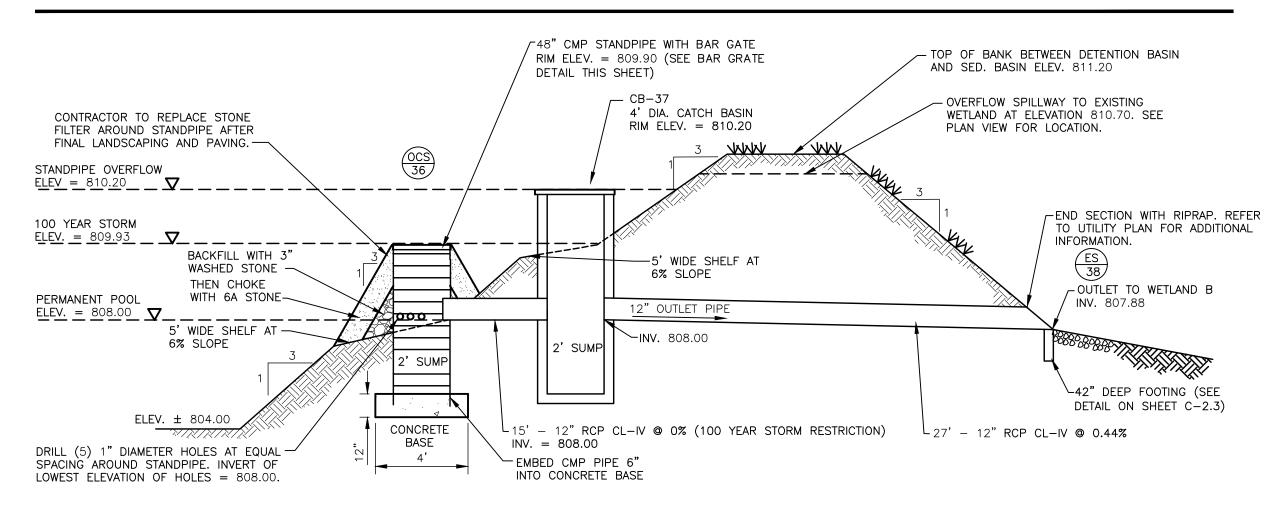
DESIGN BY: KM CHECK BY: AP

C-9.1

DRAWN BY: MN

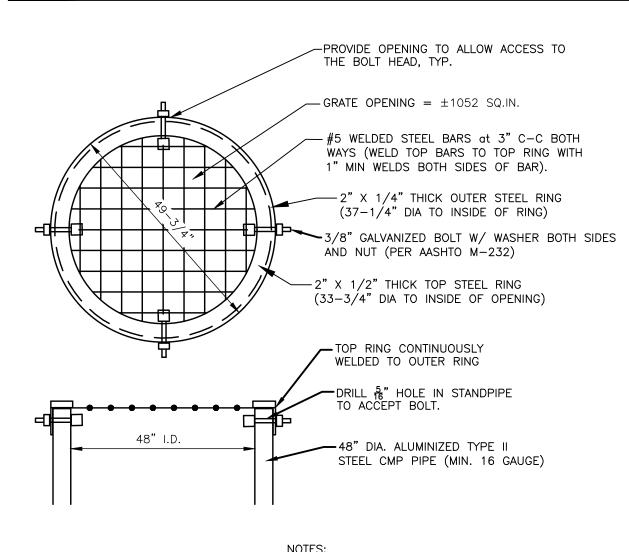


# DETENTION BASIN DETAIL - SECTION THROUGH OCS-36 AND BERM



NOTE: LIMESTONE OR CONCRETE AGGREGATE SHALL NOT BE USED FOR BACKFILL AROUND THE STANDPIPE RISER.

# BAR GRATE DETAIL - FOR OUTLET CONTROL STRUCTURE



NOTES:

1. BAR GRATE TO BE BOLTED THROUGH STANDPIPE AS SHOWN 2. ALL DIMENSIONS ASSUME OUTSIDE CMP PIPE DIAMETER OF 37". ADJUST DIMENSIIONS AS NEEDED FOR ACTUAL PIPE O.D.

# DETENTION POND CALCULATIONS

# **VOLUME SUMMARY**

EXTENDED DETENTION VOLUME = 28,843 CF

100-YEAR VOLUME 28,843 CF

### STORAGE ELEVATIONS

EXTENDED DETE ELEVATION ELEVATION ED ELEVATION	=	809.70 810.00	VOLUME 1 VOLUME 2 Ved 809.91	25,173 30,445 28,843
100-YEAR ELEVATION	=	809.70	VOLUME 1	25,173
ELEVATION	=	810.00	VOLUME 2 V100	30,445 28,843

100 ELEVAΠON (Z100) 100 YEAR STORAGE AREA = 18,125 SFT

PROPOSED DETENTION BASIN SUMP						Р	PROPOSED DETENTION BASIN VOLUME					
	ELEVATION	AREA (FT)	AVG AREA (FT)	INC VOLUME (CF)	VOLUME (CF)	E	LEVATION	AREA (FT)	AVG AREA (FT)	INC VOLUME (CF)	TTL VOLUME (CF)	
	804	6,750	7,349				808	13,466	14,251			
	805	7,948	•	7,349	7,349		809	15,036	•	14,251	14,251	
	806	9,270	•	8,609	15,958		809.7	16,169	•	10,922	25,173	
	807	10,668	,	9,969	25,927		810	18,979	,	5,272	30,445	
	807.7	11,694	,	7,827	33,754		811	21,080	,	20,030	50,474	

NOTE: ESTIMATED GROUNDWATER DEPTH IS AT 808.1 (SEE SOIL BORING SHEET V-2.2). PERMANENT WATER SURFACE IS ESTIMATED TO BE SLIGHTLY LOWER AT 808.0 ONCE POND HAS BEEN CONSTRUCTED.

808.00

### **EXTENDED DETENTION OUTLET RESTRICTION** (DRILLED HOLES IN STANDPIPE)

## RELEASE V<sub>ed</sub> OVER 48 HOURS

0.1669 CFS

# OPENING INVERTS AT PERM WATER ELEV

$H_{avg} = \frac{2}{3} \times (Z_{ed} - Z_{bttm})$	=	1.273 FT

# 1" DIA HOLE HAS AN AREA OF

= 0.0055 SF NO. OF 1" DIA HOLES NO. OF HOLES  $=\frac{A_{ed}}{\lambda}$ = 5.45

5 - 1" DIA. HOLES

 $Q_{ffACTUAL} = A_{edACTUAL} \times 0.62\sqrt{2 \times g \times h} = 0.1531 \text{ CFS}$ 

#### DETENTION TIME FOR 5 - 1" DIA. HOLES

< 72 HOURS

# **100 YEAR OUTLET CALCULATIONS**

# (RESTRICTOR ON OUTLET)

$Q_{100all} = A \times Q_a$	=	5.06 CFS
$H_{avg} = \frac{2}{3} \times (Z_{100} - Z_{ORIFAC})$	<sub>E)</sub> =	1.41 FT

12" RESTRICTOR HAS AN AREA OF  $A_{12"} = 0.785 \text{ SF}$ 

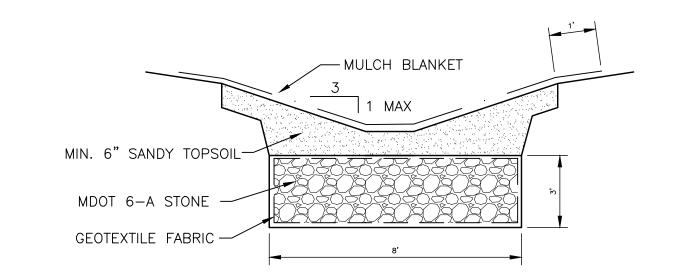
# FLOW THROUGH ONE (1) 6" DIA HOLE

 $Q_{100ACTUAL} = 0.62 \times A_{100} \mid 2 \times g \times H_{100} =$ 4.64 CFS

# **SUMMARY**

FIVE (5) 1" DIAMETER HOLES AT 808.00 IN STANDPIPE ONE (1) 12" RESTRICTOR AT 808.00 ON OUTLET

# INFILTRATION TRENCH DETAIL



### INFILTRATION TRENCH CALCULATIONS

# **INFILTRATION SWALE CALCULATIONS**

#### **INFILTRATION TRENCH VOLUMES**

941 F	=	$L_{trench}$
3.0 F	=	$D_{trench}$
8 F	=	$W_{trench}$
24 SF	ch=	$A = D_{trench} \times W_{trenc}$

 $V_{trench} = e \times A_{trench} \times L_{treneh}$ 6775 CF

## **INFILTRATION VOLUME (OVER 6 HOURS)**

 $A = L_{trench} \times W_{trench} =$ 

 $D_{trench} =$ 2.5 FT 8.0 FT

 $L_{trench} =$ 

3.60 IN/HR (AT BORING 2)

7,528 SF

0.30

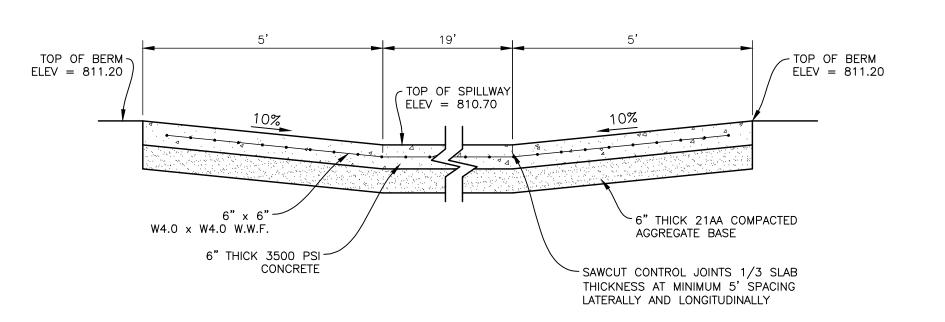
941 FT

 $V_{inf} = A_{inf} \times I \times t_{duration} = 13,550 \text{ CF}$ 

# TOTAL VOLUME STORED IN THE ENGINEERED SWALES

 $V_{total} = V_{trench} + V_{inf} = 20,326 \text{ CF} > 19,735 \text{ CF}$ INFILTRATION SWALES MEET INFILTRATION REQUIREMENTS

# SPILLWAY DETAIL - CONCRETE - SECTION VIEW



# DETENTION BASIN SPILLWAY CALCULATIONS

Weir Coefficient (C)=  $Z_{bank} = 811.20 \text{ FT}$  $Z_{weir}$  = 810.70 FT

 $H = Z_{bank} - Z_{weir} =$ 

 $Q = 100 \ YR \ INLET \ RATE = 22.29 \ CFS$ 

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CALCULA OAKS

WATER UBURN

ORIGINAL ISSUE DATE:

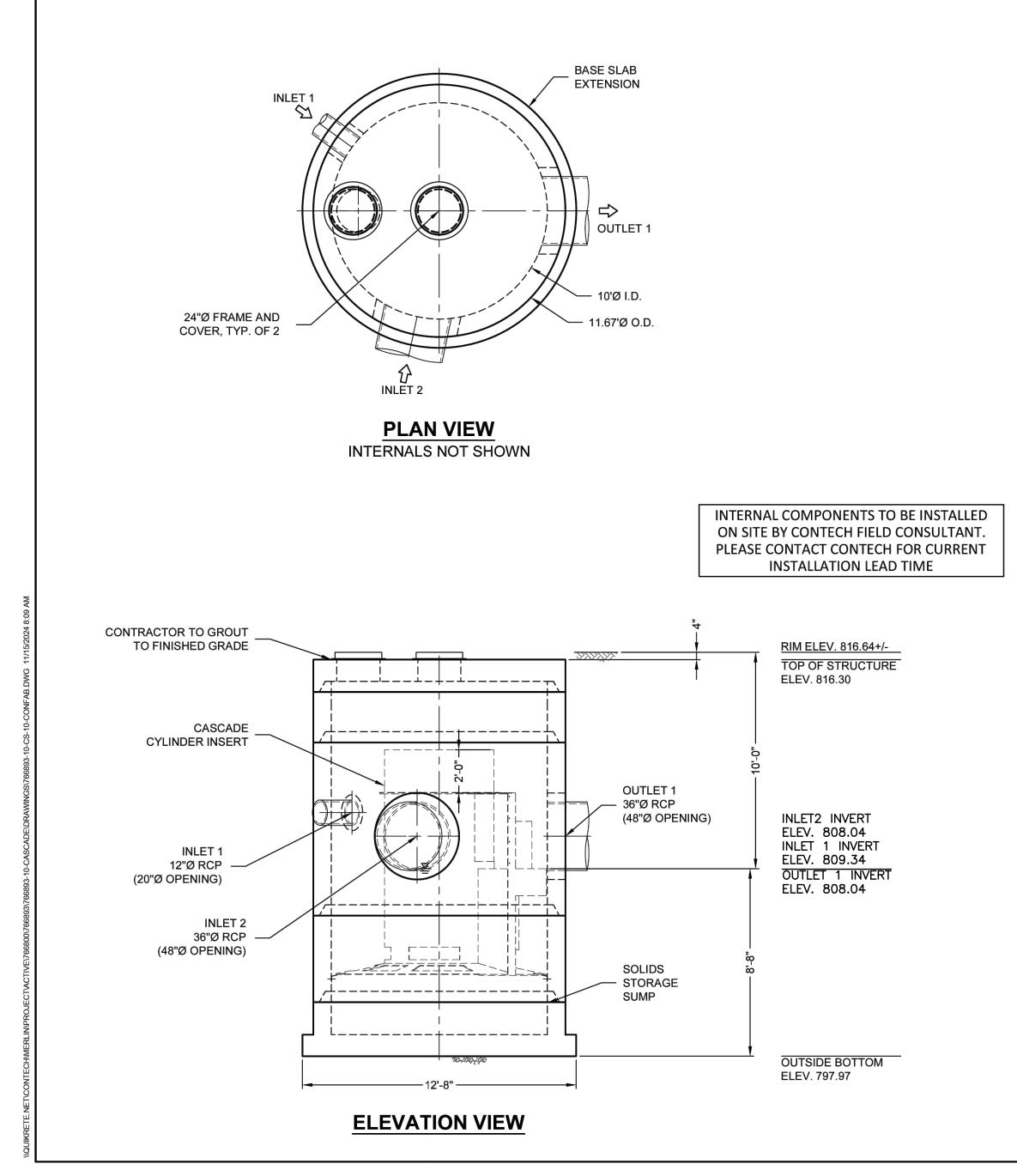
05/19/2022

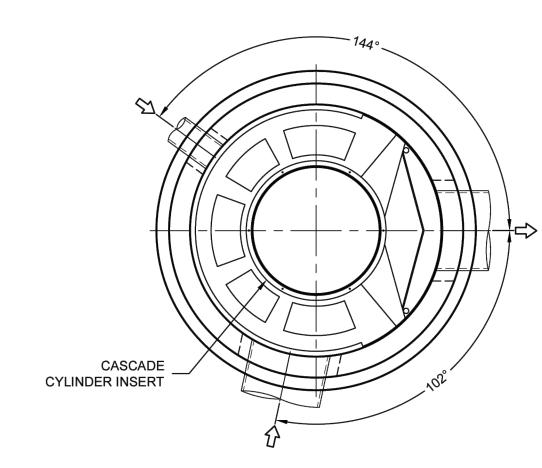
PROJECT NO: 22-051 SCALE: N/A

1/2" FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

C-9.2

# MTD-12 DETAIL





# PLAN VIEW FOR PIPE ORIENTATION TOP SLAB NOT SHOWN

MATERIAL LIST - PROVIDED BY CONTECH

1V17 ( 1 L 1 ( 1)	- INVITERIAL EIGH - FROMBED BY GOINTEGHT								
COUNT	DESCRIPTION	INSTALLED BY							
1	CS-10 CYLINDER INSERT, STD	CONTRACTOR							
1	CS-10 CYLINDER TOP	CONTRACTOR							
8	CS-10 ALUMINUM INSTALLATION BRACKETS	CONTECH							
1	CS-10 HARDWARE KIT	CONTRACTOR							
1	SEALANT FOR JOINTS	CONTRACTOR							
2	24"Ø X 4" FRAME AND COVER, EJ #41600389, OR EQUIV.	CONTRACTOR							

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.

2. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com 3. CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND

INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF 4. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL

GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO. 5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN

CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD. B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE

CASCADE SEPARATOR MANHOLE STRUCTURE. C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.

D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.

E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT

APPROXIMATE HEAVIEST PICK = 32000 LBS. OF 5 PIECES

MAXIMUM FOOTPRINT = 12.67'Ø

CONTECH **PROPOSAL** DRAWING

	766893
NCI	SHEET:
YOUT 1A	1

CS-10 - 766893-010 AUBURN ANGARA OAKS ROCHESTER HILLS, MI SITE DESIGNATION: MTD-12

11/14/24

MSB

010

SEQUENCE No.:

MSB

MSB

& ENGINEERING SOLUTIONS
exing Group
E 188 .
THOUND SULLEY
140W . 201
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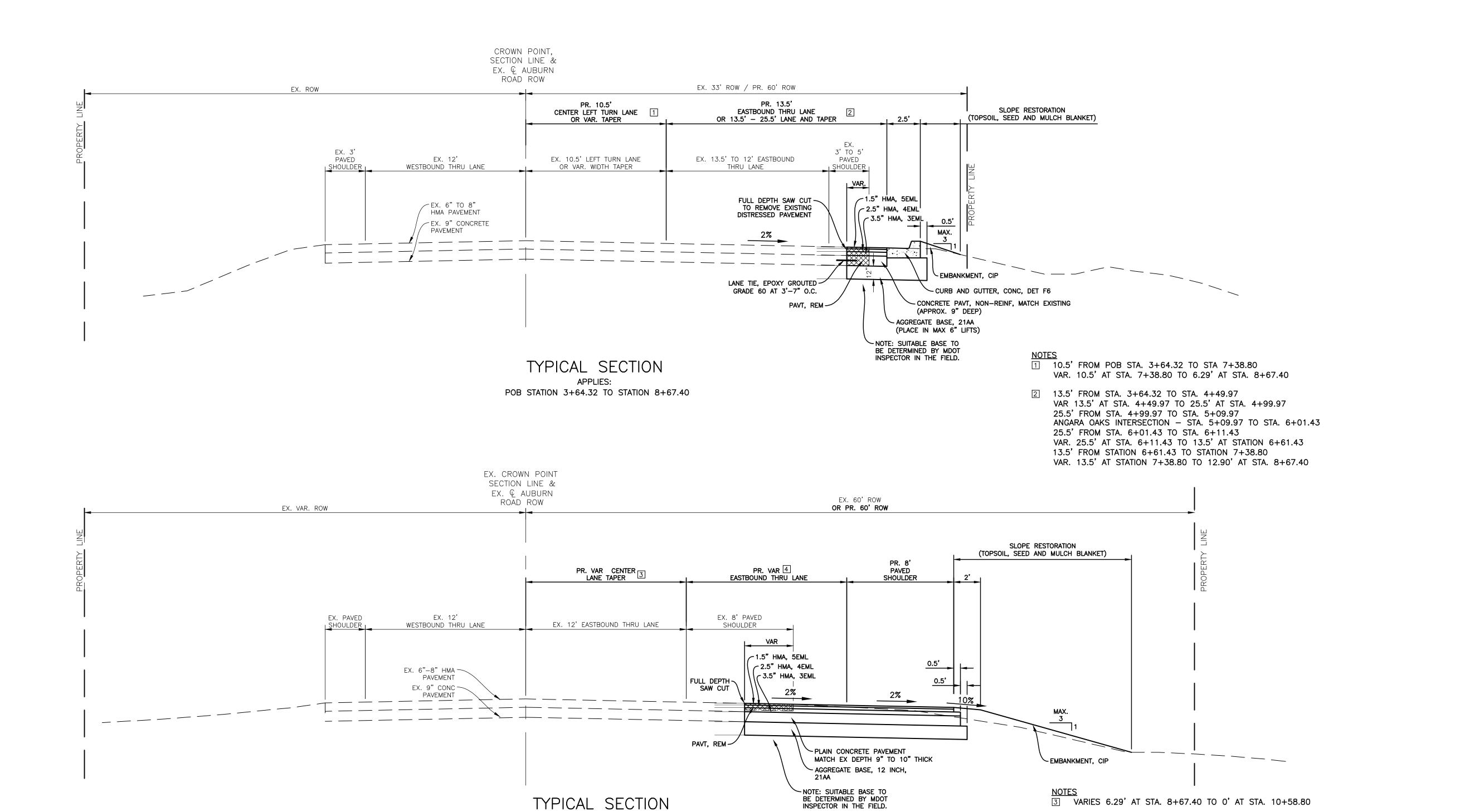
CASCADE AUBURN CONTECH

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: N/A 1/2"

FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

C-9.3



TYPICAL SECTION

APPLIES:

STATION 8+67.40 TO STATION 10+58.80

		НМА А	PPLICATION TABLE		
IDENTIFICATION NO.	ITEM	THICKNESS	RATE PER SYD	PERFORMANCE GRADE	COMMENTS
5EML	HMA, 5EML	1.5 INCHES	165 LBS	64-22	AWI 260
4EML	HMA, 4EML	2.5 INCHES	275 LBS	64-22	
3EML	HMA, 3EML	3.5 INCHES	385 LBS	58-22	
P-1	PLAIN CONCRETE	10 INCHES			
APP	HMA APPROACH	5.0 INCHES	550 LBS	64-22	1.5" HMA, 13A ON 1.5" HMA, 13A ON 2" HMA, 13A ON 8" AGG BASE, 21AA
	BOND COAT		0.05 TO 0.15 GALLONS		SS-1h (FOR INFORMATION ONLY)

# MDOT NOTES

4 VARIES 12.90' AT STA. 8+67.40 TO TO 12.00' (MATCH EX.) AT STA. 10+58.80

- 1. CONTRACTOR TO NOTIFY MDOT A MINIMUM 3 DAYS PRIOR TO PLACING ANY SIGNS
- OR BEGINNING ANY WORK WITHIN MOOT ROW.
- 2. PROPER SIGNING IS REQUIRED BEFORE ANY WORK IN R.O.W. IS STARTED.
- 3. LANE CLOSURES RESTRICTED TO 9-3 MON-FRI.
- 4. MAINTAIN TWO-WAY TRAFFIC AT ALL TIMES ON AUBURN ROAD.
- 5. FLAG PERSON REQUIRED FOR TEMPORARY ONE-LANE ROADS.

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EXISTING UNDERGROUND UTILITIES AS SHOW
ON THIS DRAWING ARE ONLY APPROXIMAT
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IMPLIED AS TO THE COMPLETENESS (
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CTIONS

ROAD

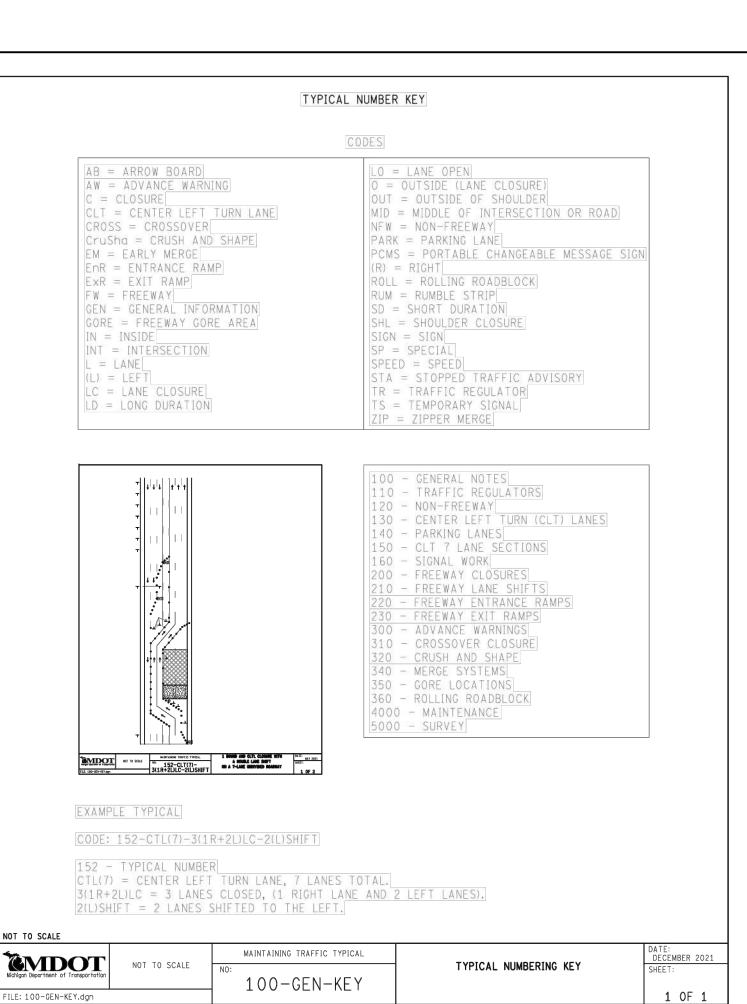
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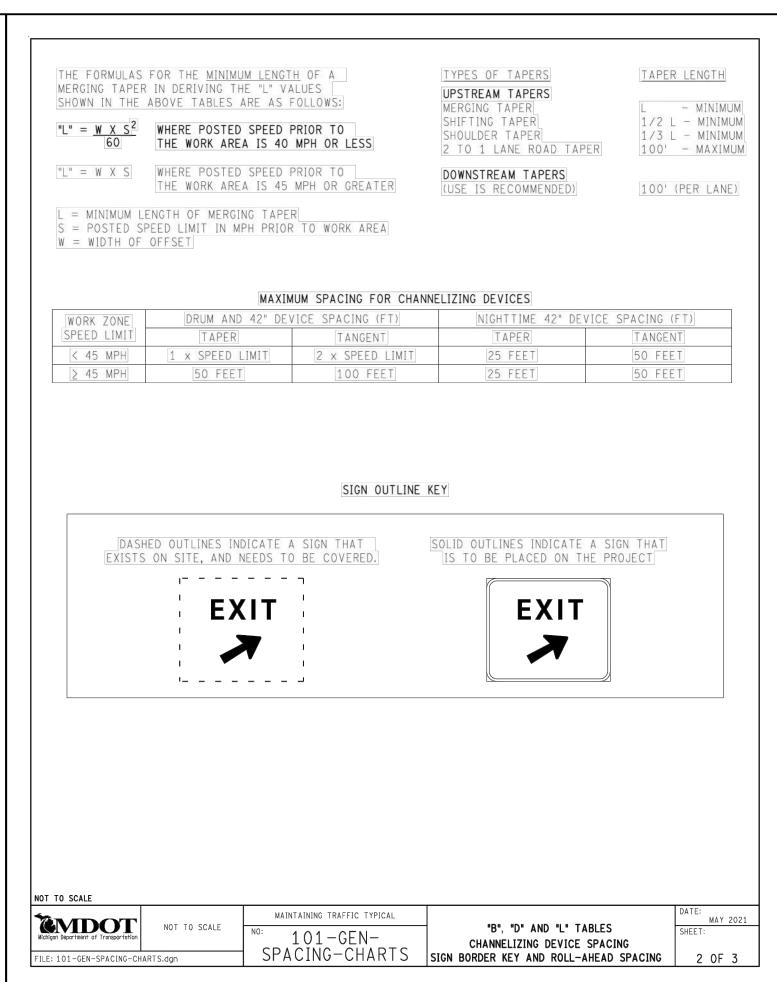
05/19/2022 PROJECT NO: 22-051

SCALE: N/A

FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

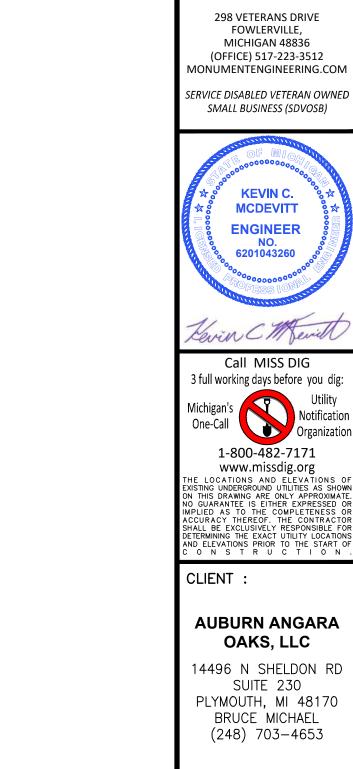
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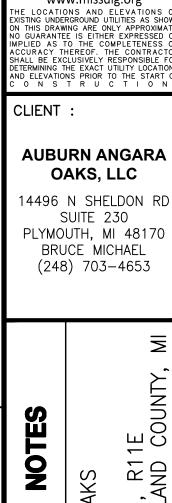






THE FOLLOWING NOTES APPLY IF CALLED FOR ON THE TRAFFIC TYPICAL





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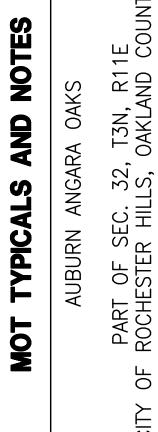
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ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051 SCALE: N/A 1/2" FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM

CHECK BY: AP

"D"			POST	ED SPEE	D LIMIT,	MPH (P	RIOR TO	WORK A	AREA)		
DISTANCES	25	30	35	40	45	50	55	60	65	70	75
D (FEET)	250	300	350	400	450	500	550	600	650	700	750

# GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE, "B"

"B"				SPEED	* , MPH (F	RIOR TO	) WORK	AREA)				
LENGTHS	20	25	30	35	40	45	50	55	60	65	70	75
B (FEET)	33	50	83	132	181	230	279	329	411	476	542	625

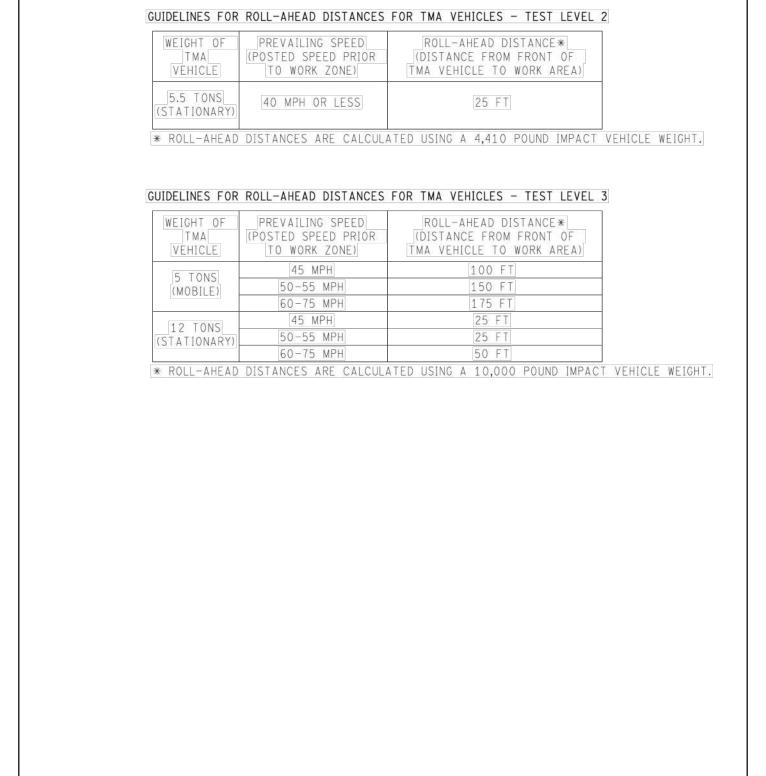
\* POSTED SPEED, OFF-PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED

OPERATING SPEED.

# MINIMUM MERGING TAPER LENGTH, "L" (FEET)

MATANON MERCINO TALEN ELIOTINI E VICETA											
OFFSET			POST	ED SPEE	D LIMIT,	MPH (P	RIOR TO	WORK A	(REA)		
(FEET)	25	30	35	40	45	50	55	60	65	70	75
1	11	15	21	27	45	50	55	60	65	70	75
2	21	30	41	54	90	100	110	120	130	140	150
3	32	45	62	80	135	150	165	180	195	210	225
4	42	60	82	107	180	200	220	240	260	280	300
5	53	75	103	134	225	250	275	300	325	350	375
6	63	90	123	160	270	300	330	360	390	420	450
7	73	105	143	187	315	350	385	420	455	490	525
8	84	120	164	214	360	400	440	480	520	560	600
9	94	135	184	240	405	450	495	540	585	630	675
10	105	150	205	267	450	500	550	600	650	700	750
1 1	115	165	225	294	495	550	605	660	715	770	825
12	125	180	245	320	540	600	660	720	780	840	900
13	136	195	266	347	585	650	715	780	845	910	975
14	146	210	286	374	630	700	770	840	910	980	1050
15	157	225	307	400	675	750	825	900	975	1050	1125

NOT TO SCALE				
Michigan Department of Transportation	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL  NO: 101-GEN-	"B", "D" AND "L" TABLES CHANNELIZING DEVICE SPACING,	DATE: MAY 2021 SHEET:
FILE: 101-GEN-SPACING-CH	HARTS.dgn	SPACING-CHARTS	SIGN BORDER KEY, AND ROLL-AHEAD SPACING	1 OF 3



MAINTAINING TRAFFIC TYPICAL

101-GEN-

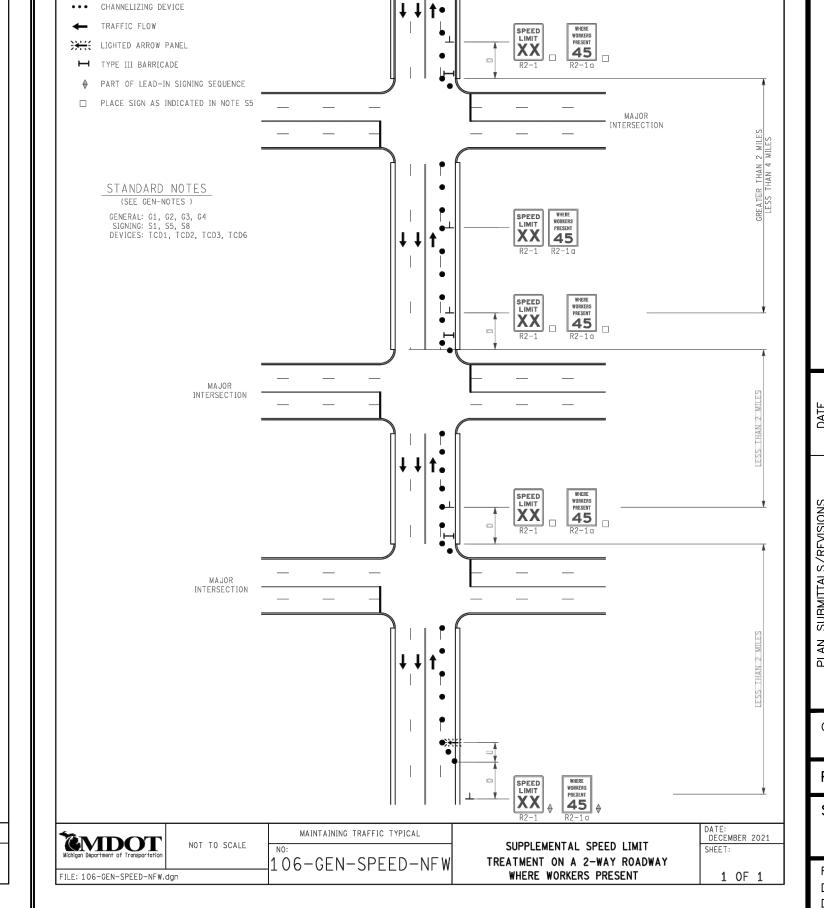
"B", "D" AND "L" TABLES

CHANNELIZING DEVICE SPACING

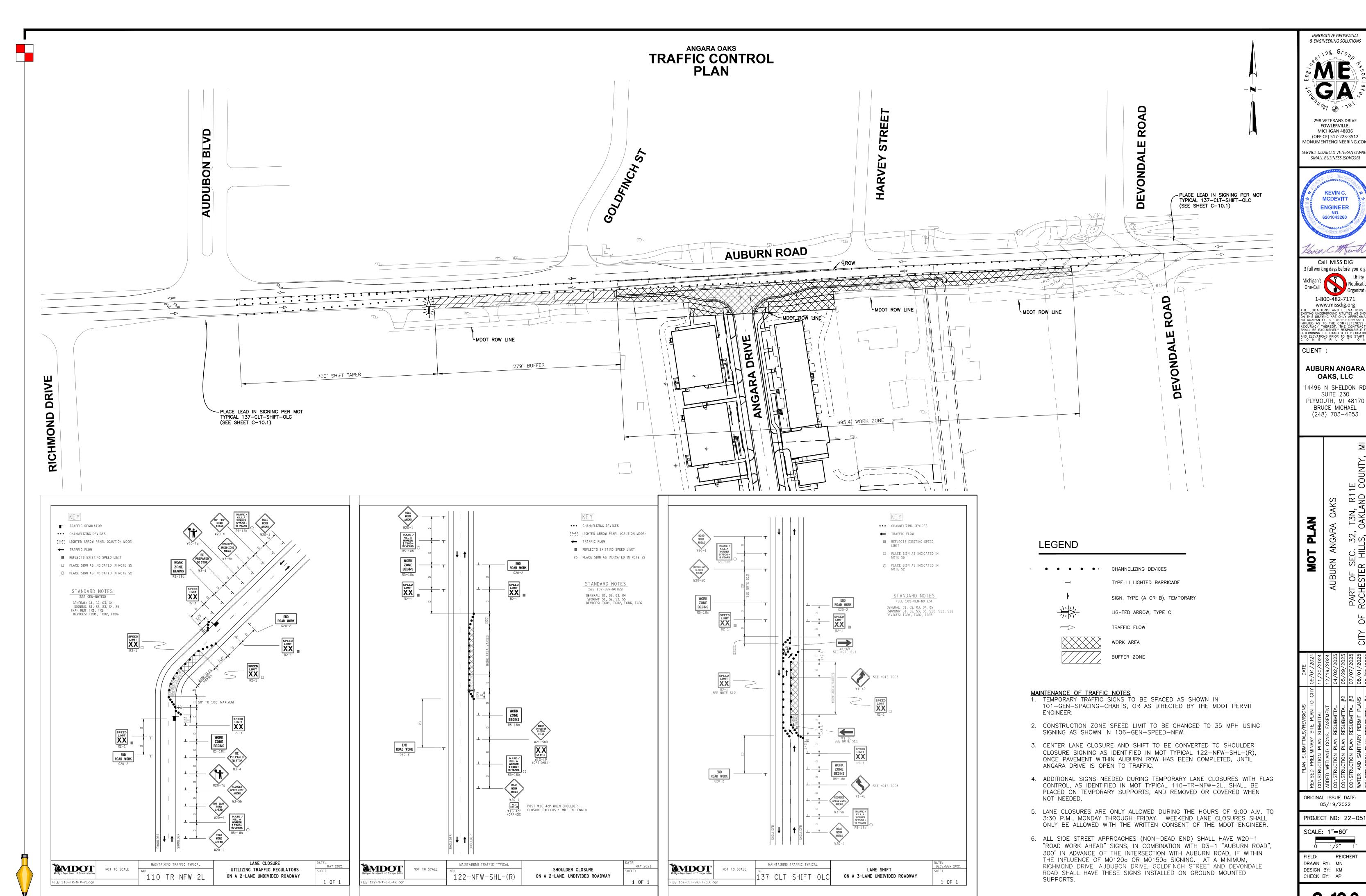
SPACING-CHARTS | SIGN BORDER KEY AND ROLL AHEAD SPACING

MDOT





**C-10.1** 



FILE:P:\Projects\2022\22-051 Auburn Angara Sub\Dwg\Engineering\22-051\_C-10.1\_MOT.dwg PLOT DATE:8/20/2025 10:15 AM

C-10.2

DATUM: NAVD88

ARROW ATOP FIRE HYDRANT AT THE N.W. CORNER OF LOT 11. ELEV = 835.42'

ARROW ATOP FIRE HYDRANT N. SIDE OF AUBURN ROAD OPPOSITE N.E. CORNER OF LOT 11. ELEV = 831.89'

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EXISTING UNDERGROUND UTILITIES AS SHO
ON THIS DRAWING ARE ONLY APPROXIMA
NO GUARANTEE IS EITHER EXPRESSED
IMPLIED AS TO THE COMPLETENESS
ACCURACY THEREOF. THE CONTRACT
SHALL BE EXCLUSIVELY RESPONSIBLE F
DETERMINING THE EXACT UTILITY LOCATIO
AND ELEVATIONS PRIOR TO THE START
C O N S T R U C T I O N

CLIENT:

**AUBURN ANGARA** OAKS, LLC

14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL

(248) 703-4653

JBURN

ORIGINAL ISSUE DATE:

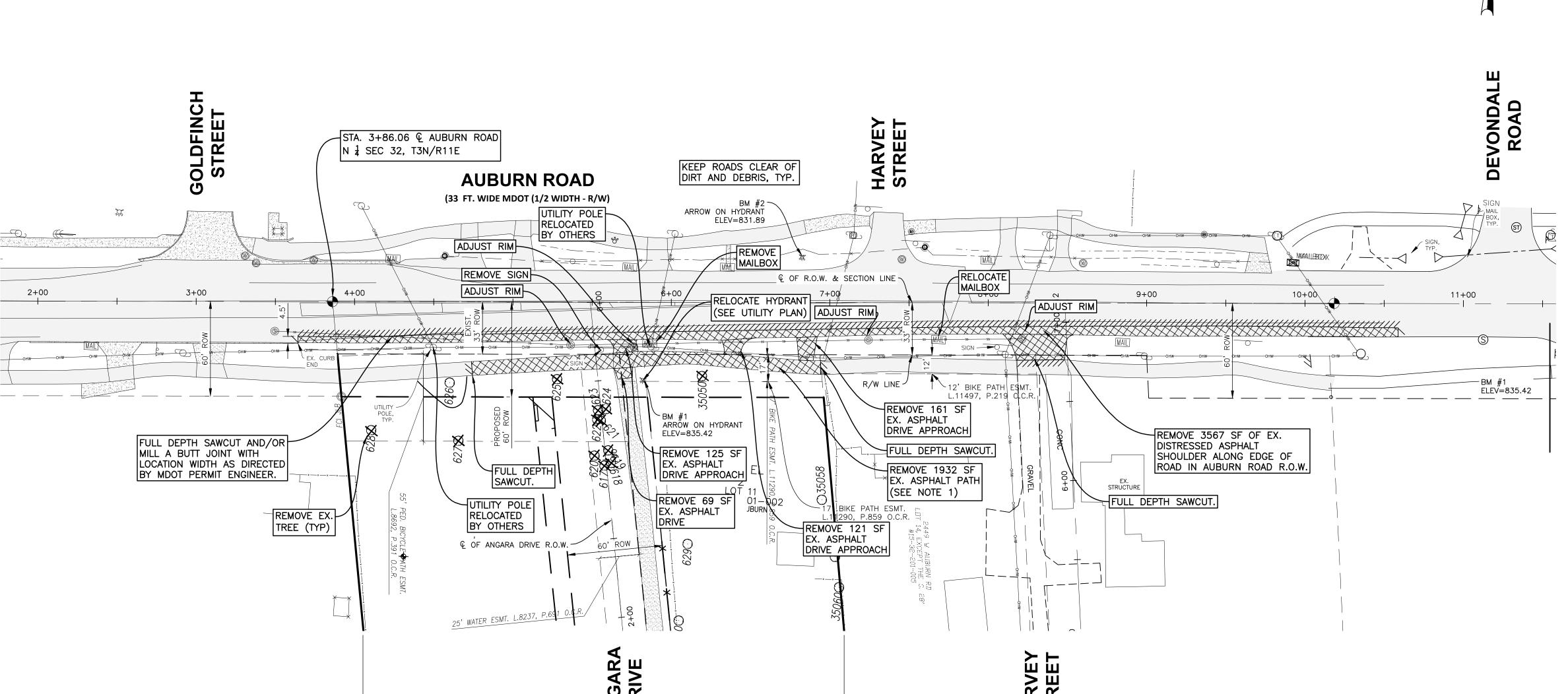
05/19/2022 PROJECT NO: 22-051

SCALE: 1" = 40'

1/2" FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM

CHECK BY: AP

C-10.3



# LEGEND: O FOUND IRON SET IRON **R** RECORD DISTANCE **M** MEASURED DISTANCE EXISTING GRAVEL EXISTING PAVER STONE EXISTING BUILDING EXISTING CONCRETE EXISTING ASPHALT EXISTING LANDSCAPED AREA — — — — EXISTING STORM SEWER EXISTING WATERMAIN EXISTING OVERHEAD WIRES ----×--- EXISTING FENCE 🖘 EXISTING UTILITY POLE EXISTING WATER SHUT OFF EXISTING GATE VALVE EXISTING HYDRANT EXISTING WELL EXISTING GAS SHUT OFF EXISTING SANITARY STRUCTURE EXISTING STORM STRUCTURE

# REMOVAL LEGEND

ABANDON IN PLACE . . . . . . . . . ./ / / / / / / / / ABANDON LINEAR FEATURE REMOVE LINEAR FEATURE  $\cdot$  X X X X X X X X REMOVE OBJECT REMOVE PAVEMENT

DS EXISTING DOWN SPOUT EXISTING UTILITY PEDESTAL

EXISTING BOULDER RET. WALL

x 655.00 EXISTING GRADE

# REMOVAL NOTES

- 1. UTILITY OBJECTS SUCH AS GAS METER, TRANSFORMER, TELEPHONE PEDESTAL, UTILITY POLE & WIRES ARE TO BE REMOVED OR RELOCATED BY OTHERS.
- 2. ANY TREES NOT MARKED PER PLAN ARE TO BE PROTECTED & PRESERVED DURING CONSTRUCTION.
- CONTRACTOR TO SAWCUT EXISTING PAVEMENT FULL DEPTH SO AS TO REMOVE EXISTING DISTRESSED PAVEMENT, OR PAVEMENT DETERMINED TO BE INSUFFICIENT BY THE MDOT PERMIT

ENGINEER. LOCATIONS SHOWN ARE APPROXIMATE AREAS OF DISTRESSED PAVEMENT.

- TRAFFIC NOTES
- 1. LANE CLOSURES SHALL BE RESTRICTED TO 9 A.M. TO 3 P.M., MONDAY THROUGH FRIDAY AND SHALL ONLY BE UTILIZED UPON THE AFTER NOTIFICATION AND CONSENT OF THE MDOT PERMIT ENGINEER.
- 2. MAINTAIN TWO-WAY TRAFFIC ON AUBURN ROAD AT ALL TIMES.
- 3. TRAFFIC REGULATORS ARE REQUIRED FOR TEMPORARY LANE CLOSURES.
- 4. CONTRACTOR TO PROVIDE TEMPORARY GRAVEL PATH TO ALLOW CONTINUOUS PEDESTRIAN ACCESS ALONG THE PATHWAY ALONG THE SOUTH SIDE OF AUBURN ROAD AT ALL TIMES. SHORT TERM CLOSURES WILL BE ALLOWED ONLY UPON APPROVAL OF THE CITY OF ROCHESTER HILLS AND MDOT.

SUBJECT PROPERTY

PROPOSED

**EXISTING** 

── WM ── Ŵ ── ₩ATER MAIN, MH, VALVE IN BOX, HYDRANT

├── - - ── CULVERT/ END SECTION

SANITARY SEWER, MH, CLEAN OUT

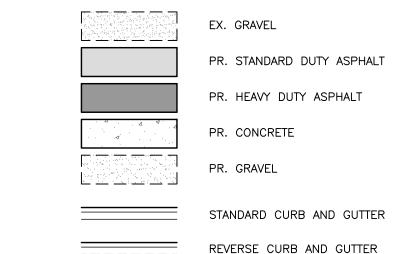
GAS GAS UG GAS, MH, VALVE, LINE MARKER

UG-ELEC UG ELEC (ELEC, CABLE, FIBER)

ST) — D.S. Y.D. — STORM SEWER, MH, CB, INLET, DOWN SPOUT, YARD DRAIN

WATER WELL, METER, STOP BOX, POST INDICATOR VALVE

# PAVEMENT LEGEND



298 VETERANS DRIVE
FOWLERVILLE,
MICHIGAN 48836
(OFFICE) 517-223-3512
MONUMENTENGINEERING.COM

SERVICE DISABLED VETERAN OWNED
SMALL BUSINESS (SDVOSB)

KEVIN C.

\*\* MCDEVITT

\*\* ENGINEER

NO.
6201043260

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THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF C O N S T R U C T I O N .

CLIENT :

AUBURN ANGARA OAKS, LLC

14496 N SHELDON RD
SUITE 230
PLYMOUTH, MI 48170
BRUCE MICHAEL
(248) 703-4653

SOUNTY, MI

ANGARA OAKS

2. 32, T3N, R11E

HILLS, OAKLAND CO

CONSTRUCTION
AUBURN ANGARA
PART OF SEC. 32, T3

| CITY 09/04/2024 | 11/20/2024 | 12/19/2024 | 04/02/2025 | 42 05/29/2025 | 43 07/07/2025 | 15 08/01/2025

DEPELIMINARY SITE PLAN TO CITY
SUCTION PLAN SUBMITTAL
WETLAND CONS. EASEMENT
SUCTION PLAN RESUBMITTAL
SUCTION PLAN RESUBMITTAL #3
SUCTION PLAN RESUBMITTAL #3
AND SANTITARY PERMIT PLANS

ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051

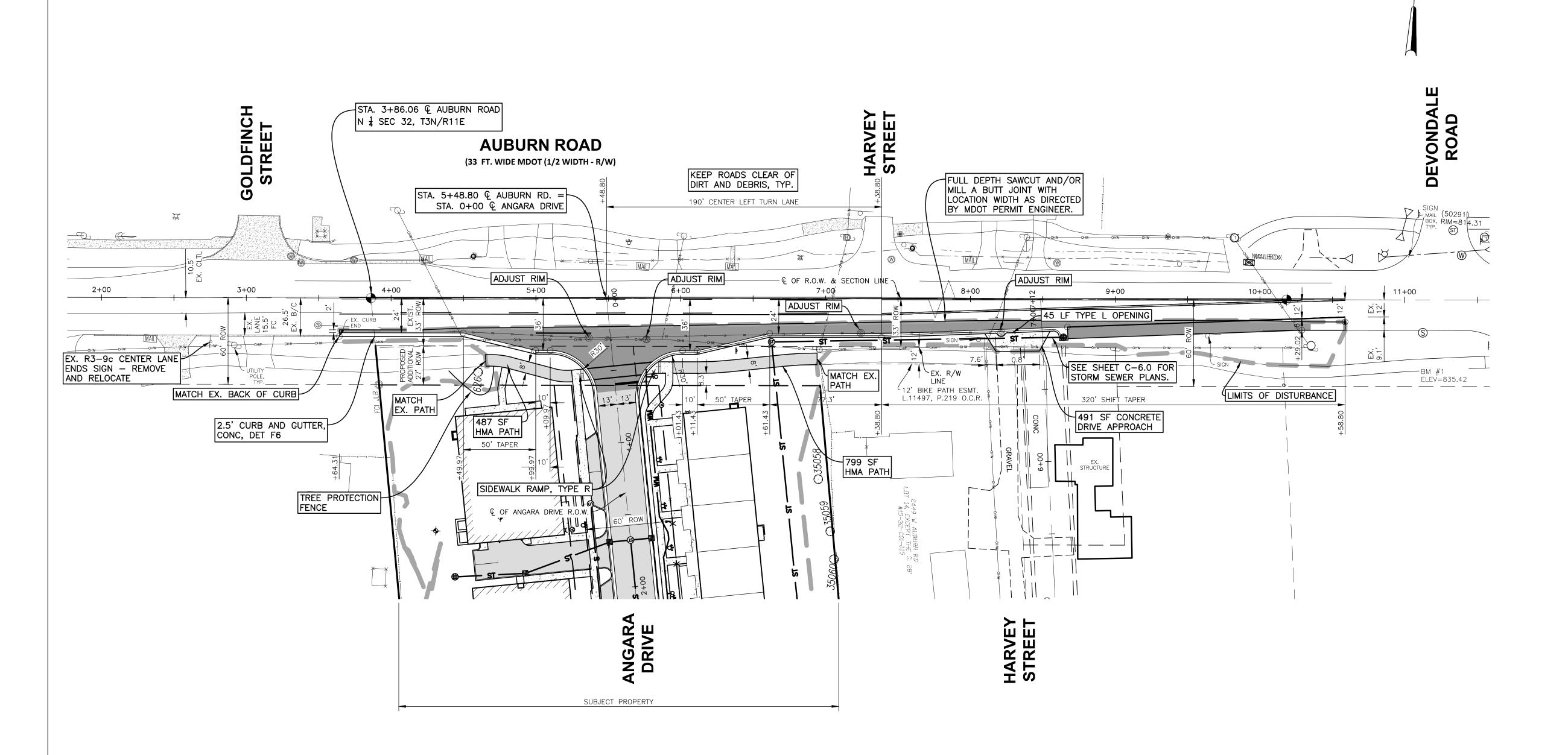
SCALE: 1" = 40'

0 1/2" 1"

FIELD: REICHERT

FIELD: REICHERT
DRAWN BY: MN
DESIGN BY: KM
CHECK BY: AP

C-10.4



# MDOT NOTES

- 1. CALL INSPECTOR OR PERMIT SUPERVISOR BEFORE BEGINNING ANY WORK IN R.O.W.
- 2. PROPER SIGNING IS REQUIRED BEFORE ANY WORK IN R.O.W. IS STARTED.
- 3. LANE CLOSURES RESTRICTED TO 9-3 MON-FRI.
- 4. MAINTAIN TWO-WAY TRAFFIC AT ALL TIMES.
- 5. FLAG PERSON REQUIRED FOR TEMPORARY ONE-LANE ROADS.

# GRADING LEGEND

PROPOSED TOP OF PAVEMENT GRADE

940.00 SW
PROPOSED SIDEWALK GRADE

940.00 FG
PROPOSED TOP CURB GRADE
PROPOSED TOP CURB GRADE
PROPOSED GUTTER PAN GRADE
PROPOSED GUTTER PAN GRADE

940.0 MA
MATCH EXISTING
PROPOSED FINISH FLOOR GRADE
PROPOSED RIM GRADE

940.00 RIM
PROPOSED RIM GRADE

ADJUSTED RIM GRADE

EXISTING ELEVATION

EXISTING CONTOUR

\_\_\_\_\_900\_\_\_\_ PROPOSED CONTOUR

LIMITS OF DISTURBANCE

KEVIN C.

\*\* MCDEVITT

\*\* ENGINEER

NO.
6201043260

INNOVATIVE GEOSPATIAL

& ENGINEERING SOLUTIONS

I'ng Group

298 VETERANS DRIVE FOWLERVILLE,

MICHIGAN 48836 (OFFICE) 517-223-3512

MONUMENTENGINEERING.COM

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Notification
Organization

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CLIENT :

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14496 N SHELDON RD SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

> 1E COUNTY, MI

RN ANGARA OAKS SEC. 32, T3N, R11E

GRADING A
AUBURN
PART OF SEC

TO CITY 09/04/2024

11/20/2024

NT 12/19/2024

AL 04/02/2025

AL #3 07/07/2025

AL #3 07/07/2025

PRELIMINARY SITE PLAN TO CITY OUTION PLAN SUBMITTAL

WETLAND CONS. EASEMENT

UCTION PLAN RESUBMITTAL #2

UCTION PLAN RESUBMITTAL #3

UCTION PLAN RESUBMITTAL #3

OUTION PLAN RESUBMITTAL #3

ORIGINAL ISSUE DATE:

05/19/2022 PROJECT NO: 22-051

SCALE: 1" = 60'

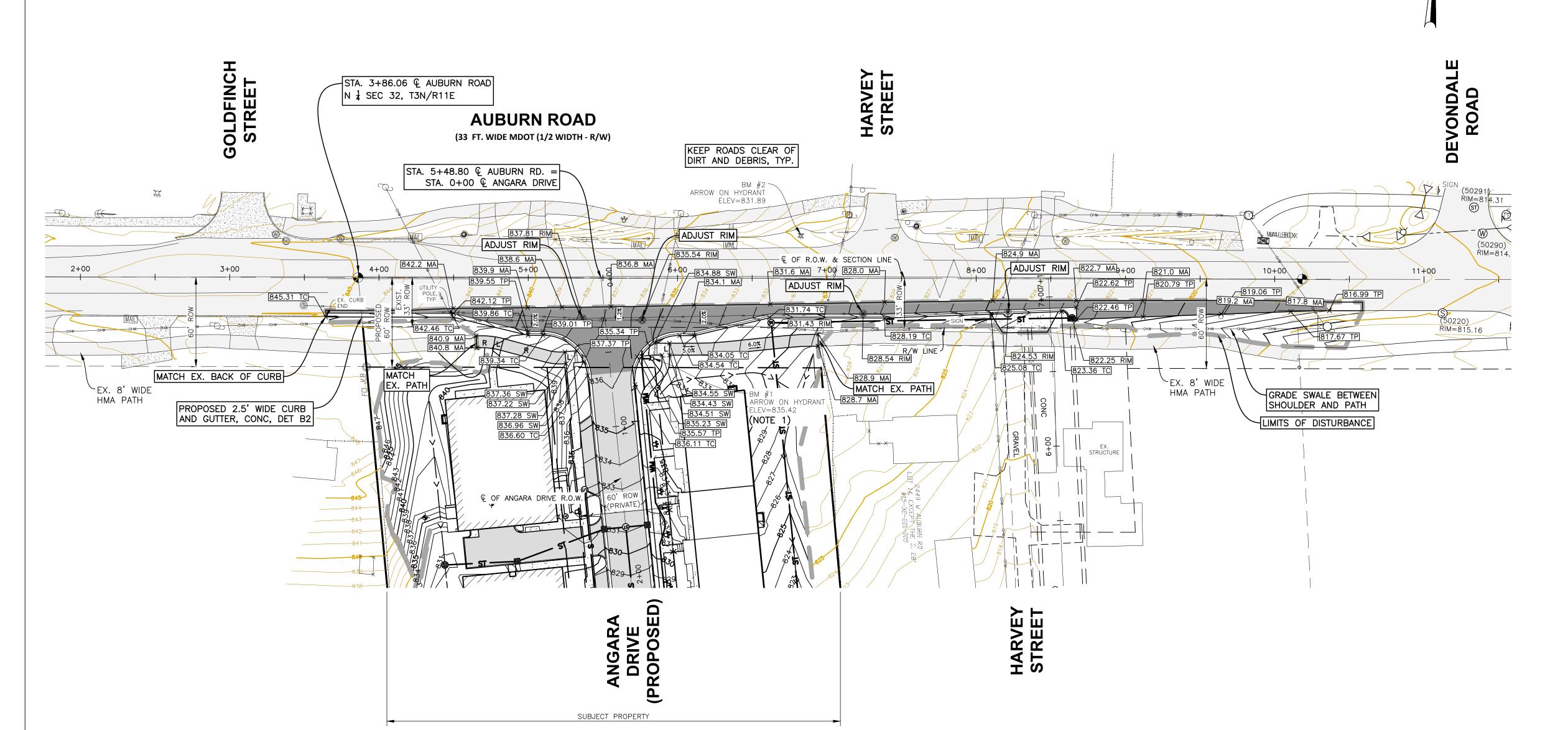
0 1/2" 1"

FIELD: REICHERT

DRAWN BY: MN

DESIGN BY: KM

C-10.5



# MDOT NOTES

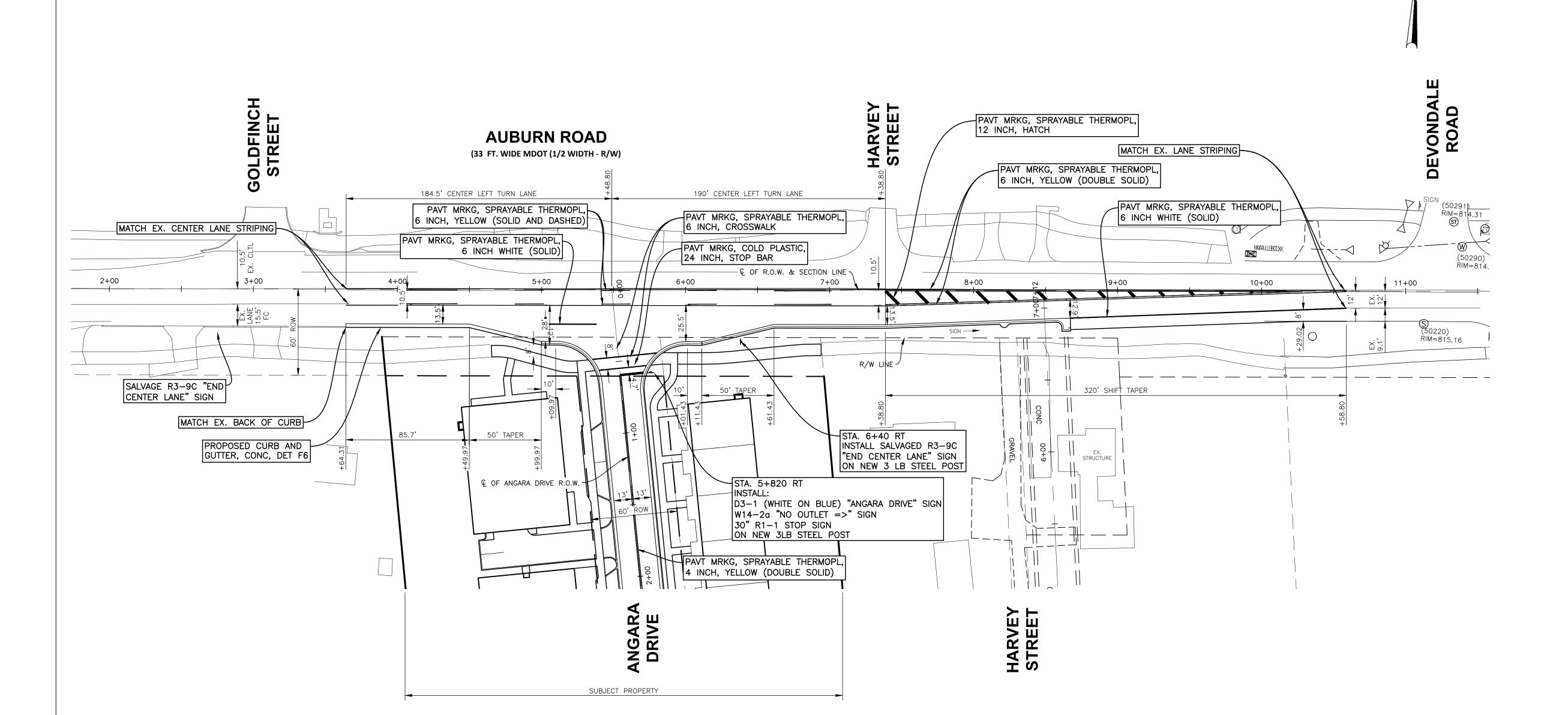
1. CONTRACTOR TO NOTIFY MDOT THROUGH MI-PERMITS 3 DAYS PRIOR TO BEGINNING ANY WORK IN R.O.W.

2. PROPER SIGNING IS REQUIRED BEFORE ANY WORK IN R.O.W. IS STARTED.

# **GRADING NOTES**

 CONTRACTOR TO ESTABLISH NEW BENCHMARK PRIOR TO REMOVING EXISTING HYDRANT.

CHECK BY: AP





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BRUCE MICHAEL
(248) 703-4653

703-4653

3ARA OAKS 32, T3N, R11E

AUBURN ANGARA

PAVEMENI MA

 IE PLAN TO CITY
 09/04/2024

 BMITTAL
 11/20/2024

 EASEMENT
 12/19/2024

 SUBMITTAL
 04/02/2025

 SUBMITTAL
 #2
 05/29/2025

 SUBMITTAL
 #3
 07/07/2025

 ERMIT PLANS
 08/01/2025

PLAN SUBMITTALS/REVISIONS
EVISED PRELIMINARY SITE PLAN TO
DNSTRUCTION PLAN SUBMITTAL
DNSTRUCTION PLAN RESUBMITTAL
DNSTRUCTION PLAN RESUBMITTAL #
DNSTRUCTION PLAN RESUBMITTAL #
DNSTRUCTION PLAN RESUBMITTAL #
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ORIGINAL ISSUE DATE: 05/19/2022

PROJECT NO: 22-051

SCALE: 1" = 60'

SCALE: 1" = 60"

0 1/2" 1"

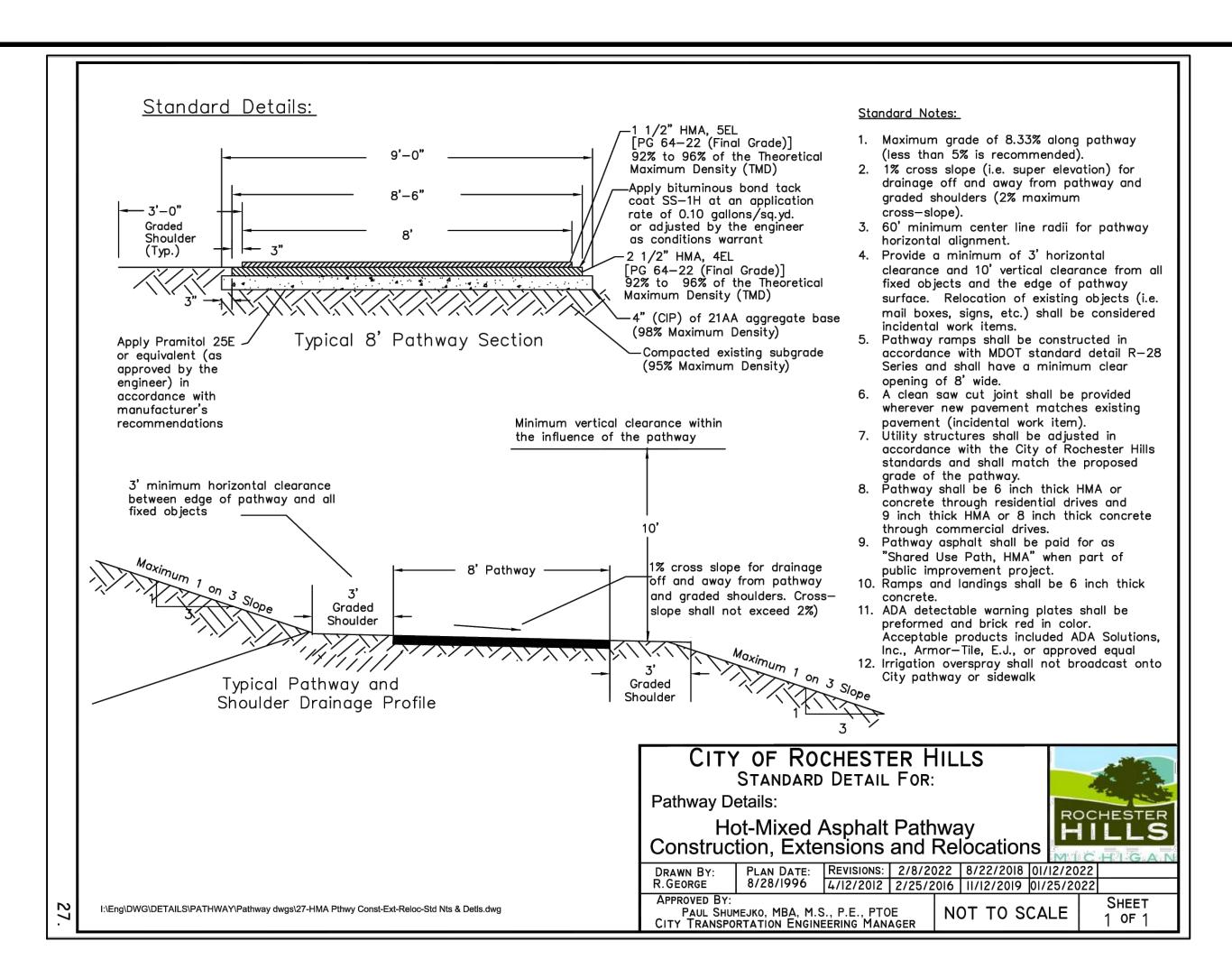
FIELD: REICHERT

FIELD: REICHERT
DRAWN BY: MN
DESIGN BY: KM
CHECK BY: AP

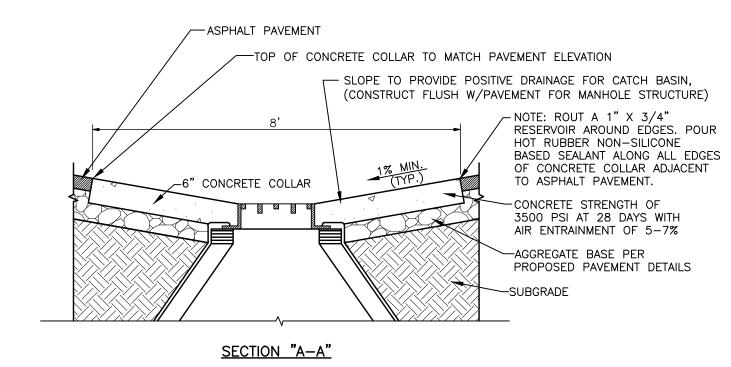
C-10.6

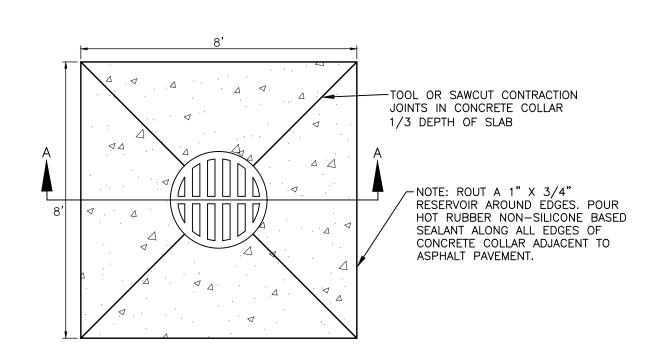
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# APRON DETAIL - CONCRETE AROUND CATCH BASIN



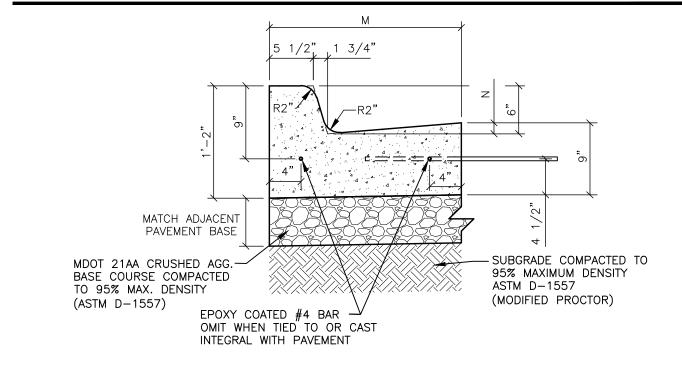


# IMAGES OF RETAINING WALL BLOCK STYLE



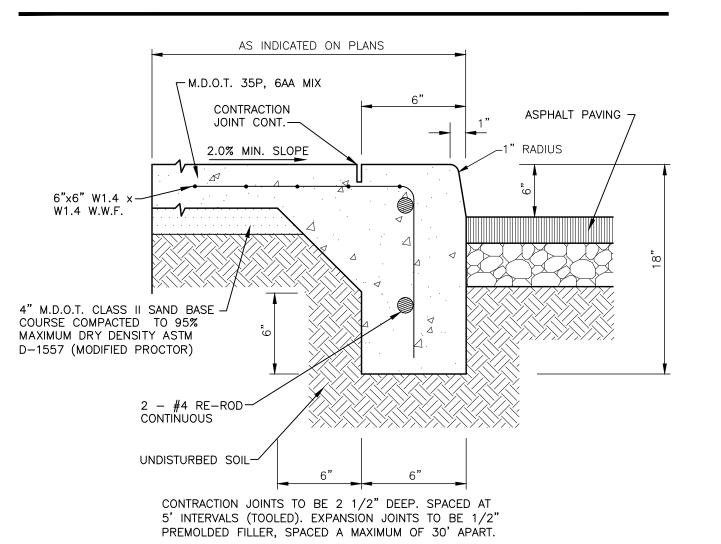


### CURB AND GUTTER DETAIL - MDOT - FX - WITH TABLE

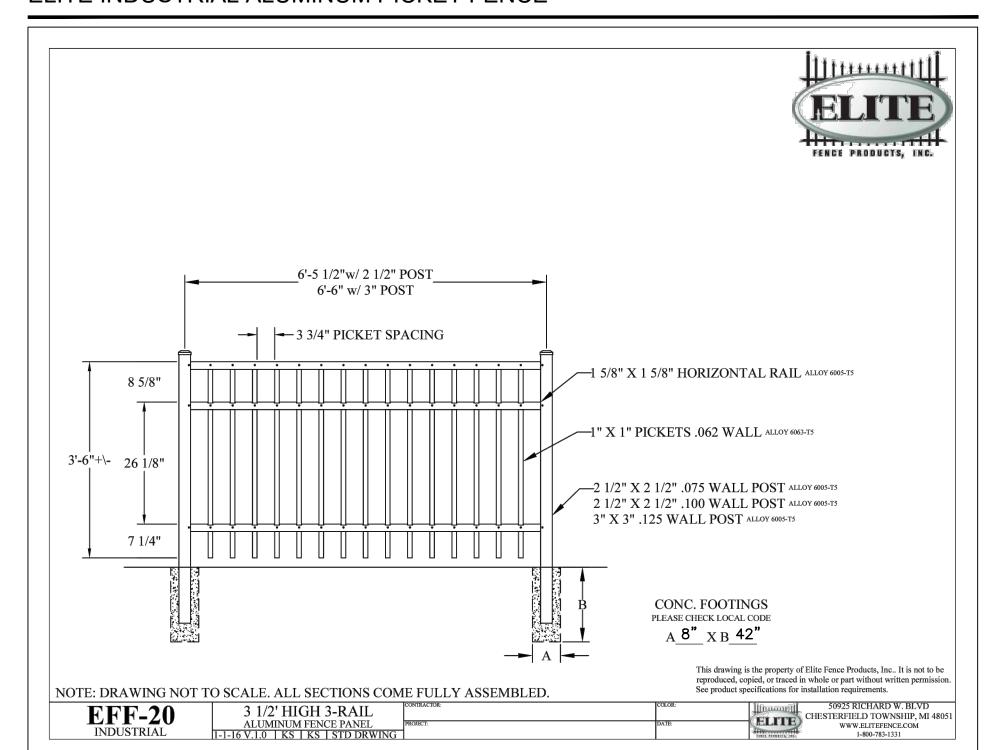


DETAIL	DIMEN	NSION	LANE TIES	CONCRETE	
DETAIL	М	N	LANE HES	CYD / LFT	
F1	1'-6"	7/8"	AS SHOWN	0.0484	
F2	1'-6"	7/8"	OMITTED	0.0484	
F3	2'-0"	1 3/8"	AS SHOWN	0.0610	
F4	2'-0"	1 3/8"	OMITTED	0.0610	
F5	2'-6"	1 7/8"	AS SHOWN	0.0737	
F6	2'-6"	1 7/8"	OMITTED	0.0737	

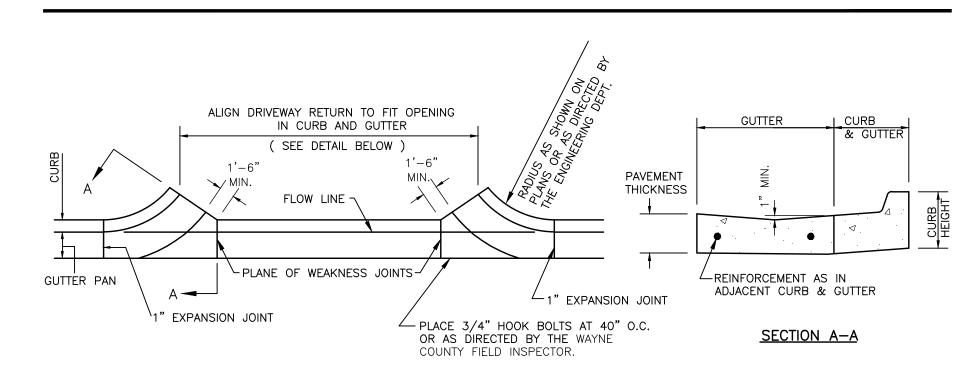
## INTEGRAL CURB AND SIDEWALK DETAIL



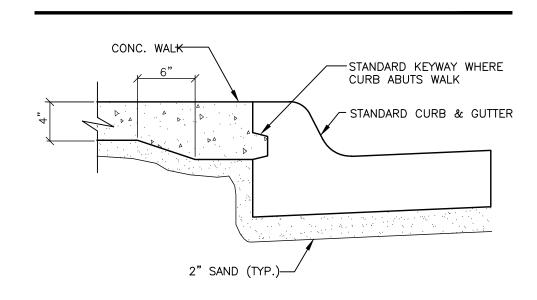
# ELITE INDUSTRIAL ALUMINUM PICKET FENCE



# M.D.O.T. DRIVEWAY OPENING DETAIL "M"



# SIDEWALK DETAIL - KEYWAY SECTION



NOTE: TO BE USED FOR SIDEWALK ADJACENT TO STANDARD CURB SECTION WITHIN RIGHT OF WAY.

ORIGINAL ISSUE DATE:

05/19/2022

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MICHIGAN 48836

(OFFICE) 517-223-3512

MONUMENTENGINEERING.CON

ERVICE DISABLED VETERAN OWNE

SMALL BUSINESS (SDVOSB)

**KEVIN C.** 

**MCDEVITT** 

**ENGINEER** 

6201043260

Kevin CM Ferrie

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CONSTRUCTOR

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OAKS, LLC

14496 N SHELDON RE

SUITE 230

PLYMOUTH, MI 48170

BRUCE MICHAEL

(248) 703-4653

OAKS

AUBURN

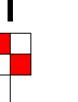
Michigan's 🖊

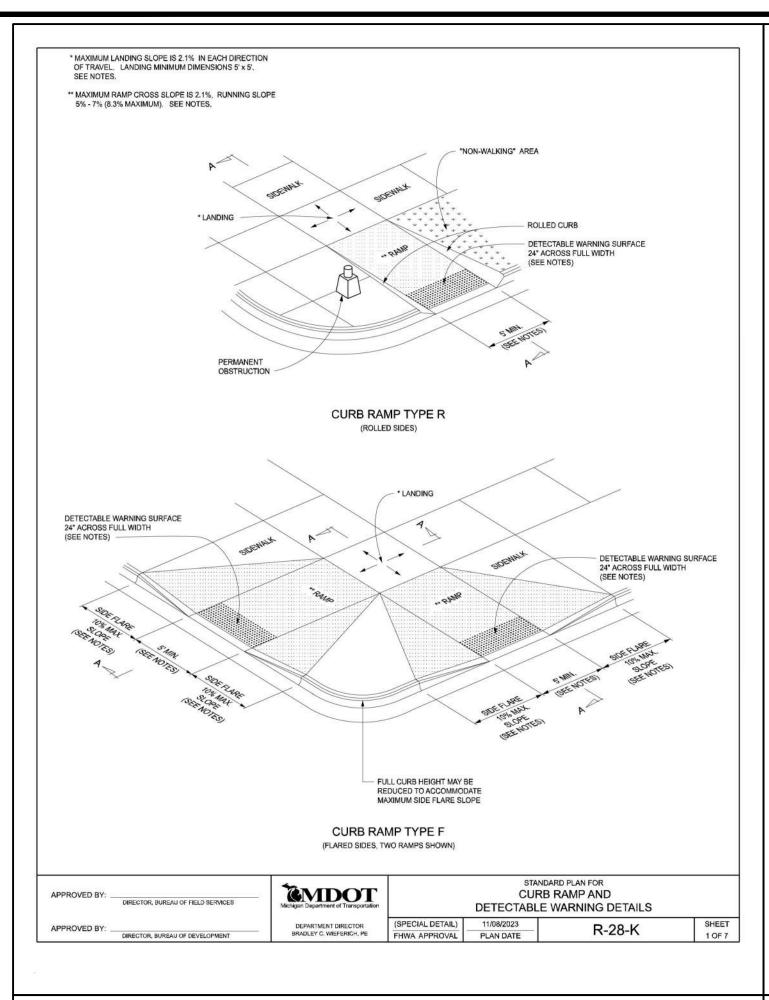
CLIENT:

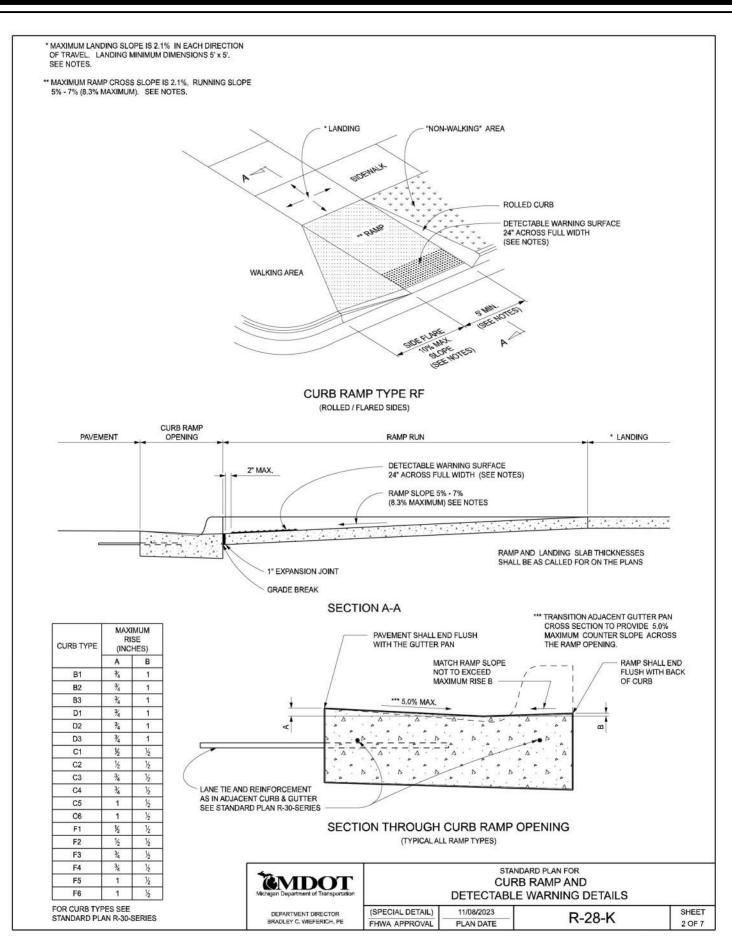
PROJECT NO: 22-051 SCALE: N/A

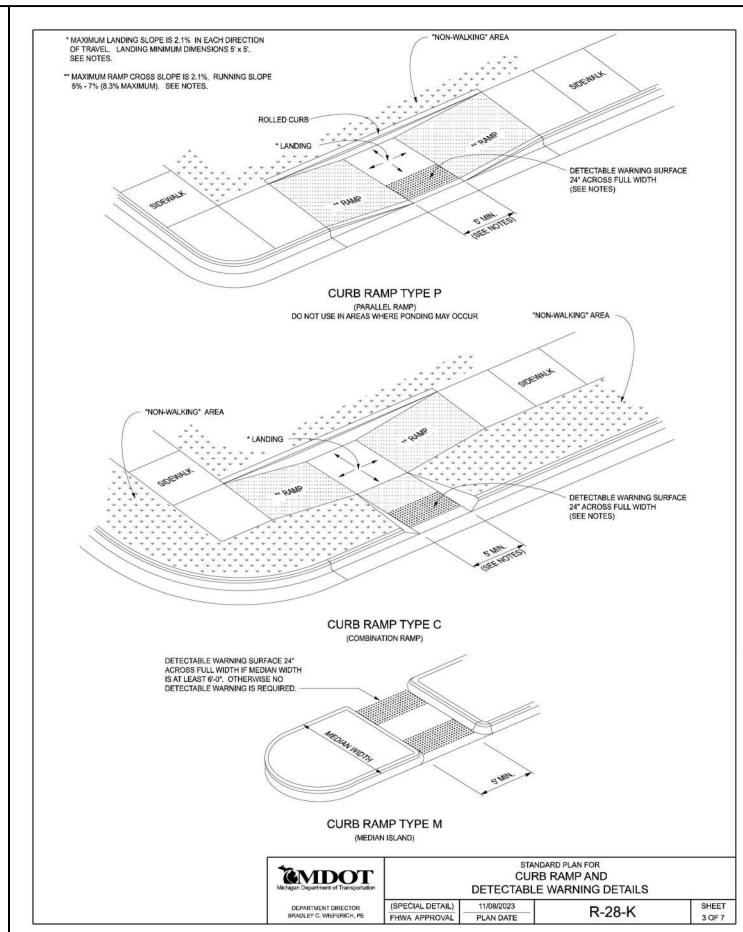
FIELD: REICHERT DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

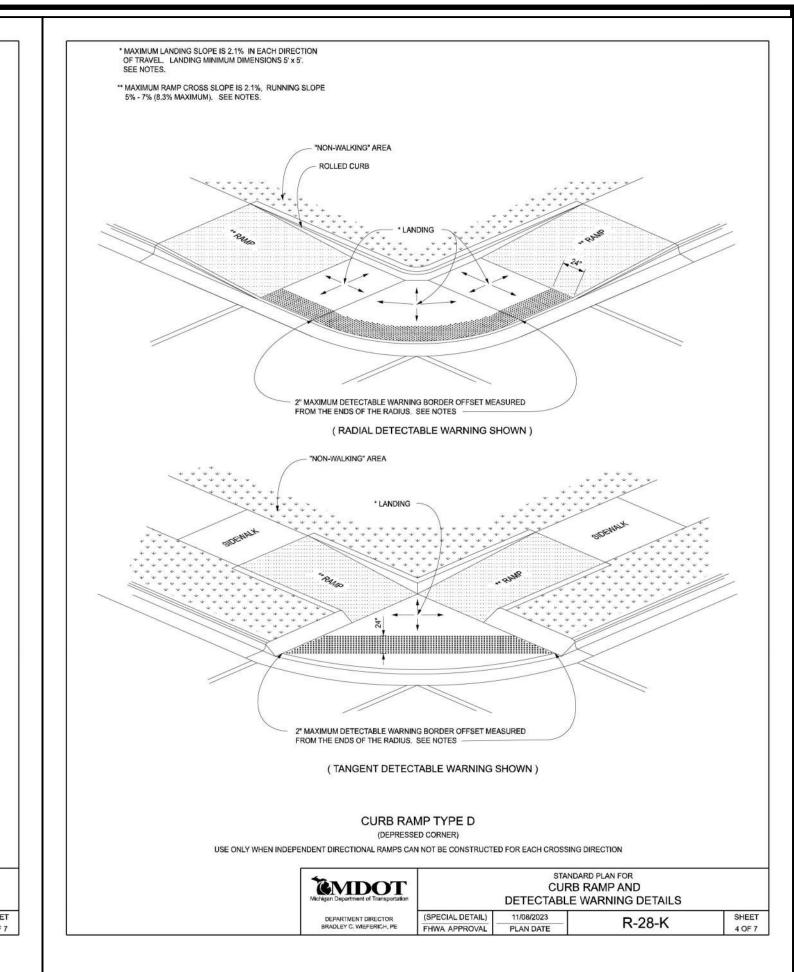
C-11.0

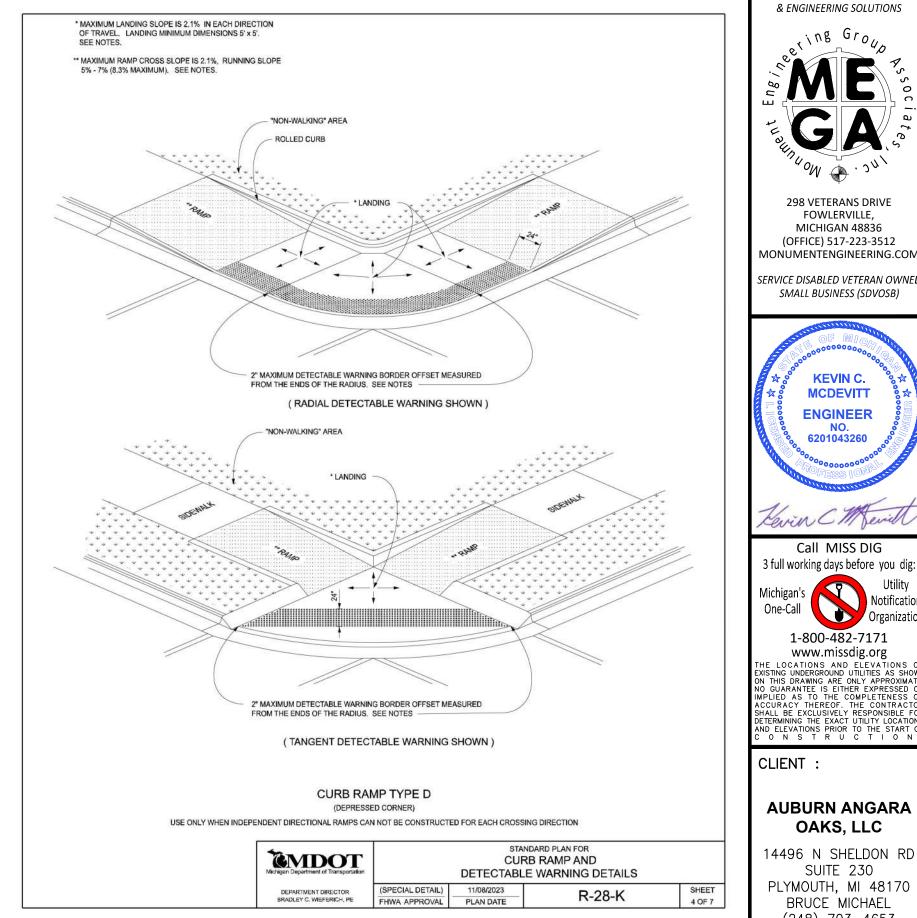














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SMALL BUSINESS (SDVOSB)

**KEVIN C.** 

**MCDEVITT** 

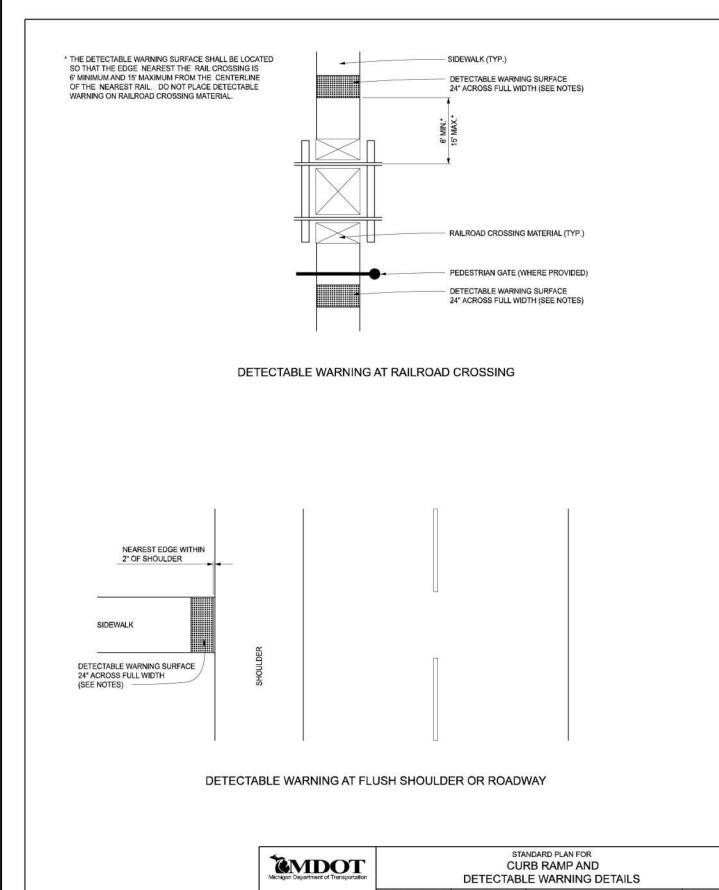
**ENGINEER** 

6201043260

Call MISS DIG

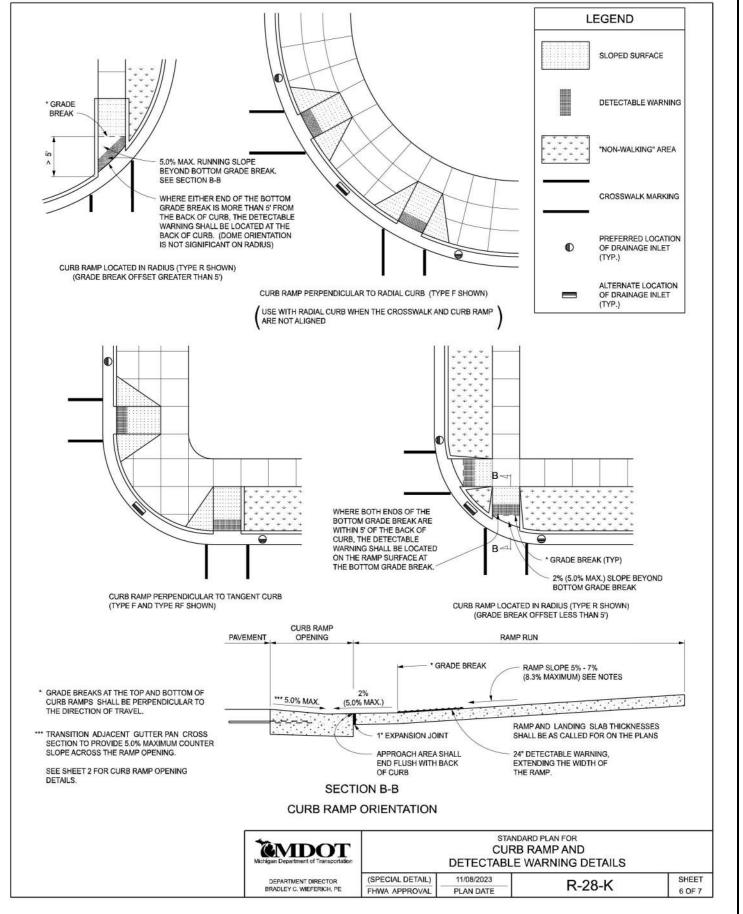
3 full working days before you dig

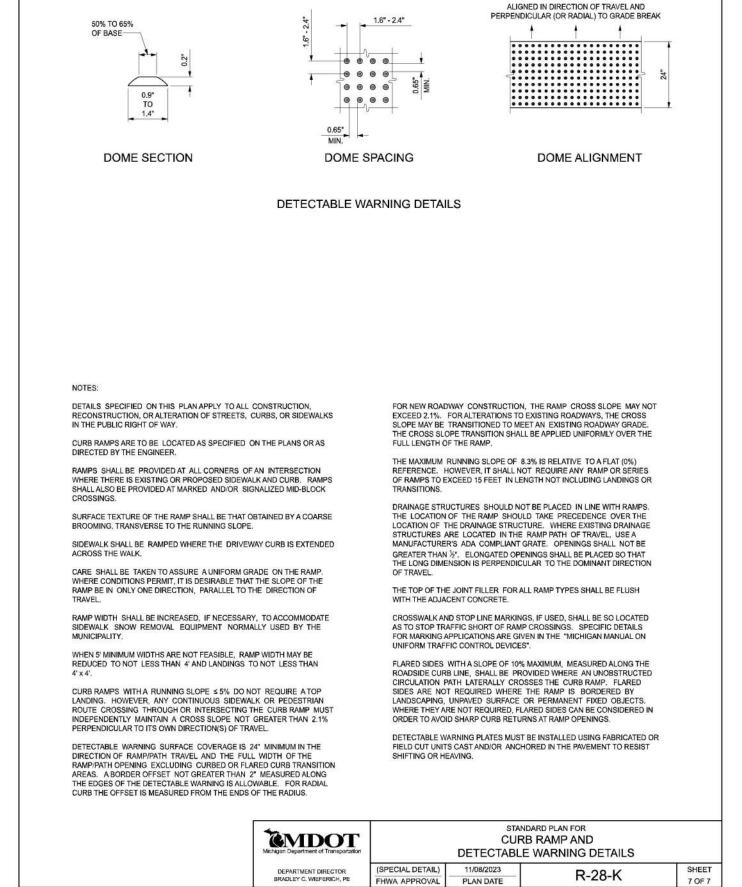
1-800-482-7171 www.missdig.org

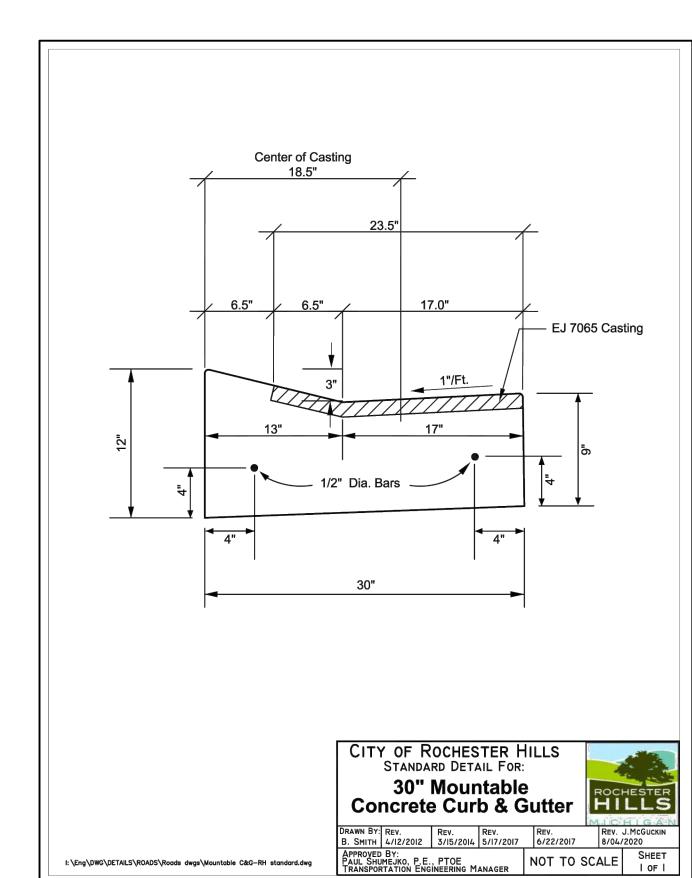


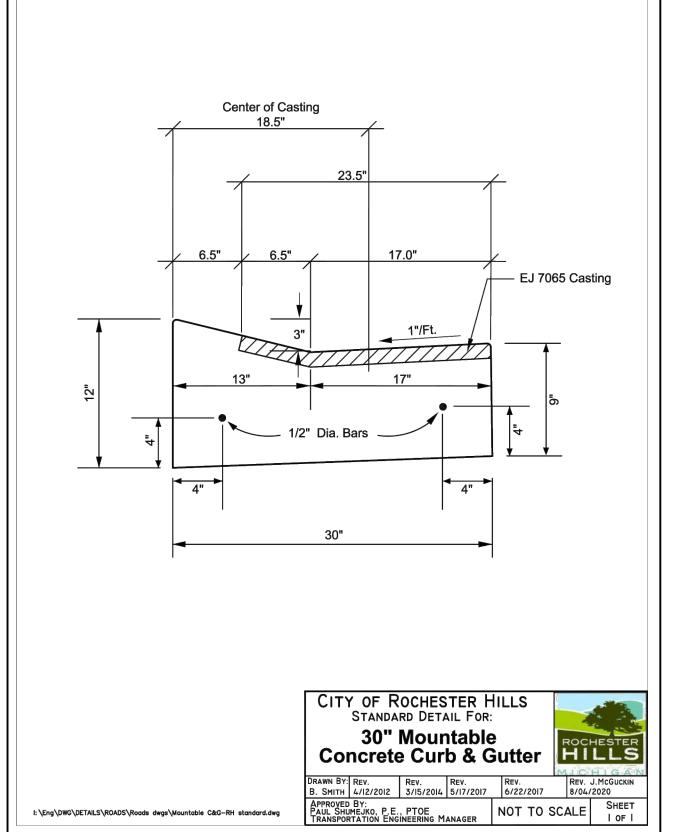
(SPECIAL DETAIL)

R-28-K











ORIGINAL ISSUE DATE:

SCALE: N/A

DRAWN BY: MN DESIGN BY: KM CHECK BY: AP

FIELD:

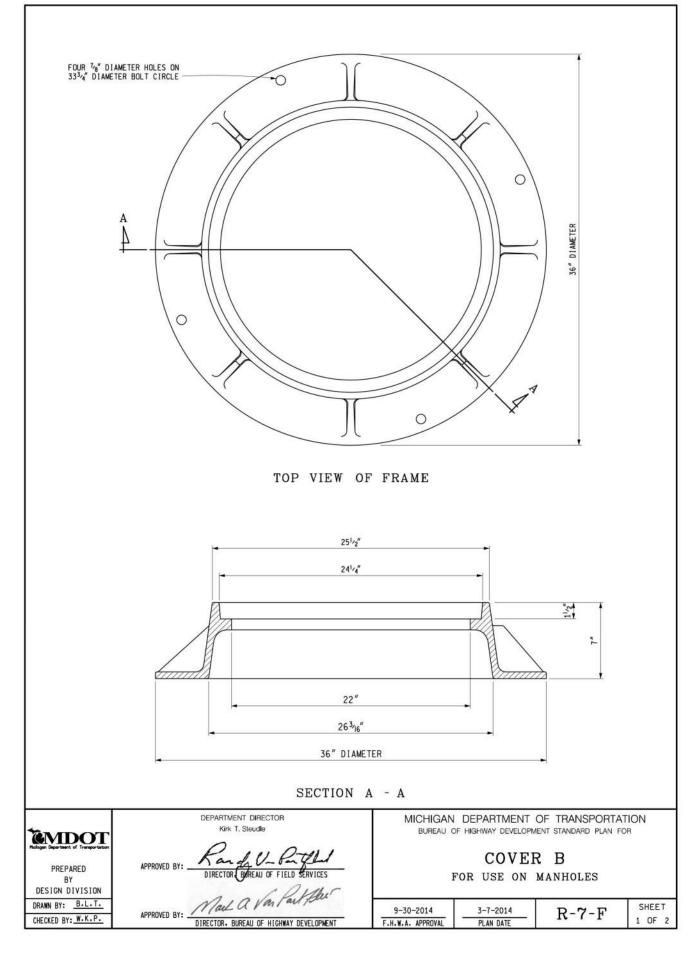
05/19/2022

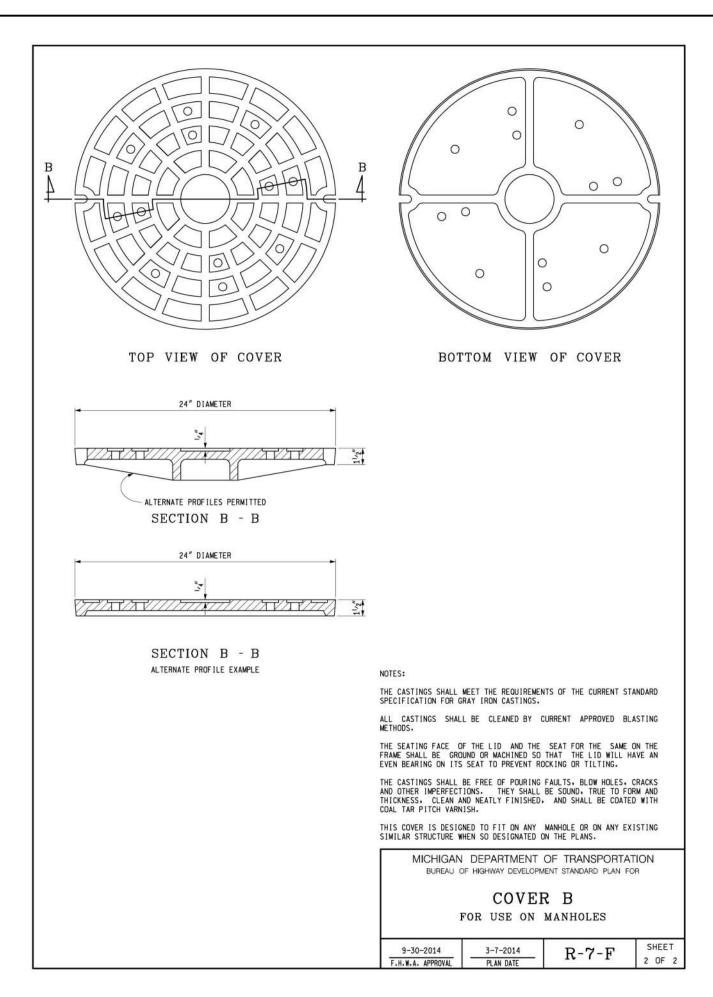
PROJECT NO: 22-051

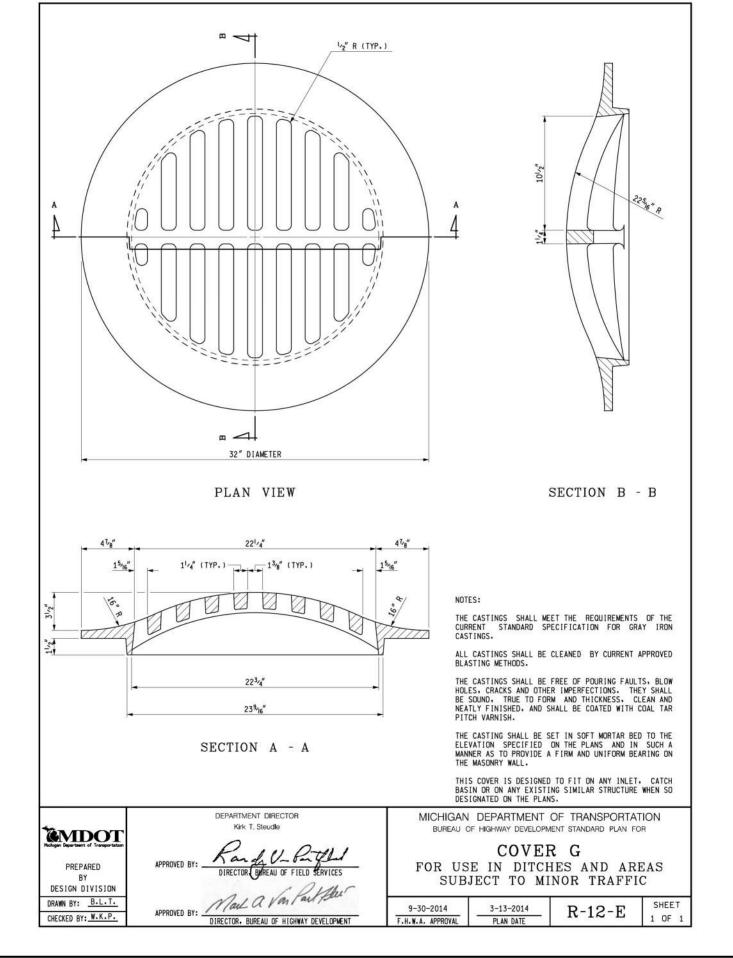
**C-11.1** 

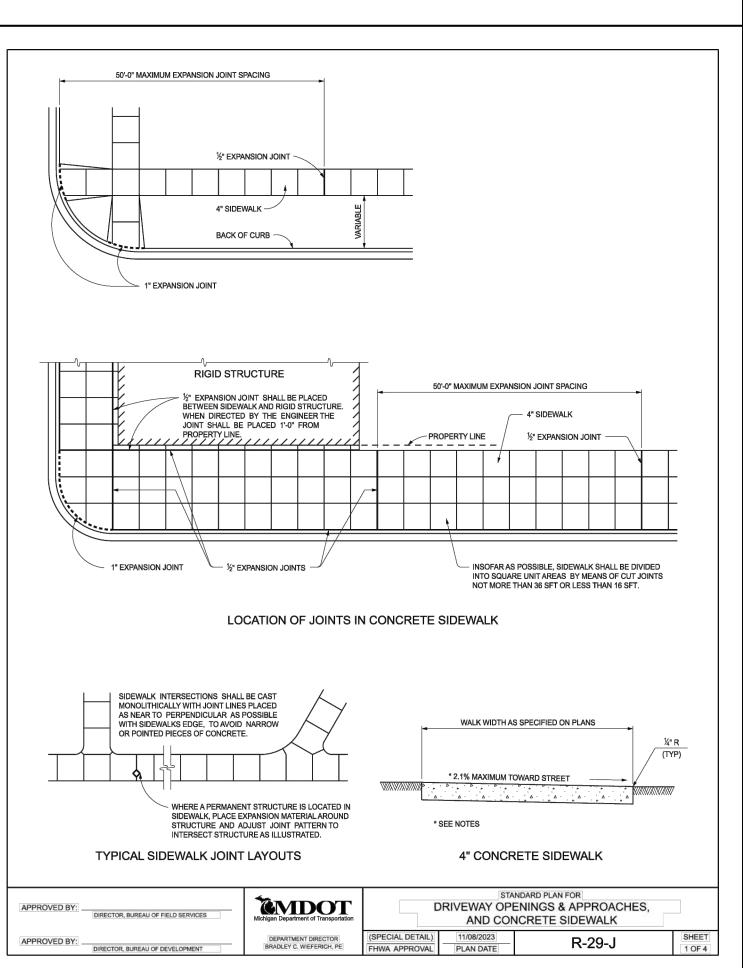
REICHERT

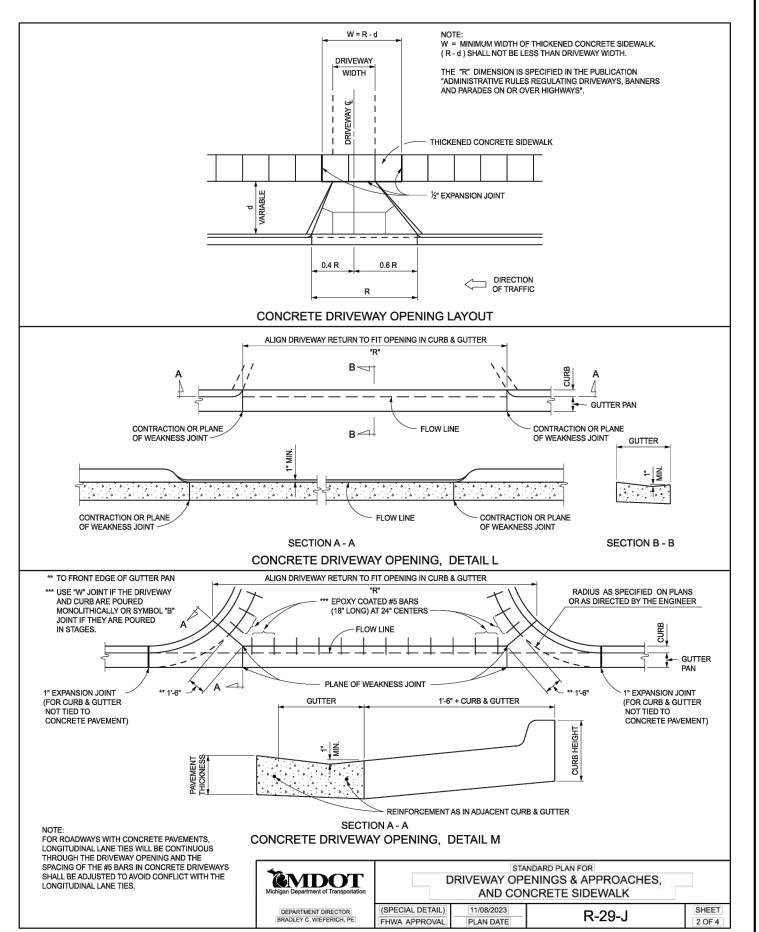


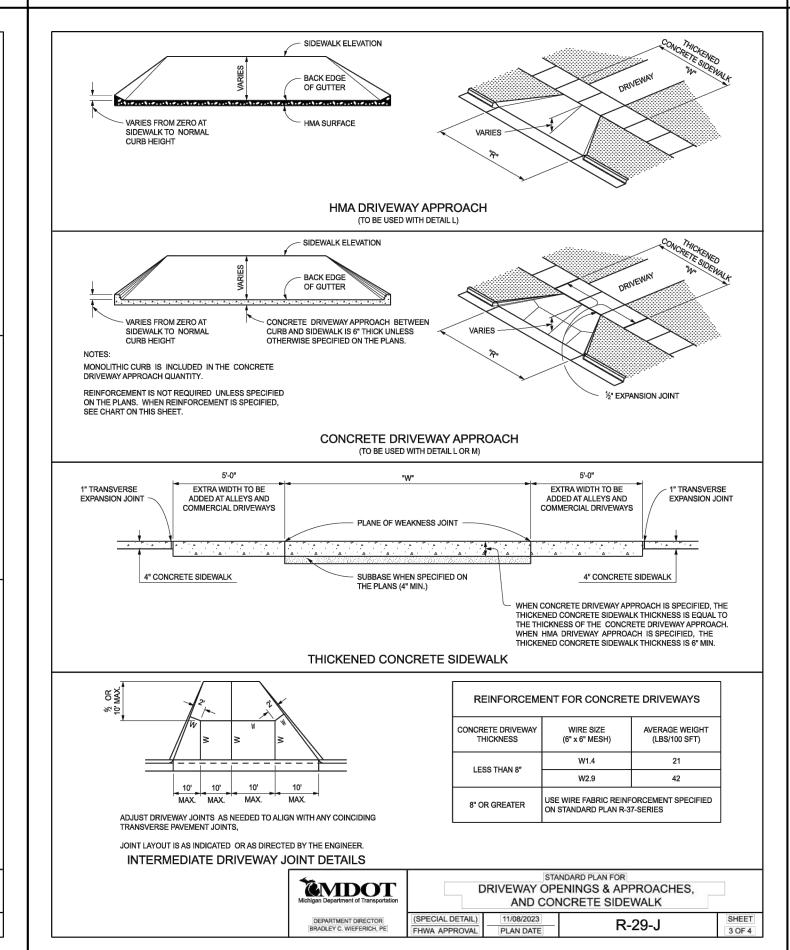


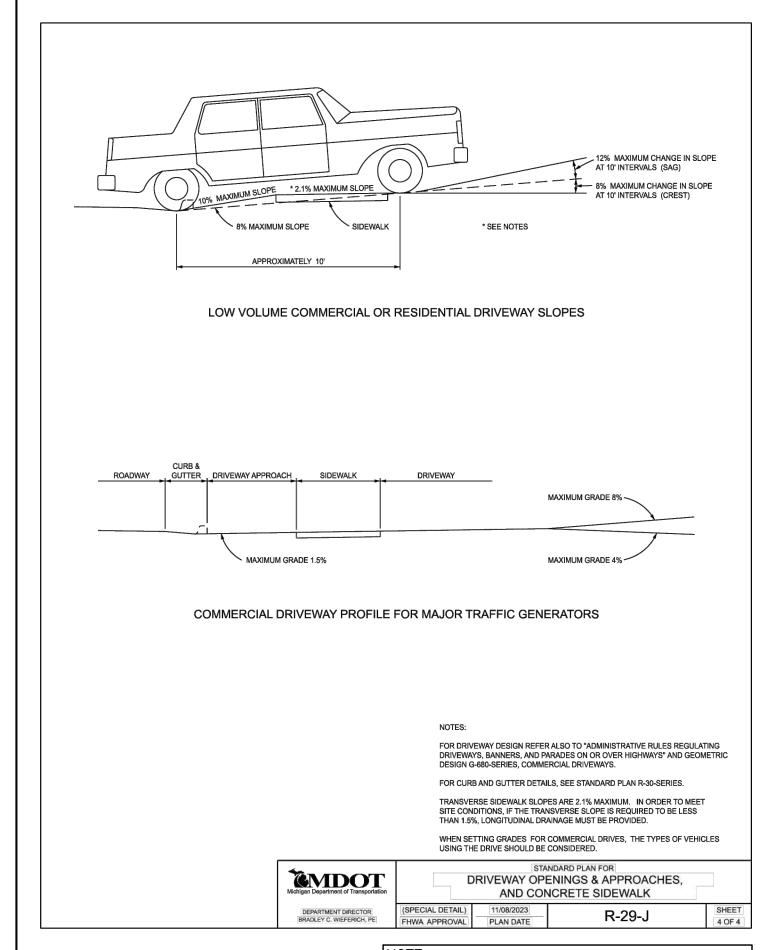


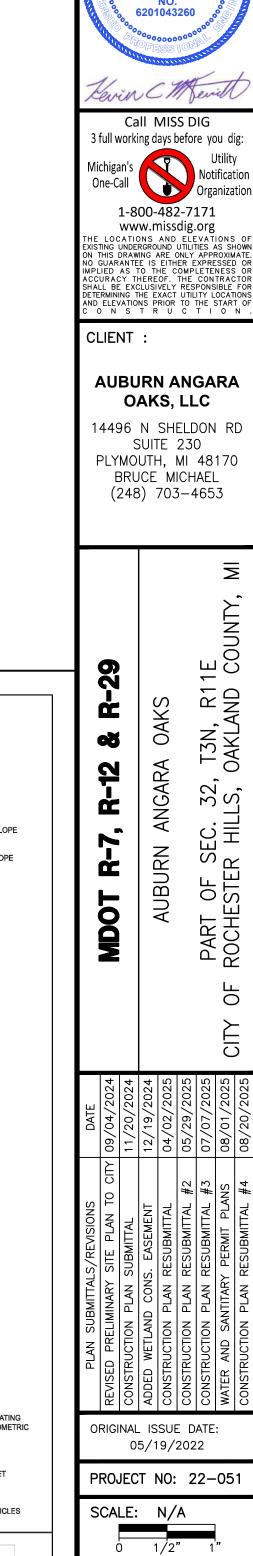












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298 VETERANS DRIVE

FOWLERVILLE, MICHIGAN 48836 (OFFICE) 517-223-3512 MONUMENTENGINEERING.COM SERVICE DISABLED VETERAN OWNEL SMALL BUSINESS (SDVOSB)

> KEVIN C. MCDEVITT ENGINEER

FILE:P:\Projects\2022\22-051 Auburn Angara Sub\Dwg\Engineering\22-051\_C-11.0\_Details.dwg PLOT DATE:8/20/2025 10:16 AM

CITY FILE #22-037 SECTION #32

FIELD:

R-29-J TO BE USED FOR STANDARD DRIVEWAY APPROACHES IN AUBURN ROAD ONLY. DO NOT USE FOR ANGARA DRIVE INTERSECTION OR FOR

DRIVE APPROACHES ON PRIVATE STREETS.

DRAWN BY: MN
DESIGN BY: KM
CHECK BY: AP

REICHERT

- ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CURRENT STANDARDS AND SPECIFICATIONS OF THE LOCAL MUNICIPALITY, THE LOCAL WATER AND/OR SEWER AUTHORITY. THE COUNTY D.P.W., THE COUNTY DRAIN COMMISSIONER, MICHIGAN DEPARTMENT OF TRANSPORTATION, MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES AND ENERGY, THE STATE OF MICHIGAN, AND THE COUNTY ROAD COMMISSION WHERE APPLICABLE.
- RULES, REGULATIONS OR LAWS OF ANY CONTROLLING GOVERNMENTAL AGENCY SHALL GOVERN, WHEN THEY ARE MORE STRINGENT THAN THE REQUIREMENTS OF
- SHOULD THE CONTRACTOR ENCOUNTER A CONFLICT BETWEEN THESE PLANS AND SPECIFICATIONS, EITHER AMONG THEMSELVES OR WITH THE REQUIREMENTS OF ANY AND ALL REVIEWING AND PERMIT—ISSUING AGENCIES, CONTRACTOR SHALL SEEK CLARIFICATION IN WRITING FROM THE ENGINEER BEFORE COMMENCEMENT OF CONSTRUCTION. FAILURE TO DO SO SHALL BE AT SOLE EXPENSE TO THE
- THE CONTRACTOR SHALL PROVIDE ALL MATERIALS, LABOR AND EQUIPMENT TO COMPLETE THE TYPE OF WORK WHICH IS BID, IN ACCORDANCE WITH THE PLANS, SPECIFICATIONS, DETAILS AND TO THE SATISFACTION OF THE OWNER AND OWNER'S REPRESENTATIVE.
- CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT. INCLUDING SAFETY OF ALL PERSONS ANI PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONTRACTOR FURTHER AGREES TO DEFEND. INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL.
- ANY WORK WITHIN STREET OR HIGHWAY RIGHT-OF-WAYS SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE GOVERNMENTAL AGENCIES HAVING JURISDICTION AND SHALL NOT BEGIN UNTIL PERMITS HAVE BEEN ISSUED BY THESE GOVERNING AUTHORITIES.
- 7. ALL NECESSARY PERMITS, BONDS, INSURANCES, ETC., SHALL BE PAID FOR BY THE CONTRACTOR.
- 8. ALL ELEVATIONS SHOWN ARE BASED ON BENCHMARKS PROVIDED BY THE LOCAL MUNICIPALITY UNLESS OTHERWISE NOTED ON THE DRAWINGS.
- 9. ALL ITEMS OF WORK NOT SPECIFICALLY INDICATED AS PAY ITEMS ON THE DRAWINGS OR IN THE BID PACKAGE SHALL BE CONSIDERED INCIDENTAL ITEMS.
- 10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DUST CONTROL DURING THE PERIODS OF CONSTRUCTION.
- 11. AT LEAST THREE (3) WORKING DAYS PRIOR TO ANY EXCAVATION, THE CONTRACTOR SHALL CONTACT MISS DIG (1-800-482-7171) TO VERIFY THE LOCATION OF ANY EXISTING UNDERGROUND UTILITIES AND SHALL NOTIFY REPRESENTATIVES OF OTHER UTILITIES IN THE VICINITY OF THE WORK.
- 12. ALL PROPERTIES OR FACILITIES IN THE SURROUNDING AREAS, PUBLIC OR PRIVATE, DESTROYED OR OTHERWISE DISTURBED DUE TO CONSTRUCTION, SHALL BE REPLACED AND/OR RESTORED TO THE ORIGINAL CONDITION BY THE CONTRACTOR, AT NO ADDITIONAL COST TO THE OWNER.
- 13. MANHOLE, CATCH BASIN, GATE WELL RIMS AND HYDRANT FINISH GRADE ELEVATIONS MUST BE AS-BUILT AND APPROVED BY THE ENGINEER BEFORE THE CONTRACTOR'S WORK IS CONSIDERED COMPLETE. AGENCY REQUIREMENTS FOR RECORD DRAWINGS
- 14. CONTRACTOR SHALL REMOVE AND DISPOSE OF OFF-SITE ANY TREES, BRUSH, STUMPS. TRASH OR OTHER UNWANTED DEBRIS, AT THE OWNER'S DIRECTION, INCLUDING OLD BUILDING FOUNDATIONS AND FLOORS. THE BURNING OR BURYING OF TRASH, STUMPS OR OTHER DEBRIS WILL NOT BE ALLOWED.
- 15. ALL REFERENCES TO M.D.O.T. SPECIFICATIONS REFER TO THE MOST CURRENT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
- 16. ALL CONTRACTORS BIDDING THIS PROJECT SHALL HAVE VISITED THE SITE TO BECOME THOROUGHLY FAMILIAR WITH THE SITE AND THE CONDITIONS IN WHICH THEY WILL BE CONDUCTING THEIR OPERATIONS. ANY VARIANCE FOUND BETWEEN THE PLANS AND EXISTING CONDITIONS SHALL BE REPORTED IMMEDIATELY TO THE DESIGN ENGINEER.
- 17. THE LOCATIONS AND DIMENSIONS SHOWN ON THE PLANS FOR EXISTING UNDERGROUND FACILITIES ARE IN ACCORDANCE WITH AVAILABLE INFORMATION PROVIDED BY THE UTILITY COMPANIES AND GOVERNMENTAL AGENCIES WITHOUT UNCOVERING AND MEASURING. THE DESIGN ENGINEER DOES NOT GUARANTEE THE ACCURACY OF THIS INFORMATION OR THAT ALL EXISTING UNDERGROUND
- 18. THE OWNER MAY EMPLOY AND PAY FOR THE SERVICES OF AN ENGINEER TO PROVIDE ON-SITE INSPECTION AND VERIFY IN THE FIELD THAT ALL BACKFILL PAVEMENTS AND CONCRETE CURB AND GUTTER HAVE BEEN PLACED AND COMPACTED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS. IF. IN THE OPINION OF THE ENGINEER. THE WORK DOES NOT MEET THE TECHNICAL OR DESIGN REQUIREMENTS STIPULATED FOR THE WORK, THE CONTRACTOR SHALL MAKE ALL NECESSARY ADJUSTMENTS AS DIRECTED BY THE ENGINEER. THE CONTRACTOR SHALL MAKE NO DEVIATIONS FROM THE CONTRACT DOCUMENTS WITHOUT SPECIFIC WRITTEN APPROVAL OF THE OWNER.
- 19. ALL EXCAVATED MATERIAL REMOVED FROM THE SANITARY SEWER, STORM SEWER AND WATER MAIN TRENCHES UNDER, THROUGH AND WITHIN 3 FEET OF THE 45° ZONE OF INFLUENCE LINE OF EXISTING OR PROPOSED PAVING. SIDEWALK AREAS AND PER PLANS, NOT SUITABLE FOR BACKFILL, SHALL BE REMOVED FROM THESE AREAS AND DISPOSED OF.
- 20. THE CONTRACTOR SHALL RESTORE TO THEIR PRESENT CONDITIONS ANY PAVEMENT OR PUBLIC RIGHTS-OF-WAY THAT IS DISTURBED BY THE OPERATIONS OF THE CONTRACTOR. ALL RESTORATION WORK IN PUBLIC RIGHTS-OF-WAY SHALL BE PERFORMED TO THE SATISFACTION OF THE GOVERNMENT AGENCIES HAVING
- 21. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY BARRICADES, SIGNAGE AND LIGHTS TO PROTECT THE WORK AND SAFELY MAINTAIN TRAFFIC, IN ACCORDANCE WITH LOCAL REQUIREMENTS AND THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (LATEST EDITION).
- 22. O.S.H.A. SAFETY REQUIREMENTS ALL WORK, WORK PRACTICE, AND MATERIALS SHALL COMPLY WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL SAFETY, OCCUPATIONAL, HEALTH AND ENVIRONMENTAL REGULATIONS AND ALSO NFPA AND ANSI CODES AS APPLICABLE. ALL WORK INSIDE A CONFINED SPACE SUCH AS MANHOLES OR UNDERGROUND STRUCTURES SHALL BE COORDINATED WITH UTILITY OWNER AND ALL WORKER SAFETY REQUIREMENTS STRICTLY ENFORCED. LAND SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
- 23. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ARRANGE FOR OR SUPPLY TEMPORARY WATER SERVICE, SANITARY FACILITIES AND ELECTRICITY.
- 24. CONTRACTOR SHALL PROVIDE FOR THE CONTINUOUS OPERATION OF EXISTING FACILITIES WITHOUT INTERRUPTION DURING CONSTRUCTION UNLESS SPECIFICALLY AUTHORIZED OTHERWISE BY THE RESPECTIVE AUTHORITY.
- 25. THE CONTRACTOR SHALL NOTE EXISTING UNDERGROUND UTILITIES IN THE PROJECT PLANS. TRENCH BACKFILL FOR EXISTING UTILITIES SHALL BE EXAMINED CRITICALLY. ANY TRENCH WHICH, IN THE OPINION OF THE SOILS ENGINEER ARE FOUND TO BE SOFT, UNSTABLE, OR UNSUITABLE MATERIAL SHALL BE COMPLETELY EXCAVATED AND BACKFILLED WITH SUITABLE MATERIAL. SAND BACKFILL SHALL BE USED UNDER PAVEMENT OR WITHIN 3 FEET OF THE 45° INFLUENCE LINE OF PAVEMENT OR STRUCTURES.

# **EROSION CONTROL STANDARDS**

- 1. ALL EROSION AND SEDIMENT CONTROL WORK SHALL CONFORM TO STANDARDS AND SPECIFICATIONS OF THE JURISDICTIONAL AGENCY UNDER PART 91 OF ACT 451 OF
- UNDER "MICHIGAN'S PERMIT-BY-RULE FOR CONSTRUCTION ACTIVITIES", PROMULGATED UNDER ACT 245, PUBLIC ACTS OF 1929 AS AMENDED, AN NPDES STORM WATER DISCHARGE COVERAGE PERMIT IS REQUIRED FOR ANY CONSTRUCTION ACTIVITY THAT DISTURBS 1 ACRES OR MORE OF LAND. A CERTIFIED STORM WATER OPERATOR IS REQUIRED FOR THE SUPERVISION AND INSPECTION OF THE SOIL EROSION CONTROL MEASURES AT THE CONSTRUCTION SITE IN ACCORDANCE WITH THE PROVISIONS OF THESE RULES.
- DAILY INSPECTIONS SHALL BE MADE BY CONTRACTOR WHILE WORKING TO DETERMINE THE EFFECTIVENESS OF EROSION AND SEDIMENT CONTROL MEASURES ANY NECESSARY REPAIRS SHALL BE PERFORMED WITHOUT DELAY. ALL SOIL EROSION CONTROL PROVISIONS SHALL BE PROPERLY MAINTAINED DURING CONSTRUCTION.
- EROSION AND ANY SEDIMENTATION FROM WORK ON THIS SITE SHALL BE CONTAINED ON THE SITE AND NOT ALLOWED TO COLLECT ON ANY OFF-SITE AREAS OR IN WATERWAYS. WATERWAYS INCLUDE BOTH NATURAL AND MAN-MADE OPEN DITCHES, STREAMS, STORM DRAINS, LAKES, AND PONDS.
- CONTRACTOR SHALL APPLY TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES WHEN REQUIRED AND AS DIRECTED ON THESE PLANS. CONTRACTOR SHALL REMOVE TEMPORARY MEASURES AS SOON AS PERMANENT STABILIZATION OF SLOPES, DITCHES, AND OTHER EARTH CHANGE AREAS HAVE BEEN COMPLETED.

## **EROSION CONTROL STANDARDS** CONTINUED

- 6. STAGING THE WORK WILL BE DONE BY THE CONTRACTOR AS DIRECTED IN THESE PLANS AND AS REQUIRED TO ENSURE PROGRESSIVE STABILIZATION OF DISTURBED
- 7. SOIL EROSION CONTROL PRACTICES WILL BE ESTABLISHED IN EARLY STAGES OF CONSTRUCTION BY THE CONTRACTOR, SEDIMENT CONTROL PRACTICES WILL BE APPLIED AS A PERIMETER DEFENSE AGAINST ANY TRANSPORTING OF SILT OFF THE
- DUST SHALL BE CONTROLLED BY WATERING OR BY OTHER APPROVED MEANS HROUGHOUT ALL CONSTRUCTION OPERATIONS.
- 9. ALL WATER FROM DEWATERING OR SURFACE DRAINAGE FROM THE CONSTRUCTION SITE SHALL BE CONTROLLED TO FLIMINATE SEDIMENT CONTAMINATION OF OFF-SITE WATERWAYS OR STORM SEWERS. SUCH MEASURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO ANY DEWATERING OR LAND DISTURBANCE.
- 10. PERMANENT SOIL EROSION CONTROL MEASURES FOR SLOPES, CHANNELS, DITCHES OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN 5 CALENDAR DAYS AFTER FINAL GRADING OR THE FINAL EARTH CHANGE HAS BEEN COMPLETED. WHEN IT IS NOT POSSIBLE TO PERMANENTLY STABILIZE A DISTURBED AREA AFTER AN EARTH CHANGE HAS BEEN COMPLETED OR WHERE SIGNIFICANT EARTH CHANGE HAS BEEN COMPLETED OR WHERE SIGNIFICANT EARTH CHANGE ACTIVITY CEASES, TEMPORARY SOIL EROSION CONTROL MEASURES SHALL BE IMPLEMENTED WITHIN CALENDAR DAYS. ALL TEMPORARY SOIL EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND ESTABLISHED BEFORE A CERTIFICATE OF COMPLIANCE IS

# STORM SEWER SPECIFICATIONS

- THESE SPECIFICATIONS SHALL BE USED IN CONJUNCTION WITH THE GENERAL SPECIFICATIONS AND THE SPECIFICATIONS AND DETAIL SHEETS OF THE GOVERNING AGENCIES. IF ANY CONFLICT IS FOUND BETWEEN THE SPECIFICATIONS, THE STRICTER SPECIFICATIONS SHALL BE FOLLOWED.
- CONTRACTOR SHALL FURNISH CERTIFIED EVIDENCE THAT ALL MATERIAL TESTS AND INSPECTIONS HAVE BEEN PERFORMED AND THAT THE PRODUCT HAS BEEN MANUFACTURED IN COMPLIANCE WITH THE APPLICABLE SPECIFICATIONS.
- PROPER IMPLEMENTS, TOOLS AND FACILITIES SHALL BE PROVIDED AND USED FOR UNLOADING AND DISTRIBUTING MATERIALS ALONG THE LINE OF WORK. ANY PIPE OR FITTING DAMAGED IN TRANSPORTATION OR HANDLING SHALL BE REJECTED AND IMMEDIATELY REMOVED FROM THE JOB SITE
- 4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFE STORAGE OF ALL MATERIAL INTENDED FOR THE WORK. HE SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT DAMAGE TO MATERIALS, EQUIPMENT AND WORK.
- PIPE BEDDING, UNLESS OTHERWISE INDICATED, SHALL BE CL. II SAND, CRUSHED STONE OR ROUNDED GRAVEL. BEDDING MATERIAL SHALL HAVE 95% PASSING A 3/4" SIEVE AND AT LEAST 50% RETAINED ON A NO. 4 SIEVE.
- 6. POROUS FILTER MATERIAL FOR PERFORATED SUBSURFACE DRAINS SHALL BE CRUSHED ROCK OR GRAVEL GRADED BETWEEN 1-1/2" AND 3/4" OR PER PLANS
- 7. BACKFILL, UNLESS OTHERWISE NOTED, SHALL BE COARSE SAND, FINE GRAVEL OR EARTH HAVING A LOW PLASTICITY INDEX, FREE OF ROCKS, DEBRIS AND OTHER FOREIGN MATERIALS AND DEFINED AS ALL PASSING THROUGH A 3/8" SIEVE AND NOT MORE THAN 10% BY VOLUME PASSING THROUGH A 200-MESH SIEVE.
- STORM SEWER PIPING AND FITTINGS SHALL BE OF THE SIZE AND TYPE INDICATED ON THE DRAWINGS AND SHALL CONFORM TO THE FOLLOWING:
- A. POLYVNYL CHLORIDE (PVC) AND ACRYLONITRILE BUTADIENE STYRENE (ABS) FOR PIPE UP TO AND INCLUDING 10" IN DIAMETER, SHALL CONFORM TO ASTM D3034. SDR 23.5 FOR PVC PIPE AND ASTM D2751 FOR ABS PIPE WITH ELASTOMETRIC GASKET JOINTS CONFORMING TO ASTM D3212 OR CHEMICALLY WELDED PIPE JOINTS CONFORMING TO ASTM F545.
- B. REINFORCED CONCRETE PIPE, FOR PIPE 12" IN DIAMETER AND UP, SHALL CONFORM TO ASTM C-76. CLASS IV UNLESS MODIFIED BY THE DRAWINGS. JOINTS SHALL BE MODIFIED GROOVED TONGUE WITH RUBBER GASKET CONFORMING TO ASTM C-443.
- C. PERFORATED SUBSURFACE DRAIN PIPE SHALL BE PVC CONFORMING TO ASTM D-2729 OR PERFORATED, CORRUGATED HIGH DENSITY POLYETHYLENE PIPE CONFORMING TO AASHTO M-294. JOINTS FOR PVC AND POLYETHYLENE PIPE SHALL BE PREFABRICATED COUPLING WITH SOLVENT
- MANHOLES, CATCH BASINS, AND INLETS SHALL BE OF THE SIZE AND TYPE INDICATED ON THE DRAWINGS AND SHALL BE CONSTRUCTED OF THE FOLLOWING:
- A. REINFORCED PRE-CAST CONCRETE MANHOLE SECTIONS INCLUDING CONCENTRIC OR ECCENTRIC CONES AND GRADE RINGS SHALL BE 4000 PSI CONCRETE AND CONFORM TO ASTM C-478-64T.
- B. BRICK SHALL BE SOUND, HARD-BURNED THROUGHOUT AND OF UNIFORM SIZE AND QUALITY AND SHALL BE IN ACCORDANCE WITH AASHTO M 91,
- C. CONCRETE MASONRY SHALL BE SOLID PRE-CAST SEGMENTAL UNITS CONFORMING TO ASTM C-139.
- 10. IRON CASTINGS SHALL CONFORM TO ASTM A-48, CLASS 30. BEARING SURFACES BETWEEN CAST IRON FRAMES, COVERS AND GRATES SHALL BE MACHINED, FITTED TOGETHER AND MATCHED-MARKED TO PREVENT ROCKING. SYSTEM IDENTIFYING LETTERS 2" HIGH SHALL BE STAMPED OR CAST INTO ALL COVERS SO THAT THEY ARE PLAINLY VISIBLE. SEE MUNICIPALITY STANDARDS FOR ACTUAL WORDING.
- 11. CASTINGS SHALL BE MANUFACTURED BY EAST JORDAN IRON WORKS, INC., NEENAH FOUNDRY COMPANY OR EQUAL.
- 12. CONCRETE AND MASONRY MATERIALS FOR CONSTRUCTION OF STORM DRAINAGE STRUCTURES SHALL CONSIST OF THE FOLLOWING:
  - A. PORTLAND CEMENT SHALL BE STANDARD BRAND OF PORTLAND CEMENT CONFORMING TO ASTM C-150, TYPE I OR IA.
  - B. FINE AND COARSE AGGREGATES FOR CONCRETE SHALL BE PER ASTM C-33.
  - C. AGGREGATE FOR CEMENT MORTAR SHALL BE CLEAN, SHARP SAND CONFORMING TO ASTM C-144.
  - D. HYDRATED LIME SHALL COMPLY WITH ASTM C-207, TYPE S.
  - E. WATER SHALL MEET THE REQUIREMENTS OF MDOT SPEC SECTION 911.
- F. REINFORCING STEEL FOR CONCRETE SHALL BE INTERMEDIATE-GRADE NEW BILLET STEEL CONFORMING TO ASTM A-615, GRADE 40.
- 13. CONCRETE, UNLESS OTHERWISE NOTED, SHALL HAVE COMPRESSIVE STRENGTH AFTER 28 DAYS OF 3000 PSI MINIMUM WITH 3" MAXIMUM SLUMP.
- A. CONCRETE FILL BELOW GRADE MAY BE 2500 PSI AT 28 DAYS.
- B. CONCRETE, WHERE EXPOSED TO THE WEATHER, SHALL BE AIR-ENTRAINED.
- AIR ENTRAINMENT SHALL BE ACCOMPLISHED BY THE USE OF ADDITIVES CONFORMING TO ASTM C-260. AIR CONTENT SHALL BE 6% + 1%. ADDITIVE SHALL BE USED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S PRINTED
- C. READY-MIX CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF ASTM
- 14. MORTAR SHALL BE SPECIFIED HEREINAFTER. USE METHOD OF MIXING MORTAR AT JOB SO THAT SPECIFIED PROPORTIONS OF MORTAR MATERIALS CAN BE CONTROLLED AND ACCURATELY MAINTAINED DURING WORK PROGRESS. MORTAR SHALL NOT BE MIXED IN GREATER QUANTITIES THAN REQUIRED FOR IMMEDIATE USE, WITH AMOUNT OF WATER CONSISTENT WITH SATISFACTORY WORKABILITY. RE-TAMPERING OF MORTAR IS NOT PERMITTED.
  - A. MORTAR FOR LAYING BRICK OR CONCRETE MASONRY UNITS SHALL CONFORM TO ASTM C-270, TYPE M, AVERAGE COMPRESSIVE STRENGTH 2500 PSI MINIMUM AT 28 DAYS. MORTAR MIX SHALL BE PROPORTIONED BY VOLUME.
  - B. MORTAR FOR PLASTERING SHALL CONSIST OF 1 PART PORTLAND CEMENT AND 2-1/2 PARTS SAND.
- C. MORTAR FOR GROUTING OF RIP-RAP SHALL CONSIST OF 1 PART PORTLAND CEMENT AND 3-1/2 PARTS SAND.
- 15. PERFORM ALL EXCAVATING AND TRENCHING TO DIMENSIONS AND ELEVATIONS INDICATED ON DRAWINGS.

# STORM SEWER SPECIFICATIONS,

EXPEDITE THE WORK.

THICKNESSES:

- 16. OPEN NO MORE TRENCH IN ADVANCE OF PIPE LAYING THAN IS NECESSARY TO
- 17. CARE SHALL BE TAKEN NOT TO EXCAVATE BELOW THE DEPTHS INDICATED ON DRAWINGS. WHERE EXCESSIVE OR UNAUTHORIZED EXCAVATION TAKES PLACE, THE OVERDEPTH SHALL BE BACKFILLED TO THE PROPER GRADE WITH COMPACTED BEDDING MATERIAL, AT NO EXPENSE TO THE OWNER.
- 18. WHERE UNSTABLE SOIL IS ENCOUNTERED, CONTRACTOR SHALL NOT PLACE PIPE UNTIL A SOLID BED HAS BEEN PROVIDED.
- 19. EXCAVATION FOR DRAINAGE STRUCTURES SHALL EXTEND A SUFFICIENT DISTANCE FROM THE WALLS AND FOOTINGS TO ALLOWS FOR FORMS, CONSTRUCTION OF WALLS, CONNECTIONS AND FOR INSPECTION.
- 20. PROVIDE REQUIRED TIMBER SHEETING, BRACING AND SHORING TO PROTECT SIDES OF EXCAVATION. DO NOT BRACE SHEETING AGAINST PIPE. PROVIDE SUITABLE LADDERS FOR SAFE ENTRY TO AND EXIT FROM EXCAVATION.
- 21. DURING EXCAVATION, MATERIAL SUITABLE FOR BACKFILLING SHALL BE PILED IN AN ORDERLY MANNER A SUFFICIENT DISTANCE FROM THE BANKS OF TRENCHES TO AVOID OVERLOADING, AND TO PREVENT SLIDES OR CAVE-INS.
- 22. WHEN WET EXCAVATION IS ENCOUNTERED, THE TRENCH SHALL BE DE-WATERED UNTIL THE PIPE HAS BEEN LAID AND BACKFILLED TO A POINT AT LEAST 1 FOOT ABOVE TOP OF PIPE.

23. MANHOLES AND CATCH BASINS SHALL BE CONSTRUCTED OF BRICK, CONCRETE

MASONRY UNITS OR PRE-CAST CONCRETE WITH CAST IRON FRAMES, COVERS AND MANHOLE STEPS. 24. THE WALL THICKNESS OF MANHOLES AND CATCH BASINS CONSTRUCTED OF VARIOUS MATERIALS AND SET AT VARIOUS DEPTHS SHALL MEET THESE MINIMUMS.

ADHERE TO REQUIREMENTS OF THE GOVERNING AGENCY IF THEY EXCEED THESE

•	<u>DEPTH</u>	BRICK.	CONCRETE BLOCK	PRE-CAS CONCRET
•	0' - 10'	8"	6"	6"
•	10' - 16'	12 <b>"</b>	8"	8"
•	16' - 25'	16 <b>"</b>	12 <b>"</b>	12"

- 25. WHENEVER EXISTING MANHOLES OR SEWER PIPE ARE TO BE TAPPED, DRILL HOLES 4" CENTER, TO CENTER, AROUND THE PERIPHERY OF OPENINGS TO CREATE A PLANE OF WEAKNESS JOINT BEFORE BREAKING SECTION OUT.
- 26. MANHOLE STEPS SHALL BE BUILT INTO AND THOROUGHLY ANCHORED TO WALLS. STEPS SHALL BE FACTORY INSTALLED IN PRE-CAST STRUCTURES.
- 27. ALL PIPING ENTERING OR LEAVING DRAINAGE STRUCTURES SHALL BE ADEQUATELY SUPPORTED BY POURED IN-PLACE CONCRETE FILL FROM PIPE CENTER TO UNDISTURBED GROUND.
- 28. SET FRAMES IN FULL BED OF STIFF MORTAR OR BITUMINOUS MASTIC JOINTING COMPOUND AT FINAL ELEVATION.
- 29. ALL TIMBER SHEETING BELOW A PLANE 12" ABOVE TOP OF PIPE SHALL REMAIN IN PLACE IN ORDER NOT TO DISTURB PIPE GRADING. BEFORE BACKFILLING, REMOVE ALL OTHER SHEETING BRACING AND SHORING.
- 30. BEDDING USED FOR TRENCH BOTTOM SHALL BE EXTENDED UP THE SIDES AND CAREFULLY PLACED AROUND AND OVER PIPE IN 6" MAXIMUM LAYERS. EACH LAYER SHALL BE THOROUGHLY AND CAREFULLY COMPACTED TO 95% OF MAXIMUM DRY DENSITY AS PER ASTM D-1557 (MODIFIED PROCTOR) UNTIL 12" OF COVER EXISTS OVER PIPE.
- 31. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH SPECIFIED BACKFILL MATERIAL TO SPECIFIED SUBGRADE ELEVATION. BACKFILLING SHALL BE COMPACTED TO 90% OF MAXIMUM DRY DENSITY PER ASTM D-1557.
- 32. WITHIN 3' OF THE 45' INFLUENCE LINE OF THE SUBGRADE OF STREETS, DRIVES, PARKING LOTS AND OTHER AREAS TO HAVE OR HAVING IMPROVED HARD SURFACES, BACKFILL SHALL BE MATERIAL SPECIFIED AND SHALL BE DEPOSITED IN 6" LOOSE LAYERS AT OPTIMUM MOISTURE CONTENT (±2%) COMPACTED TO 95% OF MAXIMUM DRY DENSITY PER ASTM D1557. (MODIFIED PROCTOR) SUITABLE MATERIALS FOUND ON SITE MAY BE USED.
- 33. BEFORE BACKFILLING AROUND DRAINAGE STRUCTURES, ALL FORMS, TRASH AND DEBRIS SHALL BE REMOVED AND CLEARED AWAY. SELECTED EXCAVATED MATERIAL SHALL BE PLACED SYMMETRICALLY ON ALL SIDES IN 8" MAXIMUM LAYERS; EACH LAYER SHALL BE MOISTENED AND COMPACTED WITH MECHANICAL OR HAND TAMPERS.
- 34. AFTER INSTALLATION OF PIPES AND DRAINAGE STRUCTURES, CLEAN THEM, AND ADJUST TOPS TO FINISH GRADE. PIPE SHALL BE STRAIGHT BETWEEN STRUCTURES, WITH THE FULL INSIDE DIAMETER VISIBLE WHEN SIGHTING BETWEEN
- 35. ENDS OF HEADWALL AND END SECTIONS FOR PIPES LARGER THAN 6 INCHES. SHALL BE FITTED WITH A #4 ROUND MINIMUM WELDED STEEL ROD GRATING. RODS SHALL BE SPACED 6" O.C. MAXIMUM. WELD ROD AT ALL INTERSECTIONS. GRATE SHALL BE REMOVABLE FOR ACCESS AND CLEANING.
- 36. RIP-RAP SHALL BE LAID FROM THE BOTTOM UPWARD; STONES SHALL BE LAID BY HAND WITH 8" MINIMUM DIMENSION PERPENDICULAR TO GRADE WITH WELL-BROKEN JOINTS. COMPACTED AS IT GOES, TRUE TO LINE. ALL JOINTS SHALL BE FILLED WITH CEMENT MORTAR. SURFACE STONE TO BE EXPOSED. CLEAN JOINTS WITH
- 37. THE CONTRACTOR SHALL DO ALL REQUIRED EXCAVATION AND TRENCHING WORK AND THE CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR THE COMPLETION OF THE WORK HEREIN REGARDLESS OF THE NATURE OF MATERIALS ENCOUNTERED DURING THE COURSE OF THE WORK. THE OWNER WILL NOT BE LIABLE FOR ANY COSTS WHATSOEVER ASSOCIATED WITH, BUT NOT LIMITED TO. THE PRESENCE OF ROCK. PEAT. SUBTERRANEAN STREAMS, EXCESSIVE WATER OR OTHER DIFFICULT OR UNANTICIPATED SUB-SURFACE PHENOMENA.
- 38. ALL CONNECTIONS TO EXISTING SEWERS SHALL BE PER MUNICIPAL REQUREMENTS, AND ALL COSTS INCLUDING TESTING AND/OR VIDEO OF SEWERS SHALL BE

# WATER MAIN SPECIFICATIONS

INCIDENTAL TO THE JOB.

- WATER MAIN SPECIFICATIONS SHALL BE USED IN CONJUNCTION WITH THE GENERAL SPECIFICATIONS, THE WATERMAIN SPECIFICATIONS, AND THE DETAIL SHEETS OF THE GOVERNING AGENCIES. IF ANY CONFLICT IS FOUND BETWEEN THE SPECIFICATIONS, THE STRICTER SPECIFICATIONS SHALL BE FOLLOWED.
- 2. DUCTILE IRON PIPE, 16" DIAMETER AND SMALLER, SHALL CONFORM TO ANSI/AWWA SPECIFICATION C151/A21.51, CLASS 54. DUCTILE IRON FITTINGS SHALL CONFORM TO ANSI/AWWA SPECIFICATION C110/A21.10 FOR STANDARD FITTINGS OR TO ANSI/AWWA SPECIFICATION C153/A21.53 FOR COMPACT FITTINGS. DUCTILE IRON PIPE AND FITTINGS SHALL HAVE A DOUBLE THICKNESS CEMENT MORTAR LINING CONFORMING TO ANSI SPECIFICATION A21.4.
- 3. JOINTS FOR DUCTILE IRON WATER MAIN SHALL BE U.S. PIPE AND FOUNDRY COMPANY "TYTON JOINT" OR APPROVED EQUAL.
- ALL WATER MAIN SHALL BE INSTALLED WITH A MINIMUM COVER OF FIVE FEET, OR AS SPECIFIED BY THE LOCAL GOVERNING MUNICIPALITY, BELOW FINISH GRADE UNLESS OTHERWISE NOTED IN THE PLANS. WHEN WATER MAINS MUST DIP TO PASS UNDER A STORM SEWER OR SANITARY SEWER, THE SECTIONS WHICH ARE DEEPER THAN NORMAL SHALL BE KEPT TO A MINIMUM LENGTH BY THE USE OF VERTICAL 11-1/4 BENDS PROPERLY ANCHORED.
- SEE THE WATER MAIN STANDARD DETAIL SHEETS OF THE GOVERNING AGENCY FOR THE SPECIFIC TYPE OF HYDRANTS AND VALVES TO BE USED FOR THIS PROJECT. THESE DETAIL SHEETS ARE INCLUDED AS PART OF THE PLANS.
- MUST PASS A PRESSURE TEST COMPLYING WITH THE CURRENT SPECIFICATIONS AND PROCEDURES OF THE AGENCY. BEFORE ANY WATER MAIN SYSTEM WILL BE ACCEPTED BY THE GOVERNING

EXISTING WATER MAIN AND THE NEW WATER MAIN AT ALL NEW CONNECTIONS.

6. BEFORE ANY WATER MAIN WILL BE ACCEPTED BY THE GOVERNING AGENCY, IT

- AGENCY, THE FIRE HYDRANTS MUST BE PAINTED AS INDICATED ON THE WATER MAIN STANDARD DETAIL SHEETS. 8. TWO INCH (2") DIAMETER CORPORATION STOPS SHALL BE PROVIDED IN BOTH THE
- 10. PHYSICAL CONNECTIONS SHALL NOT BE MADE BETWEEN EXISTING AND NEW WATERMAINS UNTIL TESTING IS SATISFACTORILY COMPLETED.

9. ALL TEES, BENDS CONNECTIONS, ETC. ARE INCIDENTAL TO THE JOB.

## WATER MAIN SPECIFICATIONS. **CONTINUED**

- 11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFE STORAGE OF ALL MATERIAL INTENDED FOR THE WORK. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT DAMAGE TO MATERIALS EQUIPMENT AND
- 12. PIPE BEDDING, UNLESS OTHERWISE INDICATED, SHALL BE CRUSHED STONE OR ROUNDED GRAVEL. BEDDING MATERIAL SHALL HAVE 95% PASSING A 3/4" SIEVE AND 50% RETAINED ON A NO. 4 SIEVE; LOAD FACTOR SHALL BE 1.9.
- 13. BACKFILL, UNLESS OTHERWISE NOTED, SHALL BE COARSE SAND, FINE GRAVEL OR EARTH HAVING A LOW PLASTICITY INDEX. FREE OF ROCKS, DEBRIS AND OTHER FOREIGN MATERIALS AND DEFINED AS ALL PASSING THROUGH A 3/8" SIEVE AND NOT MORE THAN TEN PERCENT (10%) BY VOLUME PASSING THROUGH A 200 MESH
- 14. GATE WELLS SHALL BE REINFORCED PRE-CAST CONCRETE SECTIONS INCLUDING CONCENTRIC OR ECCENTRIC CONES AND GRADE RINGS SHALL BE 4000 PSI CONCRETE AND CONFORM TO ASTM C-478.
- 15. THRUST BLOCKS, IF REQUIRED BY THE MUNICIPALITY, SHALL BE MADE OF 3000 PSI CONCRETE WET MIX

16.	THE	MAXIMUM WIDTH OF	TRENCH TO TOP OF PIPE SHALL	L BE AS FOLLOWS:
	•	PIPE DIAMETER	TRENCH WIDTH	
	•	THROUGH 12" 15" THROUGH 36"	36" O.D. PLUS 24"	
		42" THROUGH 60"	O.D. PLUS 30"	
	•	66" AND LARGER	O.D. PLUS 36"	

- 17. OPEN NO MORE TRENCH IN ADVANCE OF PIPE LAYING THAN IS NECESSARY TO EXPEDITE THE WORK.
- 18. CARE SHALL BE TAKEN NOT TO EXCAVATE BELOW THE DEPTHS INDICATED ON DRAWINGS. WHERE EXCESSIVE OR UNAUTHORIZED EXCAVATION TAKES PLACE, THE OVERDEPTH SHALL BE BACKFILLED AT THE PROPER GRADE WITH COMPACTED BEDDING MATERIAL, AT NO EXPENSE TO THE OWNER.
- 19. WHERE UNSTABLE SOIL IS ENCOUNTERED, CONTRACTOR SHALL NOT PLACE PIPE UNTIL A SOLID BED HAS BEEN PROVIDED.
- 20. EXCAVATION FOR STRUCTURES SHALL EXTEND A SUFFICIENT DISTANCE FROM THE WALLS AND FOOTINGS TO ALLOW FOR FORMS, CONSTRUCTION OF WALLS, CONNECTIONS AND FOR INSPECTION.
- 21. GATE WELLS SHALL BE CONSTRUCTED OF BRICK, CONCRETE MASONRY UNITS OR PRE-CAST CONCRETE WITH CAST IRON FRAMES, COVERS AND MANHOLE STEPS, AS INDICATED ON DRAWINGS AND SPECIFIED HEREIN.
  - A. COMPLETELY FILL JOINTS ON PRE-CAST CONCRETE SECTIONS WITH BITUMINOUS MASTIC JOINTING COMPOUND OR JOINTS SHALL BE MADE WITH CEMENT MORTAR WITH INSIDE POINTING AND OUTSIDE RUBBER WRAP.
  - B. BRICK SHALL BE WET WHEN LAID. LAY BRICK OR CONCRETE MASONRY UNITS IN MORTAR SO AS TO FORM FULL BED, WITH END AND SIDE JOINTS IN ONE OPERATION, WITH JOINTS NOT MORE THAN 3/8" WIDE EXCEPT WHEN BRICKS OR CONCRETE MASONRY UNITS ARE LAID RADIALLY. IN WHICH CASE THE NARROWEST PART OF JOINT SHALL NOT EXCEED 1/4". LAY IN TRUE LINE AND, WHENEVER PRACTICAL, JOINTS SHALL BE CAREFULLY STRUCK AND POINTED ON INSIDE.
  - C. PROTECT FRESH BRICK WORK FROM FREEZING, FROM DRYING EFFECTS OF SUN AND WIND, AND FOR SUCH TIME AS DIRECTED BY THE GEOTECHNICAL ENGINEER. IN FREEZING WEATHER, HEAT SUFFICIENTLY TO REMOVE ICE AND
- 22. GATE WELL STEPS SHALL BE BUILT INTO AND THOROUGHLY ANCHORED TO WALLS. 23. ALL PIPING ENTERING OR LEAVING GATE WELLS SHALL BE ADEQUATELY SUPPORTED BY POURED-IN-PLACE CONCRETE FILL FROM PIPE CENTER TO

FROST FROM BRICK WORK.

UNDISTURBED GROUND.

- 24. THE OUTSIDE SURFACES OF BRICK OR CONCRETE MASONRY PORTION OF GATE WELLS SHALL BE PLASTERED AND TROWELED SMOOTH WITH 1/2" LAYERS OF CEMENT MORTAR.
- 25. SET FRAMES IN FULL BED OF STIFF MORTAR OR BITUMINOUS MASTIC JOINTING COMPOUND AT FINAL ELEVATION. 26. IF REQUIRED BY THE MUNICIPALITY, PLACE HORIZONTAL AND/OR VERTICAL

THRUST BLOCKS AT ALL PLUGS. CAPS. TEES AND FITTINGS. THE COST OF

THRUST BLOCKS SHALL BE INCLUDED IN THE PRICE BID PER FOOT FOR WATER THRUST BLOCKS SHALL NOT BE BACKFILLED PRIOR TO OBSERVATION BY THE CONTROLLING GOVERNMENTAL AGENCY. IF THRUST BLOCKS ARE NOT UTILIZED, ALL FITTINGS SHALL HAVE RESTRAINED JOINTS PER THE MANUFACTURER. 27. IN UNSTABLE SOIL CONDITIONS, THRUST BLOCKS SHALL BE SUPPORTED BY PILING

DRIVEN TO SOLID FOUNDATIONS OR BY REMOVAL OF THE UNSTABLE SOILS AND

REPLACEMENT WITH BALLAST OF SUFFICIENT STABILITY TO RESIST THE THRUSTS.

THE COST OF PILING OR BALLAST AT THRUST BLOCKS SHALL BE INCLUDED IN

- THE PRICE BID FOR WATER MAIN. 28. PLACE ALL CONCRETE ANCHORAGES AND ENCASEMENTS, AS CALLED FOR ON THE DRAWINGS. THE COST OF RESTRAINED JOINTS OR ANCHORAGE AND ENCASEMENTS
- SHALL BE INCLUDED IN THE PRICE BID FOR WATER MAIN. 29. BEDDING USED FOR TRENCH BOTTOM SHALL BE EXTENDED UP THE SIDES AND CAREFULLY PLACED AROUND AND OVER PIPE IN 6" MAXIMUM LAYERS. EACH LAYER SHALL BE THOROUGHLY AND CAREFULLY COMPACTED TO 95% OF MAXIMUM DRY DENSITY AS PER ASTM D-1557(MODIFIED PROCTOR) UNTIL 12" OF COVER
- EXISTS OVER PIPE. 30. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH SPECIFIED BACKFILL MATERIAL TO SPECIFIED SUBGRADE ELEVATION. BACKFILLING SHALL BE COMPACTED TO 90%
- 31. WITHIN 3' OF THE 45' INFLUENCE LINE OF THE SUBGRADE OF STREETS, DRIVES, PARKING LOTS AND OTHER AREAS PAVED, OR AREAS PROPOSED TO BE PAVED, PLACE SAND BACKFILL IN 6" LOOSE LAYERS AT OPTIMUM MOISTURE CONTENT (±2%) AND COMPACTED TO 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-1557 (MODIFIED PROCTOR)
- 32. BEFORE BACKFILLING AROUND STRUCTURES, ALL FORMS, TRASH AND DEBRIS SHALL BE REMOVED AND CLEARED AWAY. SELECTED EXCAVATED MATERIAL SHALL BE PLACED SYMMETRICALLY ON ALL SIDES IN 8" MAXIMUM LAYERS; EACH LAYER SHALL BE MOISTENED AND COMPACTED WITH MECHANICAL OR HAND
- 33. THE CONTRACTOR SHALL DO ALL REQUIRED EXCAVATION AND TRENCHING WORK AND THE CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR THE COMPLETION OF THE WORKS HERFIN REGARDLESS OF THE NATURE OF MATERIALS. ENCOUNTERED DURING THE COURSE OF THE WORK. THE OWNER WILL NOT BE LIABLE FOR ANY COSTS WHATSOEVER ASSOCIATED WITH, BUT NOT LIMITED TO, THE PRESENCE OF ROCK, PEAT, SUBTERRANEAN STREAMS, EXCESSIVE WATER OR OTHER DIFFICULT OR UNANTICIPATED SUB-SURFACE PHENOMENA.

# SANITARY SEWER SPECIFICATIONS

OF MAXIMUM DRY DENSITY PER ASTM D-1557.

- THESE SPECIFICATIONS SHALL BE USED IN CONJUNCTION WITH THE GENERAL SPECIFICATIONS AND THE SANITARY SEWER SPECIFICATIONS AND DETAIL SHEETS OF THE GOVERNING AGENCIES. IF ANY CONFLICT IS FOUND BETWEEN THE
- SPECIFICATIONS, THE STRICTER SPECIFICATIONS WILL BE FOLLOWED. THE GOVERNING AGENCY WILL INSPECT THE INSTALLATION OF ALL SANITARY
- PROPER IMPLEMENTS, TOOLS AND FACILITIES SHALL BE PROVIDED AND USED FOR UNLOADING AND DISTRIBUTING MATERIALS ALONG THE LINE OF WORK. ANY PIPE OR FITTING DAMAGED IN TRANSPORTATION OR HANDLING SHALL BE REJECTED AND IMMEDIATELY REMOVED FROM THE JOB SITE.
- 4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFE STORAGE OF ALL MATERIAL INTENDED FOR THE WORK. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT DAMAGE TO MATERIALS, EQUIPMENT AND
- THE CONTRACTOR SHALL DO ALL REQUIRED EXCAVATION AND TRENCHING WORK AND THE CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR THE COMPLETION OF THE WORKS HEREIN REGARDLESS OF THE NATURE OF MATERIALS ENCOUNTERED DURING THE COURSE OF THE WORK. THE OWNER WILL NOT BE LIABLE FOR ANY COSTS WHATSOEVER ASSOCIATED WITH. BUT NOT LIMITED TO THE PRESENCE OF ROCK, PEAT, SUBTERRANEAN STREAMS, EXCESSIVE WATER OR OTHER DIFFICULT OR UNANTICIPATED SUB-SURFACE PHENOMENA.

# SANITARY SEWER SPECIFICATION.

- 6. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE AND SCHEDULE THE SANITARY SEWER INSTALLATION WITH THE GRADING. EXCAVATION AND OTHER SITE UTILITY SUBCONTRACTORS AND THE OWNERS REPRESENTATIVE
- SO AS TO PROVIDE FOR A SMOOTH AND ORDERLY PROGRESSION OF THE WORK 7. SANITARY SEWER PIPING AND FITTINGS SHALL BE OF THE SIZE AND TYPE INDICATED ON THE DRAWINGS AND SHALL CONFORM TO THE REQUIREMENTS OF
- THE GOVERNING AGENCY. REINFORCED PRE-CAST CONCRETE MANHOLE SECTIONS INCLUDING CONCENTRIC OR ECCENTRIC CONES AND GRADE RINGS SHALL BE 4000 PSI CONCRETE AND
- CONFORM TO ASTM C-478 OR AASHTO M-199. 9. OPEN NO MORE TRENCH IN ADVANCE OF PIPE LAYING THAN IS NECESSARY TO EXPEDITE THE WORK.
- 10. CARE SHALL BE TAKEN NOT TO EXCAVATE BELOW THE DEPTHS INDICATED ON DRAWINGS. WHERE EXCESSIVE OR UNAUTHORIZED EXCAVATION TAKES PLACE, THE OVERDEPTH SHALL BE BACKFILLED AT THE PROPER GRADE WITH
- 11. PROVIDE REQUIRED TIMBER SHEETING, BRACING AND SHORING TO PROTECT SIDES OF EXCAVATION. DO NOT BRACE SHEETING AGAINST PIPE. PROVIDE STAGING AND SUITABLE LADDERS WHERE REQUIRED.

COMPACTED BEDDING MATERIAL, AT NO EXPENSE TO THE OWNER.

- 12. DURING EXCAVATION, MATERIAL SUITABLE FOR BACKFILLING SHALL BE PILED IN AN ORDERLY MANNER A SUFFICIENT DISTANCE FROM THE BANKS OF TRENCHES TO AVOID OVERLOADING, AND TO PREVENT CAVE-INS.
- 13. WHEN WET EXCAVATION IS ENCOUNTERED, THE TRENCH SHALL BE DE-WATERED UNTIL THE PIPE HAS BEEN LAID AND BACKFILLED TO A POINT AT LEAST 1 FOOT ABOVE TOP OF PIPE.
- 14. SANITARY SEWER CROSSINGS SHALL BE MADE WITH 18" OF VERTICAL CLEARANCE FROM ANOTHER UTILITY AND SHALL BE MADE WITHOUT PLACING POINT LOADS ON EITHER PIPE. CONSTRUCT SADDLES, OR PLACE PROTECTIVE CONCRETE CAP TO PREVENT DAMAGE.
- 15. ALL CONNECTION BRANCHES IN THE SEWER PIPE SHALL BE SECURELY AND COMPLETELY FASTENED TO, OR FORMED IN. THE WALL OF THE PIPE DURING THE COURSE OF MANUFACTURE. ALL PIPE CONTAINING SUCH CONNECTION BRANCHES SHALL BE INSTALLED WITH THE MAIN SEWER. THE PROPOSED LOCATION OF THE WYE SHALL BE PER PLAN OR AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
- 16. SERVICE LEADS SHALL TERMINATE (WITH AN APPROVED STOPPER) PER PLANS OR AS DIRECTED BY OWNER OR OWNER'S REPRESENTATIVE.
- 17. EACH RISER AND/OR SERVICE LEAD SHALL BE MARKED WITH A 2 INCH X 2 INCH X 8 FOOT LONG HARDWOOD MARKER, PLACED VERTICALLY AT THE END
- 18. DOWNSPOUTS, WEEP TILE, FOOTING DRAINS, OR ANY CONDUIT, THAT CARRIES STORM OR GROUND WATER SHALL NOT BE ALLOWED TO DISCHARGE INTO A
- 19. ANY CONNECTION TO AN EXISTING SANITARY SEWER MANHOLE SHALL BE MADE IN STRICT CONFORMANCE WITH THE PLANS AND SPECIFICATIONS, WITH ALL WORK BEING DONE IN A WORKMANLIKE MANNER. THIS WORK SHALL INCLUDE THE CONSTRUCTION OF A PROPER CHANNEL IN THE EXISTING MANHOLE AT WHICH THE CONNECTION IS TO BE MADE. TO DIRECT THE FLOW OF INCOMING FLUIDS TO THE EXISTING OUTLET IN A MANNER WHICH WILL TEND TO CREATE THE LEAST AMOUNT OF TURBULENCE. ANY PORTION OF THE EXISTING STRUCTURE WHICH WOULD INTERFERE WITH SUCH CONSTRUCTION SHALL B REMOVED. THE COST OF ALL CONNECTIONS, INCLUDING ALL TESTING AND/OR TELEVISING REQUIRED BY THE LOCAL MUNICIPALITY. SHALL BE INCLUDED IN THE CONTRACT PRICE FOR THE MAIN SEWER UNLESS OTHERWISE PROVIDED IN THE
- 20. WHEN CONNECTIONS ARE MADE WITH SEWERS OR DRAINS CARRYING FLUIDS, SPECIAL CARE MUST BE TAKEN THAT NO PART OF THE WORK IS BUILT UNDER WATER. A FLUME OR DAM MUST BE INSTALLED AND PUMPING MAINTAINED, IF NECESSARY, AND THE NEW WORK KEPT DRY UNTIL COMPLETED AND ANY CONCRETE OR MORTAR HAS SET.
- 21. ALL TIMBER SHEETING BELOW A PLANE 12" ABOVE TOP OF PIPE SHALL REMAIN IN PLACE IN ORDER NOT TO DISTURB PIPE GRADING. BEFORE BACKFILLING,
- REMOVE ALL OTHER SHEETING, BRACING AND SHORING. 22. BEDDING USED FOR TRENCH BOTTOM SHALL BE EXTENDED UP THE SIDES AND CAREFULLY PLACED AROUND AND OVER PIPE IN 6" MAXIMUM LAYERS. EACH LAYER SHALL BE THOROUGHLY AND CAREFULLY COMPACTED TO 95% OF MAXIMUM DRY DENSITY AS PER ASTM D-1557 (MODIFIED PROCTOR) UNTIL 12"
- 23. REMAINDER OF TRENCH SHALL BE BACKFILLED WITH SPECIFIED BACKFILL MATERIAL AS APPROVED BY THE GEOTECHNICAL ENGINEER TO SPECIFIED SUBGRADE ELEVATION. BACKFILLING SHALL BE COMPACTED TO 90% OF
- MAXIMUM DRY DENSITY PER ASTM D-1557. 24. WITHIN 3' OF THE 45' INFLUENCE LINE OF THE SUBGRADE OF STREETS, DRIVES, PARKING LOTS AND OTHER AREAS TO HAVE OR HAVING IMPROVED HARD SURFACES, BACKFILL SHALL BE MATERIAL SPECIFIED AND SHALL BE DEPOSITED IN 6" LOOSE LAYERS AT OPTIMUM MOISTURE CONTENT (±2%) AND COMPACTED TO 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-1557 (MODIFIED PROCTOR). SUITABLE MATERIALS FOUND ON SITE MAY BE USED IF APPROVED BY THE GEOTECHNICAL ENGINEER AND OWNER'S REPRESENTATIVE. WHERE SERVICE OR UTILITY LINES CROSS PAVEMENT OR SIDEWALK, BEDDING SHALL
- E CARRIED TO 3 FEET BEHIND THE CURB LINE OR 3 FEET BEHIND THE SIDE OF SIDEWALK FARTHEST AWAY FROM THE PROPOSED PAVEMENT. 25. BEFORE BACKFILLING AROUND MANHOLES, ALL FORMS, TRASH AND DEBRIS SHALL BE REMOVED AND CLEARED AWAY. SELECTED EXCAVATED MATERIAL SHALL BE PLACED SYMMETRICALLY ON ALL SIDES IN 8" MAXIMUM LAYERS; EACH LAYER SHALL BE MOISTENED AND COMPACTED WITH MECHANICAL AND
- 26. SANITARY SEWER MANHOLES MUST BE WATER-TIGHT AND SHALL BE PRECAST SECTIONS WITH MODIFIED GROOVED TONGUE JOINTS WITH RUBBER GASKETS CONFORMING TO ASTM DESIGNATION C478. CAST IRON STEPS SHALL BE CAST INTO THE MANHOLE SECTIONS AT 16" O.C. DURING MANUFACTURE AND AT 45° FROM THE CENTERLINE OF THE SEWER. MANHOLE STEPS SHALL BE NEENAH
- R-1980-E, EAST JORDAN IRON WORKS, 8500 OR APPROVED EQUAL. 27. WHEN EXISTING REINFORCED CONCRETE MANHOLES OR SEWER PIPES ARE TO BE TAPPED. A HOLE OF THE APPROPRIATE DIAMETER, SHALL BE CORE DRILLED, THROUGH THE WALL OF THE MANHOLE OR SEWER PIPE. TO ACCEPT A RESILIENT CONNECTOR CONFORMING TO ASTM DESIGNATION C-923. RESILIENT CONNECTORS SHALL BE "KOR-N-SEAL" AS MANUFACTURED BY "THE CORE AND
- SEAL CO." OR APPROVED EQUAL. 28. ALL SEWERS SHALL BE SUBJECTED TO INFILTRATION. AIR OR EXFILTRATION TESTS OR A COMBINATION THEREOF IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS, OR PER THE SEWER AUTHORITY'S STANDARDS, PRIOR TO
- A. ALL SEWERS OVER 24" DIAMETER SHALL BE SUBJECTED TO INFILTRATION TESTS. ALL SEWERS OF 24" DIAMETER OR SMALLER, WHERE GROUND WATER LEVEL ABOVE THE TOP OF SEWER IS OVER SEVEN (7) FEET,

SHALL BE SUBJECTED TO AN INFILTRATION TEST.

PER 24 HOUR PERIOD.

ACCEPTANCE OF THE SYSTEM AND PRIOR TO REMOVAL OF THE BULKHEADS.

SHALL BE SUBJECT TO AIR TESTS OR EXFILTRATION TESTS. 29. NO SANITARY SEWER INSTALLATION OR PORTION THEREOF SHALL HAVE INFILTRATION EXCEEDING 100 GALLONS PER INCH DIAMETER PER MILE OF PIPE

B. ALL SEWERS OF 24" DIAMETER OF LESS, WHERE THE GROUND WATER

LEVEL ABOVE THE TOP OF THE SEWER IS SEVEN (7) FEET OR LESS,

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THE LOCATIONS AND ELEVATIONS EXISTING UNDERGROUND UTILITIES AS SHO NO THIS DRAWING ARE ONLY APPROXIMA OF GUARANTEE IS EITHER EXPRESSED MPLIED AS TO THE COMPLETENESS ACCURACY THEREOF. THE CONTRACT SHALL BE EXCLUSIVELY RESPONSIBLE FORTERMINING THE EXACT UTILITY LOCATIO AND ELEVATIONS PRIOR TO THE START CONSTANT OF THE START OF THE STA

CLIENT:

OAKS, LLC 14496 N SHELDON RE SUITE 230 PLYMOUTH, MI 48170 BRUCE MICHAEL (248) 703-4653

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CITY FILE #22-037 SECTION #32

## GRADING AND EARTHWORK **SPECIFICATIONS**

- ALTHOUGH A SUB-SURFACE INVESTIGATION MAY HAVE BEEN MADE BY THE OWNER, THE BIDDER AND ANY SUB-CONTRACTORS SHALL MAKE A PERSONAL INVESTIGATION OF SITE AND EXISTING SURFACE AND SUB-SURFACE CONDITIONS. THE CONTRACTOR IS RESPONSIBLE TO ACQUAINT HIMSELF WITH CONDITIONS OF THE WORK AREA. THE CONTRACTOR IS ADVISED TO DETERMINE THE SUB-SURFACE SOIL CONDITIONS AND GROUND WATER CONDITIONS TO HIS OWN SATISFACTION PRIOR TO BIDDING. NO MODIFICATIONS TO THE UNIT PRICES BID FOR ANY ITEM WILL BE MADE DUE TO VARIABLE SUB-SURFACE CONDITIONS. DEWATERING, I DETERMINED NECESSARY BY THE CONTRACTOR, BY WELL POINTING OR DEEP WELLS WILL BE INCIDENTAL TO THE INSTALLATION COST OF THE ITEM.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING DETERMINED TO HIS SATISFACTION PRIOR TO THE SUBMISSION OF HIS BID THE CONFIRMATION OF THE GROUND. THE CHARACTER AND QUALITY OF THE SUBSTRATA, THE TYPES AND QUANTITIES OF MATERIALS TO BE ENCOUNTERED. THE NATURE OF THE GROUNDWATER CONDITIONS. THE PROSECUTION OF THE WORK, THE GENERAL AND LOCAL CONDITIONS INCLUDING RECENT CLIMATIC CHANGES. THE TIME OF YEAR IN WHICH CONSTRUCTION WILL TAKE PLACE AND ALL OTHER MATTERS WHICH CAN IN ANY WAY AFFECT THE WORK UNDER THIS CONTRACT.
- PRIOR TO COMMENCING THE EXCAVATION THE CONTRACTOR SHALLSUBMIT A PLAN OF HIS PROPOSED OPERATIONS AND TIME SCHEDULE TO THE OWNER & OWNERS REPRESENTATIVE FOR THEIR APPROVAL.
- THE CONTRACTOR SHALL CONSIDER, AND HIS PLAN FOR EXCAVATION SHALL REFLECT, THE EQUIPMENT AND METHODS TO BE EMPLOYED IN THE EXCAVATION AND WHAT METHODS WILL BE USED WHEN WET CONDITIONS ARE ENCOUNTERED REQUIRING GROUNDWATER CONTROL OR OTHER MOISTURE CONDITIONING. CONTRACTOR SHALL SUBMIT AN OUTLINE OF HIS EARTHWORK METHODS WHICH SHALL TAKE INTO ACCOUNT THE OVERALL CONSTRUCTION SCHEDULE. THE PRICES ESTABLISHED IN THE PROPOSAL FOR THE WORK TO BE DONE SHALL REFLECT ALL COSTS PERTAINING TO THE WORK. NO CLAIMS FOR EXTRAS BASED ON SUBSTRATA OR GROUNDWATER TABLE CONDITIONS OR MOISTURE CONDITIONING
- THE CONTRACTOR SHALL KEEP INFORMED AND THE OWNER'S REPRESENTATIVE INFORMED AT ALL TIMES AS TO A "FILL SURPLUS OR SHORTAGE" SITUATION. SHORTAGE OR SURPLUS OF SUITABLE MATERIAL AT THE CONCLUSION OF TH GRADING AND EARTHWORK OPERATION SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND HE WILL BE REQUIRED TO SUPPLY THE DEFICIENCY OR DISPOSE OF THE SURPLUS WITHOUT ADDITIONAL COST TO THE OWNER.
- THE CONTRACTOR SHALL REMOVE VEGETATION, DEBRIS, UNSATISFACTORY SOIL MATERIALS, OBSTRUCTIONS, AND OTHER DELETERIOUS MATERIALS FROM GROUND SURFACE PRIOR TO CUT OR FILL OPERATIONS. SUCH MATERIAL SHALL BECOME PROPERTY OF THE CONTRACTOR TO BE DISPOSED OF IN A LEGAL MANNER OFF
- MATERIALS FOR FILL OR BACKFILL REQUIRED TO GRADE THE SITE AND ACHIEVE DESIGN ELEVATIONS SHALL BE EITHER ON OR OFF-SITE SOILS WHICH ARE FREE OF ORGANIC MATTER AND DEBRIS. NO TOPSOIL SHALL BE USED AS ENGINEERED
- 8. NO FILL MAY BE PLACED UNTIL THE EXPOSED SURFACES HAVE BEEN APPROVED BY THE GEOTECHNICAL ENGINEER. ALL FILL MATERIALS SHALL BE
- 9. IF ANY UNKNOWN SUBSURFACE STRUCTURES ARE ENCOUNTERED DURING CONSTRUCTION, THEY SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE AND DESIGN ENGINEER PRIOR TO PROCEEDING.
- 10. ALL FILL MATERIAL SHALL BE PLACED AND COMPACTED AT THE OPTIMUM MOISTURE CONTENT OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
- 11. NO FROZEN MATERIAL SHALL BE USED AS FILL NOR WILL ANY FILL BE PLACED ON A FROZEN BASE.
- 12. NO ROCK OR SIMILAR MATERIAL GREATER THAN 6" DIAMETER SHALL BE PLACED IN THE FILL UNLESS RECOMMENDATIONS FOR SUCH PLACEMENT HAVE BEEN SUBMITTED BY THE GEOTECHNICAL ENGINEER IN ADVANCE AND APPROVED BY THE OWNER AND OWNER'S REPRESENTATIVE.
- 13. COMPACT FILL MATERIAL TO AT LEAST THE FOLLOWING PERCENTAGE OF MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D-1557 (MODIFIED PROCTOR). NO DEVIATION FROM THESE COMPACTION DENSITIES WILL BE ALLOWED UNLESS SPECIFICALLY RECOMMENDED BY THE GEOTECHNICAL ENGINEER AND APPROVED BY THE OWNER AND OWNER'S REPRESENTATIVE.
- % OF MAXIMUM DRY DENSITY FILL AREAS
- FILL UNDER BUILDING (EXTENDING 5' BEYOND FOOTINGS AT A SLOPE OF 1 ON 1) FILL UNDER PAVEMENT OR SIDEWALKS
- FILL PLACED UNDER OR BEHIND RETAINING WALLS
- ALL OTHER FILL
- 14. ALL FILL MATERIAL SHALL BE PLACED AND COMPACTED IN LIFTS, THAT WILL NOT EXCEED THE DEPTH IN WHICH THE COMPACTION EQUIPMENT CAN ACHIEVE THE MAXIMUM DENSITY REQUIRED FOR THE ENTIRE DEPTH OF THE MATERIAL PLACED IN
- 15. ALL AREAS WHERE FILL HAS BEEN PLACED OR THE EXISTING SOILS HAVE BEEN DISTURBED SHALL BE SUBJECT TO COMPACTION TESTING BY THE GEOTECHNICAL ENGINEER AND SHALL BE TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER, OWNER AND OWNER'S REPRESENTATIVE.
- 16. FILL MATERIAL UNDER PAVEMENTS OR STRUCTURES SHALL BE FREE OF ORGANIC OR DELETERIOUS MATERIALS. IT SHALL BE SUITABLE FOR SUPPORTING PAVEMENTS AND STRUCTURES WITHOUT ADVERSE SHRINKING OR SWELLING.
- 17. FILL MATERIAL IN BERMS AND LANDSCAPE AREAS SHALL BE SUITABLE TO SUPPORT GROWTH OF THE LANDSCAPING MATERIALS (TYPICAL FOR THE LOCAL CLIMATE) AND AS PROPOSED BY THE LANDSCAPE ARCHITECT.
- 18. THE CONTRACTOR IS RESPONSIBLE FOR THE REMOVAL AND DISPOSAL OF, IN A LEGAL MANNER, ANY TREES, BRUSH OR DEBRIS THAT ARE WITHIN THE DESIGNATED CUTTING AND FILLING AREAS TO BRING THE SITE TO PROPOSED
- 19. THE CONTRACTOR SHALL STOCKPILE EXCAVATED MATERIAL ONLY IN DESIGNATED AREAS AS DIRECTED BY THE OWNER OR OWNER'S REPRESENTATIVE.
- 20. DURING THE PERFORMANCE OF SITE GRADING OPERATIONS, THE SUBGRADE SHALL BE EXAMINED CRITICALLY, AND ANY AREAS DISCOVERED WHICH, IN THE OPINION OF THE OWNER'S REPRESENTATIVE OR GEOTECHNICAL ENGINEER. ARE SOFT AND UNSTABLE. SHALL BE EXCAVATED TO SUCH DEPTHS AS MAY BE NECESSARY TO INSURE SATISFACTORY SUPPORTING PROPERTIES AS DETERMINED BY THE GEOTECHNICAL ENGINEER. THESE AREAS OF EXCAVATION SHALL BE BACKFILLED IMMEDIATELY AND SHALL BE BROUGHT BACK TO THE ELEVATION OF THE SURROUNDING AREAS WITH APPROVED FILL MATERIAL AND IN ACCORDANCE WITH THE EARTH FILL CONSTRUCTION PROCEDURE.
- 21. NEWLY GRADED AREAS SHALL BE PROTECTED FROM THE ACTION OF THE ELEMENTS. ANY SETTLEMENT, DISPLACEMENT, PONDING OR WASHING OUT THAT MAY OCCUR PRIOR TO COMMENCING THE NEXT PHASE OF CONSTRUCTION SHALL BE REPAIRED, AND GRADES REESTABLISHED TO THE REQUIRED ELEVATIONS AND
- 22. THE FINISHED SUBGRADE SURFACE SHALL BE SHAPED TO INDICATED PROFILES AND SHALL BE REASONABLY SMOOTH AND FREE FROM IRREGULAR SURFACE CHANGES AND SHALL BE NO MORE THAN 1 INCH ABOVE OR BELOW THE INDICATED SUBGRADE ELEVATIONS.
- 23. THE GRADING CONTRACTOR SHALL BACKFILL ALL PARKING LOT PLANTERS AND LAWN AREAS TO WITHIN 2 INCHES OF THE TOP ADJACENT CURB GRADES. THE TOP 4 INCHES MINIMUM SHALL BE TOPSOIL, FREE FROM DEBRIS AND STONES LARGER THAN 1 INCH IN DIAMETER
- 24. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY PUMPS, DITCHING, WELL POINT SYSTEMS AND OTHER MEANS FOR REMOVING WATER FROM EXCAVATIONS. TRENCHES, SUBGRADES AND OTHER PARTS OF THE WORK. THE CONTRACTOR SHALL CONTINUE DE-WATERING OPERATIONS UNTIL THE WATER HAS BEEN REMOVED ENTIRELY. UPON COMPLETION OF WATER REMOVAL THE CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO DRY THE SOILS, REGRADE TO PROPOSED ELEVATIONS AND COMPACT SOILS TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER AND OWNER'S REPRESENTATIVE
- 25. THE CONTRACTOR SHALL DISPOSE OF WATER IN A SAFE AND SANITARY WAY TO PREVENT FLOODING OR INJURY TO PUBLIC OR PRIVATE PROPERTY AND SHALL OBTAIN APPROVAL OF THE LOCAL GOVERNING AUTHORITY BEFORE DISCHARGING RUN-OFF WATER TO THEIR SYSTEM. SEE EROSION CONTROL NOTES FOR ADDITIONAL REQUIREMENTS.
- 26. THE CONTRACTOR SHALL PROVIDE A SMOOTH TRANSITION BETWEEN EXISTING GRADES AND NEW GRADES.

#### BITUMINOUS PAVING SPECIFICATIONS

- REFERENCE SPECIFICATIONS WHERE APPLICABLE TO WORK UNDER THIS SECTION ARE REFERRED TO BY ABBREVIATION AS FOLLOWS:
  - A. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO).
  - B. THE ASPHALT INSTITUTE (TAI)

SECTION 904. GRADE CSS-1H.

- C. MICHIGAN DEPARTMENT OF TRANSPORTATION/ CURRENT STANDARD SPECIFICATIONS FOR CONSTRUCTION (MDOT)
- D. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)
- AGGREGATE BASE COURSE SHALL MEET THE REQUIREMENTS OF SECTION 902 OF THE MDOT STANDARD SPECIFICATION FOR CONSTRUCTION AND SHALL CONSIST OF 21AA CRUSHED AGGREGATE. THE USE OF SLAG IS PROHIBITED.
- TACK COAT SHALL BE EMULSIFIED ASPHALT MEETING REQUIREMENTS OF MOOT
- 4. AGGREGATE SHALL CONSIST OF CRUSHED STONE, CRUSHED GRAVEL, A MIXTURE OF UNCRUSHED GRAVEL WITH EITHER CRUSHED STONE OR CRUSHED GRAVEL, OF OTHER INERT MATERIAL HAVING SIMILAR CHARACTERISTICS. IT SHALL BE COMPOSED OF CLEAN, TOUGH, DURABLE FRAGMENTS FROM AN EXCESS OF FLAT OR ELONGATED PIECES, AND SHALL BE FREE OF ORGANIC MATTER AND DELETERIOUS SUBSTANCES AND MEET THE REQUIREMENTS OF MDOT STANDARD SPECIFICATIONS, SECTION 902, 21AA. CONTRACTOR MAY USE CRUSHED HMA AGGREGATE SCREENED TO MEET THE REQUIREMENTS OF MDOT 21AA MATERIAL.
- 5. FINE AGGREGATE SHALL BE WELL GRADED FROM COARSE TO FINE AND CONSIST OF NATURAL SAND, STONE SCREENINGS, OR A BLEND OF NATURAL SAND AND STONE SCREENINGS. IT SHALL BE COMPOSED OF ROUGH SURFACED AND ANGULAR GRAINS OF QUARTZ OR OTHER HARD DURABLE ROCK AND MEET THE REQUIREMENTS OF MDOT STANDARD SPECIFICATIONS, SECTION 902 FOR CLASS II OR CLASS III GRANULAR MATERIAL. CONTRACTOR MAY USE CRUSHED HMA AGGREGATE SCREENED TO MEET THE REQUIREMENTS OF MDOT CLASS II OR CLASS
- ASPHALT CEMENT SHALL COMPLY WITH THE REQUIREMENTS OF MDOT SECTION
- 7. HOT MIXED ASPHALT (HMA) SHALL COMPLY WITH MDOT SECTION 501 OF STANDARD SPECIFICATIONS FOR CONSTRUCTION.
- 8. BITUMINOUS LEVELING COURSE SHALL BE MDOT HMA, 13A, UNLESS OTHERWISE REQUIRED BY THE MUNICIPALITY OR ROAD AGENCY WITH JURISDICTION.
- 9. BITUMINOUS WEARING COURSE SHALL BE MDOT HMA, 36A UNLESS OTHERWISE REQUIRED BY THE MUNICIPALITY OR ROAD AGENCY WITH JURISDICTION. CONTRACTOR MAY SUBSTITUTE 13A WITH THE APPROVAL OF THE OWNER AND
- 10. THE CONTRACTOR SHALL SUBMIT, TO THE OWNER, TWO COPIES OF MATERIALS CERTIFICATES SIGNED BY MATERIAL PRODUCER AND CONTRACTOR. CERTIFICATES SHALL STATE THAT EACH MATERIAL ITEM MEETS SPECIFIED REQUIREMENTS.
- 11. THE CONTRACTOR SHALL SUBMIT TO THE GEOTECHNICAL ENGINEER, JOB-MIX FORMULAS FOR EACH REQUIRED ASPHALT AGGREGATE MIXTURE. MIX DESIGNS SHALL BE WITHIN ALLOWABLE TOLERANCES AS SPECIFIED BY MDOT FOR THE PARTICULAR APPLICATION.
- 12. SUBGRADE PREPARATIONS SHALL CONSIST OF THE FINAL MACHINING OF THE SUBGRADE IMMEDIATELY PRIOR TO PLACING THE BITUMINOUS BASE COURSE. THE SUBGRADE SHALL BE COMPACTED PER PLANS AND DETAILS. THE SUBGRADE SHALL BE TRUE TO LINE AND GRADE.
- 13. CRUSHED AGGREGATE BASE COURSE SHALL BE COMPACTED TO A DENSITY EQUAL TO AT LEAST 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-1557 (MODIFIED PROCTOR).
- 14. BITUMINOUS CONCRETE PAVEMENT CONSTRUCTION METHODS SHALL CONFORM TO APPLICABLE PORTIONS OF SECTION 501 OF THE MDOT STANDARD SPECIFICATIONS
- 15. THE CONTRACTOR SHALL NOT PLACE THE AGGREGATE BASE COURSE OR THE BITUMINOUS BASE COURSE PRIOR TO THE APPROVAL OF THE SUBGRADE BY THE
- 16. EACH LIFT AND COURSE OF BITUMINOUS CONCRETE SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER, PRIOR TO THE PLACEMENT OF A SUCCEEDING COURSE
- 17. APPLY BITUMINOUS TACK COATS ONLY WHEN TEMPERATURE HAS NOT BEEN BELOW 35 DEGREES F. FOR 12 HOURS IMMEDIATELY PRIOR TO APPLICATION. CONSTRUCT BITUMINOUS CONCRETE WEARING COURSE ONLY WHEN ATMOSPHERIC OR LIFT IS CLEAN AND DRY. BASE COURSE MAY BE LAID WHEN TEMPERATURE IS ABOVE 35 DEGREES F. AND RISING AND APPROVED BY THE GEOTECHNICAL
- 18. THE BITUMINOUS CONCRETE SHALL BE TRANSPORTED FROM THE MIXING PLANT TO THE POINT OF USE IN VEHICLES CONFORMING TO THE REQUIREMENTS OF SECTION 501 OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION. DELIVERIES SHALL BE SCHEDULED SO THAT SPREADING AND ROLLING OF ALL BITUMINOUS CONCRETE PREPARED FOR ONE DAY'S RUN CAN BE COMPLETED DURING DAYLIGHT. UNLESS ADEQUATE ARTIFICIAL LIGHTING IS PROVIDED. HAULING OVER FRESHLY PLACED BITUMINOUS MAT SHALL NOT BE PERMITTED UNTIL THE BITUMINOUS CONCRETE HAS BEEN COMPACTED, AS SPECIFIED, AND ALLOWED TO COOL TO ATMOSPHERIC TEMPERATURE.
- 19. UPON ARRIVAL, THE BITUMINOUS CONCRETE SHALL BE SPREAD TO A THICKNESS NOT TO EXCEED 3-INCHES AND TO THE FULL WIDTH BY AN APPROVED BITUMINOUS PAVER. IT SHALL BE STRUCK OFF IN A UNIFORM LAYER OF SUCH DEPTH THAT, WHEN THE WORK IS COMPLETED, IT SHALL HAVE THE REQUIRED THICKNESS AND CONFORM TO THE GRADE AND CONTOUR INDICATED. THE SPEED OF THE PAVER SHALL BE REGULATED TO ELIMINATE PULLING AND TEARING OF THE RITUMINOUS MAT. LINESS OTHERWISE DIRECTED, PLACEMENT OF THE BITUMINOUS CONCRETE SHALL BEGIN ALONG THE CENTERLINE OF A CROWNED SECTION OR ON THE HIGH SIDE OF AREAS WITH A ONE—WAY SLOPE. THE BITUMINOUS CONCRETE SHALL BE PLACED IN CONSECUTIVE ADJACENT STRIPS HAVING A MINIMUM WIDTH OF 10 FEET, EXCEPT WHERE EDGE LANES REQUIRE LESS WIDTH TO COMPLETE THE AREA. TRANSVERSE JOINTS IN ADJACENT LANES SHALL BE OFFSET A MINIMUM OF 10 FEET. WHERE POSSIBLE, JOINTS SHALL BE LOCATED AT THE LANE EDGES.
- 20. ON AREAS WHERE IRREGULARITIES OR UNAVOIDABLE OBSTACLES MAKE THE USE OF MECHANICAL SPREADING AND FINISHING EQUIPMENT IMPRACTICAL, THE BITUMINOUS CONCRETE MAY BE SPREAD AND RAKED BY HAND TOOLS.
- 21. THE BITUMINOUS CONCRETE SHALL BE PLACED AT A TEMPERATURE OF NOT LESS THAN 250 NOR HIGHER THEN THE RECOMMENDED TEMPERATURE OF THE BINDER PRODUCER OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
- 22. THE BITUMINOUS CONCRETE MIXTURE SHALL BE THOROUGHLY AND UNIFORMLY COMPACTED BY ROLLING. THE SURFACE SHALL BE ROLLED WHEN THE BITUMINOUS MAT HAS ATTAINED SUFFICIENT STABILITY SO THAT THE ROLLING DOES NOT CAUSE UNDUE DISPLACEMENT, CRACKING AND SHOVING. THE SEQUENCE OF ROLLING OPERATIONS SHALL BE AT THE DISCRETION OF THE
- 23. THE SPEED OF THE ROLLER SHALL, AT ALL TIMES, BE SUFFICIENTLY SLOW TO AVOID DISPLACEMENT OF THE HOT BITUMINOUS CONCRETE. ANY DISPLACEMENT OCCURRING AS A RESULT OF REVERSING THE DIRECTION OF THE ROLLER, OR FROM ANY OTHER CAUSE, SHALL BE CORRECTED AT ONCE.
- 24. SUFFICIENT ROLLERS SHALL BE FURNISHED TO HANDLE THE OUTPUT OF THE PLANT. ROLLING SHALL CONTINUE UNTIL ALL ROLLER MARKS ARE ELIMINATED, THE SURFACE IS OF UNIFORM TEXTURE AND TRUE TO GRADE AND CROSS-SECTION, AND THE REQUIRED FIELD DENSITY IS OBTAINED.
- 25. TACK COAT SHALL BE APPLIED TO THE SURFACE OF PREVIOUS LIFTS AND COURSES OF BITUMINOUS CONCRETE AND TO SURFACES ABUTTING OR PROJECTING INTO THE BITUMINOUS CONCRETE. 26. IMMEDIATELY BEFORE PLACING A SUCCEEDING LIFT OR COURSE OF BITUMINOUS
- CONCRETE THE PRECEDING LIFT OR COURSE SHALL BE CLEARED OF ANY DEBRIS OR STANDING WATER BY APPROPRIATE METHODS. 27. TO PREVENT ADHESION OF THE BITUMINOUS CONCRETE TO THE ROLLER, THE
- WHEELS SHALL BE KEPT PROPERLY MOISTENED, BUT EXCESSIVE WATER WILL NOT
- 28. IN AREAS NOT ACCESSIBLE TO THE ROLLER, THE BITUMINOUS CONCRETE SHALL BE THOROUGHLY COMPACTED WITH HOT HAND TAMPERS.
- 29. ANY BITUMINOUS CONCRETE THAT BECOMES LOOSE AND BROKEN, MIXED WITH DIRT. OR IN ANY WAY DEFECTIVE SHALL BE REMOVED AND REPLACED WITH FRESH HOT BITUMINOUS CONCRETE AND IMMEDIATELY COMPACTED TO CONFORM TO THE SURROUNDING AREA. THIS WORK SHALL BE DONE AT THE CONTRACTOR'S EXPENSE. SKIN PATCHING SHALL NOT BE ALLOWED.
- 30. THE CONTRACTOR SHALL PROVIDE AT LEAST TWO ROLLERS FOR EACH PAVER OPERATING ON THE WORK. THE CONTRACTOR SHALL USE ADDITIONAL ROLLERS AS REQUIRED TO OBTAIN THE SPECIFIED PAVEMENT DENSITY.

# BITUMINOUS PAVING SPECIFICATIONS.

- 31. THE CONTRACTOR SHALL CAREFULLY MAKE JOINTS BETWEEN OLD AND NEW PAVEMENTS, OR BETWEEN SUCCESSIVE DAYS' WORK, TO ENSURE A CONTINUOUS BOND BETWEEN ADJOINING WORK. CONSTRUCT JOINTS TO HAVE THE SAME TEXTURE, DENSITY AND SMOOTHNESS AS OTHER SECTIONS OF THE BITUMINOUS CONCRETE COURSE. THE CONTRACTOR SHALL CLEAN CONTACT SURFACES OF SAND, DIRT, OR OTHER OBJECTIONABLE MATERIAL AND APPLY TACK COAT BEFORE
- 32. THE CONTRACTOR SHALL TEST THE FINISHED SURFACE OF EACH BITUMINOUS CONCRETE COURSE FOR SMOOTHNESS, USING A 10 FOOT STRAIGHTEDGE APPLIED PARALLEL WITH AND AT RIGHT ANGLES TO CENTERLINE OF PAVED AREA. SURFACE SHALL NOT BE ACCEPTABLE IF EXCEEDING THE FOLLOWING TOLERANCES FOR SMOOTHNESS.
  - A. LEVELING COURSE SURFACE: 1/4 INCH, PLUS OR MINUS 1/4 INCH.
  - B. SURFACE COURSE: 1/4 INCH
- 33. THE CONTRACTOR SHALL TEST CROWNED SURFACES WITH A CROWN TEMPLATE, CENTERED AND AT RIGHT ANGLES TO THE CROWN. SURFACES WILL NOT BE ACCEPTABLE IF THE FINISHED CROWN SURFACES VARY MORE THAN 1/4 INCH FROM THE CROWN TEMPLATE.
- 34. AFTER FINAL ROLLING, THE CONTRACTOR SHALL NOT PERMIT VEHICULAR TRAFFIC ON THE BITUMINOUS CONCRETE PAVEMENT UNTIL IT HAS COOLED AND HARDENED, AND IN NO CASE SOONER THAN SIX HOURS OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
- 35. THE AGGREGATE BASE MUST EXTEND A MINIMUM OF 1' BEHIND THE BACK-OF-CURB OR BEYOND EDGE OF PAVEMENT WHEN NO CURB IS PROPOSED.

# CONCRETE CURB, SIDEWALK AND PAVEMENT SPECIFICATIONS

- 1. THESE SPECIFICATIONS SHALL GOVERN THE CONSTRUCTION OF ALL PAVEMENTS, CURB AND GUTTER. SIDEWALKS, SERVICE WALKS, DRIVEWAY APPROACHES, AND LOADING DOCK AREAS, AS INDICATED ON THE DRAWINGS.
- 2. REFERENCE SPECIFICATIONS WHERE APPLICABLE TO WORK UNDER THIS SECTION ARE REFERRED BY ABBREVIATION AS FOLLOWS:
  - A. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO).
  - B. AMERICAN CONCRETE INSTITUTE (ACI)
  - C. MICHIGAN DEPARTMENT OF TRANSPORTATION / CURRENT STANDARD SPECIFICATIONS FOR CONSTRUCTION (MDOT)
  - D. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
- THE FINE AGGREGATE SHALL MEET ALL REQUIREMENTS OF SECTION 902 OF OF MDOT SPECIFICATION FOR NO. 2NS NATURAL SAND.
- THE COARSE AGGREGATE SHALL MEET ALL REQUIREMENTS OF SECTION 902 OF M.D.O.T. SPECIFICATIONS FOR 6AA COARSE AGGREGATE
- THE CONTRACTOR SHALL SUBMIT, TO THE OWNER, TWO COPIES OF MATERIALS CERTIFICATES SIGNED BY MATERIAL PRODUCER AND CONTRACTOR. CERTIFICATES SHALL STATE THAT EACH MATERIAL ITEM MEETS SPECIFIED REQUIREMENTS.
- THE CONTRACTOR SHALL SUBMIT. TO THE GEOTECHNICAL ENGINEER. JOB MIX-FORMULAS FOR EACH REQUIRED CEMENT-AGGREGATE MIXTURE. MIX DESIGNS SHALL BE WITHIN ALLOWABLE TOLERANCES AS SPECIFIED FOR THE PARTICULAR
- CONCRETE MIX SHALL BE AIR-ENTRAINED AND PROPORTIONED TO PROVIDE THE
- A. COMPRESSIVE STRENGTH AT 28 DAYS: 3500 PSI MIN., OR AS INDICATED
- B. TOTAL AIR CONTENT BY VOLUME: 5% TO 8%.

FOLLOWING:

- C. SLUMP 3 INCH MAXIMUM, OR AS INDICATED ON PLANS. THE CONTRACTOR SHALL AT HIS EXPENSE FURNISH SAMPLES OF FRESH CONCRETE AND PROVIDE SAFE AND SATISFACTORY FACILITIES FOR OBTAINING THE
- 9. CONSTRUCT CONCRETE CURBING ONLY WHEN GROUND TEMPERATURE IS ABOVE 35

DEGREES F. AND BASE IS DRY.

- 10. ALL CEMENT USED IN CURB CONSTRUCTION SHALL BE PORTLAND CEMENT, TYPE I OR IA ASTM C-150.
- 11. WATER USED IN CONCRETE SHALL MEET THE REQUIREMENTS OF MDOT SECTION
- 12. AIR ENTRAINING ADMIXTURE SHALL BE SELECTED FROM THE MDOT QUALIFIED
- 13. ALL READY-MIXED CONCRETE SUPPLIERS MUST BE APPROVED BY THE OWNER AND MEET THE CURRENT REQUIRMENTS OF THE NATIONAL READY MIX CONCRETE ASSOCIATION (NRMCA). IF REQUESTED BY THE OWNER, SUBMIT A WRITTEN DESCRIPTION OF PROPOSED READY-MIXED CONCRETE MANUFACTURER, GIVING QUALIFICATIONS OF PERSONAL, LOCATION OF BATCHING PLANT, LIST OF PROJECTS SIMILAR IN SCOPE OF SPECIFIED WORK, AND OTHER INFORMATION AS MAY BE REQUESTED BY THE OWNER.
- 14. THE CONTRACTOR SHALL SUBMIT A STATEMENT OF PURCHASE FOR READY-MIXED CONCRETE: PRIOR TO ACTUAL DELIVERY OF CONCRETE, SUBMIT TO THE GEOTECHNICAL ENGINEER FOUR COPIES OF STATEMENT OF PURCHASE, GIVING THE DRY WEIGHTS OF CEMENT AND SATURATED SURFACE DRY WEIGHTS OF FINE AND COARSE AGGREGATES AND QUANTITIES. TYPE AND NAME OF ADMIXTURES (IF ANY) AND OF WATER PER CU.YD., THAT WILL BE USED IN THE MANUFACTURE OF THE CONCRETE. THE CONTRACTOR SHALL ALSO FURNISH EVIDENCE SATISFACTORY TO THE GEOTECHNICAL ENGINEER THAT THE MATERIALS TO BE USED AND PROPORTIONS SELECTED WILL PRODUCE CONCRETE OF THE QUALITY SPECIFIED. WHATEVER STRENGTHS ARE OBTAINED, THE QUANTITY OF CEMENT USED SHALL NOT BE LESS THAN THE MINIMUM SPECIFIED.
- 15. READY-MIXED CONCRETE DELIVERY TICKETS: SUBMIT ONE COPY OF EACH DELIVERY TICKET TO THE GEOTECHNICAL ENGINEER AND CONTRACTOR IN ACCORDANCE WITH SECTION 16 OF ASTM C94.
- 16. READY-MIXED CONCRETE SHALL BE BATCHED, MIXED AND TRANSPORTED IN ACCORDANCE WITH ASTM C94, AND COMPLY WITH ACI 304 "RECOMMENDED PRACTICE FOR MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE," EXCEPT AS OTHERWISE SPECIFIED HEREIN.
- 17. READY-MIXED CONCRETE SHALL BE MIXED AND DELIVERED TO THE POINT OF DISCHARGE AT THE JOB BY MEANS OF A READY MIX CONCRETE TRUCK.
- 18. NO WATER FROM THE TRUCK WATER SYSTEM OR ELSEWHERE SHALL BE ADDED AFTER THE INITIAL INTRODUCTION OF THE MIXING WATER FOR THE BATCH. UNDER NO CIRCUMSTANCES SHALL THE APPROVED MAXIMUM WATER CONTENT BE EXCEEDED NOR SHALL THE SLUMP EXCEED THE MAXIMUM SPECIFIED.
- 19. DISCHARGE OF THE CONCRETE SHALL BE COMPLETED WITHIN 1-1/2 HOURS OR BEFORE THE DRUM HAS REVOLVED 300 REVOLUTIONS, WHICHEVER COMES FIRST, AFTER THE INTRODUCTION OF THE MIXING WATER TO THE CEMENT AND AGGREGATES OR THE INTRODUCTION OF THE CEMENT TO THE AGGREGATES.
- 20. IN HOT WEATHER (AIR TEMPERATURE 80-DEGREES F. AND ABOVE) OR UNDER CONDITIONS CONTRIBUTING TO QUICK STIFFENING OF THE CONCRETE, THE TIME SHALL BE REDUCED TO ONE HOUR.
- 21. CONCRETE DELIVERED IN COLD WEATHER (AIR TEMPERATURE 45-DEGREES F. AND LOWER) SHALL HAVE A TEMPERATURE NOT LESS THAN 60-DEGREES F. AT THE POINT OF DISCHARGE AT THE JOB, AND IN COMPLIANCE WITH ACI 306R "COLD WEATHER CONCRETING". CONCRETE PLACING WILL NOT BE PERMITTED WHEN THE AIR TEMPERATURE IS 35-DEGREES F. OR LOWER.
- 22. CONCRETE DELIVERED UNDER HOT WEATHER CONDITIONS CONTRIBUTING TO QUICK STIFFENING OF CONCRETE, OR IN AIR TEMPERATURE OF 80-DEGREES F. AND OVER, SHALL HAVE A TEMPERATURE BETWEEN 60- AND 80-DEGREES F. AT THE POINT OF DISCHARGE AT THE JOB, AND IN ACCORDANCE WITH ACI 305R "HOT WEATHER CONCRETING."
- 23. IN NO CASE SHALL THE MIXER OR TRUCK BE FLUSHED OUT ONTO THE STREET PAVEMENT, IN A CATCH BASIN OR SEWER MANHOLE, OR IN ANY PUBLIC RIGHT-OF-WAY. SEE SOIL EROSION CONTROL PLAN FOR CONCRETE WASHOUT
- 24. REINFORCEMENT BARS SHALL BE PER MDOT SECTION 905.
- 25. TIE WIRE SHALL BE BLACK, ANNEALED STEEL WIRE, NOT LESS THAN 16 GAUGE.

# CONCRETE CURB, SIDEWALK AND PAVEMENT SPECIFICATIONS, CONTINUED

- 26. BAR SUPPORTS SHALL CONFORM TO THE BAR SUPPORT SPECIFICATIONS CONTAINED IN CONCRETE REINFORCING STEEL INSTITUTE'S (CRSI) "MANUAL OF STANDARD PRACTICE." PROVIDE CHAIRS, SPACERS AND OTHER DEVICES SUITABLE FOR PROPER SPACING SUPPORTING AND FASTENING REINFORCING BARS.
- 27. WHEN FORMS ARE USED AND THE CURB RADIUS IS LESS THAN 200 FEET. THE CURVED ALIGNMENT SHALL BE PROVIDED FOR BY EITHER STANDARD STEEL FORMS EQUIPPED WITH FLEXIBLE LINES OR BY FLEXIBLE FORMS. THE FORMS SHALL BE OF THE FULL DEPTH OF THE SECTION. CURB AND GUTTER FORMS SHALL BE SO CONSTRUCTED AS TO PERMIT THE INSIDE OF THE FORMS TO BE SECURELY FASTENED TO THE OUTSIDE FORMS.
- 28. ALL NEW CURB SHALL BE PLACED ONLY ON A PREPARED SUBGRADE, SMOOTH AND LEVELED TO THE GRADES ESTABLISHED BY THE ENGINEER.
- 29. COMPACT AND CUT-TO-GRADE SUBGRADE UNDER FORMS SO THAT FORMS WHEN SET WILL BE UNIFORMLY SUPPORTED FOR THE ENTIRE LENGTH. SECURELY STAKE

AND BRACE OR TIE FORMS TO PREVENT LEAKAGE OF MORTAR. BRACING WITH

30. COAT SURFACES OF FORMS TO BE IN CONCRETE WITH A LIGHT CLEAR PARAFFIN OIL OR PARTING COMPOUND WHICH WILL NOT STAIN THE CONCRETE.

EARTH WILL NOT BE PERMITTED.

SO AS TO IMPART A ROUGH FINISH.

- 31. THE INTERIOR SURFACES OF CONCRETE CONVEYING EQUIPMENT SHALL BE MAINTAINED FREE OF HARDENED CONCRETE, DEBRIS, WATER, SNOW, ICE AND OTHER DELETERIOUS MATERIALS.
- 32. CURBING MAY BE CONSTRUCTED EITHER BY USE OF FORMS OR BY A MECHANICAL CURB AND GUTTER PAVER. PROVIDED THE REQUIRED FINISH, AND CROSS-SECTION, AS SHOWN ON DRAWINGS ARE OBTAINED. CONCRETE SHALL BE PLACED TO PROVIDE ONE COURSE MONOLITHIC STRUCTURE WITHOUT THE USE OF MORTAR TOPPING OR SAND-CEMENT DRIER. CONCRETE SHALL BE SPADED OR VIBRATED SUFFICIENTLY TO ENSURE SATISFACTORY CONSOLIDATION.
- 33. PROVIDE REINFORCEMENT FOR CONCRETE CURB AS SHOWN ON THE DRAWINGS. REINFORCEMENT SHALL BE KEPT CLEAN AND FREE FROM OBJECTIONABLE RUST BENDS OR KINKS IN REINFORCING BARS SHALL BE CORRECTED BEFORE PLACING. ALL REINFORCEMENT SHALL BE ACCURATELY LOCATED IN FORMS AND SECURELY HELD IN PLACE BEFORE AND DURING CONCRETE PLACING. BY SUPPORTS ADEQUATE TO PREVENT DISPLACEMENT DURING THE COURSE OF CONSTRUCTION.
- 34. THE CONCRETE CURB SURFACE SHALL BE STRUCK OFF THE REQUIRED CROSS-SECTION WITH A TEMPLATE. AFTER THE CONCRETE CURB HAS BEEN FLOATED TO AN EVEN SURFACE. THE CONTRACTION JOINT SHALL BE CUT AND ALL SLAB EDGES ROUNDED WITH A 1/2 INCH RADIUS EDGING TOOL THAT WILL FINISH TO A WIDTH OF 2 INCHES. AFTER THE CONCRETE HAS SLIGHTLY SET, A BROOM SHALL BE BRUSHED LIGHTLY ACROSS THE SURFACE PARALLEL TO FORMS
- 35. CONTRACTION JOINTS SHALL BE CUT IN CONCRETE CURBING AT MINIMUM 10' INTERVALS. THE JOINT SHALL CUT 1/4 INCH WIDE BY 1/3 THE DEPTH OF THE CONCRETE CURB SECTION. JOINTS SHALL ALSO BE LOCATED ADJACENT TO CURB
- 36. ISOLATION JOINTS SHALL BE PLACED IN CURBING AT TANGENT POINTS IN CURB RETURNS AT INTERSECTIONS, AT BOTH SIDES OF STRUCTURES LOCATED IN THE LINE AND IN RUNS OF CURB AT INTERVALS NOT EXCEEDING 400 FEET. ISOLATION JOINTS SHALL BE 1" THICK PRE-FORMED JOINT FILLER STRIPS. THE STRIPS SHALL EXTEND THE FULL DEPTH OF THE CONCRETE CURB SECTION. ISOLATION JOINTS SHALL BE PLACED IN CURB AT THE END OF EACH DAYS POUR AND WHEN ABUTTING PREVIOUSLY POURED CURB.
- 37. THE CURING COMPOUND SHALL BE A WHITE PARAFIN BASED COMPOUND SELECTED FROM MDOT'S QUALIFIED PRODUCTS LIST APPLIED AT 200 SQ/FT/GAL.
- 38. ALL CONTRACTION JOINTS IN CONCRETE CURB SECTIONS SHALL BE SEALED WITH EITHER HOT POURED JOINT SEALER OR COLD APPLIED JOINT SEALER.
- 39. SLIGHTLY UNDERFILL JOINT GROOVE WITH JOINT SEALER TO PREVENT EXTRUSION OF THE SEALER. REMOVE EXCESS JOINT SEALER MATERIALS AS SOON AFTER
- 40. FRESHLY PLACED CONCRETE SHALL BE PROTECTED AS REQUIRED TO MAINTAIN THE TEMPERATURE OF THE CONCRETE AT NOT LESS THAN 50 DEGREES F. NOR MORE THAN 80 DEGREES F. AND IN A MOIST CONDITION CONTINUOUSLY FOR THI PERIOD OF TIME NECESSARY FOR THE CONCRETE TO CURE. CHANGES IN TEMPERATURE OF THE CONCRETE DURING CURING SHALL BE AS UNIFORM AS POSSIBLE AND SHALL NOT EXCEED 5 DEGREES F. IN ANY ONE HOUR, NOR 50 DEGREES F. IN ANY 24 HOUR PERIOD.
- 41. COLD WEATHER PROTECTION: WHEN THE TEMPERATURE OF THE ATMOSPHERE IS 40-DEGREES F. AND BELOW, THE CONCRETE SHALL BE PROTECTED BY HEATING, INSULATION COVERING, OR COMBINATION THEREOF AS REQUIRED TO MAINTAIN THE IEMPERATURE OF THE CONCRETE AT OR ABOVE 50-DEGREES E. AND IN A MOIST CONDITION CONTINUOUSLY FOR THE CONCRETE CURING PERIOD. COLD WEATHER PROTECTION SHALL MEET THE REQUIREMENTS OF ACI 306R "COLD WEATHER
- 42. HOT WEATHER PROTECTION: WHEN THE TEMPERATURE OF THE ATMOSPHERE IS 90-DEGREES F. AND ABOVE, OR DURING OTHER CLIMATIC CONDITIONS WHICH WILL CAUSE TOO RAPID DRYING OF THE CONCRETE, THE CONCRETE SHALL BE PROTECTED BY WINDBREAKS, SHADING, FOG SPRAYING LIGHT COLORED MOISTURE RETAINING COVERING, OR A COMBINATION OF THEREOF AS REQUIRED TO MAINTAIN THE TEMPERATURE OF THE CONCRETE BELOW 80-DEGREE F. AND IN A MOIST CONDITION CONTINUOUSLY FOR THE CONCRETE CURING PERIOD. HOT WEATHER PROTECTION SHALL MEET THE REQUIREMENTS OF ACI 305R "HOT WEATHER
- 43. ALL FORMS, RAILS AND STAKES SHALL BE REMOVED WITHIN 24 HOURS AFTER PLACING THE CURB. EXPOSED EDGES OF CONCRETE SHALL BE IMMEDIATELY BACKFILLED OR SPRAYED WITH CURING COMPOUND.
- 44. AFTER COMPLETION OF CONCRETE CURBING IN AN AREA, REMOVE ALL WEATHER PROTECTION MATERIALS, RUBBISH AND DEBRIS RESULTING FROM SPECIFIED WORK, SWEEP CONCRETE CURBS CLEAN, AND SEAL JOINTS.

45. ALL CEMENT USED IN SIDEWALK CONSTRUCTION SHALL BE PORTLAND CEMENT,

- TYPE I OR IA ASTM C-150. 46. ALL NEW WALKS AND CONCRETE PAVEMENTS SHALL BE PLACED ONLY ON A PREPARED SUBGRADE, SMOOTHED AND LEVELED TO THE GRADES ESTABLISHED BY THE ENGINEER. IN CLAY SOILS THE SUBGRADE SHALL BE EXCAVATED 2-INCHES BELOW THE SIDEWALK BASE AND FILLED WITH APPROVED SAND MEETING MDOT
- CLASS II, SAND DESIGNATION. 47. CONSTRUCT CONCRETE SURFACE COURSE ONLY WHEN GROUND TEMPERATURE IS
- 48. SIDEWALKS SHALL PITCH TOWARD THE STREET OR AWAY FROM BUILDINGS WITH A MAXIMUM CROSS SLOPE OF 1/4-INCH PER FOOT OF WIDTH AND A MINIMUM CROSS SLOPE OF 1/8-INCH PER FOOT OF WIDTH. CROSS SLOPE DIRECTION TRANSITIONS SHALL BE ACCOMPLISHED IN LENGTHS OF 10 FEET OR LESS.

ABOVE 35 DEGREES F. AND BASE IS DRY.

FROZEN SUBGRADE.

- 49. PRIOR TO PLACING THE CONCRETE, ALL DEBRIS, STONES, DIRT, ETC., SHALL BE REMOVED FROM THE SUBGRADE. THE SUBGRADE SHALL BE MOISTENED WITH WATER IN SUCH A MANNER AS TO THOROUGHLY WET THE MATERIAL WITHOUT FORMING PUDDLES OR POCKETS OF WATER. NO CONCRETE SHALL BE PLACED ON
- 50. FORMS SHALL BE METAL OR WOOD AND OF AN APPROVED SECTION. THEY SHALL BE STRAIGHT, FREE FROM DISTORTION AND SHALL SHOW NO VERTICAL VARIATION GREATER THAN 1/8-INCH IN 10-FOOT LENGTHS FROM THE TRUE PLANE SURFACE ON THE TOP OF THE FORMS WHEN TESTED WITH A 10-FOOT STRAIGHTEDGE, AND SHALL SHOW NO LATERAL VARIATION GREATER THAN 1/4-INCH IN 10-FEET FROM THE TRUE PLANE SURFACE OF THE LATERAL FACE OF THE FORM WHEN TESTED WITH A 10-FOOT STRAIGHTEDGE. THEY SHALL BE OF THE DEPTH SPECIFIED FOR THE SIDEWALK, OR CONCRETE PAVEMENT PER PLANE AND DETAILS, AND BE
- 51. THE CONCRETE SHALL BE DEPOSITED CONTINUOUSLY IN THE FORMS IN SUCH A MANNER AS TO AVOID SEGREGATION AND IT SHALL BE THOROUGHLY TAMPED OR VIBRATED SO THAT THE FORMS ARE ENTIRELY FILLED AND THE CONCRETE THOROUGHLY CONSOLIDATED. THE SLABS SHALL BE PLACED IN SECTIONS OR BLOCKS IN ONE OPERATION AS A MONOLITH.

SECURELY HELD IN PLACE AND TRUE TO LINE AND GRADE.

52. THE CONCRETE SURFACE SHALL BE STRUCK OFF TO A PLANE SURFACE WITH A STRAIGHTEDGE. AFTER THE CONCRETE HAS BEEN FLOATED TO AN EVEN SURFACE, THE CONTRACTION JOINT SHALL BE CUT AND ALL SLAB EDGES ROUNDED WITH A 1/2-INCH RADIUS EDGING TOOL THAT WILL FINISH TO A WIDTH OF 2-INCHES. AFTER THE CONCRETE HAS SLIGHTLY SET, A BROOM SHALL BE BRUSHED LIGHTLY ACROSS THE SURFACE AT RIGHT ANGLES TO FORMS SO AS TO IMPART A ROUGH FINISH.

53. CONTRACTION JOINTS SHALL BE PLACED AT RIGHT ANGLES TO THE EDGE OF THE

5-FEET IN 4" SIDEWALK, OR 8-FEET IN 6" SIDEWALK, OR AS SHOWN ON THE

SIDEWALK OR CONCRETE PAVEMENT AND PERPENDICULAR TO THE SURFACE AND AT A DEPTH OF AT LEAST 1/4 THE SLAB THICKNESS WITH A MINIMUM DEPTH OF 1-1/4-INCHES FOR SIDEWALKS AND 3-INCHES FOR CONCRETE PAVEMENT SLABS. 54. CONTRACTION JOINTS IN SIDEWALKS SHALL BE SPACED AT A MINIMUM OF EVERY

# CONCRETE CURB, SIDEWALK AND PAVEMENT SPECIFICATIONS, CONTINUED

- 55. ISOLATION PAPERS SHALL BE OF THE PRE-MOLDED, NON-EXTRUDING, ASPHALT IMPREGNATED TYPE, NOT LESS THAN 1/2-INCH THICK. THE LENGTH SHALL BE EQUAL TO THE WIDTH OF THE SLAB, AND THE DEPTH EQUAL TO THE THICKNESS
- OF THE SLAB PLUS 1-INCH. 56. ISOLATION JOINTS SHALL BE PLACED AT THE FOLLOWING LOCATION FOR

SIDEWALKS AND CONCRETE PAVEMENTS:

- A. AT THE BACK OF THE CURB AND FRONT EDGE OF THE SIDEWALKS AND PAVEMENT SLABS ADJACENT TO EACH DRIVEWAY APPROACH AND SERVICE
- B. AT INTERVALS NOT TO EXCEED 50-FEET IN ALL PUBLIC SIDEWALKS.
- C. AT THE BACK OF THE CURB WHERE THE RAMPS EXTEND FROM THE KEY FLAG TO THE PAVEMENT.
- D. BETWEEN THE KEY FLAG AND THE RAMP IN ALL CASES, EXCEPT WHERE THERE ARE EXISTING EXPANSION JOINTS AT THE INTERSECTIONS OF THE SIDEWALKS AND THE KEY FLAG.
- E. AT ANY PLACE WHERE A SIDEWALK OR CONCRETE PAVEMENT ABUTS A BUILDING OR FIXED STRUCTURE.
- F. AT ANY OTHER LOCATIONS INDICATED ON THE PLAN. 57. CONTRACTION JOINTS IN THE CONCRETE PAVEMENT WILL BE AS FOLLOWS:
- A. TRANSVERSE JOINTS SHALL BE AT MAXIMUM 10-FOOT INTERVALS OR AS SHOWN ON PLANS AND DETAILS.
- B. LONGITUDINAL JOINTS SHALL BE AT MAXIMUM 12-FOOT INTERVALS OR AS SHOWN ON PLANS AND DETAILS.
- 58. PRIOR TO APPLYING JOINT SEALER, CLEAN JOINT GROOVE OF FOREIGN MATTER

# TRAFFIC LANE AND PARKING LOT MARKING

- PROVIDE ALL MATERIALS, LABOR, EQUIPMENT, AND SERVICES NECESSARY TO COMPLETE ALL TRAFFIC LANE AND PARKING LOT MARKINGS AS INDICATED IN THE CONSTRUCTION DOCUMENTS.
- 3. THE PAINT SHALL MEET THE REQUIREMENTS OF FEDERAL SPECIFICATION TT-P-115C(3), WITH OR WITHOUT REFLECTORIZED BEADS AS REQUIRED ON THE
- 4. COLOR SHALL BE AS SPECIFIED ON THE PLANS OR AS FOLLOWS:
- SHOWN ON THE PLANS. B. TRAFFIC MARKING AND CURB FACES SHALL BE WHITE UNLESS NOTED
- BLUE UNLESS NOTED OTHERWISE. AND CLEAN, WHEN THE ATMOSPHERIC TEMPERATURE IS ABOVE 40-DEGREES F AND WHEN THE WEATHER IS NOT EXCESSIVELY WINDY, DUSTY OR FOGGY AND
- ALL EQUIPMENT FOR THE WORK SHALL BE APPROVED BY THE CONTRACTOR AND SHALL INCLUDE THE APPARATUS NECESSARY TO PROPERLY CLEAN THE EXISTING
- THE MECHANICAL MARKER SHALL BE AN APPROVED ATOMIZING SPRAY-TYPE MARKING MACHINE SUITABLE FOR APPLICATION OF TRAFFIC PAINT. IT SHALL PRODUCE AN EVEN AND UNIFORM FILM THICKNESS AT THE REQUIRED COVERAGE AND SHALL BE DESIGNED SO AS TO APPLY MARKINGS OF UNIFORM CROSS-SECTIONS AND CLEAR-CUT EDGES WITHOUT RUNNING OR SPATTERING AND WITHIN THE L LIMITS FOR STRAIGHTNESS SET FORTH HEREIN. WHEN NEEDED, A DISPENSER SHALL BE FURNISHED. WHICH IS PROPERLY DESIGNED FO ATTACHMENT TO THE MECHANICAL MARKER AND SUITABLE FOR DISPENSING THE
- 8. SUITABLE ADJUSTMENTS SHALL BE PROVIDED ON THE SPRAYER/SPRAYERS OF A MACHINE FOR PAINTING THE WIDTH REQUIRED. MULTIPLE PARALLEL PASSES TO
- IMMEDIATELY BEFORE APPLICATION OF THE PAINT, THE EXISTING SURFACE SHALL AND THE PAVEMENT. THE SURFACE SHALL BE THOROUGHLY CLEANED BY MATERIALS. AREAS WHICH CANNOT BE SATISFACTORILY CLEANED BY BROOMING AND BLOWING SHALL BE SCRUBBED AS DIRECTED WITH A WATER SOLUTION OF TRI-SODIUM PHOSPHATE (10% BY WEIGHT) OR AN APPROVED EQUAL SOLUTION AFTER SCRUBBING, THE SOLUTION SHALL BE RINSED OFF AND THE SURFACE
- 10. EXISTING MARKINGS OR STRIPES WHICH ARE TO BE ABANDONED OR REMOVED SHALL BE OBLITERATED OR OBSCURED BY THE BEST METHODS SUITED FOR THE
- PURPOSE AND TO THE SATISFACTION OF THE OWNER OR OWNER'S 11. THE CONTRACTOR IS RESPONSIBLE FOR LAYING OUT A SAMPLE SECTION OF STRIPING WHICH IS TO BE APPROVED BY THE OWNER OR OWNERS REPRESENTATIVE AS TO QUALITY BEFORE THE CONTRACTOR MAY PROCEED WITH

THE STRIPING. THE CONTRACTOR IS TO INSURE THAT ALL SUBSEQUENT STRIPING

- MEETS THE QUALITY OF THE APPROVED SAMPLE APPLICATION. 12. ON THOSE SECTIONS OF PAVEMENTS WHERE NO PREVIOUSLY APPLIED FIGURES, MARKINGS, OR STRIPES ARE AVAILABLE TO SERVE AS A GUIDE, SUITABLE LAYOUTS AND LINES OF PROPOSED STRIPES SHALL BE SPOTTED IN ADVANCE OF
- INTERVALS AS WILL ENSURE ACCURATE LOCATION OF ALL MARKINGS.
- 14. MARKINGS SHALL BE APPLIED AT THE LOCATIONS AND TO THE DIMENSIONS AND SPACING INDICATED ON THE PLANS OR AS SPECIFIED. PAINT SHALL NOT BE APPLIED UNTIL THE INDICATED ALIGNMENT IS LAID OUT AND THE CONDITIONS OF THE EXISTING SURFACE HAVE BEEN APPROVED BY THE OWNER OR OWNER'S
- 15. THE PAINT SHALL BE MIXED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS BEFORE APPLICATION. THE PAINT SHALL BE THOROUGHLY MIXED AND APPLIED TO THE SURFACE OF THE PAVEMENT WITH THE MARKING MACHINE AT ITS ORIGINAL CONSISTENCY WITHOUT THE ADDITION OF THINNER. IF THE PAINT IS APPLIED BY BRUSH, THE SURFACE SHALL RECEIVE TWO (2) COATS; THE FIRST COAT SHALL BE THOROUGHLY DRY BEFORE THE SECOND COAT IS
- CONCRETE SURFACES. CURING COMPOUND MUST BE REMOVED FOR THE ENTIRE WIDTH OF THE PAINTED STRIPE OR SYMBOL PRIOR TO PAINTING NEW CONCRETE. 17. IN THE APPLICATION OF STRAIGHT STRIPES, ANY DEVIATION IN THE EDGES EXCEEDING 1/2-INCH IN 50-FEET SHALL BE OBLITERATED AND THE MARKING CORRECTED. THE WIDTH OF THE MARKINGS SHALL BE AS DESIGNATED WITHIN A TOLERANCE OF 5 PERCENT (5%). ALL PAINTING SHALL BE PERFORMED TO THE
- 18. PAINT SHALL BE APPLIED UNIFORMLY BY SUITABLE EQUIPMENT AT A RATE OF 0.0094 GAL./S.F. FOR STENCILS AND 0.00313 GAL./FT. FOR STRIPING. PAINT APPLICATION SHALL PRODUCE AN AVERAGE WET FILM THICKNESS OF
- THE PAINT IS DRYING. THE FRESH PAINT SHALL BE PROTECTED FROM INJURY OR DAMAGE OF ANY KIND. THE CONTRACTOR SHALL BE DIRECTLY RESPONSIBLE AND SHALL ERECT OR PLACE SUITABLE WARNING SIGNS, FLAGS, OR BARRICADES, PROTECTIVE SCREENS OR COVERINGS AS REQUIRED. ALL SURFACES SHALL E PROTECTED FROM DISFIGURATION BY SPATTER, SPLASHES, SPILLAGE, DRIPPINGS OF PAINT OR OTHER MATERIAL.

# AND LOOSE PARTICLES, AND DRY SURFACE.

- WORK INCLUDES, BUT NOT LIMITED TO PAINTING OF LETTERS, MARKINGS, STRIPES AND ISLANDS ON THE PAVEMENT SURFACE APPLIED IN ACCORDANCE WITH THIS SPECIFICATION AND AT THE LOCATIONS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
- A. TRAFFIC LANE STRIPING SHALL BE WHITE OR YELLOW REFLECTORIZED, AS
- OTHERWISE. C. PARKING LOT STRIPING SHALL BE WHITE, UNLESS NOTED OTHERWISE.

D. HANDICAP STALL STRIPING MEETING CURRENT ADA REQUIREMENTS SHALL BE

- THE PAINTING SHALL BE PERFORMED ONLY WHEN THE EXISTING SURFACE IS DRY WHEN RAIN IS NOT FORECASTED FOR AT LEAST 2 HOURS AFTER PAINT IS
- SURFACE, A MECHANICAL MARKING MACHINE, AND SUCH AUXILIARY HAND EQUIPMENT AS MAY BE NECESSARY TO SATISFACTORILY COMPLETE THE JOB.
- REQUIRED QUANTITY OF REFLECTIVE BEADS.
- PAINT THE REQUIRED WIDTH WILL NOT BE ALLOWED. BE DRY AND ENTIRELY FREE FROM DIRT. GREASE, OIL, ACIDS, DEBRIS, OR OTHER FOREIGN MATTER WHICH WOULD REDUCE THE BOND BETWEEN THE COAT OF PAINT SWEEPING AND BLOWING AS REQUIRED TO REMOVE ALL DIRT. DEBRIS AND LOOSE
- DRIED PRIOR TO PAINTING.
- THE PAINT APPLICATION. CONTROL POINTS SHALL BE SPACED AT SUCH
- 13. THE CONTRACTOR SHALL PROVIDE AN EXPERIENCED TECHNICIAN TO SUPERVISE THE LOCATION ALIGNMENT, LAYOUT, DIMENSIONS AND APPLICATION OF THE PAINT.
- BITUMINOUS SEAL COAT, SLURRY SEAL OR THE PLACEMENT OF THE BITUMINOUS SURFACE COURSE AND THE MARKING OF THE PAVEMENT. THE PAINT SHALL NOT BLEED EXCESSIVELY, CURL, OR DISCOLOR WHEN APPLIED TO BITUMINOUS OR

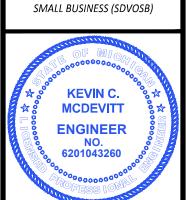
16. A MINIMUM OF ONE (1) WEEK SHALL ELAPSE BETWEEN APPLICATION OF THE

- SATISFACTION OF THE OWNER OR OWNER'S REPRESENTATIVE BY COMPETENT AND EXPERIENCED EQUIPMENT OPERATORS, LABORERS, AND ARTISANS IN A NEAT AND WORKMANLIKE MANNER.
- 19. AFTER APPLICATIONS OF THE PAINT, ALL MARKINGS SHALL BE PROTECTED WHILE

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